

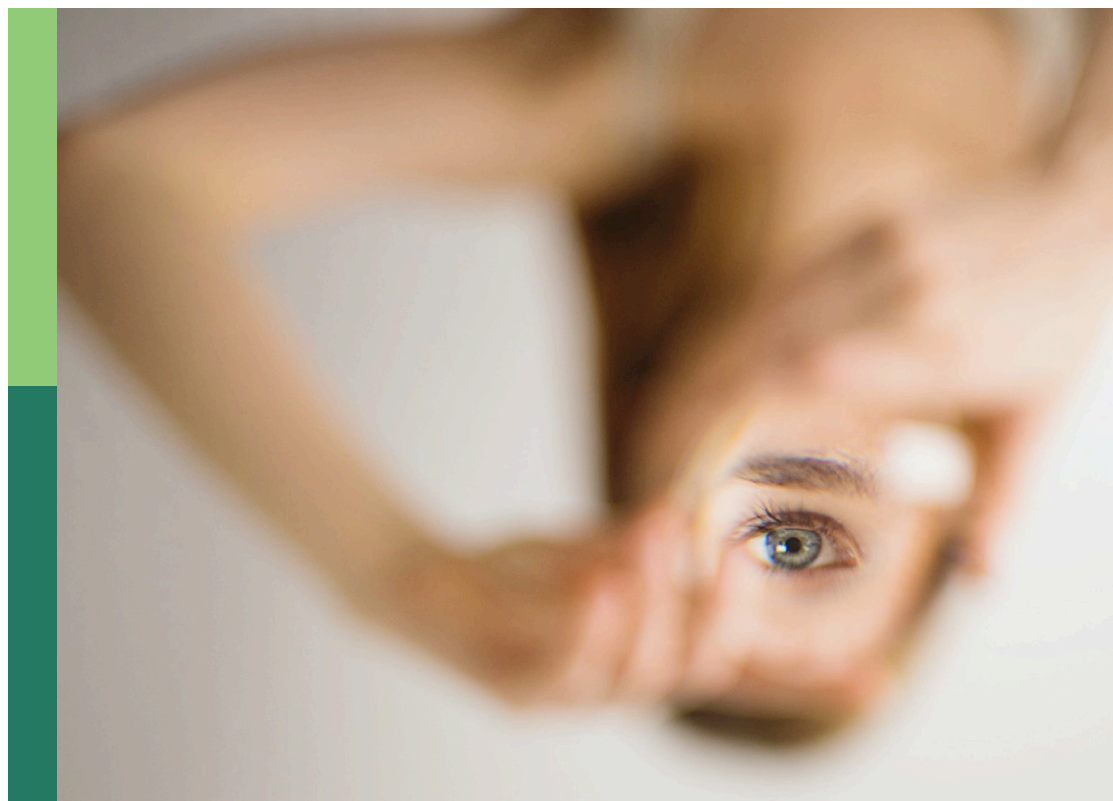
Advances and new perspectives in higher education quality

Edited by

Ana B. Bernardo, María Esteban, Ellian Tuero Herrero,
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Advances and new perspectives in higher education quality

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Table of contents

- 05 **Editorial: Advances and new perspectives in higher education quality**
Ana B. Bernardo, María Esteban, Ellián Tuero, Joana R. Casanova and Antonio Cervero
- 07 **Invariant and suboptimal trajectories of self-regulated learning during secondary school: implications focused on quality in higher education**
Fabiola Sáez-Delgado, Javier Mella-Norambuena, Yaranay López-Angulo, Yenniffer Sáez and Verónica León-Ron
- 19 **Assessing higher education students' critical thinking with the PENCRISSAL test - Portuguese short version: a psychometric study**
Silvia F. Rivas, Amanda Franco, Rui Marques Vieira, Leandro S. Almeida and Carlos Saiz
- 25 **The core self-evaluations, psychological capital, and academic engagement: a cross-national mediation model**
Ramona Paloş, Elena Mirela Samfira, Delia Virgă and Daliborka Purić
- 34 **Training medical students in motivational interviewing using a blended learning approach: a proof-of-concept study**
Rebecca Erschens, Bettina Fahse, Teresa Festl-Wietek, Anne Herrmann-Werner, Katharina E. Keifenheim, Stephan Zipfel, Andreas J. Fallgatter and Kerstin Velten-Schurian
- 47 **The influence of Big Five personality traits on college students' key competencies: the mediating effect of psychological capital**
Anqi Hu, Xueyan Li and Hongfeng Song
- 62 **Towards a competency-based doctoral curriculum at the University of Zambia: lessons from practice**
Chisoni Mumba, James Maimbo Sichone, Sody Munsaka, Geoffrey Kwenda, Musso Munyeme, Martin Simuunza, Bernard M. Hang'ombe, Andrew M. Phiri, Wilbroad Mutale, Marie H. Martin, Douglas C. Heimbürger, King S. Nalubamba, Wilma Nchito, Patricia Katowa-Mukwato, Mary Hondalus, Eystein Skjerve and John Bwalya Muma
- 74 **Transformational leadership of physical education instructors and university students' satisfaction with online classes**
Angelita Bautista Cruz and Hyun-Duck Kim
- 83 **The influence of challenge research stressors on research creativity among Chinese doctoral students: a mediated moderation model**
Chunlei Liu, Min Wu and Xiaoqing Gao

- 99 **Integrated laboratory classes to learn physiology in a psychology degree: impact on student learning and experience**
Judith Sánchez, Beatriz Navarro-Galve, Marta Lesmes, Margarita Rubio and Beatriz Gal
- 107 **An analysis of the psychometric properties of the writing-specific cognitive strategies questionnaire for undergraduate students**
Olga Arias-Gundín and Patricia Robledo
- 116 **The photographic heritage as a motivational resource to learn and teach history**
Santiago Ponsoda-López de Atalaya, Rubén Blanes-Mora and Juan Ramón Moreno-Vera
- 127 **Academic emotions, college adjustment, and dropout intention in university students**
Rubia Cobo-Rendón, Viviana Hojman, Diego García-Álvarez and Ramon Cobo Rendon
- 139 **Research on the impact of the socio-educational environment on the academic performance of college students: the mediating role of study motivation**
Weiqin Wang, Lu Han, Qingjiao Lu, Xingjun Lv, Yu Liu and Dongxuan Wang
- 154 **Integrating EQUIP competency-based training into a university curriculum: a qualitative inquiry with students and faculty at Makerere University in Uganda**
Morris Ndeezi, Gloria A. Pedersen, Benjamin Alipanga, Ibrahim Lubereenga, Brandon A. Kohrt and Roscoe Kasujja
- 166 **Resilience and self-regulated learning as predictors of student competence gain in times of the COVID 19 pandemic – evidence from a binational sample**
Margarete Imhof, Debra Worthington, Julian Burger and Henrik Bellhäuser
- 177 **The influence of grit on life satisfaction of Brazilian undergraduate students: academic adaptation as a mediator**
Ana Paula Porto Noronha, João Lucas Dias-Viana and Ana Paula Ozório Cavallaro



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Editorial: Advances and new perspectives in higher education quality

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KEYWORDS

higher education quality, new teaching methods, student satisfaction, student performance, educational quality indicators

Editorial on the Research Topic

Advances and new perspectives in higher education quality

The technological advance that occurred in the last decades of the 20th century generated a transformation in society and its production systems, increasingly demanding more specialized, more qualified, competent, and committed professionals. Consequently, educational systems have been modernizing and democratizing, making tertiary education a possibility within the reach of the majority of young people. To respond to the new demands of the professional market, Higher Education has implemented new degrees, master's degrees, training courses, etc., and launched different quality assurance systems, with the aim of improving the teaching, research, management activity of university centers, etc.

To achieve the objective of improving the quality and efficiency of the university system, it is necessary to carry out research that provides knowledge about the current characteristics of students and university and pre-university institutions, and then, based on them, design more efficient educational processes. In this sense, higher education institutions need validated instruments with high reliability to evaluate their students and better understand their qualities with the aim of providing them with the skills and resources necessary for their academic and professional success. Examples of this type of instruments are the PENCRIASAL—dedicated to evaluating critical thinking skills—(Rivas et al.) or the Writing-Specific Cognitive Strategies Questionnaire—dedicated to evaluating preferences regarding writing strategies—(Arias Gundin et al.), whose psychometric properties are explored in this monograph.

However, research has shown how students arrive at university with baggage that -in some way- conditions their learning processes (Wang et al.). Advances in this research field show how the transition period from secondary education to university can be critical for many of them, inclining them to fail or favoring their permanence in the institution. Consequently, the preparation of students in secondary school is of special importance, since this must ensure that they acquire a series of academic skills and psychosocial resources that guarantee their subsequent success. To this end, it is necessary to refer to a prolific line of research that confirms how a large part of students enter the university without being self-regulated students, which hinders their adequate progress in

the institution (Saéz-Delgado et al.) On the other hand, and focusing on the university stage, the student's psychological capital has proven to influence the way they approach academic tasks, potentially resulting in greater academic commitment (Palos et al.) and mediating between their personality traits and the development of key competencies (Hu et al.) Similarly, how the student sees his own career can favor his adjustment to the requirements of the university and even prevent him from dropout his university studies (Cobo-Rendón et al.).

Regarding the teaching-learning processes, the university is making real efforts to renew its teaching methodologies and thereby improve the quality of instruction. In this sense, the planification of teaching by competencies is yielding excellent results both in undergraduate studies (Erschens et al.), as well as in postgraduate studies (Ndeezi et al.) and doctorate studies (Mumba et al.). Likewise, other pedagogies such as integrated laboratory practices (Sánchez et al.) or the use of photographs to learn about historical events (Ponsoda-López de Atalaya et al.) generate high student motivation and foster an improvement of educational results.

In relation to the above, it is also necessary to highlight the role of the teaching staff, who after the modernization of the university system plays a fundamental role as facilitators of learning. In relation to this, the research results obtained by Liu et al.—are illustrative—who confirm how adequate feedback favors the motivation, work and creativity of students- or those obtained by Bautista Cruz and Kim, who confirm how a leadership attitude on the part of the teaching staff positively influences the satisfaction of the university student.

The works compiled in this Research Topic are examples of the progress that Higher Education institutions have made toward quality in the development of their functions. Without a doubt, the knowledge generated by these and other research on the topic will contribute to shaping the Higher Education of the future.

Author contributions

AB: Conceptualization, Funding acquisition, Investigation, Supervision, Validation, Visualization, Writing—review &

editing. ME: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing—original draft, Writing—review & editing. ET: Software, Supervision, Validation, Writing—review & editing. JC: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Supervision, Validation, Visualization, Writing—original draft, Writing—review & editing. AC: Conceptualization, Formal analysis, Investigation, Methodology, Writing—original draft.

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Invariant and suboptimal trajectories of self-regulated learning during secondary school: implications focused on quality in higher education

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It has been shown that self-regulation of learning is a key variable for an adequate transition and adjustment from secondary school to tertiary education, and it is also associated with successful academic results; therefore, it is relevant to analyze its levels of development in the pre-university stage. The aim of this research was to evaluate the trajectories of self-regulation of learning in secondary school students. The method considered a longitudinal design and included a sample of 403 students from 9th to 12th grade in Chile. An instrument with adequate psychometric properties was used to measure the learning self-regulation process (disposition, performance and self-evaluation phases). The results showed that self-regulation is at suboptimal levels in its different phases ($M=4.25$ to $M=4.71$). Linear mixed models showed: a significant effect of sex on the disposition variable in favor of females; and that the phases of disposition, performance and self-evaluation do not change over time. It is concluded that, if self-regulation of learning is not specifically trained, it does not increase during secondary school. The findings are discussed considering the possible practical implications for educational policies, research, timely intervention and impact on the quality of school and university education.

KEYWORDS

self-regulated learning, secondary school, transition to higher education, quality of education, longitudinal study

1. Introduction

1.1. Changes in society and new educational requirements in higher education

In the last decades, important changes in the development of competency-based educational programs can be identified, also, to considerable progress in information and communication technologies, and accelerated globalization, implying multiple challenges in the world of education (Espada et al., 2020). In this context, universities around the world

have been striving to move from a solely knowledge-centered approach to a broader competency-based approach in university curricula to drive improvement in the quality of teaching-learning processes (Hensley et al., 2021). In other words, curricula should incorporate, not only disciplinary content, but also those skills that will enable students to become future independent and productive individuals in their society and to contribute to the progress of their country (Mustapha et al., 2023). Therefore, higher education has the responsibility to proceed with high efficiency in the academic and professional preparation of young people entering university. It is required to train the student body for in-depth learning, and critical thinking, enabling them to adjust and respond to the changes that have occurred in today's society, and take responsibility for their learning and future professional work (Šteh and Šarić, 2020).

To achieve these objectives, one of the main generic competencies of Higher Education that needs to be developed is lifelong learning ("Learning to Learn"), whose key component or cornerstone is the ability to self-regulate learning (SRL) (Lluch and Cano, 2023). Therefore, at present, in order to achieve teaching-learning processes that pursue as an ultimate goal the improvement of the quality of Higher Education, it is necessary to consider solid training in this competence, i.e., as a learning outcome to be achieved (Anthonysamy et al., 2020b). That is, SRL should be pursued intentionally and systematically (Lluch and Cano, 2023).

1.2. Model and conceptualization of self-regulation of learning

In the specialized literature, it is possible to identify different models of SRL with empirical evidence that are organized or agglomerated into two large groups. On the one hand, there are those models based on social cognitive theory (Boekaerts and Niemivirta, 2000; Pintrich, 2000; Zimmerman, 2000) that are characterized by being strongly rooted in the self-efficacy framework (Bandura, 1991), and that assumes that people's own beliefs in their efficacy contribute substantially to the various subprocesses in self-regulation (e.g., goal setting, self-monitoring, and the interpretation of causal attributions for success and failure; de la Fuente et al., 2022). In particular, two of these models emphasize motivational beliefs within the planning phase (Pintrich, 2000; Zimmerman, 2000). On the other hand, there are those models that are supported by cognitive and metacognitive aspects (Winne and Hadwin, 1998; Efklides, 2011), which are characterized to a greater extent by strategies referring to attentional control, monitoring, and evaluations of progress toward task goals. Although these models do not exclude motivational beliefs as relevant aspects, they emphasize mainly cognitive mechanisms (critical thinking, and problem-solving skills).

While there are a variety of SRL models with their own particularities or emphasis on the skills they include, it is certain that there is consensus regarding the following characteristics: (a) SRL can be developed, (b) self-regulatory behavior is the result of internal processes, including affective, cognitive, metacognitive, and motivational, (c) in general, three cyclical sequential phases are identified: Disposition, performance, and self-evaluation; (d) delineating these sequential phases allows understanding the behavior and use of different strategies that students exhibit in the pursuit of

desired learning goals to achieve their purposes (Pogorskiy and Beckmann, 2023).

Therefore, this study is based on the proposal of a model that understands SRL as a cyclical process that takes place before, during, and after learning (see Figure 1). Specifically, before learning ("disposition phase"), learners analyze the task, set goals, and elaborate a specific plan to achieve the demands, all of these strategies are activated by motivational beliefs. During learning (performance phase), includes a variety of strategies that the learner uses for successful task completion when motivation is sufficient, such as, for example, monitoring planning, progress in meeting goals, a sufficient environment and materials for study, and whether these strategies are being effective or adjusting them if necessary. Finally, after learning ("self-evaluation phase"), where, after students complete their performance in coherence with the chosen objectives, they evaluate and react to their behaviors and performance results to attribute the possible factors that caused their success or failure (Sáez-Delgado et al., 2022). The product of this final phase of the SRL cycle impacts students' motivational beliefs in future performance in which similar academic demands and requirements exist (Pogorskiy and Beckmann, 2023).

From the background, it is possible to define SRL as the proactive and diligent participation of students within a contextualized, dynamic and cyclical process, where they initiate, manage and adapt strategies for the pursuit of established objectives (see Figure 1), through which they can demonstrate the control of their own learning (Sáez-Delgado et al., 2022).

Therefore, a self-regulated student actively supervises and controls their learning, monitors the effectiveness of cognitive and metacognitive strategies in their study process, makes decisions to modify these strategies if necessary, so that they can achieve their goals, and show a high level of autonomy and determination in their learning to meet academic demands.

1.3. Reality of self-regulatory processes in secondary and higher education

Self-regulated learning is essential to ensure lifelong and productive learning in different contexts (Lim et al., 2023; Mustapha et al., 2023), and it is fundamental for students to persevere and succeed in their studies (Xu et al., 2023). Moreover, evidence abounds showing its positive association with academic outcomes such as grades (Dignath and Büttner, 2008; Pardo et al., 2017; Theobald, 2021; Lim et al., 2023), also, its association with non-academic outcomes (student satisfaction, student engagement and attitude toward learning), which are essential for learning progression in a university (Anthonysamy et al., 2020a), and, in general, for the benefits it brings toward efficient human capital for the future workplace. The value of SRL has even been demonstrated in complex, unprecedented, and conducive scenarios of deregulation such as the impact of the covid-19 pandemic on the education system (Holzer et al., 2021).

In the context of Higher Education, university students are expected to manage a lot of information and tasks in a more autonomous environment than they may have been used to in secondary school (Sáez et al., 2018; Sáez-Delgado et al., 2020). They often need to juggle simultaneously the high load of demands in the different courses, with their social life, in addition, in many cases the

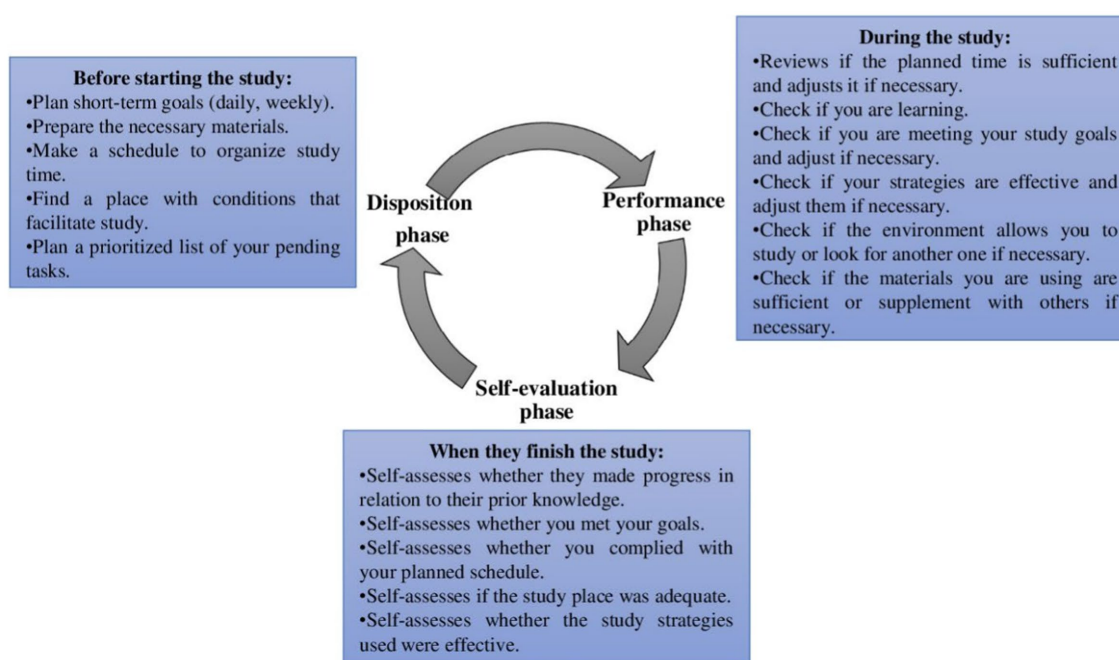


FIGURE 1

Specific strategies according to the phases of the empirical-theoretical model of self-regulation (Sáez-Delgado et al., 2022).

dedication to a part-time job (Jeong and Feldon, 2023). However, in Higher Education, university students often have insufficient strategies to regulate their own learning independently, suggesting the need for adequate support (Sáez-Delgado et al., 2020; Lobos et al., 2021; Jeong and Feldon, 2023; Lim et al., 2023). In fact, research has documented that, most frequently, students do not spontaneously regulate their learning (Lim et al., 2023), and lack sufficient knowledge and strategies to effectively complete and achieve their academic challenges, which highlights the lack of regulation in their study processes (Jeong and Feldon, 2023).

In the case of Secondary Education, the panorama is similar, and it is not strange to identify studies that affirm that students do not achieve optimal development of self-regulation strategies (Sáez-Delgado et al., 2021). Researchers have evidenced low use of planning strategies, difficulties to complete tasks or to monitor progress and solve problems (Lawanto et al., 2013), low self-efficacy (Bai and Wang, 2021), external causal attributions as responsible for their performances, especially in the case of students at risk of dropping out (Ardura et al., 2021), that is, they are more prone to attribute failure to uncontrollable factors than to controllable factors (Ngunu et al., 2019). This becomes complex, as the transition stage from secondary school to college can be particularly difficult for students, they need to be prepared to adapt to the independent learning environment of college, however, they are often insufficiently prepared to take responsibility for their own learning (Higgins et al., 2021; López-Angulo et al., 2023).

Although it is recognized that the ability to distinguish effective study strategies is associated with study planning that favors learning and that in addition, at the beginning of the career it is a determinant for the transit of students from secondary education to tertiary education, there does not seem to exist sufficiently solid bridges of self-regulatory skills that allow supporting the adjustment to university (Vosniadou, 2020;

Blackmore et al., 2021). Because of the above, different efforts have been developed in universities to support students in the development of self-regulatory strategies for their study (Sáez et al., 2018). Although, a positive effect of these initiatives is shown, many times they are remedial and may be implemented late. For this reason, the focus is on Secondary Education, and studying the level of self-regulation at this educational level prior to university is of great importance (Ben-Eliyahu and Linnenbrink-Garcia, 2015; Sáez-Delgado et al., 2022).

SRL trajectories are likely to be substantially heterogeneous due to the dynamic and multidimensional nature of the self-regulatory process. Indeed, numerous cross-sectional studies have identified distinct profiles among students based on their use of SRL strategies (Dörrenbächer and Perels, 2016; Li et al., 2020; Sulisworo et al., 2020), suggesting the need for a longitudinal, person-oriented analytic approach to report heterogeneous SRL development (Jeong and Feldon, 2023).

Although the importance of understanding students' self-regulatory processes for providing quality education is recognized, little is known about how students' SRL profiles develop over time (Li et al., 2020), or the potential increase in students' SRL at different grades along their academic trajectory, where they are supposed to be gaining educational experience (Higgins et al., 2021). The lack of a predefined and formal SRL trajectory makes it more difficult to assess students' progress (e.g., by comparing it to a specific SRL baseline) and to provide relevant feedback and scaffolding, when appropriate (Mella-Norambuena et al., 2021).

1.4. Knowledge gap and aims of the current study

Given that the literature reveals that university students show significant study difficulties, and that the efforts of higher education

institutions seem insufficient to reverse unsatisfactory experiences that, in many cases, lead to academic failure or dropout (López-Angulo et al., 2023), it is essential to focus on the level of development of self-regulation of learning in the pre-university stage (Sáez-Delgado et al., 2021, 2022). Currently, the results are limited in terms of the cross-sectional nature of the data, and therefore, authors have recently suggested the need to carry out research with a longitudinal design to confirm the self-regulation trajectories of students in secondary education (Lluch and Cano, 2023; Xu et al., 2023). It has even been suggested to analyze self-regulation trajectories considering the different grades of secondary education (Karademir and Deveci, 2019). This would make it possible to answer the knowledge gap regarding the possible variation in self-regulation levels as one progresses through different grades of secondary education (Jeong and Feldon, 2023). It would also facilitate understanding the current preparation of students to face university studies when they graduate from secondary education.

On the other hand, given the sex differences in secondary school students previously found in the literature on self-regulation (Torrano and Soria, 2017), it is considered important to include this variable since, if these differences are confirmed, this would provide valuable information for the design of special programs and training that attempt to develop self-regulation strategies. That is, it would be possible to suggest differentiated intervention modalities with emphasis on those self-regulatory processes that show more weaknesses in both men and women (Wu and Cheng, 2019).

Therefore, the present study implemented a longitudinal design and set as its general aim to evaluate the trajectories of self-regulation of learning (disposition, performance, and self-evaluation phase) in secondary school students during one academic year. The specific questions of the study are:

RQ1. Are there differences in self-regulated learning levels according to sex and grade?

RQ2. Are there variations in the levels of self-regulation of learning considering the interaction of the time variable and sex variable?

2. Materials and methods

2.1. Participants

For this study, two data collections on the same sample were considered. The first data collection (T1), was composed of a sample of 598 students, of whom 309 (51.7%) were female, 279 (46.7%) were male and 10 (1.6%) preferred not to state their sex. The mean age was 15.47 (SD = 1.16) years. Regarding the school level of the sample, 153 (25.6%) were 9th graders, 229 (38.3%) were 10th graders, 162 (27.1%) were 11th graders, and 54 (9.0%) were 12th graders. This sample was used to answer RQ1. The second data collection (T2), which was intended to follow up on the initial sample (T1), succeeded in obtaining responses from 403 students who participated in T1. This consisted of 202 males (50.1%) and 201 females (49.9%). In relation to school level, the sample consisted of 85 (21.1%) 9th grade students, 157 (38.9%) 10th grade students, 116 (28.8%) 11th grade students and

45 (11.2%) 12th grade students. All participants were Chilean students from secondary schools in the Biobío region of Chile.

2.2. Instruments

The Self-Regulation of Learning Instrument for Secondary Education Students (SRLI-SE) was used to measure the variable self-regulation of learning. The original and complete version of 34 items was validated for Chilean secondary school students (Sáez-Delgado et al., 2021). In this research, the abbreviated version of this instrument, previously used in Chile, was applied, showing adequate psychometric properties (Sáez-Delgado et al., 2022). Specifically, this instrument measures the learning self-regulation process by means of three scales in correspondence with the three phases proposed in the student self-regulation model (see Figure 1). The name of the first scale is "Disposition learning scale," it has 5 items and measures the frequency with which students use self-regulation strategies to prepare their study, an example of items is: "Before I start studying, I plan short-term goals." The name of the second scale is "Learning performance scale," it has 6 items and measures the frequency with which students use strategies to control their study based on a previously established planning, an example of items is: "While studying, I check if I am learning." Finally, the name of the third scale is: "Self-evaluation learning scale," it has 5 items and measures the frequency with which students reflect on the results obtained in some task or school test, an example of items is: "When I finish my study, I self-evaluate if I made progress in relation to my previous knowledge." The internal consistency of the three scales has shown to be adequate (Disposition: $\alpha > 0.79$ and $\Omega > 0.82$; Performance: $\alpha > 0.87$ and $\Omega > 0.91$; Self-evaluation: $\alpha > 0.85$ and $\Omega > 0.87$). The response format for each of the scales is the same, 7-point Likert-type (1 = never; 2 = almost never; 3 = seldom; 4 = half the time; 5 = frequently; 6 = almost always; 7 = always). Additionally, in this study, following previous examples from the literature (Verstege et al., 2019; Li et al., 2020; Jeong and Feldon, 2023) and in addition to validation by an expert panel composed of 5 PhDs with high expertise in the variable self-regulation and psychometrics, three SRL profiles were established. A longitudinal grouping approach of SRL level among learners determined by their frequency of use of self-regulation strategies was used: (a) Learners at optimal SRL levels (6–7 points), (b) Learners at suboptimal SRL levels (3–5), (c) Learners at insufficient SRL levels (1–2).

The questionnaire also included sociodemographic questions. Specifically, we asked about sex (the response options were: male, female, prefer not to answer); grade (the response options were 9th, 10th, 11th, and 12th) and the age variable.

2.3. Data collection procedure

To implement the study, it was first submitted for evaluation by the Institutional Ethics and Bioethics Committee of the Universidad Católica de la Santísima Concepción, Chile. Once the project underwent a detailed review and was approved by the Committee, meetings were arranged with secondary school principals to explain the research and invite them to participate. Those who agreed to participate in the research facilitated a meeting with the

management team to agree on the data collection strategy, which included the prior authorization of the parents of the participating students, who signed an informed consent form, while the students approved their participation in the study through an informed consent form.

The data were collected at two moments over time to respond to the objectives of the study corresponding to the first and second academic semester of the year 2022 in Chile. Specifically, the first and second data collection was carried out from April to June and later from August to October, respectively. The instruments were applied online using the SurveyMonkey tool. For the participants of this study, activities were carried out for the benefit of their schools. Specifically, a report was delivered with the overall results of the study and an invitation to a seminar where the findings were disseminated by the research team.

2.4. Data analysis procedure

In the first part of the study, which considered the evaluation of the variables at T1, descriptive frequency analyses were performed for the categorical variables. For numerical variables, central tendency and dispersion analyses were performed. Then, for the evaluation of differences in the variables of disposition, performance, and self-evaluation according to sex and educational level (grade), the assumptions of normality and homoscedasticity were evaluated using the Kolmogorov–Smirnov test with the Lilliefors modification and the Levene test, respectively. The results showed that both assumptions were not met and the groups were not balanced, therefore, it was decided to apply robust tests, for comparison by sex. Specifically, Yuen's test was used for the comparison by sex, while for the comparison by educational level (grade), the trimmed means Anova test was used. Both tests are available in the WRS2 library.

In the second part of this study, where it was proposed to evaluate the effect of the interaction of time and sex on the variables disposition, performance, and self-evaluation, linear mixed models were used. The fixed effects considered were (1) evaluation time (T1 and T2), (2) sex (male or female), and (3) the interaction effect between evaluation time and sex. As a random effect, only the school intercept was considered in the model. To fit the linear mixed-effects model, the “lmer” function of the Lme4 library was used. The “ranova” function from the lmerTest library was used to evaluate the significance of the random effect in the model. All analyses were performed in R software version 4.2.2.2, with the RStudio IDE version 2023.03.0.

3. Results

3.1. Descriptive analysis of the variables

First, a descriptive analysis of the variable age and the SRL phases is presented. Table 1 shows that the variable disposition toward learning presented the highest mean $M = 4.71$; on the contrary, the variable with the lowest mean was the phase of self-evaluation of learning $M = 4.25$ (see Table 1). According to the interpretation of the instrument applied, it is possible to observe that, at T1, the learners show suboptimal levels of ARA.

3.2. Results of RQ1. Differences in SRL phases according to grade level and sex

3.2.1. Results of the analysis in the SRL phases in the comparison by grade level

Differences by school level (grade) of the students were evaluated. The assumption of normality was not met and there was unbalance in the data, therefore, the robust trimmed means Anova test was performed. The analysis showed that there were no significant differences by level for the variables disposition, performance, and self-evaluation (see Table 2). According to the interpretation of the instrument applied, it is possible to point out that in T1 and in the different grades, the learner evidences suboptimal levels of ARA.

3.2.2. Results of the analysis in the SRL phases in the comparison by sex

The sample for the comparison by sex was composed of 588 students. Students who preferred not to indicate their sex were eliminated from this comparison due to their low representativeness. The average age reported in this subsample was 15.46 ($SD = 1.08$) years. Regarding the level of study, 149(25.3%) were 9th graders, 226(38.4%) were 10th graders, 311(27.6%) were 11th graders, and 51(8.7%) were 12th graders.

Due to the failure to meet the assumptions for a two-group comparison with a parametric test, it was decided to use Yuen's robust test. Significant differences according to sex were found for the variables disposition $T(332.84) = 3.12$, $p < 0.01$. $ES = 0.2$ and for the variable performance $T(352.66) = 1.97$, $p < 0.05$. $ES = 0.12$ (see Table 3).

3.3. Results of RQ2. Variations in the SRL phases considering the interaction of the time variable and the sex variable

3.3.1. Descriptive results of the variables in the longitudinal study

Table 4 shows that the lowest mean of the variables studied was presented at T1 of the self-evaluation phase of the SRL process for the group of 12th grade secondary school males. On the other hand, the highest mean was presented at T1 of the disposition phase of the SRL process in the group of 12th grade secondary school females. At all times and phases of the self-regulation process, the group made up of women is the one with the highest averages. While, the lowest averages in all times and phases, is the one made up of men, except in the T2 self-evaluation phase.

TABLE 1 Descriptive analysis of the SRL phases.

	Mean	SD	Median	Skew	Kurtosis
Age	15.51	1.13	15.00	1.58	10.35
Disposition phase	4.71	1.43	4.80	−0.40	−0.25
Performance phase	4.61	1.50	4.67	−0.36	−0.45
Self-evaluation phase	4.25	1.59	4.20	−0.08	−0.75

TABLE 2 Comparison analysis in the SRL phases according to grade level.

	9th grade (n = 153)		10th grade (n = 229)		11th grade (n = 162)		12th grade (n = 54)			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Levene Test	ANOVA trimmed
DP	4.66	1.38	4.68	1.49	4.73	1.39	4.83	1.44	$F(3,594) = 0.53$	$F(3,227.79) = 0.38$
PP	4.58	1.44	4.56	1.58	4.68	1.47	4.75	1.43	$F(3,594) = 0.96$	$F(3,227.45) = 0.54$
SP	4.25	1.50	4.21	1.69	4.27	1.56	4.36	1.55	$F(3,594) = 1.38$	$F(3,231.94) = 0.90$

DP, Disposition Phase; PP, Performance Phase, SP, Self-evaluation Phase.

TABLE 3 Comparison analysis in the phases of SRL according to sex.

	Male (n = 279)			Female (n = 309)					
	M	SD	K-S Lilliefors	M	SD	K-S Lilliefors	Levene Test	Yuen-test	ES
DF	4.50	1.50	D = 0.051*	4.90	1.33	D = 0.057*	$F(1,586) = 4.56^*$	$t(332.84) = 3.12^{**}$	d = 0.2
PF	4.48	1.52	D = 0.056*	4.74	1.47	D = 0.063**	$F(1,586) = 0.33$	$t(352.66) = 1.97^*$	d = 0.12
SE	4.19	1.62	D = 0.051*	4.30	1.56	D = 0.052*	$F(1,586) = 0.22$	$t(346.87) = 0.64$	N/A

DP, Disposition Phase; PP, Performance Phase, SP, Self-evaluation Phase.

To evaluate the variation over time between measures of the variables of interest (SRL disposition phase, performance, and self-evaluation) and to test whether there is an interaction effect between time and sex, a linear mixed model was tested with time and sex as fixed effects and school as a random effect for the intercept.

3.3.2. Linear mixed model on the SRL disposition phase

The mixed model was evaluated considering the random effect of school only on the intercept. In this model it could be observed that the fixed effect of sex was significant ($p < 0.01$) in favor of females. On the other hand, time and the interaction between time and sex were not significant. According to the interpretation of the applied instrument, it is possible to point out that at T1 and T2 the students did not significantly change their level of disposition in the SRL process. Regarding the calculation of the conditional and marginal coefficient of determination for mixed-effects models, the results indicated an $R^2_m = 0.010$ and an $R^2_c = 0.035$. The calculation of the significance of the random effect of the school was significant $p < 0.001$ (Ver Table 5; Figure 2).

3.3.3. Linear mixed model on SRL performance phase

In relation to the model for the learning performance phase in the SRL process, it can be observed that the fixed effect of sex, time and the interaction between them did not result significant. According to the interpretation of the applied instrument, it is possible to point out at T1 and T2 the students did not significantly change their level of performance of the SRL process. Regarding the calculation of the conditional and marginal coefficient of determination for mixed effects models, the results indicated an $R^2_m = 0.004$ and an $R^2_c = 0.039$, the calculation of the significance of the random effect was significant $p < 0.001$ (Ver Table 6; Figure 3).

3.3.4. Mixed linear model on the SRL self-evaluation phase

In relation to the model for the self-evaluation phase of learning, it can be observed that the fixed effect of sex, time, and the interaction

between them did not result significant. According to the interpretation of the applied instrument, it is possible to point out that at T1 and T2 the students did not significantly vary their level of self-evaluation of the SRL process. Regarding the calculation of the coefficient of conditional and marginal determination for mixed effects models, the results indicated an $R^2_m = 0.003$ and an $R^2_c = 0.055$, the calculation of the significance of the random effect was significant $p < 0.001$ (Ver Table 7; Figure 4).

4. Discussion

This study aimed to answer two research questions that will be discussed below. Some reflections on the findings of this study and their implications for the quality of education, the limitations of the study, and future lines of research are also presented.

4.1. Discussion of RQ1. Differences in the levels of SRL according to sex and grade

Regarding the differences according to sex, the results showed significant differences in favor of females for the disposition phase and for the performance phase in the SRL process. This coincides with previous research and at different academic levels. In primary school a study involving 291 students from Hong Kong found sex differences in the use of SRL strategies, specifically in the strategies of planning, acting on feedback, and self-initiation in academic writing contexts in favor of girls (Bai et al., 2020). In secondary schools, similar results have also been found, for example, research with students from Turkey (Karademir and Deveci, 2019) and other studies with students from China in both face-to-face (Chen et al., 2023) and online learning contexts (Liu et al., 2021) found that self-regulation skills differ significantly as a function of sex in favor of female students. In Higher Education, these differences are also confirmed, for example, a study of 153 undergraduate students of Biological Education in Indonesia showed that female students are more self-regulated, specifically in

TABLE 4 Description of the SRL phases according to sex, grade, and time.

Sex	Grade	<i>n</i>	Edad	Disposition phase		Performance phase		Self-evaluation phase	
			Mean	T1 Mean (SD)	T2 Mean (SD)	T1 Mean (SD)	T2 Mean (SD)	T1 Mean (SD)	T2 Mean (SD)
Male	9th	36	14.25	4.32 (1.59)	4.49 (1.77)	4.38 (1.58)	4.51 (1.79)	4.04 (1.68)	4.24 (1.81)
Male	10th	89	15.26	4.47 (1.69)	4.57 (1.6)	4.44 (1.7)	4.49 (1.59)	4.14 (1.8)	4.37 (1.64)
Male	11th	59	16.42	4.65 (1.39)	4.79 (1.46)	4.66 (1.47)	4.72 (1.49)	4.37 (1.5)	4.49 (1.51)
Male	12th	18	17.39	4.66 (1.3)	4.36 (1.38)	4.56 (1.49)	4.52 (1.17)	3.96 (1.61)	4.58 (1.28)
Female	9th	49	14.41	4.96 (1.31)	4.96 (1.6)	4.83 (1.38)	4.72 (1.74)	4.48 (1.47)	4.33 (1.8)
Female	10th	68	15.13	4.98 (1.3)	4.46 (1.4)	4.8 (1.52)	4.54 (1.54)	4.24 (1.59)	4.14 (1.63)
Female	11th	57	16.09	4.79 (1.46)	4.73 (1.46)	4.73 (1.57)	4.64 (1.57)	4.27 (1.69)	4.41 (1.61)
Female	12th	27	17.07	5.15 (1.54)	4.9 (1.42)	4.93 (1.53)	4.84 (1.59)	4.64 (1.64)	4.66 (1.46)

TABLE 5 Effect of time and sex on the disposition phase of SRL.

Predictors	Estimates	CI	<i>p</i>
(Intercept)	4.59	4.34–4.84	< 0.001
Time [2]	0.09	−0.20 – 0.38	0.543
Sex [female]	0.41	0.12–0.70	0.006
Time [2] * sex [female]	−0.31	−0.72–0.09	0.131
<i>Random effects</i>			
σ^2	2.17		
$\tau_{00school}$	0.06		
ICC	0.02		
N_{school}	19		
Observations	806		
Marginal R^2 /Conditional R^2	0.010 / 0.035		

goal setting, task strategies, time management, and self-evaluation (Anazifa et al., 2023); on the other hand, in a study in 700 undergraduate students of the Faculty of Foreign Languages in Turkey, similar results are revealed showing that female students are more self-regulated in comparison to male students (Adigüzel and Orhan, 2017). Therefore, it is possible to conclude that the sex variable is a factor that differentiates students' self-regulation skills in favor of female students at the school and university levels. This is further reinforced in research that has found that male students procrastinate in their studies more and show more addiction to smartphones than female students as a product of poor time management, variables directly associated with self-regulatory processes (Halili and Zainuddin, 2015).

Regarding differences by grade, data analysis did not detect significant differences in any of the self-regulation phases (disposition, performance, and self-evaluation). This is consistent with previous results in secondary education. For example, research on students in Turkey showed that self-regulation skills did not differ significantly as a function of grade (Karademir and Deveci, 2019). The same was concluded by a study that analyzed differences in 1,113 students in grades 11 and 12 of a public secondary school in China (Chen et al., 2023). On the other hand, an interesting result from a cross-sectional study of 1,260 Shanghai secondary school students in China (grades 10–12) analyzed whether the SRL level of these students varied across

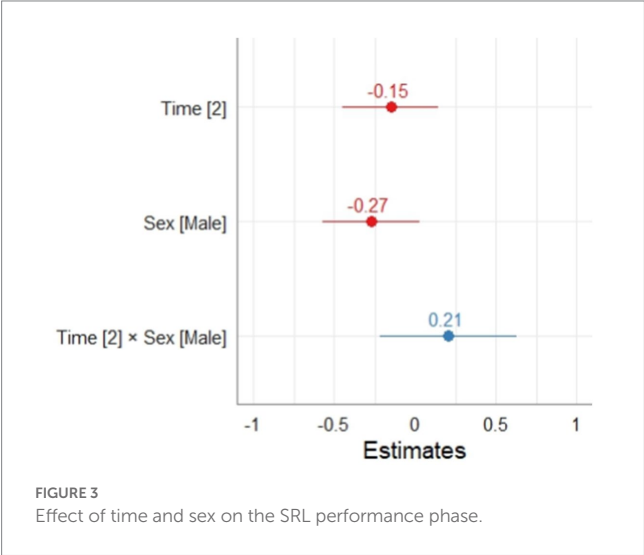
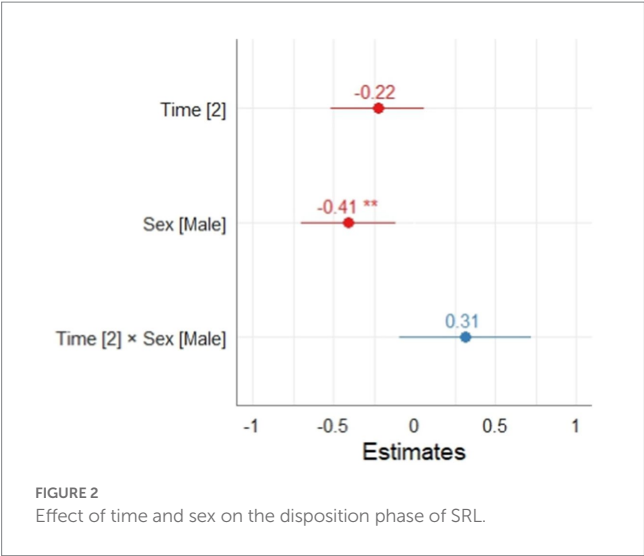
grades, although, these differences were not significant, still, the authors conclude from their findings of descriptive analyses that, in general, students' SRL decreased as they got older (Guo, 2020); based on the analyses of mean differences by grade in the use of self-regulation strategies, since it was evidenced that 10th and 11th-grade students reported higher means compared to 12th-grade students in the strategies of rehearsal, elaboration, organization, metacognitive strategies, and intrinsic motivation.

4.2. Discussion of RQ2. Variations in the levels of SRL considering the interaction of the time variable and the sex variable

In the linear mixed models, significant differences by sex were found in favor of females for the learning disposition variable. This confirms the findings of the first objective cross-sectional cohort, which revealed that women are more self-regulated than men. However, in this case, differences are observed in the first phase of the cyclical SRL model, which is particularly important, since it is the phase that sets the self-regulation process in action. Also, other longitudinal studies have shown differences at the beginning of secondary school as a function of sex, with girls reporting greater use of self-regulation strategies compared to boys (Schuitema et al., 2012).

On the other hand, mixed-model results also indicated that the dispositional phases, performance, and self-evaluation of the SRL process do not change over time, i.e., students who responded regarding the frequency of self-regulation strategy use in one academic semester, and then those same students in a following academic semester, did not increase their SRL. This suggests that, while SRL strategies are not trained, these skills are not developed. These findings are also consistent with previous research results that have used longitudinal designs (Barbosa et al., 2018).

Other longitudinal studies have even shown more discouraging results. A longitudinal study on a sample of 412 Italian students between 12 and 22 years of age showed that self-regulatory self-efficacy decreased as they progressed through the following grades, with the decrease being greater and significant for males; specifically, self-regulatory efficacy decreased by 0.077 for males and 0.035 for females each year. In addition, a growth curve model showed that the smaller the decline in self-regulatory efficacy in the students' trajectories, the higher the grades at the end of secondary school and the greater the probability of



remaining in secondary school. The model explained 55% of the variance of dropout in males and 57% in females (Caprara et al., 2008). Another longitudinal study of 182 university students analyzed procrastination, which is considered a failure of self-regulation, measuring this variable at 4 moments during an academic semester, where the results showed that procrastination increased significantly throughout the semester (Yerdelen et al., 2016). A study on 735 students in the first year of lower secondary school in the Netherlands applied four measurements over time (the first in September/October 2004, i.e., at the beginning of the first year; the second in February/March; the third in May/June; and the fourth in September/October 2005, i.e., at the beginning of the second year). The results showed a relatively low use of strategies by the students in the different measures of the study where the authors point out that it could perhaps be due to the fact that the research participants were just starting to attend secondary school, where they become more responsible for their learning than in primary school. On the other hand, the results showed a general decrease in students' perception of their self-regulated learning behavior as time progressed (van der Veen and Peetsma, 2009). Additionally, with respect to trajectories of self-regulation according to course, a study in 648

TABLE 6 Effect of time and sex on the performance phase of SRL.

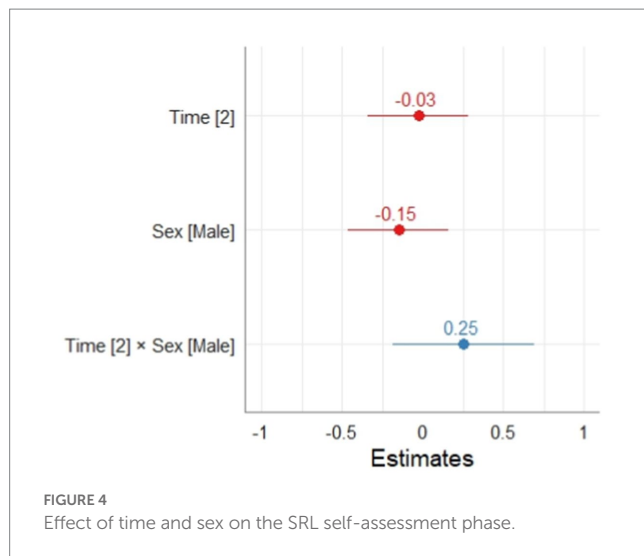
Predictors	Estimates	CI	<i>p</i>
(Intercept)	4.60	4.32–4.87	< 0.001
Time [2]	0.06	–0.24 – 0.36	0.704
Sex [female]	0.27	–0.03 – 0.57	0.080
Time [2]* sex [female]	–0.21	–0.63 – 0.21	0.334
<i>Random effects</i>			
σ^2	2.33		
$\tau_{00school}$	0.08		
ICC	0.03		
N_{school}	19		
Observations	806		
Marginal R^2 /Conditional R^2	0.004/0.039		

TABLE 7 Effect of time and sex on the self-evaluation phase of SRL.

Predictors	Estimates	CI	<i>p</i>
(Intercept)	4.30	3.99–4.60	< 0.001
Time [2]	0.23	–0.08 – 0.54	0.150
Sex [female]	0.15	–0.16 – 0.46	0.348
Time [2]* sex [female]	–0.25	–0.69 – 0.18	0.253
<i>Random effects</i>			
σ^2	2.50		
$\tau_{00school}$	0.14		
ICC	0.05		
N_{school}	19		
Observations	806		
Marginal R^2 /Conditional R^2	0.003/0.055		

Netherlands secondary school students observed a decline in the first semester except for the use of metacognitive strategies, which remained the same [the SRL measure was measured at the beginning of secondary education and again in the middle of the first year (Schuitema et al., 2012)].

Therefore, it is possible to conclude from the findings of this study and on the support found in previous research, that secondary school students do not spontaneously improve their SRL by the mere fact of advancing from one academic semester to another. There seems to be stagnation and even regression of self-regulatory competence. It is possible to discuss some possible explanations regarding the lack of increased use of self-regulatory strategies during secondary school. First, is to consider the evolutionary perspective, i.e., as students move to the next semester or higher grade (increase in age), they acquire a greater ability to assess their actual rather than exaggerated competence, as opposed to when they were younger (van der Veen and Peetsma, 2009; Guo, 2020). Second, another possible explanation might find meaning in the underpinning of social cognitive theory (Bandura, 1999), which has emphasized that students might be influenced by their social environment (learning environment or school climate), i.e., while early adolescence is often characterized by a growing need for autonomy and self-awareness, the environment of the upper grades of secondary education becomes more evaluative,



with more instances of formality and with a more competitive and impersonal character, implying a progressive undermining of SRL during this academic stage of students (Guo, 2020). This need for competition responds to the different demands that adolescents perceive in adult life (Pascoe et al., 2020). Thirdly, one should analyze the institutional emphasis that educational centers place on the development of competencies for life with different objectives, which are visualized and concretized in their mission and vision. In this sense, there are two big and interesting ideas when analyzing the purpose of education, one is related to preparing people to be productive and efficient in life and the other has to do with preparing them to manage their happiness and well-being (Alam, 2022). Considering that the Sustainable Development Goals (SDGs) and the 2030 Agenda propose to emphasize quality education, health, and well-being it is necessary to consider the development of transversal skills for self-management in life (English and Carlsen, 2019; Webb et al., 2019). At this point, it becomes imperative and necessary to reflect on how to move toward the transformation of education to play a leading role that contributes to resilient and sustainable happiness and development of well-being for all, this would reflect an innovative perspective that reinvigorates education and shapes the learning priorities of the 21st century (Malik, 2018), and therefore it would be necessary to consider the development of cognitive and emotional regulation to consolidate progress toward the challenge of quality in education (Parinussa et al., 2023).

In summary, whatever possible explanation is discussed regarding SRL levels in secondary school, it can be concluded that SRL does not increase as a natural consequence of human development; rather, it is learned and cultivated intentionally. Furthermore, from the results of this study and previous research, it is also concluded that SRL levels are lower than expected in order to adequately adjust to college.

4.3. Reflections on SRL and quality of education

The promotion of SRL in the school environment becomes relevant because it is associated with better academic experiences

and outcomes, as well as with the general well-being of students (Rodríguez et al., 2022; Sverdlík et al., 2022). From this perspective, SRL can contribute to the reduction of existing gaps by equipping students with a key competency for their successful academic performance, thus increasing the possibilities of access to opportunities and professional academic training, which consequently favors the quality of education. This is supported by accumulated evidence, which has shown that beyond the sociodemographic variables which may describe situations of vulnerability in schools, those students who are self-regulated, achieve control of their study and learning process, advancing with determination toward the achievement of their personal and academic goals (Sáez-Delgado et al., 2021, 2022).

Therefore, the findings of this research on SRL in secondary school students contribute to the challenge promoted by the 2030 Agenda for Sustainable Development (English and Carlsen, 2019; Webb et al., 2019). That is, they are a valuable input for reflection and the elaboration of proposals that contribute positively to the academic formation of SRL strategies in secondary school students in Chile, this will allow ensuring a subsequent transition and successful adjustment to Higher Education. It is necessary to intend the development of self-regulatory competence of students in the pre-university stage, given the challenging contexts of academic demands typical of tertiary education where students must potentially face heavier academic workloads, practices or processes of stricter teaching-learning and with less guidance or supervision by teachers (Liu et al., 2021). Thus, the development of the ARA in secondary education will facilitate permanence or retention, avoid failure and academic dropout, especially in the first academic semesters at the university.

4.4. Limitations of the study and future lines of research

The results of this study need to be put in context and consider some limitations for their generalization. The first limitation of this study comes from the measurement of SRL, which consists of a self-report instrument, which could reveal some biases in the responses of the students who participated in the study, due to social desirability (Bensch et al., 2019; Vésteinsdóttir et al., 2019). Another limitation is regarding the data collection dates, corresponding to the first and second semesters of 2022, which coincide with the first academic year in Chile of return to face-to-face classes after physical isolation as a result of the COVID-19 pandemic. Therefore, it is necessary to consider that students could have a decrease in their SRL skills due to their previous learning experience in emergency remote teaching modality.

Regarding future lines of research, it is necessary that the SRL is intentionally pursued in the pre-university stage, that is, in secondary education. Ideally, it should become a specific learning outcome integrated into the subjects, to ensure that everyone who has passed this educational level goes on to higher education with a level of competence that facilitates their proper transition to a new academic context full of new challenges. For this reason, a study with a quasi-experimental design that is implemented in secondary education grades would be necessary to obtain a deep

understanding of how SRL develops through interventions that push students toward the adoption of different self-regulation strategies to achieve their study goals (Lluch and Cano, 2023). An important challenge would also be to be able to define an expected sequence of different levels of SRL that is developed and demonstrated as they progress through the different grades of secondary education, thus promoting progressively greater autonomy and control of their learning process in students (Lluch and Cano, 2023). This would respond to a knowledge gap regarding how students' SRL profiles develop over time in both secondary education and university (Li et al., 2020). The authorities of secondary schools are encouraged to consider among their strategies to advance toward the quality of education, the promotion of SRL in their centers (Obianujo, 2023). This promotion of ARA is a complex, dynamic and non-linear process that is likely to continue throughout the school and academic years, and should not be focused on a single experience. Therefore, the adoption of a perspective that is adapted to the multifactorial and long-term nature of self-regulatory capacities is required. Having a solid strategy to facilitate ARA in secondary education would avoid the development of compensatory or remedial interventions in the first years of university that may not be effective, thus, ecological interventions would contribute to a sustainable and quality education, leading to experiences and more successful academic trajectories that allow avoiding phenomena such as failure or dropout (Mustapha et al., 2023; Pogorskiy and Beckmann, 2023).

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Comité Ético Científico de la Universidad Católica de la Santísima Concepción, Concepción, Chile. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

References

- Adigüzel, A., and Orhan, A. (2017). The relation between english learning students' levels of self-regulation and metacognitive skills and their english academic achievements. *J. Educ. Pract.* 8, 115–125. Available at: <https://files.eric.ed.gov/fulltext/EJ1138845.pdf>
- Alam, A. (2022). Investigating sustainable education and positive psychology interventions in schools towards achievement of sustainable happiness and wellbeing for 21st Century pedagogy and curriculum. *ECS Trans.* 107, 19481–19494. doi: 10.1149/10701.19481ecst
- Anazifa, R., Limiansi, K., and Pratama, A. (2023). Students' self-regulated learning based on gender and disciplinary differences during online learning. *J. Sci. Educ. Res.* 7, 39–45. doi: 10.21831/jserv.711.58174
- Anthony, L., Koo, A., and Hew, S. (2020a). Self-regulated learning strategies and non-academic outcomes in higher education blended learning environments: a one decade review. *Educ. Inf. Technol.* 25, 3677–3704. doi: 10.1007/s10639-020-10134-2

Author contributions

FS-D contributed to the literature, abstract, and full-text review, as well as the data extraction, the data analysis, and the writing of the manuscript. JM-N contributed to well as the data extraction, the data analysis of the study, the interpretation of the results, and the writing of the manuscript. YL-A contributed to the design of the study, abstract, full-text review, interpretation of the results, and the writing of the manuscript. VL-R and YS contributed to the interpretation of the results, the writing of the manuscript, and full-text review. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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- Anthony, L., Koo, A., and Hew, S. (2020b). Self-regulated learning strategies in higher education: fostering digital literacy for sustainable lifelong learning. *Educ. Inf. Technol.* 25, 2393–2414. doi: 10.1007/s10639-020-10201-8
- Ardura, D., Zamora, A., and Pérez-Bitrián, A. (2021). The role of motivation on secondary school students' causal attributions to choose or abandon chemistry. *Chem. Educ. Res. Pract.* 22, 43–61. doi: 10.1039/d0rp00168f
- Bai, B., Shen, B., and Mei, H. (2020). Hong Kong primary students' self-regulated writing strategy use: influences of gender, writing proficiency, and grade level. *Stud. Educ. Eval.* 65:100839. doi: 10.1016/j.stueduc.2020.100839
- Bai, B., and Wang, J. (2021). Hong Kong secondary students' self-regulated learning strategy use and English writing: influences of motivational beliefs. *System* 96, 102404–102444. doi: 10.1016/j.system.2020.102404
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organ. Behav. Hum. Decis. Process.* 50, 248–287. doi: 10.1016/0749-5978(91)90022-L

- Bandura, A. (1999). Social cognitive theory: an agentic Albert Bandura. *Asian J. Soc. Psychol.* 2, 21–41. doi: 10.1111/1467-839X.00024
- Barbosa, J., Ferreira, M. A., Severo, M., and Severo, M. (2018). Do reciprocal relationships between academic workload and self-regulated learning predict medical freshmen's achievement? A longitudinal study on the educational transition from secondary school to medical school. *Adv. Heal. Sci. Educ.* 23, 733–748. doi: 10.1007/s10459-018-9825-2
- Ben-Eliyahu, A., and Linnenbrink-Garcia, L. (2015). Integrating the regulation of affect, behavior, and cognition into self-regulated learning paradigms among secondary and post-secondary students. *Metacognition Learn.* 10, 15–42. doi: 10.1007/s11409-014-9129-8
- Bensch, D., Paulhus, D. L., Stankov, L., and Ziegler, M. (2019). Teasing apart overclaiming, overconfidence, and socially desirable responding. *Assessment* 26, 351–363. doi: 10.1177/1073191117700268
- Blackmore, C., Vitali, J., Ainscough, L., Langfield, T., and Colthorpe, K. (2021). A review of self-regulated learning and self-efficacy: the key to tertiary transition in science, technology, engineering and mathematics (STEM). *Int. J. High Educ.* 10, 169–177. doi: 10.5430/ijhe.v10n3p169
- Boekaerts, M., and Niemivirta, M. (2000). Self-regulated learning: Finding a balance between learning goals and ego-protective goals. In *Handbook of self-regulation*. Academic Press. 417–450. doi: 10.1016/B978-012109890-2/50042-1
- Borno State University, Maiduguri-Nigeria Mustapha, A. M., Zakaria, A. Z. M., Yahaya, N., Abuhassna, H., et al. (2023). Students' motivation and effective use of self-regulated learning on learning management system moodle environment in higher learning institution in Nigeria. *Int. J. Inf. Educ. Technol.* 13, 195–202. doi: 10.18178/ijiet.2023.13.1.1796
- Caprara, G., Fida, R., Vecchione, M., del Bove, G., Vecchio, G. M., Barbaranelli, C., et al. (2008). Longitudinal analysis of the role of perceived self-efficacy for self-regulated learning in academic continuance and achievement. *J. Educ. Psychol.* 100, 525–534. doi: 10.1037/0022-0663.100.3.525
- Chen, J., Lin, C. H., Chen, G., and Fu, H. (2023). Individual differences in self-regulated learning profiles of Chinese EFL readers: a sequential explanatory mixed-methods study. *Stud. Second. Lang. Acquis.* 1, 1–24. doi: 10.1017/s0272263122000584
- de la Fuente, J., Martínez-Vicente, J. M., Santos, F. H., Sander, P., Fadda, S., Karagiannopoulou, A., et al. (2022). Advances on self-regulation models: a new research agenda through the SR vs ER behavior theory in different psychology contexts. *Front. Psychol.* 13, 1–16. doi: 10.3389/fpsyg.2022.861493
- Dignath, C., and Büttner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition Learn.* 3, 231–264. doi: 10.1007/s11409-008-9029-x
- Dörrenbächer, L., and Perels, F. (2016). Self-regulated learning profiles in college students: their relationship to achievement, personality, and the effectiveness of an intervention to foster self-regulated learning. *Learn. Individ. Differ.* 51, 229–241. doi: 10.1016/j.lindif.2016.09.015
- Efklides, A. (2011). Interactions of metacognition with motivation and affect in self-regulated learning: the MASRL model. *Educ. Psychol.* 46, 6–25. doi: 10.1080/00461520.2011.538645
- English, L., and Carlsen, A. (2019). Lifelong learning and the sustainable development goals (SDGs): probing the implications and the effects. *Int. Rev. Educ.* 65, 205–211. doi: 10.1007/s11159-019-09773-6
- Espada, M., Navia, J. A., Roca, P., and Gómez-López, M. (2020). Development of the learning to learn competence in the university context: flipped classroom or traditional method? *Res. Learn. Technol.* 28, 1–11. doi: 10.25304/rlt.v28.2251
- Guo, W. (2020). Grade-level differences in teacher feedback and students' self-regulated learning. *Front. Psychol.* 11, 1–17. doi: 10.3389/fpsyg.2020.00783
- Halili, S., and Zainuddin, Z. (2015). Academic procrastination among secondary school students: exploring the role of smartphone addiction. A mixed method approach. *J. Distance Educ. e-Learn.* 9, 334–340. Available at: <https://www.tojst.net/journals/tojdel/volumes/tojdel-volume09-103.pdf#page=8>
- Hensley, L., Sayers, R., Brady, A., and Cutshall, J. (2021). Supporting autonomy, competence, and relatedness in a learning-to-learn course: college students' insights into effective instruction. *Teach. Psychol.* 48, 236–247. doi: 10.1177/0098628320977270
- Higgins, N., Rathner, J., and Frankland, S. (2021). Development of self-regulated learning: a longitudinal study on academic performance in undergraduate science. *Res. Sci. Technol. Educ.* 1, 1–25. doi: 10.1080/02635143.2021.1997978
- Holzer, J., Lüftenegger, M., Korlat, S., Pelikan, E., Salmela-Aro, K., Spiel, C., et al. (2021). Higher education in times of COVID-19: university students' basic need satisfaction, self-regulated learning, and well-being. *AERA Open*. 7:110031. doi: 10.1177/23328584211003164
- Jeong, S., and Feldon, D. (2023). Changes in self-regulated learning profiles during an undergraduate peer-based intervention: a latent profile transition analysis. *Learn. Instr.* 83, 101710–101713. doi: 10.1016/j.learninstruc.2022.101710
- Karademir, C., and Deveci, O. (2019). Secondary school students' (11–14 years) effective input characteristics for mathematics, self-regulation skills and self-esteem. *Eur. J. Educ. Stud.* 5, 264–287. doi: 10.5281/zenodo.2558418
- Lawanto, O., Butler, D., Cartier, S., Santoso, H., Lawanto, K., and Clark, D. (2013). An exploratory study of self-regulated learning strategies in a design project by students in grades 9–12. *Des. Technol. Educ.* 18:4457. Available at: <https://files.eric.ed.gov/fulltext/EJ1007162.pdf>
- Li, S., Chen, G., Xing, W., Zheng, J., and Xie, C. (2020). Longitudinal clustering of students' self-regulated learning behaviors in engineering design. *Comput. Educ.* 153, 103899–103813. doi: 10.1016/j.compedu.2020.103899
- Lim, L., Bannert, M., van der Graaf, J., Singh, S., Fan, Y., Surendranair, S., et al. (2023). Effects of real-time analytics-based personalized scaffolds on students' self-regulated learning. *Comput. Hum. Behav.* 139, 107547–107518. doi: 10.1016/j.chb.2022.107547
- Liu, X., He, W., Zhao, L., and Hong, J. C. (2021). Gender differences in self-regulated online learning during the COVID-19 lockdown. *Front. Psychol.* 12, 1–8. doi: 10.3389/fpsyg.2021.752131
- Lluch, L., and Cano, E. (2023). How to embed SRL in online learning settings? Design through learning analytics and personalized learning design in moodle. *J. New Approach. Educ. Res.* 12:120. doi: 10.7821/naer.2023.1.1127
- Lobos, K., Sáez-Delgado, F., Bruna, D., Cobo-Rendon, R., and Díaz-Mujica, A. (2021). Design, validity and effect of an intra-curricular program for facilitating self-regulation of learning competences in university students with the support of the 4planning app. *Educ. Sci.* 11, 1–16. doi: 10.3390/educsci11080449
- López-Angulo, Y., Sáez-Delgado, F., Mella-Norambuena, J., Bernardo, A. B., and Díaz-Mujica, A. (2023). Predictive model of the dropout intention of Chilean university students. *Front. Psychol.* 13, 1–17. doi: 10.3389/fpsyg.2022.893894
- Malik, R. (2018). Educational challenges in 21st century and sustainable development. *J. Sust. Dev. Educ. Res.* 2:17509. doi: 10.17509/jsderv.21i.12266
- Mella-Norambuena, J., Badilla-Quintana, M., and Lopez Angulo, Y. (2021). Predictive models based on the use of learning analytics in higher education: a systematic review. *Texto Livre*. 15, 1–22. doi: 10.35699/1983-3652.2022.36310
- Mustapha, A., Zakaria, M., Yahaya, N., Abuhassna, H., Mamman, B., and Isa, A., et al. (2023). Students motivation and effective use of self-regulated learning on learning management system moodle environment in higher learning institution in Nigeria. *Int. J. Inf. Educ. Technol.* 13, 195–202. doi: 10.18178/ijiet.2023.13.1.1796
- Ngunu, S., Kinai, T., Ndambuki, P., and Mwaura, P. (2019). Causal attributions as correlates of secondary school students' academic achievement. *Educ. Res. Int.* 2019, 1–7. doi: 10.1155/2019/1950753
- Obianujo, A. (2023). The relationship between self-regulated learning and students' learning outcomes in physics. *Sapientia Found J. Educ. Sci. Gen. Stud.* 5, 401–412. Available at: <http://sfjesgs.com/index.php/SFJESGS/article/view/397/397>
- Pardo, A., Han, F., and Ellis, R. (2017). Combining university student self-regulated learning indicators and engagement with online learning events to predict academic performance. *IEEE Trans. Learn. Technol.* 10, 82–92. doi: 10.1109/TLT.2016.2639508
- Parinussa, J., Taryana, T., Ningtyas, A. A., Rachman, R. S., and Tannady, H. (2023). Developing student emotional intelligence by involving the active role of teacher. *J. Educ.* 5, 8528–8533. doi: 10.31004/joe.v5i3.1638
- Pascoe, M., Hetrick, S., and Parker, A. (2020). The impact of stress on students in secondary school and higher education. *Int. J. Adolesc. Youth* 25, 104–112. doi: 10.1080/02673843.2019.1596823
- Pintrich, P. (2000). Multiple goals, multiple pathways: the role of goal orientation in learning and achievement. *J. Educ. Psychol.* 92, 544–555. doi: 10.1037/0022-0663.92.3.544
- Pogorskiy, E., and Beckmann, J. (2023). From procrastination to engagement? An experimental exploration of the effects of an adaptive virtual assistant on self-regulation in online learning. *Comp. Educ. Artif. Intell.* 4, 100111–100120. doi: 10.1016/j.caeai.2022.100111
- Rodríguez, S., González-Suárez, R., Vieites, T., Piñeiro, I., and Díaz-Freire, F. M. (2022). Self-regulation and students' well-being: a systematic review 2010–2020. *Sustainability* 14, 1–26. doi: 10.3390/su14042346
- Sáez, F., Bustos, C., Pérez, M. V., Mella, J. A., Lobos, K. A., and Díaz, A. E. (2018). Disposición al estudio, autoeficacia y atribuciones causales en estudiantes universitarios chilenos. *Propósitos y Represent.* 6, 1–18. doi: 10.20511/pyr2018.v6n1.179
- Sáez, F., Díaz, A., Panadero, E., and Bruna, D. V. (2018). Revisión sistemática sobre competencias de autorregulación del aprendizaje en estudiantes universitarios y programas intracurriculares para su promoción. *Form Univ.* 11, 83–98. doi: 10.4067/s0718-50062018000600083
- Sáez-Delgado, F., Díaz-Mujica, A. E., Bustos, C. E., and Pérez-Villalobos, M. V. (2020). Impacto de un programa intracurricular sobre la disposición al estudio en universitarios. *Form Univ.* 13, 101–110. doi: 10.4067/S0718-50062020000400101
- Sáez-Delgado, F., López-Angulo, Y., Mella-Norambuena, J., Baeza-Sepúlveda, C., Contreras-Saavedra, C., and Lozano-Peña, G. (2022). Teacher self-regulation and its relationship with student self-regulation in secondary education. *Sustainability* 14, 1–22. doi: 10.3390/su142416863
- Sáez-Delgado, F., Mella-Norambuena, J., López-Angulo, Y., Olea-González, C., García-Vásquez, H., and Porter, B. (2021). Association between self-regulation of learning, forced labor insertion, technological barriers, and dropout intention in Chile. *Front. Educ.* 6, 1–10. doi: 10.3389/feduc.2021.801865

- Schuitema, J., Peetsma, T., and van der Veen, I. (2012). Self-regulated learning and students' perceptions of innovative and traditional learning environments: a longitudinal study in secondary education. *Educ. Stud.* 38, 397–413. doi: 10.1080/03055698.2011.643105
- Šteh, B., and Šarić, M. (2020). Enhancing self-regulated learning in higher education. *Rev za Elem Izobr.* 13, 129–150. doi: 10.18690/rei.13.special.129-150.2020
- Sulisworo, D., Fitrianiawati, M., Maryani, I., Hidayat, S., Agusta, E., and Saputri, W. (2020). Students' self-regulated learning (SRL) profile dataset measured during Covid-19 mitigation in Yogyakarta Indonesia. *Data Br.* 33:106422. doi: 10.1016/j.dib.2020.106422
- Sverdlik, A., Rahimi, S., and Vallerand, R. (2022). Examining the role of passion in university students' academic emotions, self-regulated learning and well-being. *J. Adult Contin Educ.* 28, 426–448. doi: 10.1177/14779714211037359
- Theobald, M. (2021). Self-regulated learning training programs enhance university students' academic performance, self-regulated learning strategies, and motivation: a meta-analysis. *Contemp. Educ. Psychol.* 66, 101976–101913. doi: 10.1016/j.cedpsych.2021.101976
- Torrano, F., and Soria, M. (2017). Diferencias de género y aprendizaje autorregulado: el efecto del rendimiento académico previo. *Rev. Comp. Educ.* 28, 1027–1042. doi: 10.5209/RCED.51096
- van der Veen, I., and Peetsma, T. (2009). The development in self-regulated learning behaviour of first-year students in the lowest level of secondary school in the Netherlands. *Learn. Individ. Differ.* 19, 34–46. doi: 10.1016/j.lindif.2008.03.001
- Verstege, S., Pijera-Díaz, H., Noroozi, O., Biemans, H., and Thorsdottir, F. (2019). Relations between students' perceived levels of self-regulation and their corresponding learning behavior and outcomes in a virtual experiment environment. *Comput. Hum. Behav.* 100, 325–334. doi: 10.1016/j.chb.2019.02.020
- Vésteinsdóttir, V., Joinson, A., Reips, U. D., Danielsdottir, H. B., Thorarinsdottir, E. A., and Thorsdottir, F. (2019). Questions on honest responding. *Behav. Res. Methods* 51, 811–825. doi: 10.3758/s13428-018-1121-9
- Vosniadou, S. (2020). Bridging secondary and higher education. The importance of self-regulated learning. *Euro. Rev.* 28, S94–S103. doi: 10.1017/S1062798720000939
- Webb, S., Holford, J., Hodge, S., Milana, M., and Waller, R. (2019). Conceptualising lifelong learning for sustainable development and education 2030. *Int. J. Lifelong Educ.* 38, 237–240. doi: 10.1080/02601370.2019.1635353
- Winne, P., and Hadwin, A. (1998). "Studying as self-regulated learning" in *Metacognition in Educational Theory and Practice*. eds. P. H. Winne and A. F. Hadwin (London: Routledge)
- Wu, J., and Cheng, T. (2019). Who is better adapted in learning online within the personal learning environment? Relating gender differences in cognitive attention networks to digital distraction. *Comput. Educ.* 128, 312–329. doi: 10.1016/j.compedu.2018.08.016
- Xu, K., Cunha-Harvey, A. R., King, R. B., de Koning, B. B., Paas, F., Baars, M., et al. (2023). A cross-cultural investigation on perseverance, self-regulated learning, motivation, and achievement. *Comp. A. J. Comp. Int. Educ.* 53, 361–379. doi: 10.1080/03057925.2021.1922270
- Yerdelen, S., McCaffrey, A., and Klassen, R. (2016). Longitudinal examination of procrastination and anxiety, and their relation to self-efficacy for self-regulated learning: latent growth curve modeling. *Educ. Sci. Theory Pract.* 16, 5–22. doi: 10.12738/estp.2016.1.0108
- Zimmerman, B. (2000). "Attaining self-regulation a social cognitive perspective" in *Handbook of self-regulation*. eds. M. Boekaerts, P. Pintrich and M. Zeidner (San Diego: American Psychological Association)



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Assessing higher education students' critical thinking with the PENCRIAL test - Portuguese short version: a psychometric study

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The development of critical thinking in higher education is fundamental, preparing students to think well, find explanations, make decisions and solve problems. Given the importance of its promotion, its assessment is crucial, since the two are inseparable. Moreover, the number of instruments that are validated to assess critical thinking in the Portuguese language and culture are scarce. We present the validation psychometric study of the PENCRIAL test (short version) to the Portuguese language, a critical thinking assessment test for higher education students, designed and validated in Spain (full and short version), which presents adequate reliability and validity psychometric characteristics to assess key-dimensions of critical thinking. A sample of 225 Portuguese higher education students from three universities (two public and one private) performed a reduced version of the PANCRIAL test. The results obtained allowed replicating the Spanish reduced version in Portugal (only changing one of the six items), and the confirmatory factorial analysis permits to identify two factors intercorrelated, legitimizing the combination of the six items in a global score. This short version can be used as a screening test, and its potential is pointed out to assess students critical thinking to support teaching and research in higher education.

KEYWORDS

critical thinking, reasoning, decision making, problem solving, higher education, assessment, transversal competences

1. Introduction

Critical Thinking (CT) tends to be considered an elusive construct, given the diversity of meanings that are recognized for it in different areas (Davies, 2015). Even so, CT can be defined as a higher form of thinking that includes skills, dispositions, thinking criteria and a knowledge base, and that is useful in a diversity of life spheres, for 'thinking well', finding explanations, making decisions and solving problems (Franco et al., 2017c). Two core facets of CT – cognition and disposition – are found in this definition, which combine and materialize in its eminently applied character and its relevance today (Saiz, 2020).

Although CT is pointed out as transversally relevant in the various spheres of individuals' lives, we will focus on the academic life sphere. Regardless of the year and subject area, CT is considered to be particularly important in the context of Higher Education. This is because it is precisely at this stage of psychosocial development and culmination of academic training

(without considering the compelling need for lifelong learning that is now imperative) and preparation for the world – of work, of course, but also of life in society – that student-individuals are expected to prove capable of thinking critically about the diversity of information, issues, and decisions required (Franco et al., 2015; Halpern and Dunn, 2021, 2023).

The relevance of CT is widely recognised by Higher Education Institutions, both nationally and internationally, which identify the fostering of critical thinkers as one of their *raison d'être* (Davies, 2015; Hauke, 2019). Nevertheless, in such a purpose of CT development, it is important to consider two dimensions associated to it: its promotion and assessment. In fact, if the aim is to trigger the development of university students' CT, it is unavoidable to dedicate time and space to its promotion – either directly, with the students themselves, and usually by infusion, in the context of curricular units; or indirectly, with their teachers, in the framework of continuing education (Franco et al., 2018b). Simultaneously, it is equally inescapable to dedicate space and time to its assessment – namely of the impact caused by the intervention for the promotion of CT (Halpern, 2016). However, the importance of CT assessment is more comprehensive. The design and construction of instruments that allow measuring the expression of students' CT skills and dispositions, as well as their relationship with other areas of these individuals' daily lives that go beyond the academic one, open up endless possibilities in the field of cognitive assessment and personal and social well-being (Franco and Almeida, 2015; Franco et al., 2017a,b, 2018a; Franco and Saiz, 2020). Thus, in the context of Higher Education, the assessment of the students' CT serves the possibility of making pedagogical decisions that are better adjusted to the characteristics of the students and better guide them in their learning.

Given its relevance, in this article we will focus on the dimension of the students' CT assessment in the specific context of Higher Education. There is a diversity of instruments to enable the assessment of CT (cf. Phan, 2010; Franco and Almeida, 2017). However, most of these instruments were created in the USA and were neither translated, adapted and validated for the Portuguese population – or for Portuguese-speakers –, nor thought of and designed for this culture and language. Given the absence of a reliable and validated test to assess the CT of Portuguese-speaking individuals (we refer not only to citizens of Portugal, but also to Brazilians and those from African Countries speaking Portuguese), from which data may emerge that may be compared to data from the assessment of CT in other countries, we carried out a study of the translation, adaptation and validation of the CT assessment test named PENCRISAL, starting with a Portuguese sample.

The PENCRISAL test was constructed by Rivas and Saiz (2012), teacher-researchers at the University of Salamanca in Spain. This complete version of the test was validated in a sample of more than 700 participants. Using various subsamples, several item analyses were performed that were grouped into the dimensions corresponding to the proposed model and confirmed in the construct validity. An important fact that should be noted is the good convergent validity obtained with the Cornell test of critical thinking (cf. Rivas and Saiz, 2012). On the other hand, given the geographical, linguistic, and cultural proximity between Spain and Portugal, but especially given the robustness of the theoretical framework that underlies it and its empirical validity, the authors proposed to conduct the translation, adaptation and validation study of the PENCRISAL test – in its short

version – for Portuguese university students, so that it can be used in the development and promotion of CT among this population. More specifically, in this study we are considering a short version of the Spanish version of the test, validated before the Portuguese version and with the same number of items in both versions (Saiz et al., 2021). Original Spanish short version is formed by six items with adequate levels of reliability and validity coefficients. A sample of 340 university students from University of Salamanca was considered for its internal validation, and two factors (general reasoning and practical reasoning) have been obtained, each with 3 items. These two factors represent important dimensions on CT definition and being high correlated ($r=0.677$) allows to consider a global score on test (Saiz et al., 2021). In this adaptation and validation for Portuguese university students, we started with the application of 20 items from the longer version of the test where the six items of Spanish reduced version are included. With this large number of items we were interested in supporting the eventual replacement of some items from Spanish version based in the analysis of scores distribution per item. A shortened or screening version allows a faster and large-scale assessment of students in classes and at the same time permits to include other variables in the assessment protocol in function of research and professional practice purposes. In any case, it's important to assure that relevant dimensions of critical thinking are assessed and in reliability way.

2. Methods

2.1. Participants

A total of 225 higher education students took a reduced version of PENCRISAL test, aged between 17 and 47 years old ($M=22.88$, $SD=5.47$). Most of them were female (77.8%) and 51.6% were studying for a Bachelor's degree, 43.6% for a Master's degree, or 4.9% for a Ph.D. Students from three Portuguese universities (two public and one private) were considered: University of Aveiro (64.4%), University of Minho (25.3%) and Portuguese Catholic University (10.2%). This convenience sample answered the test between 2018 and 2020.

2.2. Procedures

After the identification of the PENCRISAL test, originally validated in Spain (Rivas and Saiz, 2012) and subsequently in Peru (Rivas et al., 2014), contact was made to the authors, within the framework of previous collaboration in a research project, in order to proceed with the request for its translation, adaptation, and validation for higher education students in Portugal and Portuguese speakers.

Once the authorisation was obtained, the linguistic and cultural translation of the test into the Portuguese language and culture was carried out, following recommendations in the literature in this area (Regmi et al., 2010; Borsa et al., 2012; Polit and Beck, 2014; International Test Commission, 2017) and that can be found in publications on this type of work of translation, adaptation, and validation of psychological tests (e.g., Pechorro et al., 2019; Barros and Ribeiro, 2022; Pino et al., 2022). The translation was carried out by a Portuguese researcher and a Portuguese teacher-researcher proficient in the Spanish language, and the revision of the translation was carried

out by the authors of the original version of the PENCRIASAL test and, additionally, by a Spanish researcher proficient in the Portuguese language. Along with the linguistic translation, the cultural translation of the instrument implied the slight adaptation of certain items, which were too strongly bound to Spanish culture, so as to be familiar to Portuguese culture and language. An example of this is item 7, which originally referred to a Brazilian woman who had moved to Spain to “give her children a better future” and which, in the Portuguese version, now refers to a Ukrainian woman who had moved to Portugal, for the same reasons as in the original item.

After the linguistic translation, and despite the cultural adaptation of the items, it was found that a group of items might not be familiar in the Portuguese culture. Consequently, by inter-judge agreement (namely the authors of the original instrument and the researcher and the teacher-researcher who intended to validate the test for Portuguese-speaking higher education students), it was decided to retain a set of 20 items from the original version of the PENCRIASAL test, as they were the most representative of each factor/dimension and, simultaneously, the most appropriate to the Portuguese culture. This reduced version includes the six items of short Spanish version to be validated in Portugal. In function of scores distribution per item this large number allows us to replace any items with low variance. The preliminary Portuguese short version of the PENCRIASAL test was presented to students from two Portuguese public universities and one private university, through contact made to their professors. Each student was invited to participate in the study and complete the test on an online platform, after giving informed consent.

2.3. Instrument

In its original extended version, the PENCRIASAL test (Rivas and Saiz, 2012) has 35 open-ended items that describe problem-situations, and the respondent is asked to prepare a response explaining what she/he would decide in a given situation or how she/he would solve that situation. This test assesses a set of five dimensions of CT: deductive reasoning/deduction, inductive reasoning/induction, practical reasoning/argumentation, decision-making, and problem-solving. Each of the five dimensions is assessed from a total of seven items each. In this full version of the test, an exploratory factor analysis was performed with one of the subsamples. Based on the data obtained, a confirmatory factor analysis was performed with another subsample (cf. Rivas and Saiz, 2012). The validation of the short test presented in this work is based on these data. More detailed information on the identified CT dimensions can be found in Rivas and Saiz (2012) and Saiz and Rivas (2008).

The administration of the PENCRIASAL test is carried out through an online platform with internet connection, which each respondent accesses (in a single session or, as recommended, in several sessions) by entering a unique access password, created on the basis of her/his student ID number. Although no time limit is given for the PENCRIASAL test, the total time taken varies between 60 and 90 min.

As far as their scores are concerned, 0, 1 or 2 points are awarded for each open answer provided by the respondent, depending on whether the answer is less or more precise/complete, respectively. Specifically, 0 points are awarded for an answer that is incorrectly resolved, 1 point for an answer that is correctly resolved but they lack justification or explanation of why they respond that way, and 2 points

for an answer that is correctly resolved and it presents a justification or explanation of why they respond that way. In the total score, the possible range of the PENCRIASAL test varies between 0 and 70 points, and this value varies between 0 and 14 points in each of the five dimensions assessed by the instrument.

A shortened version of PENCRIASAL exists for Spanish students. This version consists of six items, three assessing general reasoning and the other three assess practical reasoning, understood as two relevant dimensions in the definition of critical thinking (Saiz et al., 2021). In this study a version of 20 items was applied (four items per dimension), where those six items of Spanish reduced version have been intentionally included.

3. Results

Before testing factor structure of six items from short Spanish version, an exploratory analysis of the data was conducted to appreciate the variance or dispersion of students scores in each item. This analysis showed that in several items the students did not answer correctly, even partially, and obtain zero points. After that, it was necessary to replace item 3 (practical reasoning/argumentation) from Spanish short version since it did not show enough variation among the Portuguese students. Based on this descriptive analysis, the item 15 (general problem solving) was chosen to replace item 3 (practical reasoning/argumentation). On Table 1 the six items of Spanish and Portuguese version to be tested are present. As we can see, the three items of *general reasoning factor* are the same in both versions, and in *problem-solving and practical reasoning factor* the item 03 (practical reasoning) in Spanish version was substituted by item 15 (general problem solving) in Portuguese version.

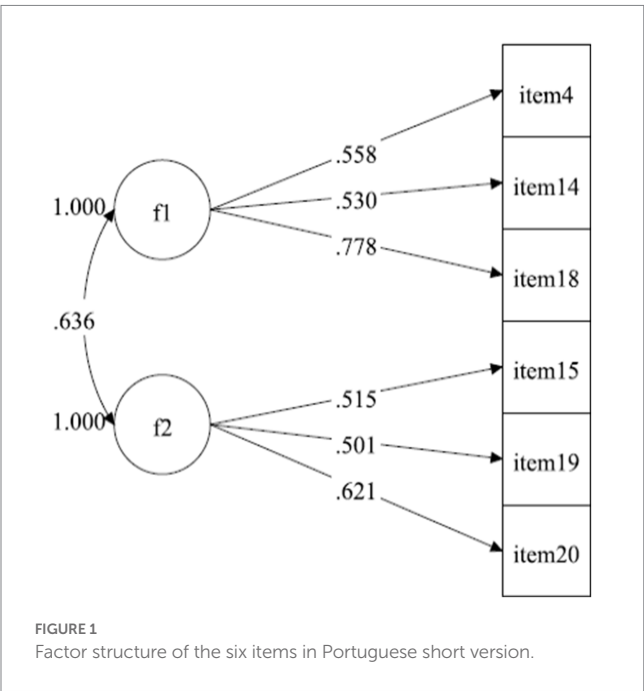
On the one hand, factor 1, with three items, incorporating items 4, 14, and 18, related to the general reasoning dimension; on the other hand, factor 2, also with three items, including items 15, 19, and 20, related to the problem-solving and practical reasoning/argumentation dimension (cf. Table 1); and item comparison table in all versions in: <https://www.pensamiento-critico.com/archivos/tableitems6EN.pdf> it should be noted that the difference between the Spanish and the Portuguese short versions lies in one item. Item 15 (captured by the Portuguese version) refers to problem-solving, whereas item 3 (captured by the Spanish version) refers to propositional reasoning.

TABLE 1 Items in Spanish short version and in Portuguese version to be tested.

	Factor 1: <i>General reasoning</i> (3 items)	Factor 2: <i>Problem-solving and practical reasoning</i> (3 items)
Portuguese version	Item 04 - Propositional Reasoning Item 14 - Analogical Reasoning Item 18 - Practical Reasoning/Argumentation	Item 15 - General Problem Solving Item 19 - Fallacy Item 20 - Fallacy
Spanish version	Item 04 - Propositional Reasoning Item 14 - Analogical Reasoning Item 18 - Practical Reasoning/Argumentation	Item 03 - Practical Reasoning/Argumentation Item 19 - Fallacy Item 20 - Fallacy

In bold, the only divergence in data between the two versions.

The difference between both CT dimensions may seem clear, although it is not necessarily so. Item 15, referring to problem-solving, involves general problem-solving strategies, not specific strategies. It is important to note here that all items in the PENCRIASAL test concern everyday problems, so that in each one it is necessary to solve the situation in a differentiated way. In situations related to reasoning, as in item 3 of the Spanish version, a conclusion must be reached, which inevitably represents a decision or a solution offered to the problem at hand. There is an equivalence between conclusion, decision, and solution, which sometimes eludes the individual's understanding, who does not always see or understand it (Saiz, 2020). For this reason, although items 3 and 15 belong to distinct CT dimensions, item 15 – of general problem-solving – resembles item 3 by the fact that both translate general forms of problem-solving. However, the fact that no coincidence was detected between the two short versions of the PENCRIASAL test in these items may result from some difference between the two populations (Portuguese and Spanish). In any case, the similarity of the format of the items – presented as everyday problems – may have led both items to be perceived as being of the same type, given their content.



After this change in one item, and maintaining basically the same test version, we performed confirmatory factor analysis (CFA), testing the model of two correlated factors already validated in the Spanish population (cf. Saiz et al., 2021). For CFA, the programme M-Plus (v. 8.6, Muthén and Muthén, 2019) was used due to the essentially ordinal nature of the items (even ranging between 0 and 2 points), the estimators used in the CFA were the mean and the weighted least-square means and variances (WLSMV). The indexes taken to determine the quality of the model fit were those recommended for this type of analysis in the literature: X-square (χ^2)/df < 3.0; Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) > 0.90; Root Mean-square Error of Approximation (RMSEA) < 0.08; and Standardized Root Mean Square Residual (SRMR) < 0.05 (MacCallum et al., 1996; Hu and Bentler, 1999; Kaplan, 2000). More specifically, the CFA performed revealed adequate fit indices: χ^2 /df = 7.01; CFI = 0.91; TLI = 0.90; RMSEA = 0.07; and SRMR = 0.039. Figure 1 shows the factor weights of the six items divided by the two factors isolated in the analysis.

As can be seen (cf. Figure 1), the six items captured in the Portuguese short version of the PENCRIASAL test are satisfactorily saturated in each factor (showing saturation indices between 0.501 and 0.778). As regards the correlation between the two emerging factors – General Reasoning and Problem-Solving and Practical Reasoning/Argumentation –, it shows a somewhat high value ($r = 0.636$), which means that both converge towards the more general construct assessment that we call CT. In this sense, it becomes legitimate to consider students' scores in each of the two factors, as well as their score by adding up the scores in both factors, as in Spanish version (correlation between two factors was 0.677). In Table 2 the loadings of six items in each factor are presented, showing values higher 0.40 in Spanish version and higher 0.50 in Portuguese version.

Considering the students' performance in the two factors separately and as a whole, the descriptive indices of the distribution of results were analysed, such as minimum and maximum values, mean and standard deviation, and also the skewness and kurtosis coefficients of the distribution (cf. Table 3).

The values obtained reveal that the students presented a lot of difficulties in the tests, as the score in each item varied between 0 and 2 points. For example, taking the set of six items, the maximum score would be 12.0 points, whereas the value in this sample was 8.0, and the average of the scores in the set of six items was only 3.28. High level of difficulty was also observed in both separate factors. It should

TABLE 2 Loadings of six items in each factor for both Spanish and Portuguese versions.

Items	Spanish version		Portuguese version	
	Factor 1	Factor 2	Factor 1	Factor 2
Item 04 - Propositional Reasoning	0.486		0.558	
Item 14 - Analogical Reasoning	0.473		0.530	
Item 18 - Practical Reasoning/Argumentation	0.551		0.778	
Item 03 - Practical Reasoning/Argumentation		0.473		–
Item 15 - General Problem Solving		–		0.515
Item 19 – Fallacy		0.437		0.501
Item 20 – Fallacy		0.487		0.621

TABLE 3 Distribution scores in the two factors and general factor.

Dimensions	Min.-Max.	Mean	SD	Skewness	Kurtosis
Factor 1	0.0–4.0	1.36	0.83	0.683	0.591
Factor 2	0.0–6.0	1.91	1.61	0.412	−0.806
General Factor	0.0–8.0	3.28	2.04	0.251	−0.769

be added that, even so, the values for skewness and kurtosis are lower than unity, which suggests a Gaussian distribution of the results, both in the two factors and in the general factor grouping the other two.

4. Discussion

Taking into account the objective of obtaining, from the PENCRIASAL test, a reduced version capable of being applied in a shorter period of time and in larger samples of students, we can point out that this objective was met. Through the CFA, it was possible to establish three items for two factors, which, as they are highly correlated, allow for the formation of a global score taking into account the six selected items.

Reflecting on the theoretical basis of the emergent factor structure, although this solution contains only six items (*cf.* Table 1), these retained items capture core CT skills related to inductive reasoning/induction, deductive reasoning/deduction, and practical reasoning (three of the five dimensions of the original short version of the PENCRIASAL test, explained above), which, when taken as a whole, illustrate the most representative CT skills. Let us analyse the nature of the items incorporated in each type of reasoning or factor in the short Portuguese version of the PENCRIASAL test.

With regard to General Reasoning (factor 1), the items that integrate it concern (i) propositional reasoning, (ii) analogical reasoning, and (iii) practical reasoning/argumentation (item 4, item 14, and item 18, respectively). In other words, the factor captures forms of inference present in everyday cognitive functioning, from the simplest (propositional reasoning), to the quite frequent ones used when the individual cannot be more precise in her/his reasoning (analogical reasoning), to the most complex ones (practical reasoning/argumentation; Saiz, 2020; Saiz et al., 2021). (i) With propositional reasoning, referring to deduction and explanation, the individual's objective is to test the hypotheses formulated, in order to find a plausible explanation for phenomena. Deduction is the only way to establish certain, non-provable conclusions, or, as logicians like to say, the only way to reach necessary truths. (ii) With analogical/causal reasoning, essentially referring to induction (by the nature of its conclusions, although referring to deduction by its structure), the individual's objective is to determine how robust a conclusion is, and to do so uses an analogy that facilitates the thinking process. Whenever we say 'it's as if...' or equivalent expressions, we are reasoning analogically. (iii) With practical reasoning/argumentation, the individual's objective is to organize the information available to her/him regarding a given topic, looking for reasons/assumptions that lead to the conclusion and support it, in order to make a diagnosis (*cf.* Saiz, 2020).

With regard to Problem-solving and Practical Reasoning (factor 2), the items within it refer to (i) general reasoning (item

15), and (ii) fallacies (items 19 and 20). In general terms, general reasoning aims at solving problems or achieving an intended objective, whereas fallacies refer to forms of invalid argumentation used in everyday life. (i) With general reasoning, the individual's objective is, fundamentally, to solve problematic situations of an ecological nature – such as those illustrated by the items of the PENCRIASAL test – from eight steps that must necessarily be followed in that order if we are to proceed properly (Saiz, 2020): consider the context; observe; examine the type of evidence; delimit the motive; collect data personally; build the likely causal scenario; determine the complete meaning of the phenomenon-problem; and make a prognosis. (ii) With regard to fallacies, in the context of argumentation, the individual's objective is to detect the arguments that are not truly so, i.e., that have no validity and that, therefore, should be identified and deconstructed, avoiding being persuaded by them (Saiz, 2020).

5. Conclusion

Given its academic relevance, but mainly due to its transversal relevance in the various spheres of life in which each individual moves, all efforts to assess the CT of Higher Education students – in order to promote it – continue to be welcome. This article, in which the psychometric validation study of the short Portuguese version of the PENCRIASAL test is presented, intends to ensure a contribution to that objective. In addition to its value as an instrument to capture central dimensions of CT in the Portuguese language and culture, this instrument will prove to be essential to continue characterising the expression of CT across countries. In fact, the PENCRIASAL test (in its extended version, with 35 items) has already been validated in Spain (*cf.* Rivas and Saiz, 2012) and also in Peru (*cf.* Rivas et al., 2014), thus this short Portuguese version offers not only an opportunity for transnational application, but also an opportunity to assess the CT in a faster way, joining the validation study of the Spanish short version (*cf.* Saiz et al., 2021).

We cannot know the absolute potential of each one, but we can measure the degree of expression of each one. This is what we can deal with (Saiz, 2017). And such to promote opportunities to mobilize and develop the CT capacities and dispositions of all students. The Portuguese short version of the PENCRIASAL test is a useful screening tool for teachers and researchers interested in knowing the cognitive characteristics of their students and how their critical thinking skills can be developed throughout their academic training or be used in the promotion of pedagogical practices that meet the students needs.

However, we must recognize that some methodological aspects can be improved and that we describe below. The short version of the test (6 items in this proposal) is suitable for a rapid assessment of critical thinking skills in large samples of students in different educational research projects. However, we must delve into future studies regarding its precision and psychometric validity. In this sense, it is convenient to use more current and powerful psychometric analysis techniques, for example, item response theory (IRT). In any case, our short version allows the integration of other psychological and academic variables of the students into the evaluation protocol in order to investigate the effects of these variables on academic performance using structural equations.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SFR and CS: conceptualization, research, and software. SFR and LA: data curation, formal analysis, and methodology. SFR, AF, RV, and LA: resources and writing – review and editing. SFR, CS, and LA: supervision, validation, and writing – original draft. All authors contributed to the article and approved the submitted version.

References

- Barros, A., and Ribeiro, E. (2022). Adaptação portuguesa do Self-Directed Search-CE: Um estudo de validação. *Revista Iberoamericana de Diagnóstico y Evaluación – e Avaliação Psicológica* 2:91. doi: 10.21865/RIDEP63.2.07
- Borsa, J., Damásio, B., and Bandeira, D. (2012). Adaptação e validação de instrumentos psicológicos entre culturas: Algumas considerações. *Paidéia* 22, 423–432. doi: 10.1590/S0103-863X2012000300014
- Davies, M. (2015). “A model of critical thinking in higher education,” in *Higher education: Handbook of theory and research*. eds. M. Paulsen and L. Perna (Berlin: Springer), 41–92.
- Franco, A., and Almeida, L. S. (2015). Real-world outcomes and critical thinking: differential analysis by academic major and gender. *Paidéia* 25, 173–181. doi: 10.1590/1982-43272561201505
- Franco, A., and Almeida, L. S. (2017). “Definição e medida do pensamento crítico,” in *Criatividade e pensamento crítico: Conceito, avaliação e desenvolvimento*. ed. L. S. Almeida (CERP), 107–132.
- Franco, A., Butler, H. A., and Halpern, D. F. (2015). “Teaching critical thinking to promote learning,” in *The Oxford handbook of undergraduate psychology education*. ed. D. S. Dunn (Oxford: University Press), 65–74.
- Franco, A., Costa, P. S., and Almeida, L. S. (2017a). Do critical thinkers drink too much alcohol, forget to do class assignments, or cheat on exams? Using a critical thinking measure to predict college students' real-world outcomes. *Psychol. Stud.* 62, 178–187. doi: 10.1016/j.tsc.2017.12.003
- Franco, A., Costa, P. S., and Almeida, L. S. (2018a). Translation, adaptation, and validation of the Halpern critical thinking assessment to Portugal: effect of disciplinary area and academic level on critical thinking. *An de Psiol* 34, 292–298. doi: 10.6018/analesps.34.2.272401
- Franco, A., Costa, P. S., Butler, H. A., and Almeida, L. S. (2017b). Assessment of undergraduates' real-world outcomes of critical thinking in everyday situations. *Psychol. Rep.* 120, 707–720. doi: 10.1177/0033294117701906
- Franco, A., and Saiz, C. (2020). A ação é filha do pensamento: a relevância do pensamento crítico na resposta aos desafios do quotidiano para a promoção do bem-estar pessoal e social. *Poiésis –Rev. do Programa de Pós-Graduação em Educação* 14, 242–255. doi: 10.19177/prppge.v14e262020242-255
- Franco, A., Vieira, R. M., and Saiz, C. (2017c). O pensamento crítico: as mudanças necessárias no contexto universitário. *Rev. de Estudos e Investig. en Psicol. y Educ.* 7, A7012–A7016. doi: 10.17979/reipe.2017.0.07.2233
- Franco, A., Vieira, R. M., and Tenreiro-Vieira, C. (2018b). Educating for critical thinking in university: the criticality of critical thinking in education and everyday life. *Essachess J. Commun. Stud.* 112, 131–144.
- Halpern, D. F. (2016). *Halpern critical thinking assessment*. Schuhfried: Vienna Test System.
- Halpern, D. F., and Dunn, D. S. (2021). Critical thinking: a model of intelligence for solving real-world problems. *J. Intelligence* 9:22. doi: 10.3390/jintelligence9020022
- Halpern, D. F., and Dunn, D. S. (2023). *Thought and knowledge: an introduction to critical thinking (6th)*. New York: Taylor and Francis.
- Hauke, E. (2019). Understanding the world today: the roles of knowledge and knowing in higher education. *Teach. High. Educ.* 24:378. doi: 10.1080/13562517.2018.1544122
- Hu, L., and Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model. Multidiscip. J.* 6:55. doi: 10.1080/10705519909540118
- International Test Commission (2017). *The ITC guidelines for translating and adapting tests*. 2nd Edn Available at: www.InTestCom.org.
- Kaplan, D. E. (2000). *Structural equation modeling: Foundations and extensions*. California: Thousand Oaks.
- MacCallum, R. C., Browne, M. W., and Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychol. Methods* 1, 130–149. doi: 10.1037/1082-989X.1.2.130
- Muthén, L. K., and Muthén, B. O. (2019). *MPlus statistical modeling software: Release 8.6*. Los Angeles, CA: Muthén and Muthén.
- Pechorro, P., Nunes, C., Gonçalves, R. A., Simões, M. R., and Oliveira, J. P. (2019). Estudo de validação do Inventário de Personalidade Narcísica – 13 numa amostra escolar de jovens portugueses. *Rev. Iberoamericana de Diagnóstico y Evaluación – e Avaliação Psicol.* 1, 71–81. doi: 10.21865/RIDEP50.1.06
- Phan, H. (2010). Critical thinking as a self-regulatory process component in teaching and learning. *Psicothema* 22, 284–292.
- Pino, I. P., Domínguez Alonso, J., and Juste, M. P. (2022). Propiedades psicométricas de la versión española del Teamwork Skills Questionnaire (TSQ). *Revista Iberoamericana de Diagnóstico y Evaluación – e Avaliação Psicológica* 1:155. doi: 10.21865/RIDEP62.1.12
- Polit, D., and Beck, C. (2014). *Study guide for essentials of nursing research: appraising evidence for nursing practice*. Filadelfia: Wolters Kluwer/Lippincott Williams and Wilkins.
- Regmi, K., Naidoo, J., and Pikington, P. (2010). Understanding the processes of translation and transliteration in qualitative research. *Int J Qual Methods* 9, 16–26. doi: 10.1177/160940691000900103
- Rivas, S. F., Morales, P. B., and Saiz, C. (2014). Propiedades psicométricas de la adaptación peruana de la prueba de pensamiento crítico PENCRIASAL. *Avaliação Psicol.* 13, 257–268.
- Rivas, S. F., and Saiz, C. (2012). Validación y propiedades psicométricas de la prueba de pensamiento crítico PENCRIASAL. *Revista Electrónica de Metodología Aplicada*. 17, 18–34.
- Saiz, C. (2017). *Pensamiento crítico y cambio*. Madrid: Pirámide.
- Saiz, C. (2020). *Pensamiento crítico y eficacia (2nd)*. Madrid: Pirámide.
- Saiz, C., Almeida, L. S., and Rivas, S. F. (2021). ¿Puede ser evaluado el pensamiento crítico de forma breve? *Psico-USF* 26:139. doi: 10.1590/1413-8271202126nesp13
- Saiz, C., and Rivas, S. F. (2008). Evaluación del pensamiento crítico: una propuesta para diferenciar formas de pensar. *Ergo Nueva Época* 22, 25–66.

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The core self-evaluations, psychological capital, and academic engagement: a cross-national mediation model

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Introduction: An academic environment with continuously more demanding tasks requires students to capitalize on their strengths to meet the challenges and engage in learning experiences. Engaged students are deeply involved in their work, are strongly connected with their studies, and are more successful in academic tasks. The present study aimed to test a model in that core self-evaluations (CSE) predicts academic engagement (AE) directly and indirectly by increasing personal resources (i.e., psychological capital; PsyCap) in the case of two different samples, Romanian and Serbian.

Methods: Data were collected through three online questionnaires from 672 undergraduate students (Romania – 458; Serbia – 214).

Results: The findings confirmed that CSE was positively related to PsyCap, which was positively associated with AE, and PsyCap mediates the relationship between the two variables in both samples. A positive evaluation of one's characteristics (high CSE) mainly affects the cognitive and emotional mechanism of appraising the academic-related tasks one encounters (high PsyCap), ultimately shaping their motivation and engagement.

Discussion: These results pointed out the importance of the CSE and PsyCap that support each other and increase students' AE, explaining the mediating mechanism of PsyCap. Also, they provide insight into the students' engagement from two different cultural and educational contexts, being helpful to universities in their effort to increase students' engagement.

KEYWORDS

core self-evaluations, psychological capital, academic engagement, personal resources, higher education

1. Introduction

An academic environment with increasingly demanding assignments requires students to capitalize on their strengths to meet challenges and engage in learning experiences (Bowden et al., 2021). Academic engagement (AE) is seen as an „intermediate outcome” that facilitates learning (Choi and Rhee, 2014) and is linked to students' intrinsic motivation, perseverance in academic activities, higher educational aspirations, and success (Lei et al., 2018; Ketonen et al., 2019; Paloş et al., 2019). Engaged students are deeply involved in their work, feel energized, are

strongly connected with their studies (Martínez et al., 2019), and are more successful in academic tasks (Schaufeli et al., 2002). Earlier studies found that AE is essentially shaped by personality (Siu et al., 2014; You, 2016; Tisu et al., 2020). For instance, recent research highlighted that AE is strongly predicted by students' core self-evaluations (CSE; Yan et al., 2018), a trait-like personality characteristic that reflects people's assessment of themselves and their self-worth (Judge et al., 2003). Prior studies illustrated that high CSE people tend to assess situations positively, are confident in their capacity to succeed, are highly motivated to value opportunities, and are more effective in self-regulation (Bipp et al., 2019), CSE being a strong predictor of AE (Yan et al., 2018). Also, psychological capital (PsyCap), a state-like personality characteristic reflecting "an individual's positive psychological state of development" (Luthans et al., 2007, p. 542), is a significant antecedent for engagement (Siu et al., 2014; Fang and Ding, 2020). Considered at the same time as a malleable personal resource that increases learning engagement (You, 2016; Alessandri et al., 2018), PsyCap stimulates various other resources that can successfully support the boost of new personal resources (Robayo-Tamayo et al., 2020). According to the Conservation Resources theory (COR; Hobfoll and Ford, 2007), resources are seen as internal and external strengths that people can use to cope with and adapt to challenging situations (Hobfoll and Ford, 2007) and are essential for motivation and goals attainment (Hobfoll et al., 2018). People use resources (e.g., personal, social) not only to deal with difficult situations but also to increase the pool of resources for future challenges. They do not exist individually, they are interrelated and form a "caravan of resources" that support and enhance each other (Hobfoll, 2011). Hence, available resources influence people's capacity to obtain more resources (Hobfoll, 2011; Robayo-Tamayo et al., 2020). The more personal resources they have, the more they can gain, which sustains them to follow their goals and engage in different activities (Ouwenel et al., 2011; Martínez et al., 2019; Ma et al., 2022).

Engagement and personality (i.e., CSE and PsyCap) were mainly explored in the organizational environment (e.g., Bipp et al., 2019; Tisu et al., 2020), but only a few of the studies were carried out in the academic areas (e.g., You, 2016; Leupold et al., 2020). To fill this gap, the present research was performed in the educational context and aimed to test a model in that CSE predicts AE directly and indirectly by increasing personal resources (i.e., PsyCap) in the case of two different samples, Romanian and Serbian (Figure 1). Our study can contribute new insights into theory. First, based on COR theory, it expands the knowledge regarding the relationships between two personality characteristics and AE for students in Higher Education. On the one side, CSE is a trait-like personality characteristic resistant to change; on the other, PsyCap is state-like and malleable (Howard, 2017). Investigating their relationship with AE helps us better understand

individual differences (Tisu et al., 2020) and how PsyCap can be trained to increase student engagement in Higher Education. Second, the model was tested in two different samples among students in Higher Education, Romanian and Serbian, to explore the cross-national validity of our results.

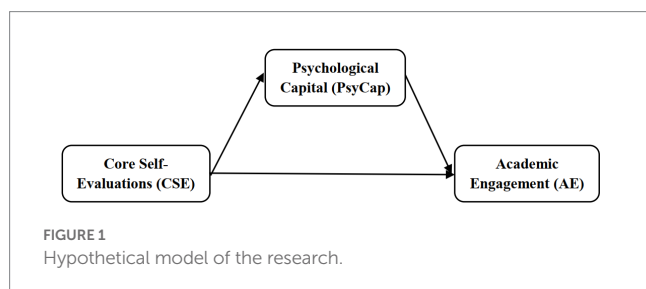
1.1. CSE and PsyCap

CSE was described as a personality trait that assesses an individual's competence, effectiveness, capabilities, and worthiness and includes four components: self-esteem [a general "appraisal of one's self-worth" (Rosenberg, 1965)], generalized self-efficacy [the people's belief that they can perform complex tasks or cope with an aversive situation in diverse areas (Schwarzer and Jerusalem, 1995)], emotional stability [the predisposition "to feel calm and secure" (Eysenck, 1990)], and locus of control [the conviction that wanted consequences are the result of the behavior rather than luck, faith, or others (Judge et al., 2003)]. People high in CSE are more confident in their abilities, can deal with different demands, and have more available resources to solve problems (Judge and Hurst, 2007). Also, they evaluate various situations more positively and are confident in their capacity to control things and achieve goals (Ma et al., 2022). CSE is linked to PsyCap, a state-like psychological attribute involved in assessing the self in relation to the environment (Howard, 2017), and also a valuable personal resource (Siu et al., 2014). PsyCap is a multidimensional construct composed of self-efficacy (the confidence that one can fulfill a demanding task), optimism (the belief that one can succeed, now and in the future), hope (persistence in achieving aims and redirecting paths if obstacles appear), and resilience (one's ability, when encountering difficult situations, to bounce back from challenges or failures) (Luthans et al., 2007). The four elements act synergistically to increase people's implication in different domains of their life (Gibson and Hicks, 2018; Sava et al., 2020). Previous research showed CSE as an antecedent for PsyCap—a motivational potential that provides toughness to attain success (Luthans et al., 2007; Luthans and Youssef-Morgan, 2017), individual differences being the strongest predictor of PsyCap. Moreover, individuals with a high level of CSE proved to be more effective in generating resources to help them be more motivated and involved in tasks (Bipp et al., 2019). Based on the above arguments, the first hypothesis was developed:

H1: CSE is positively associated with PsyCap.

1.2. PsyCap and AE

Seen as a "state of fulfillment characterized by vigor, dedication, and absorption" (Schaufeli et al., 2002, p. 74), AE was described as mental energy which could generate students' enthusiasm and motivation for their educational activities (Stoeber et al., 2011). Engaged students are curious and interested, are open to challenges and enjoy complex tasks, are more persistent and tenacious (Shih, 2008), self-efficacious with a good sense of belonging (Kahu et al., 2020) and feel deeply involved in flow conditions (Shernoff et al., 2003). According to previous studies, PsyCap is a motivational potential that supports engagement (Firouznia et al., 2021). Students with a high PsyCap are more intrinsically motivated, actively engaged



in their school-related tasks, optimistic, and enthusiastic in following their goals (Datu et al., 2018; Virgă et al., 2020; Firouznia et al., 2021). Thus, PsyCap is a psychological resource that fosters engagement as a core construct and through each dimension taken separately (Ouweneel et al., 2011; Alessandri et al., 2018). Therefore, the second hypothesis was formulated:

H2: PsyCap is positively associated with AE.

1.3. CSE and AE: PsyCap as a mediator

People with a positive self-regard (high CSE) are more likely to develop a positive feeling about their work, perceive tasks as more attractive (Judge et al., 2003), become more desired to involve in different actions, and engage more easily (Tims and Akkermans, 2017). How people evaluate themselves (i.e., CSE) impacts how they assess the world and use their resources (i.e., PsyCap) (Howard, 2017). Thus, a high level of CSE can help students to enhance their PsyCap. Those with high PsyCap will invest more effort in achieving their goals, raising their engagement (Alessandri et al., 2018). So, students who are confident in their competencies (i.e., self-efficacy), motivated to achieve their goals (i.e., hope), determined to deal with difficult situations (i.e., optimism), and capable of adequately adapting (i.e., resilience) are more academically engaged (Siu et al., 2014; Nolzen, 2018; Carmona-Halty et al., 2021; Firouznia et al., 2021). Moreover, evidence showed mutual relationships between AE and PsyCap that can be explained through the COR mechanism (Ouweneel et al., 2011; Siu et al., 2014; Martínez et al., 2019). Hence, people's capacity to gain more resources is influenced by their existing resources (Ma et al., 2022). When students' resources are high (i.e., PsyCap), their repertoire of strategies to achieve the goals and overcome the encountered obstacles is richer and more diverse; they are more confident in their strengths and engage more in the study activity. Consequently, AE leads to better performance, perceived as positive feedback of competencies and invested effort. This, in turn, enhances their PsyCap by increasing confidence in their abilities, the hope that the investment of energy will help to achieve the proposed goals and that they will have the resources to overcome obstacles (Siu et al., 2014). Therefore, we anticipate that PsyCap can better explain the relationship between CSE and AE, and we assumed that:

H3: PsyCap mediates the relationship between CSE and AE.

2. Materials and methods

2.1. Procedure and samples

This study was carried out with participants from Romania and Serbia, which allowed us to investigate the relations between CSE, PsyCap, and AE in different educational and cultural contexts. According to the Hofstede cultural dimensions model, both are similar Balkan countries with high power distance, feminism, low individualism, high uncertainty avoidance, and short-term orientation (Hofstede et al., 2010). There are slight differences only between power distance, individualism, and indulgence (Hofstede et al., 2010; Gavreliuc, 2018).

The Romanian sample comprised 458 students (73.8% women), averaging 21.69 years (SD = 5.40). The Serbian sample consisted of 214 students (77.1% women) with an average age of 23.03 years (SD = 1.97). For both countries, the students voluntarily involved in the study were enrolled in Educational Psychology and Teacher and Preschool Teacher Education courses. They were asked to bring two other students willing to participate in the research. The participants were selected through a combination of non-probability and snowball sampling methods. Interested students got a link to a Google Forms document. The first part provided information about the study objectives, the conditions, the ethical aspects, and the voluntary character of the participation. The second part was accessible only to those who expressed their agreement and included the items of three questionnaires. The time needed to answer these items was approximately 20 min. All the procedures followed the ethical standards of the Scientific Council of University Research and Creation from West University of Timisoara (26093/05.05.2022).

2.2. Instruments

CSE was measured with the 12-item Core Self-Evaluations Scale (Judge et al., 2003). CSE is a higher-order construct made up of four interrelated traits: self-esteem (e.g., "Sometimes when I fail, I feel worthless"), generalized self-efficacy (e.g., "When I try, I generally succeed"), neuroticism (e.g., "Sometimes I feel depressed"), and locus of control (e.g., "I determine what will happen in my life"). The participants agreed with the items' content on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The internal consistency was 0.84 for the Romanian and 0.78 for the Serbian samples. The questionnaire was previously used in further research in both countries (e.g., Ivanović and Ivanović, 2018; Tisu et al., 2020).

PsyCap was measured with the 24-item Psychological Capital Questionnaire (Luthans et al., 2007), with four sub-dimensions: *hope* (e.g., "Right now I see myself as being pretty successful at university"), *self-efficacy* (e.g., "I feel confident analyzing a long-term problem to find a solution"), *resilience* (e.g., "When things are uncertain for me at university, I usually expect the best"), and *optimism* (e.g., "I am optimistic about what will happen to me in the future as it pertains to studies"). The participants rated the statement on a 6-point Likert scale from *strongly disagree* to *strongly agree*. Because the four dimensions together strongly affect different variables than each taken separately (Siu et al., 2014; Nolzen, 2018), the composite score was used. Alpha Cronbach was 0.91 for the Romanian and 0.92 for the Serbian samples. The scale was adapted to be used for university students by Lupşa and Virgă (2018).

AE was measured with the 14-item Utrecht Work Engagement Scale for Students (UWES-S; Schaufeli et al., 2002). The instrument measures three dimensions: *dedication* (e.g., "My studies inspire me"), *vigor* (e.g., "When I study, I feel like I am bursting with energy"), and *absorption* (e.g., "When I am studying, I forget everything else around me"), evaluated on a 7-point like Likert scale from *never to always*. Because these three dimensions are closely related, the authors recommend using the scale's total score (Schaufeli et al., 2006). Alpha Cronbach was 0.90 for the Romanian and 0.94 for the Serbian samples. The questionnaire was previously used in other research in both countries (e.g., Petrović et al., 2017; Paloş et al., 2019).

2.3. Statistical analysis

RStudio (2020) was used for data analysis. Normal distributions were presented for all variables in both samples. We used maximum likelihood estimation methods. Thus, we assessed the goodness-of-fit of the model using the χ^2 test statistic, two relative fit indices (the Comparative Fit Index – CFI and the Tucker-Lewis index – TLI), also the Standardized Root Mean Square Residual (SRMR), and the Root Mean Square Error of Approximation (RMSEA), as absolute fit indices. As cut-off points, values higher than 0.90 (for CFI and TLI) or 0.08 or lower (for SRMR and RMSEA) mean a good model fit (Byrne, 2009). The Akaike Information Criterion (AIC) assessed the difference between the non-nested models. AIC with smaller values indicated a better model fit. Also, we tested the mediation model invariance across both Romanian and Serbian samples. Invariance between the compared groups is identified by a non-significant $\Delta\chi^2$ statistic and a change of Δ CFI value smaller than 0.01 (Cheung and Rensvold, 2002). Indirect effects were evaluated with 95% confidence intervals using 5,000 bootstrap samples.

Therefore, the measurement and structural models were tested. First, with confirmatory factor analysis (CFA), we evaluate two measurement models: a model with one factor (M1) and a three-factor model (M2). Before testing the structural models, we used item parcels based on the factorial algorithm to optimize the indicator-to-sample size ratio and apply a latent variable approach for CSE (Rogers and Schmitt, 2004). Based on the Little et al. (2002) recommendation, each parcel should contain between three and five items. Second, two structural models that place PsyCap as a mediator have been tested: a total mediation model (M4, the hypothesized model) and a fully constrained model (M5).

3. Results

3.1. Measurement models

According to Table 1, CFA was used to compare the two measurement models for both samples. Thus, we tested M1—a single-factor model (with all observed variables loading on one latent variable for common method bias) and M2—a three-factor model (CSE, PsyCap, and AE). For the Serbian and Romanian samples, the single-factor model (M1) had not a good fit with the data, but M2 fit the data better in both samples. Thus, we restrained the three-factor

model (M2). These results indicate that common-method bias is improbable to be a significant problem for both samples.

3.2. Preliminary results

The means, standard deviations, and inter-correlations for both samples are presented in Table 2. Alpha Cronbach takes values from 0.78 to 0.94, suggesting the acceptable reliability of the scales used in this research.

We used multiple-group SEM (Structural Equation Modeling) to evaluate whether the structural model was invariant across the Romanian and Serbian samples. The model hypothesized (M4) had good goodness-of-fit indices (χ^2 (66) = 241.97, CFI = 0.95, TLI = 0.93, SRMR = 0.05, RMSEA = 0.08, 90% CI [0.07, 0.10]; see Table 3). Also, an inspection of the separate paths revealed that CSE is related to PsyCap, which is related to AE in both samples. The final model in both samples (M4) (AIC = 15455.82) is shown in Figures 2, 3. Starting from M4, one constrained model (M5) was incidental to evaluate the invariance of the model in two samples. Thus, this model had all structural parameters (relationships) constrained to be equal across samples. The fit of the constrained M5 did not significantly damage as compared to M4 ($\Delta\chi^2$ = 10.89, *n.s.*; Δ CFI = 0.00). Thus, the relationships between the three observed variables specified in M4 are invariant across the samples (Romanian and Serbian).

3.3. Testing the hypotheses

3.3.1. CSE and PsyCap

H1 stated that CSE is positively associated with PsyCap. The findings presented in Figure 2 supported H1. CSE was positively related to PsyCap in both samples (β = 0.62, p < 0.001 for the Romanian sample and β = 0.70, p < 0.001 for the Serbian sample). We obtained a stronger association between CSE and PsyCap when applying the constraints of the relationship to be equal for both samples (β = 0.84, p < 0.001).

3.3.2. PsyCap and AE

H2 established that PsyCap is positively associated with AE (β = 0.69, p < 0.001 for the Romanian sample and β = 0.70, p < 0.001 for the Serbian sample). Figures 2, 3 illustrate that the results supported H2. PsyCap was positively related to AE. We obtained comparable

TABLE 1 Multiple group analyses (MGA) of the measurement models including the Romanian (N =458) and Serbian Samples (N =214).

Model	χ^2	Df	χ^2/df	CFI	TLI	RMSEA [90% CI]	SRMR	AIC	$\Delta\chi^2$	Δdf
Measurement models										
Romanian sample										
M1-single-factor model	858.75**	35	24.53	0.66	0.56	0.22 [0.21, 0.24]	0.12	11288.16		
M2-three-factors model	124.49**	32	3.89	0.96	0.95	0.07 [0.06, 0.09]	0.04	10559.90	734.26	3
Serbian sample										
M1-single-factor model	372.81**	35	10.65	0.70	0.61	0.21 [0.19, 0.23]	0.12	5117.04		
M2-three-factors model	104.35**	32	3.26	0.93	0.91	0.10 [0.08, 0.12]	0.06	4854.58	268.43	3

** p < 0.001. χ^2 , chi-square; df, degrees of freedom; TLI, Tucker-Lewis index; CFI, Comparative Fit Index; RMSEA, root mean square error of approximation; CI, confidence interval; AIC, Akaike information criterion; For M2 models, the comparison is vs. M1 for each sample.

TABLE 2 Means, standards deviation, and correlation coefficients between variables for the Romanian and (N=458) and Serbian (N=214) Samples.

Variable	M ₁	SD ₁	M ₂	SD ₂	1	2	3	4	5	6	7	8	9	10
1. CSE	43.32	8.02	45.52	6.68	(0.84/0.78)	0.49**	0.49**	0.47**	0.64**	0.61**	0.34**	0.35**	0.27**	0.37**
2. Self-efficacy	4.53	1.42	4.46	0.96	0.49**	(0.89/0.89)	0.75**	0.60**	0.54**	0.87**	0.40**	0.40**	0.35**	0.44**
3. Hope	5.15	1.09	4.62	0.99	0.50**	0.62**	(0.84/0.90)	0.66**	0.58**	0.90**	0.37**	0.41**	0.29**	0.41**
4. Resilience	4.86	0.91	4.38	0.84	0.36**	0.48**	0.55**	(0.79/0.71)	0.53**	0.82**	0.29**	0.25**	0.15**	0.26**
5. Optimism	4.65	0.77	4.65	0.83	0.31**	0.40**	0.45**	0.45**	(0.58/0.69)	0.78**	0.41**	0.40**	0.36**	0.45**
6. PsyCap	4.80	0.83	4.53	0.76	0.54**	0.85**	0.84**	0.76**	0.67**	(0.91/0.92)	0.44**	0.43**	0.34**	0.46**
7. Vigor	2.96	1.26	3.15	1.39	0.36**	0.49**	0.54**	0.42**	0.34**	0.57**	(0.82/0.90)	0.54**	0.72**	0.87**
8. Dedication	4.05	1.10	4.24	1.46	0.32**	0.42**	0.61**	0.40**	0.32**	0.56**	0.69**	(0.78/0.93)	0.67**	0.86**
9. Absorption	3.17	1.34	3.32	1.64	0.19**	0.35**	0.46**	0.31**	0.24**	0.44**	0.76**	0.69**	(0.75/0.89)	0.90**
10. AE	47.79	15.49	50.33	18.27	0.33**	0.47**	0.60**	0.42**	0.33**	0.59**	0.92**	0.88**	0.90**	(0.90/0.94)

N₁ = 458, N₂ = 214, 1 = Romania, 2 = Serbia. Romanian correlations below the diagonal and Serbian correlations above the diagonal. CSE, core self-evaluations; PsyCap, psychological capital; AE, academic engagement. Cronbach's α coefficients are presented on the diagonal: the first value is for Romanian sample and the second value is for Serbian sample. ** $p < 0.001$. Values of the internal consistency alphas are displayed in italic in the diagonal.

results but lower for each of the two samples ($\beta = 0.63, p < 0.001$) when limiting the relationship between PsyCap and AE to be equal for both samples.

3.3.3. PsyCap as a mediator

Related to H3, PsyCap acts as a mediator in the relationship between CSE and AE. The results supported the mediating role of PsyCap in both samples based on bootstrapping techniques. For the Romanian sample, the indirect path linking CSE to AE via PsyCap was 0.59 (CI 95% [0.46; 0.73]) and 0.40 (CI 95% [0.26, 0.55]) for the Serbian sample. In both samples, the result indicates that a high CSE is related to PsyCap and with high AE. Also, in M5, we tested an indirect path between the two samples, achieving the same effect of 0.53 (95% CI [0.47; 0.64]). Figures 2, 3 illustrate that PsyCap fully mediated between CSE and AE (H3 is supported). Thus, for the Romanian sample, the explained variance in the mediator, PsyCap ($R^2 = 0.48$), and the outcome, AE ($R^2 = 0.48$), was relatively like for the Serbian sample ($R^2 = 0.49$ for PsyCap, and it is less $R^2 = 0.25$ for AE).

4. Discussion

The research aimed to test if CSE predicts AE directly and indirectly by increasing personal resources (i.e., PsyCap) in the case of two different samples, Romanian and Serbian. Hence, the results showed positive relationships between CSE, PsyCap, and AE for both students' samples, emphasizing the mediator role of PsyCap. In other words, students with positive CSE are more confident in their capacity to control things, deal with academic challenges, look for and be involved in exciting and complex tasks, and set ambitious goals (Gibson and Hicks, 2018). They feel in control of their academic activities' outcomes due to their abilities and effort (Gibson and Hicks, 2018; Ma et al., 2022). Experiencing the satisfaction of good results acts as positive feedback that supports students' self-efficacy, hope, and optimism (Ouweneel et al., 2011). Therefore, their positive evaluations (high CSE) shape how they assess academic demands, mobilize, and use resources to meet these requirements (Howard, 2017). Thus, a positive evaluation of one's characteristics (high CSE) mainly influences the cognitive and emotional mechanism involved in the appraisal of the academic-related tasks they encounter (high PsyCap), ultimately shaping their motivation and engagement (Chang et al., 2012). So, according to the COR mechanism, CSE supports the use of existing resources (i.e., PsyCap) that can lead to a more significant investment of effort and engagement in academic tasks and act as a reservoir from which students can take or add other resources (Alessandri et al., 2018; Martínez et al., 2019; Firouznia et al., 2021).

The data sustained all the hypotheses, and our results are aligned with previous studies conducted in an organizational and educational context (e.g., Datu et al., 2018; Gibson and Hicks, 2018; Martínez et al., 2019). For instance, Bipp et al. (2019) found that CSE is essential in generating resources to support engagement. Although CSE is considered a trait-like characteristic, recent empirical findings showed room for change which has crucial practical implications. Leupold et al. (2020) state that self-esteem and self-confidence can be increased through cognitive and behavioral intervention, leading to high CSE. Also, the level of neuroticism can be decreased by strengthening the overall CSE and PsyCap (Gibson and Hicks, 2018). The role of PsyCap in increasing students' AE is also emphasized by former

TABLE 3 Multiple group analyses (MGA) of the structural models including the Romanian (N=458) and Serbian samples (N=214).

Model	χ^2	Df	χ^2/df	CFI	TLI	RMSEA [90% CI]	SRMR	AIC	$\Delta\chi^2$	Δdf	ΔCFI
Structural model											
M4-hypothetical model	241.97**	66	3.66	0.95	0.93	0.08 [0.07, 0.10]	0.05	15455.82			
M5-full constrains model	252.86**	68	3.71	0.95	0.93	0.09 [0.07, 0.10]	0.05	15462.71	10.89	2	0.00

** $p < 0.001$. χ^2 , chi-square; df, degrees of freedom; TLI, Tucker-Lewis index; CFI, Comparative Fit Index; RMSEA, root mean square error of approximation; CI, confidence interval; AIC, Akaike Information Criterion.

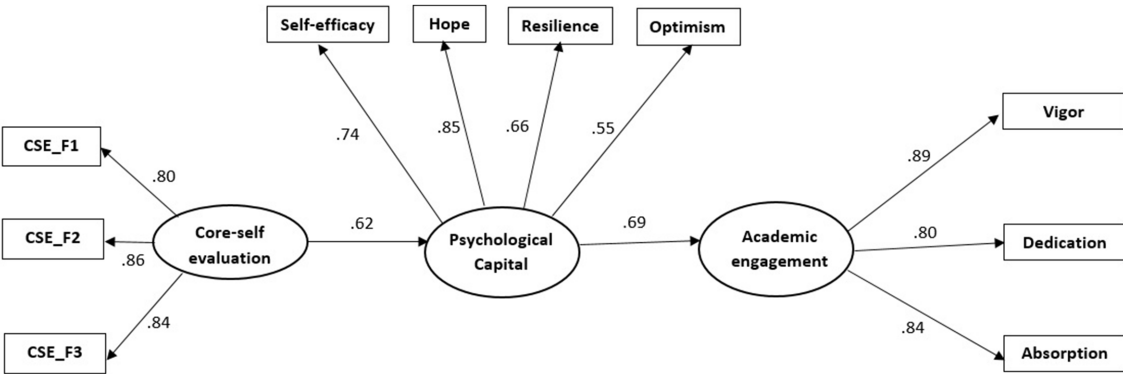


FIGURE 2
Standardized structural relations among variables from the model for the Romanian sample.

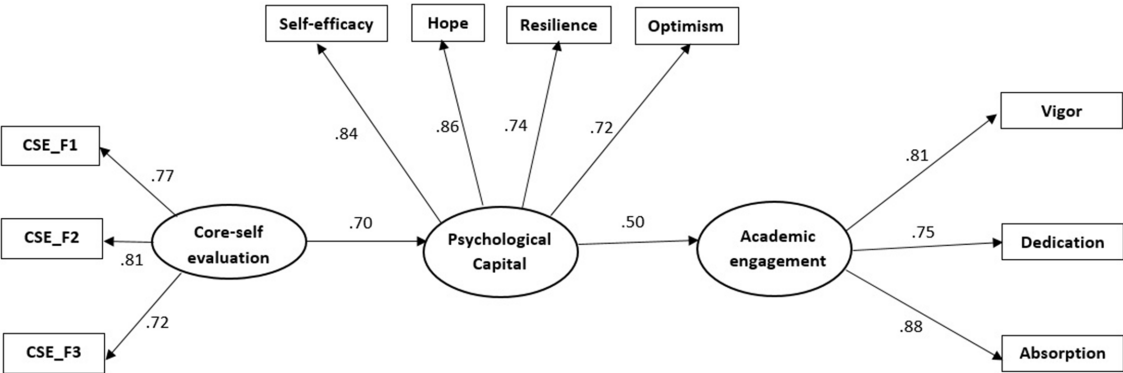


FIGURE 3
Standardized structural relations among variables from the model for the Serbian sample.

research (Luthans et al., 2016; Virgă et al., 2020). As a state-like personal resource, PsyCap can be increased through training and coaching sessions (Luthans and Youssef-Morgan, 2017; Lupşa et al., 2020). Developing students' PsyCap can improve their AE and, finally, their performance (Lupşa et al., 2020).

From the cultural perspective, the present research showed that the relationships between CSE, PsyCap, and AE are relevant for Romanian and Serbian university students. These results align with our expectations due to the similar Romanian and Serbian cultural contexts. From Hofstede's psycho-cultural model, Romania, and Serbia have a high-power distance and are collectivist, feminine, and short-term oriented (Burz and Marian, 2016; Milosevic, 2019), with similar life principles, which make them think and act relatively similarly. Despite the slight differences between power distance,

individualism, and indulgence, we can sustain that our findings were cross-validated, and the path coefficients of the model were invariant across both samples.

4.1. Limitations and directions for future research

Beyond the strengths of this study, some limitations should be mentioned. First, the two samples are not big enough to allow generalizations and inferences about cross-cultural differences but can provide initial support in understanding how personality characteristics complement each other to enhance AE. Also, the structure of the samples was unbalanced, with women being much

better represented than men. Previous findings showed small but significant gender differences in CSE, with a difference decreasing over time (e.g., Gang et al., 2020) and with greater contrast in Western than Eastern cultures (Gang et al., 2020). Regarding the impact on PsyCap, it seems that men's PsyCap is higher than females (Jin et al., 2020). AE is also shaped by gender: women students are more engaged than men students in academic-related activities (Kessels and van Houtte, 2022) and exhibit greater AE than men (Babenko et al., 2018). Hence, further research needs to include balanced samples to identify the pattern of these interactions. Second, causal inferences could not be made because our research was cross-sectional. Third, the self-reported instruments may have affected students' accuracy responses. Despite these limitations, the significance of the results should not be underestimated.

4.2. The theoretical and practical implications

Our study brings new information on COR theory about the role of two personality characteristics (i.e., CSE and PsyCap) and their relationships with an individual outcome (i.e., AE) in two different cultural and educational contexts (i.e., Romanian and Serbian). Also, this research is among the few which has worked with two personality characteristics together – CSE as trait-like and PsyCap as state-like (e.g., Tisu et al., 2020), to identify how they capitalize each other and increase students' AE. From a practical perspective, our results can be helpful to both teachers and students, enhancing teaching-learning efficiency and academic well-being. For instance, positive self-assessment (i.e., high CSE) can function as a buffer, helping students to be assertive in dealing with and facing academic demands and challenges and utilizing them as a chance for future development (Leupold et al., 2020). Students high in CSE adapt more quickly to the stressful academic environment, are more engaged in learning tasks, and capitalize to a greater extent on personal resources (Haynie et al., 2017). Working on the two dimensions of CSE, enhancing self-esteem and self-efficacy, and lowering the level of neuroticism, CSE can be strengthened (Leupold et al., 2020). Former studies discovered that PsyCap contributes to AE both as an omnibus construct and through its four dimensions (e.g., Fang and Ding, 2020; Robayo-Tamayo et al., 2020). Consequently, to increase PsyCap, interventions can target the overall construct or each of its dimensions (e.g., Lupşa et al., 2020). For example, the PsyCap intervention (PCI) program includes exercises and coaching sessions that address the four components and facilitate PsyCap development. For each dimension taken separately, previous meta-analyses showed that interventions based on stress management are effective in increasing self-efficacy; those founded on the principles of positive psychology facilitate the growth of optimism and hope; and for increasing resilience, training focused on cognitive-behavioral approaches are efficacious (e.g., CareerSKILLS intervention) (Akkermans et al., 2015; Lupşa et al., 2020). Students high in PsyCap are more academically engaged than students with low PsyCap because of their self-confidence, optimism, hope in finding ways to work, and resilience in difficult situations (Siu et al., 2014). High self-efficacious students use the available resources to face the challenges in the academic environment, trust and persevere when encountering obstacles, and their optimism influences how they interpret events and, subsequently, adapt to the context (Azila-Gbette et al., 2021).

5. Conclusion

Consistent with the COR theory (Hobfoll and Ford, 2007), personality and psychological resources are essential for students' engagement, and the self's involvement (i.e., CSE – self, and PsyCap – self in regards to the environment; Howard, 2017) can be considered a prerequisite for engagement experience. Therefore, the present research pointed out the importance of the CSE and PsyCap as two personality characteristics that support each other and increase students' AE while also explaining the mediating mechanism of PsyCap. In addition, the results highlight those variables that can be intervened from an individual and organizational perspective to build a challenging and supportive learning environment that would increase the quality of the higher education teaching-learning process.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the correspondent author Delia Virgă delia.virga@e-uvr.ro, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study. All the procedures followed the ethical standards of the Scientific Council of University Research and Creation from West University of Timisoara (26093/05.05.2022) under the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Author contributions

RP has chosen the topic and contributed to the collection of the data, writing, and supervision of the present manuscript. EMS has contributed to the collection of the data, writing, and supervision of the present manuscript. DV has contributed to the design, methodology, writing, and supervision of the present manuscript. DP has contributed to the collection of the data and supervision of the present manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Akkermans, J., Nykänen, M., and Vuori, J. (2015). "Practice makes perfect? Antecedents and consequences of an adaptive school-to-work transition" in *Sustainable working lives - managing work transitions and health throughout the life course*. eds. J. Vuori, R. W. B. Blonk and R. Price (London: Springer Publishers), 65–86.
- Alessandri, G., Consiglio, C., Luthans, F., and Borgogni, L. (2018). Testing a dynamic model of the impact of psychological capital on work engagement and job performance. *Career Dev. Int.* 23, 33–47. doi: 10.1108/CDI-11-2016-0210
- Azila-Gbettor, E. M., Mensah, C., Abiemo, M. K., and Bokor, M. (2021). Predicting student engagement from self-efficacy and autonomous motivation: a cross-sectional study. *Cogent Educ.* 8, 1942638, 1–1942614. doi: 10.1080/2331186X.2021.1942638
- Babenko, O., Mosewich, A., Abraham, J., and Lai, H. (2018). Contributions of psychological needs, exhaustion in Canadian medical students. *J. Educ. Eval. Health Prof.* 15:2. doi: 10.3352/jeehp.2018.15.2
- Bipp, T., Kleingeld, A., and Ebert, T. (2019). Core self-evaluations as a personal resource at work for motivation and health. *Pers. Individ. Differ.* 151:109556. doi: 10.1016/j.paid.2019.109556
- Bowden, J. L. H., Tickle, L., and Naumann, K. (2021). The four pillars of tertiary student engagement and success: a holistic measurement approach. *Stud. High. Educ.* 46, 1207–1224. doi: 10.1080/03075079.2019.1672647
- Burz, G., and Marian, L. (2016). Considerații privind coordonatele modelului psihocultural Hofstede în România [Considerations on coordinates of Hofstede type psychocultural model in Romania]. *Rev. Manage. Econ. Eng.* 15, 132–147.
- Byrne, B. M. (2009). *Structural equation modelling with AMOS: Basic concepts, programming, and applications* (2). Mahwah, NJ: Erlbaum.
- Carmona-Halty, M., Salanova, M., Llorens, S., and Schaufeli, W. B. (2021). Linking positive emotions and academic performance: the mediated role of academic psychological capital and academic engagement. *Curr. Psychol.* 40, 2938–2947. doi: 10.1007/s12144-019-00227-8
- Chang, C. H., Ferris, D. L., Johnson, R. E., Rosen, C. C., and Tan, J. A. (2012). Core self-evaluations: a review and evaluation of the literature. *J. Manage.* 38, 81–128. doi: 10.1177/0149206311419661
- Cheung, G. W., and Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Struct. Eq. Model.* 9, 233–255. doi: 10.1207/S15328007SEM0902_5
- Choi, B. K., and Rhee, B. S. (2014). The influences of student engagement, institutional mission, and cooperative learning climate on the generic competency development of Korean undergraduate students. *High. Educ.* 67, 1–18. doi: 10.1007/s10734-013-9637-5
- Datu, J. A. D., King, R. B., and Valdez, J. P. M. (2018). Psychological capital bolsters motivation, engagement, and achievement: cross-sectional and longitudinal studies. *J. Posit. Psychol.* 13, 230–270. doi: 10.1080/17439760.2016.1257056
- Eysenck, H. J. (1990). "Biological dimensions of personality" in *Handbook of personality: Theory and research*. ed. L. A. Pervin (New York: Guilford), 244–276.
- Fang, S., and Ding, D. (2020). The efficacy of group-based acceptance and commitment therapy on psychological capital and school engagement: a pilot study among Chinese adolescents. *J. Contextual Behav. Sci.* 16, 134–143. doi: 10.1016/j.jcbs.2020.04.005
- Firouznia, M., Hosseini, S. H., and Karamabad, M. M. M. (2021). Affective-cognitive nature of engagement: correlating psychological capital and core self-evaluations to work engagement via positive affects. *Int. J. Proc. Manag.* 14, 213–229. doi: 10.1504/IJPM.2021.113492
- Gang, H., Anderson, M. H., and Summers, J. (2020). Sex differences in Core self-evaluation: a Meta-analytic review. *Acad. Manag. Proc.* 1:17871. doi: 10.5465/AMBPP.2020.17871abstract
- Gavreliuc, A., and Gavreliuc, D. (2018). Social cognitions and cultural dimensions in the Romanian educational field. *J. Res. High. Educ.* 2, 2–18. doi: 10.2193/JRHE.2018.2
- Gibson, A., and Hicks, R. E. (2018). Psychological capital and core self-evaluations in the workplace: impacts on well-being. *Int. J. Psychol. Stud.* 10, 15–24. doi: 10.5539/ijps.v10n2p15
- Haynie, J. J., Flynn, C. B., and Mauldin, S. (2017). Proactive personality, core self-evaluations, and engagement: the role of negative emotions. *Manag. Decis.* 55, 450–463. doi: 10.1108/MD-07-2016-0464
- Hobfoll, S. E. (2011). *Conservation of resource caravans*. doi: 10.1111/j.2044-8325.2010.02016.x
- Hobfoll, S. E., and Ford, J. S. (2007). "Conservation of resources theory" in *Encyclopedia of stress*. ed. G. Fink. 2nd ed. (Elsevier: Academic Press), 562–567. doi: 10.1016/B978-012373947-6.00093-3
- Hobfoll, S. E., Halbesleben, J., Neveu, J. P., and Westman, M. (2018). Conservation of resources in the organizational context: the reality of resources and their consequences. *Annu. Rev. Organ.* 5, 103–128. doi: 10.1146/annurev-orgpsych-032117-104640
- Hofstede, G., Hofstede, G. J., and Minkov, M. (2010). *Cultures and organizations: Software of the mind*. (3rd ed.). New York: McGraw-Hill.
- Howard, M. C. (2017). The empirical distinction of core self-evaluations and psychological capital and the identification of negative core self-evaluations and negative psychological capital. *Pers. Individ. Differ.* 114, 108–118. doi: 10.1016/j.paid.2017.03.061
- Ivanović, M., and Ivanović, U. (2018). The most important self-evaluation and self-efficacy in choosing a vocational as determinants of vocational outcomes of junior karatekas. *Homo Sporticus* 20, 5–10.
- Jin, J., Li, H., Song, W., Jiang, N., Zhao, W., and Wen, D. (2020). The mediating role of psychological capital on the relation between distress and empathy of medical residents: a cross-sectional survey. *Med. Educ. Online* 25:1710326. doi: 10.1080/10872981.2019.1710326
- Judge, T. A., Erez, A., Bono, J. E., and Thoresen, C. J. (2003). The core self-evaluations scale: development of a measure. *Pers. Psychol.* 56, 303–331. doi: 10.1111/j.1744-6570.2003.tb00152.x
- Judge, T. A., and Hurst, C. (2007). Capitalizing on one's advantages: role of core self-evaluations. *J. Appl. Psychol.* 92, 1212–1227. doi: 10.1037/0021-9010.92.5.1212
- Kahu, E. R., Picton, C., and Nelson, K. (2020). Pathways to engagement: a longitudinal study of the first-year student experience in the educational interface. *High. Educ.* 79, 657–673. doi: 10.1007/s10734-019-00429-w
- Kessels, U., and van Houtte, M. (2022). Side effects of academic engagement? How boys' and girls' well-being is related to their engagement and motivational regulation. *Gender Educ.* 34, 627–642. doi: 10.1080/09540253.2021.2011840
- Ketonen, E. E., Malmberg, L. E., Salmela-Aro, K., Muukkonen, H., Tuominen, H., and Lonka, K. (2019). The role of study engagement in university students' daily experiences: a multilevel test of moderation. *Learn. Individ. Differ.* 69, 196–205. doi: 10.1016/j.lindif.2018.11.001
- Lei, H., Cui, Y., and Zhou, W. (2018). Relationships between student engagement and academic achievement: a meta-analysis. *Soc. Behav. Personal.* 46, 517–528. doi: 10.2224/sbp.7054
- Leupold, C. R., Lopina, E. C., and Erickson, J. (2020). Examining the effects of core self-evaluations and perceived organizational support on academic burnout among undergraduate students. *Psychol. Rep.* 123, 1260–1281. doi: 10.1177/0033294119852767
- Little, T. D., Cunningham, W. A., Shahar, S., and Widaman, K. F. (2002). To parcel or not to parcel: exploring the question, Weighing the Merits. *Struct. Eq. Model.* 9, 151–173. doi: 10.1207/S15328007SEM0902_1
- Lupşa, D., and Virgă, D. (2018). Psychological capital questionnaire (PCQ): analysis of the Romanian adaptation and validation. *Psihologia Resurselor Umane [Psychol. Hum. Resour.]* 16, 27–39. doi: 10.24837/pru.2018.1.484
- Lupşa, D., Virgă, D., Maricuţoiu, L. P., and Rusu, A. (2020). Increasing psychological capital: a pre-registered Meta-analysis of controlled interventions. *Appl. Psychol.* 69, 1506–1556. doi: 10.1111/apps.12219
- Luthans, F., Avolio, B. J., Avey, J. B., and Norman, S. M. (2007). Positive psychological capital: measurement and relationship with performance and satisfaction. *Pers. Psychol.* 60, 541–572. doi: 10.1111/j.1744-6570.2007.00083.x
- Luthans, K. W., Luthans, B. C., and Palmer, N. F. (2016). A positive approach to management education: the relationship between academic PsyCap and student engagement. *J. Manag. Dev.* 35, 1098–1118. doi: 10.1108/JMD-06-2015-0091
- Luthans, F., and Youssef-Morgan, C. M. (2017). Psychological capital: an evidence-based positive approach. *Annu. Rev. Organ. Psych.* 4, 339–366. doi: 10.1146/annurev-orgpsych-032516-113324
- Ma, Y., Qian, Z., and Zhong, L. (2022). Influence of Core self-evaluations on work engagement: the mediating role of informal field-based learning and the moderating role of work design. *Sustainability* 14:5319. doi: 10.3390/su14095319
- Martínez, I. M., Youssef-Morgan, C. M., Chambel, M. J., and Marques-Pinto, A. (2019). Antecedents of academic performance of university students: academic engagement and psychological capital resources. *Educ. Psychol.* 39, 1047–1067. doi: 10.1080/01443410.2019.1623382
- Milosevic, D. (2019). A comparison of Hofstede cultural dimensions: Italy, Germany and Serbia. *Econ. Manag. Nat. Resour.*, 1–8.
- Nolzen, N. (2018). The concept of psychological capital: a comprehensive review. *Manag. Rev. Q.* 68, 237–277. doi: 10.1007/s11301-018-0138-6

- Ouweneel, E., LeBlanc, P. M., and Schaufeli, W. B. (2011). Flourishing students: a longitudinal study on positive emotions, personal resources, and study engagement. *J. Posit. Psychol.* 6, 142–153. doi: 10.1080/17439760.2011.558847
- Paloş, R., Maricuţoiu, L. P., and Costea, I. (2019). Relations between academic performance, student engagement, and student burnout: a cross-lagged analysis of a two-wave study. *Stud. Educ. Eval.* 60, 199–204. doi: 10.1016/j.steduc.2019.01.005
- Petrović, I. B., Vukelić, M., and Čizmić, S. (2017). Work engagement in Serbia: psychometric properties of the Serbian version of the Utrecht work engagement scale (UWES). *Front. Psychol.* 8:1799. doi: 10.3389/fpsyg.2017.01799
- Robayo-Tamayo, M., Blanco-Donoso, L. M., Román, F. J., Carmona-Cobo, I. C., Moreno-Jiménez, B., and Garrosa, E. (2020). Academic engagement: a diary study on the mediating role of academic support. *Learn. Individ. Differ.* 80:101887. doi: 10.1016/j.lindif.2020.101887
- Rogers, W. M., and Schmitt, N. (2004). Parameter recovery and model fit using multidimensional composites: a comparison of four empirical parceling algorithms. *Multivar. Behav. Res.* 39, 379–412. doi: 10.1207/S15327906MBR3903_1
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.
- RStudio Team. (2020). *RStudio: Integrated Development for R*, RStudio, PBC, Boston, MA. Available at: <http://www.rstudio.com/>.
- Sava, S. L., Virgă, D., and Paloş, R. (2020). The role of teacher support, students' need satisfaction, and their psychological capital in enhancing students' self-regulated learning. *Stud. Psychol.* 62, 44–57. doi: 10.31577/sp.2020.01.790
- Schaufeli, W. B., Bakker, A. B., and Salanova, M. (2006). The measurement of work engagement with a short questionnaire: across-national study. *Educ. Psychol. Meas.* 66, 701–716. doi: 10.1177/0013164405282471
- Schaufeli, W. B., Martínez, I. M., Marques Pinto, A., Salanova, M., and Bakker, A. B. (2002). Burnout and engagement in university students: a cross-national study. *J. Cross-Cult. Psychol.* 33, 464–481. doi: 10.1177/0022022102033005003
- Schwarzer, R., and Jerusalem, M. (1995). "Generalized self-efficacy scale" in *Measures in health psychology: A user's portfolio. Causal and control beliefs*. eds. J. Weinman, S. Wright and M. Johnston (Windsor: NFER-NELSON), 35–37.
- Shermoff, D. J., Csikszentmihalyi, M., Schneider, B., and Shermoff, E. S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychol. Quart.* 18, 158–176. doi: 10.1007/978-94-017-9094-9_24
- Shih, S. (2008). The relation of self-determination and achievement goals to Taiwanese eighth graders' behavioral and emotional engagement in schoolwork. *Elem. School J.* 108, 313–334. doi: 10.1086/528974
- Siu, O. L., Bakker, A. B., and Jiang, X. (2014). Psychological capital among university students: relationships with study engagement and intrinsic motivation. *J. Happiness Stud.* 15, 979–994. doi: 10.1027/1866-5888/a000092
- Stoeber, J., Childs, J. H., Hayward, J. A., and Feast, A. R. (2011). Passion and motivation for studying: predicting academic engagement and burnout in university students. *Educ. Psychol.* 31, 513–528. doi: 10.1080/01443410.2011.570251
- Tims, M., and Akkermans, J. (2017). Core self-evaluations and work engagement: testing a perception, action, and development path. *PLoS ONE* 12:e0182745. doi: 10.1371/journal.pone.0182745
- Tisu, L., Lupşa, D., Virgă, D., and Rusu, A. (2020). Personality characteristics, job performance and mental health: the mediating role of work engagement. *Pers. Individ. Differ.* 153:109644. doi: 10.1016/j.paid.2019.109644
- Virgă, D., Pattusamy, M., and Kumar, D. P. (2020). How psychological capital is related to academic performance, burnout, and boredom? The mediating role of study engagement. *Curr. Psychol.* 41, 6731–6743. doi: 10.1007/s12144-022-03339-w
- Yan, X., Yang, K., Su, J., Luo, Z., and Wen, Z. (2018). Mediating role of emotional intelligence on the associations between Core self-evaluations and job satisfaction, work engagement as indices of work-related well-being. *Curr. Psychol.* 37, 552–558. doi: 10.1007/s12144-016-9531-2
- You, J. W. (2016). The relationship among college students' psychological capital, learning empowerment, and engagement. *Learn. Individ. Differ.* 49, 17–24. doi: 10.1016/j.lindif.2016.05.001



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Training medical students in motivational interviewing using a blended learning approach: a proof-of-concept study

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Background: Difficulties in implementing behavior change in patients with chronic diseases are common in clinical practice. Motivational interviewing (MI) helps clinicians to support patients in overcoming ambivalence while maintaining self-determination. The inclusion of MI in German medical training curricula is still rare. Furthermore, the effects of systematic teaching of MI, especially via blended learning, have hardly been investigated.

Methods: Medical students participated in three curricular events related to MI, consisting of instructional videos and theoretical and practical components in a blended learning format. The aim of the study was to investigate the effect of teaching MI in students' medical education. A controlled, non-randomized study was conducted with an intervention group and a control group. Both groups completed questionnaires on their experience and knowledge related to MI, completed a knowledge test and rated their satisfaction with the course. MI was taught in the 6th semester of medical coursework as part of a psychosomatic course, in the 8th semester during a psychiatry course and in the 9th semester during a weekly psychiatry clerkship.

Results: Data from the intervention group ($n = 35$) and control group ($n = 14$) were analyzed, with 65.7% of students participating in all three parts of the curriculum. Overall interest in learning MI was high, with $M = 2.92$ ($SD = 1.00$). The results indicate a greater increase in knowledge over time in the intervention group. The majority (62.86%) stated that the curriculum was relevant to their future career. Free-form text responses indicated a high level of satisfaction with practical relevance.

Conclusion: This study demonstrates the usefulness of an MI curriculum for medical students. The integration of MI into medical curricula is a promising curricular addition to improve doctor-patient communication. Future research should address patient perceptions of MI competencies and the persistence of acquired competencies.

KEYWORDS

motivational interviewing, blended learning, medical training, student training, medical curriculum

Introduction

Ambivalence and changing behavior in chronic disease

As current prevalence rates show, around 40% of the population in Germany over the age of 16 can be considered chronically ill (Bundesministerium Für Gesundheit et al., 2021). This is reflected in high rates of hypertension, diabetes, chronic obstructive pulmonary disease, cardiovascular disease, chronic back pain and obesity (Rathmann et al., 2018; Hoebel et al., 2019; Güthlin et al., 2020). In addition to these physical diseases, prevalence rates also include mental disorders, the most common of which are anxiety, affective disorders and addictive disorders (Jacobi et al., 2014). The impact of chronic diseases is associated with a high burden of disease, reduced quality of life for patients and high health care costs (Statistisches Bundesamt, 2017).

Triggers and perpetrators of chronic disease include unhealthy lifestyles and poor health choices, which often lead to a complex treatment process and complicate doctor-patient interactions (Frost et al., 2018). Unhealthy behaviors are often difficult to change or abandon due to long-standing habits and short-term positive effects. Individuals therefore experience strong ambivalence caused by the simultaneous occurrence of conflicting desires, thoughts or feelings for or against behavior change. Behavior change is crucial in the recovery process of various mental and physical illnesses, as a healthy lifestyle is associated with a significantly reduced risk of chronic disease (Ford et al., 2009). Thus, it is possible to prevent or positively influence the development of a chronic disease by changing behavior toward a healthier lifestyle, e.g., through more exercise and a healthier diet (Hu and Willett, 2002; Vainio et al., 2002) or abstaining from nicotine (Mannino and Buist, 2007). Furthermore, internal and external motivation can be considered key variables for behavior change in patients (Ryan and Deci, 2017).

Healthcare workers and physicians should therefore be involved in improving patients' motivation to change, as professional support can facilitate active participation in managing their own health and making decisions that promote self-care (Barbosa et al., 2021). But how can physicians support their patients in changing a certain behavior—especially when, due to its positive short-term consequences and its habitual character, the behavior in question is hard to give up? The ambivalence which arises from these conditions often prevent patients from making a decision.

The concept of motivational interviewing

Addressing this issue, Miller and Rollnick (1991), Miller and Rollnick (2004), and Miller and Rollnick (2012) developed motivational interviewing (MI). This approach provides well-defined negotiation techniques as well as a specific attitude, called the motivational interviewing spirit, that help build a reliable physician-patient relationship as well as evoke and enhance patients' intrinsic motivation for behavior change (e.g., utilization of an indicated medical treatment). Notably, MI aims to foster patients' intrinsic (vs. extrinsic) motivation. Therefore, performing MI does not imply convincing the patient to do what the physician thinks is best. Especially in the presence of ambivalence, confronting patients or persuading them toward a change in behavior tends to provoke

arguments against that very change. Such a confrontation highlights the advantages of the status quo and the disadvantages of the behavior change, making actual behavior change less probable.

In contrast, practicing MI means supporting the patient in identifying behavior changes that are desirable from their perspective as well as in finding out which motives or aspects they perceive to be helpful in pursuing the specific change. According to Miller and Rollnick (2012), the interviewer should take into account the following ethical values: nonmaleficence, beneficence, autonomy and justice. These values provide the ethical framework for MI. This framework implies, for example, that the interviewer does not support the patient in pursuing harmful behaviors, but that the interviewer accepts if the patient decides against a healthy behavior change. Thus, MI can augment the traditional role of a physician as an expert—someone who informs the patient of the diagnosis and recommends treatment options—and can open up a communication style that focuses on the patient's perspective, particularly when a patient shows ambivalence regarding a certain behavior change.

Effectiveness of motivational interviewing

MI was initially developed for the treatment of addictive disorders. Since then, the field of application has gradually been extended to other mental and physical diseases. In a Cochrane Review (Smedslund et al., 2011), MI was shown to significantly reduce the amount of alcohol consumption. In comparison to other interventions investigated in that study, MI was equally or more effective. Positive effects of MI have also been shown in the treatment of eating disorders (Treasure et al., 1999; Hettema et al., 2005; Cassin et al., 2008; Geller and Dunn, 2011; Westra et al., 2011) as well as overweight and obesity (Van Dorsten, 2007; Armstrong et al., 2011; Teufel et al., 2011).

In a meta-analysis (Lundahl et al., 2013), MI was found to be associated with significant effects regarding behavior change in several health-related behavior categories. Among others, MI enhanced the participation of pain patients in workshops imparting pain management strategies (Habib et al., 2005), reduced risk behavior in adolescents who previously had been treated due to an injury (Johnston et al., 2002), increased health-promoting behaviors in adolescents with HIV (Naar-King et al., 2008), improved the attitude of patients with type 2 diabetes toward health-promoting behavior changes (Rubak et al., 2009) and reduced regeneration of caries mediated by mothers' preventive behaviors (Weinstein et al., 2006).

These findings demonstrate the usefulness of MI for widespread use in the health sector and the associated need for knowledge transfer about MI.

Communication skills and motivational interviewing in medical education

Training in basic communication skills is already an integral part of medical training at various faculties (Smith et al., 2007). In addition, the use of simulated patients for in-depth practical training is widely accepted and perceived to be of great value for students (Kaplonyi et al., 2017), as is the use of peer role play as a simulation-based training method (Gelis et al., 2020). Both the German Master Plan 2020 for medical education and the national catalog of competency-based learning objectives for medicine reinforce the

importance of doctor-patient communication skills, including MI (Wissing, 2018).

Research has demonstrated the success of teaching MI techniques in the medical field, both in the training of medical students and in the training of fully qualified doctors (Frost et al., 2018; Kaltman and Tankersley, 2020). A review by Kaltman and Tankersley (2020) found that participation in MI courses led to increased knowledge and improved practical skills in medical students. A recent study by Jacobs et al. (2021) showed that MI training in pre-medical students has a positive effect on knowledge and specific skills. Another review by Dunhill et al. (2014) showed that training in MI is particularly effective when it is “intensive,” i.e., when it involves several sessions or is integrated into a longitudinal curriculum, and when interactive exercises are an integral part of the training.

Several studies were able to show that MI can be successfully taught through training and workshops (e.g., Evangeli et al., 2009; Britt and Blampied, 2010; Walters et al., 2010) for an overview see Schwalbe et al. (2014) and that training MI improves knowledge and practical skills (Madson et al., 2009). In terms of didactic modality, MI is best learned in communication workshops with feedback and targeted coaching (Miller et al., 2004) while focusing on the underlying assumptions and *spirit* of MI rather than on specific techniques (Miller and Moyers, 2006). Embodying the *spirit* is associated with an increased likelihood of internalizing other relevant MI values and behaviors such as acceptance, respect for autonomy, empathy and warmth (Moyers et al., 2005). The reported prevalence and high use of MI in the health care system highlights the need for MI to be taught at an early stage of medical education.

Motivational interviewing and the blended learning approach

Blended learning describes the combination of face-to-face teaching with online materials and courses (Delialioglu and Yildirim, 2007) and has been shown to have better outcomes in terms of knowledge acquisition compared to traditional learning and online-only learning in health education (Morton et al., 2016; Westerlaken et al., 2019; Vallée et al., 2020).

The benefits of both formats, such as the efficiency and flexibility of online materials and the interaction with peers and tutors afforded by in-person learning, can be combined in one approach. Meta-analytic results suggest that the use of blended learning in medical education and training is significantly superior to traditional teaching in terms of growth in theoretical knowledge (Vallée et al., 2020) and satisfaction with the curriculum (Li et al., 2019).

Objective and research questions

In line with the need for more high-quality research on MI in education (Frost et al., 2018), our study integrates the factors identified in the literature as helpful and practical, such as workshops with feedback and targeted coaching, *spirit* in the early stages of medical education. We complement the literature by implementing our curriculum in a blended learning format, both to optimize time management and to ensure that it can be used independently of the face-to-face seminar.

To the authors' knowledge, the only published German study on MI training for medical students in a blended learning format is the

pilot study of the present study (Keifenheim et al., 2019). In the pilot study, significant improvements in subjective and objective knowledge as well as (subjective) practical skills were achieved after the first of three parts of the MI curriculum. The present study investigates the success of MI training in a blended learning format (i.e., a combination of lecture, simulation patient videos, face-to-face practical sessions and role-play scenarios) for medical students in their 6th to 9th semester onwards as part of their mandatory medical courses.

The research questions were:

Q1: Does participation in an MI curriculum offered in a blended learning format lead to an increase in students' subjectively rated theoretical knowledge of MI?

Q2: Does participation in an MI curriculum offered in a blended learning format lead to an increase in students' subjectively assessed practical skills in MI?

Q3: Does participation in an MI curriculum offered in a blended learning format lead to an increase in students' objectively assessed theoretical knowledge of MI?

Materials and methods

Study design

This evaluation was conducted at a German medical university faculty among medical students between the 6th and 9th semesters, prior to the COVID-19 pandemic. Using a longitudinal pre-post design, students were compared with assignment to the intervention or control group (non-randomized) and the two time points of measurement (T0/T2) as independent variables. Only data from subjects who met the following criteria were used for analysis: (i) completed questionnaires at T0 (6th-semester medical students) and T2 (9th-semester medical students) and (ii) participated in at least two of the three videos and two of the three practical components.

The MI curriculum

The MI curriculum consisted of three parts (MI 1–3). While the first part focused on MI rationale, MI *spirit* and the physician-patient relationship, the second and third parts concentrated on specific MI techniques. MI *spirit* was briefly summarized at the beginning of MI 2 and MI 3 and constituted the basis of all role-play interactions when training specific MI techniques. In order to show and train students on different uses, each part of the curriculum highlighted a specific field of application (eating disorders, addictive disorders and health-promoting behavior).

The materials were prepared by a psychotherapist and resident psychiatrist who has acquired theoretical and practical knowledge through literature studies and several MI workshops, as well as several years of experience in the application of MI in addictive disorders, health-promoting behaviors and eating disorders. MI trainers were psychotherapists and physicians with at least 1 year of professional experience. They studied MI literature, curriculum videos and instructions for the practical sessions. In addition, they received a practical training of about 3 h with the psychotherapist or physician. Throughout the course of the curriculum, trainers were supervised by the psychotherapist or physician. Table 1 summarizes the content of the curriculum.

Participants and study procedure

The link to the online questionnaire was sent to 6th-semester medical students of the respective medical faculty (*control group* in the winter semester, *intervention group* in the summer semester) (time T0). The intervention group then took part in a compulsory first course of the newly introduced curriculum on MI (MI 1).

The course (3 units, 135 min) on MI was integrated into an existing seminar (“Psychosomatic Medicine and Psychotherapy”) as one of six sessions. In advance, the students were asked to watch online teaching and demonstration videos (2 units, 90 min). In the so-called “teaching videos,” theoretical knowledge was conveyed to the students in the form of a recorded lecture. For the “therapy demonstration videos,” example conversations (with simulation patients) were filmed in which a doctor applies MI. In the 8th and 9th semesters, the students in the intervention group took part in further seminars on MI (MI 2 and MI 3). Here, too, a 1.5-h session on MI was integrated into an existing course (in the 8th-semester seminar “Psychiatry” and in the 9th-semester weekly internship “Psychiatry”). In addition, the students were asked to watch teaching and demonstration videos on an online platform (approximately 30 min).

The control group studied in the 6th semester according to the original timetable, without the opportunity to participate in the MI sessions. At the end of the 9th semester, all participants in the control group who had completed the questionnaire at time T0 received an email with a link to a very similar, slightly adapted questionnaire (time T2). [Figure 1](#) summarizes the study procedure in detail.

Evaluation instruments

The Questionnaire on Motivational Interviewing (see [Figure 1](#)) consisted of a “knowledge test” section, an “assessment of subjective theoretical knowledge and practical skills” section and a section on “satisfaction with the curriculum.”

Knowledge test

The knowledge test consisted of 12 questions on MI methods adapted from [Poirier et al. \(2004\)](#) in a multiple-choice format with five possible answers (one of which was “correct”). The questions related to the topics covered in the curriculum (see [Table 1](#)). Four

multiple-choice questions were asked for each curriculum unit MI 1–3. [Table 2](#) shows three examples for the respective curriculum units.

Rating on subjective theoretical knowledge and practical skills

In addition to demographic items (age, gender, semester, specialization) and items on previous training in communication skills in general and MI in particular, this section included a subjective assessment of knowledge and skills in MI and an objective test of theoretical knowledge. At T0, the questionnaire also included an item on interest in MI. Subjective ratings of theoretical knowledge, interest and practical skills in MI were made using Likert-scale items ranging from 0 (non-existing) to 4 (very high). Theoretical knowledge and interest were each assessed with one item, and practical skills were assessed with a total score and four subscales for individual methods. Again, a scale from 0 (non-existent) to 4 (very high) was used.

The subscales related to the specific competencies, as well as their corresponding questions, were:

- (i) *Practice of the therapeutic stance of MI* (“How do you currently assess your practical skills in applying the specific therapeutic stance of motivational interviewing?”)
- (ii) *Basic interview skills based on Miller and Rollnick* (“How do you currently rate your practical skills in using the basic interview skills of ‘open questions,’ ‘confirmation,’ ‘simple and complex reflection’ and ‘summarizing?’”)
- (iii) *Eliciting change talk* (“How do you currently rate your practical skills in initiating and reinforcing change talk with patients?”)
- (iv) *Rolling with resistance* (“How do you currently rate your practical skills in rolling with patient resistance, e.g., to indicated treatment?”).

Curriculum satisfaction

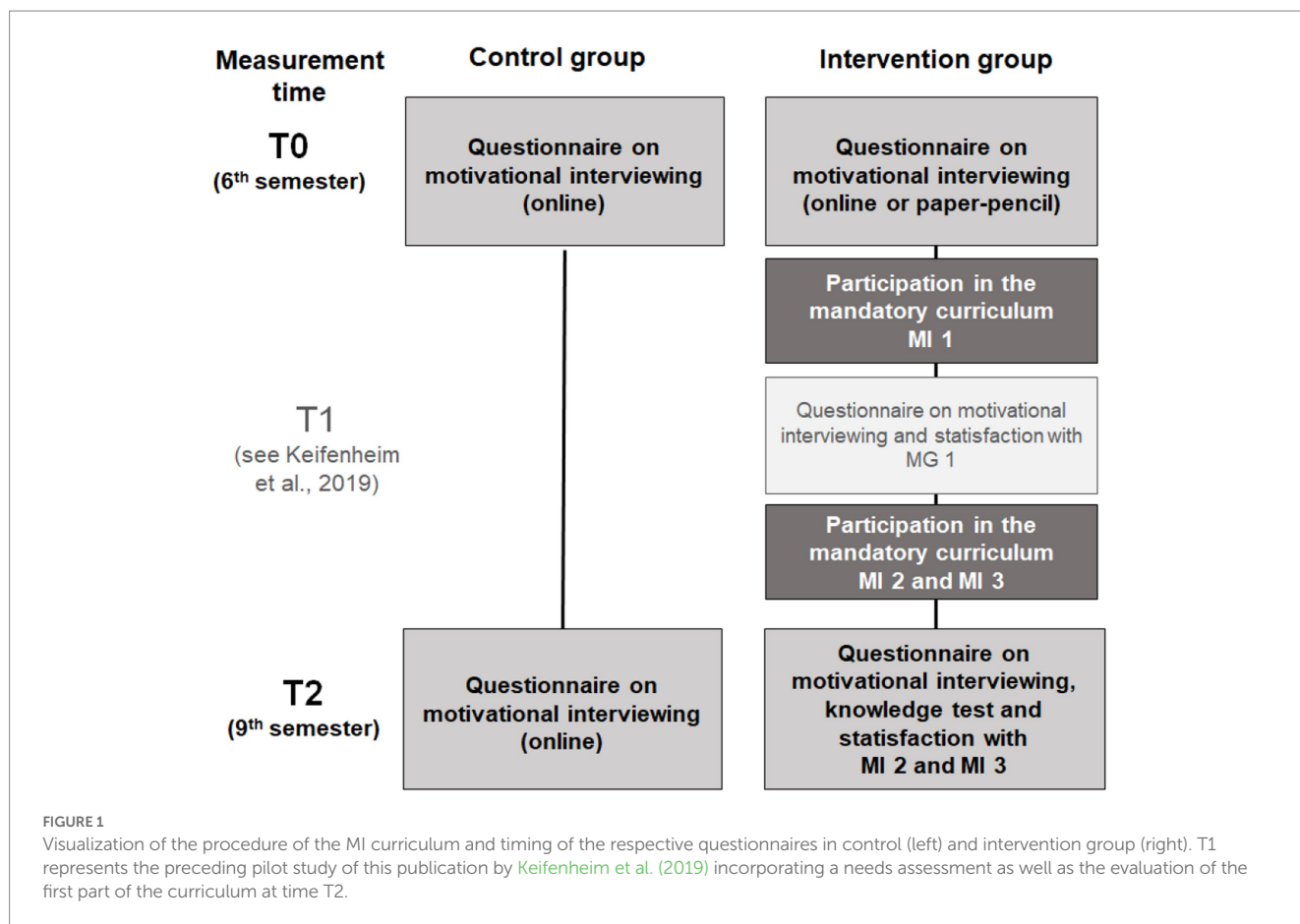
In addition, participants in the intervention group completed a curriculum satisfaction questionnaire at T2. The curriculum was rated on a scale from 1 to 6 at three levels:

- (i) Overall
- (ii) In terms of its relevance to the future medical profession

TABLE 1 Content overview of the MI curriculum for each semester.

	Semester		
	6th semester (MI part 1)	8th semester (MI part 2)	9th semester (MI part 3)
Teaching course	seminar “Psychosomatic Medicine and Psychotherapy”	seminar “Psychiatry”	weekly internship “Psychiatry”
Different aspects of MI	History and development of MI	Review MI 1	Review MI 2
	MI Rationale (e.g., change talk, sustain talk)	Evoking change talk (e.g., importance ruler)	Evoking change talk (e.g., elicit-provide-elicited)
	MI spirit (OARS) ¹	Enhancing change talk	Responding to sustain talk and discord
	Building up physician-patient relationship	Evoking hope and confidence	Limitations
	Focusing and developing goals	Developing a change plan	
Focused health issue	Eating disorders	Addictive disorders	Health promoting behavior

¹OARS: Open questions, affirmations, reflective listening, and summary reflections.



- (iii) With regard to the three specific sub-components of “instructional videos,” “therapy videos” and “practical exercises” (in each case with regard to their comprehensibility and perceived relevance for learning MI)

In addition, the use of the e-learning format was assessed. Participants also had the opportunity to give positive and negative feedback in a free-form text response.

Data analysis

SPSS for Windows (version 22.0) was used for quantitative analysis. Data were analyzed visually and by Kolmogorov–Smirnov test under the assumption of normal distribution. However, if a non-normal distribution was suspected, non-parametric Mann–Whitney U test was also used. Homogeneity of variance was tested using Levene’s test. Descriptive statistics of participants between the two groups were tested for differences in means and distributions using *t*-tests and *chi-squared* tests. Analyses of variance were calculated using T0 and T2 as within-subject factors and group (control vs. intervention) as a between-subject factor to examine the impact of the MI curriculum. The Mann–Whitney U test was used to test for homogeneity of variance. Partial eta squared (η^2) was used as the effect size for ANOVA and Pearson’s correlation coefficient *r* for *t*-tests. Correlations were calculated using Pearson’s correlation coefficient *r*, Spearman’s correlation coefficient *r_s*, or Kendall’s correlation coefficient τ depending

on the scale level. At the nominal scale level, possible correlation was tested using Fisher’s exact chi-squared test and the non-parametric Mann–Whitney U test. *p*-values below 0.05 were considered significant.

For qualitative analysis, feedback in the free-response format was categorized according to qualitative content analysis (Mayring and Fenzl, 2010). Missing answers in the multiple-choice knowledge test were defined as “wrong,” similar to the procedure in a written exam. In the case of missing questionnaire data, the item, but not the participant, was excluded from the analysis of variance. If the questionnaire was canceled, the participant was excluded from the data analysis. Students who attended fewer than two parts of the seminar or watched fewer than two information videos were also excluded.

Results

Sample characteristics

Participation and dropout

At baseline (T0), the medical students were in their 6th semester. Participation in the study was conditional on consent within the intervention group (IG) and participation in the MI curriculum. Of the 91 students in the IG who completed the questionnaire at baseline, 39 also completed the questionnaires at T2. Of these, 35 met the evaluation criteria (participated in at least two practice days and viewed at least two videos) and could therefore be included in the evaluation of the study. Of the 23

TABLE 2 Illustration of examples from the knowledge test questionnaire for MI1 - MI3.

MI Unit	Which statement is accurate?	Multiple choice answers ¹
6th semester (MI part 1)	In motivational interviewing, doctors should...	a) ... argue for a change in behavior.
		b) emphasize the need to accept the diagnosis (e.g., “You have an eating disorder”).
		c) ...Give priority to expert knowledge.
		d) ...adapt their intervention to the patient’s readiness to change
		e) ...offer solutions.
8th semester (MI part 2)	In motivational interviewing, if a doctor doubts that the intentions expressed by the patient (e.g., starting alcohol-specific treatment) are serious, ...	a) .. he/she should gently confront the patient.
		b) .. he/she should appreciate the intention to change and ask for the reasons for this statement
		c) .. he/she should show appreciation, but make it clear that a lack of motivation could significantly limit the success of the therapy.
		d) .. he/she should not react to this and try to establish a “real” motivation in the further conversation.
		e) he/she should reconsider the therapy goals with the patient.
9th semester (MI part 3)	By exploring the barriers to behavior change ..	a) .. the patient’s unrealistic expectations of success should be relativized.
		b) .. motivation for change can be enhanced. ..
		c) ...the motivation to change is usually reduced.
		d) .. the chances of actually changing behavior should be assessed.
		e) .. the doctor-patient relationship in particular should be strengthened.

¹In bold: correct answer.

students in the control group (CG) who completed the questionnaire at T0, 15 students also completed the questionnaire at T2. One person in the CG—presumably due to a sabbatical/research semester—was still in the 8th semester at T2, and thus in the IG cohort, and was therefore excluded from the analysis. Consequently, 14 subjects of the CG were included in the evaluation of the study. [Figure 2](#) provides an overview of the progression of the participants.

Demographics

The IG consisted of 21 women and 14 men aged between 22 and 31 years ($M = 24.51$, $SD = 2.76$). The 14 subjects of the CG included 10 women and 4 men aged between 23 and 34 years ($M = 27.29$, $SD = 3.69$). A homogeneity test showed no significant difference in gender distribution between the groups. Participants in the two groups differed significantly in terms of age. A detailed overview can be found in [Table 3](#). We interpret the difference to mean that the CG started their studies in a summer semester, which, as the German A-Level takes place in the spring/summer, tends to result in older

students. Furthermore, the variable age had no influence on the assessment of subjective theoretical and practical knowledge or on the objective theoretical knowledge test (all $r < |0.18|$, all $p > 0.281$). See [Table 3](#) for demographic details.

Association between practice intensity and assessment of subjective theoretical knowledge and objective knowledge

Of the 35 participants in the IG, 23 (65.7%) participated in all three practice components, 11 (31.4%) participated in MI 1 and MI 2 and one (2.9%) participated in MI 1 and MI 3. Of the 35 IG participants, 20 (57.1%) watched all of the videos from the practice components, 11 (31.4%) only watched the videos from MI 1 and MI 2, two (5.7%) watched the videos from MI 1 and MI 3 and two (5.7%) watched the videos from MI 2 and MI 3. The number of practical days completed (two or three) correlated neither with the increase in knowledge in objective theoretical knowledge ($r = 0.18$, $p = 0.150$) nor with subjective theoretical knowledge ($r = 0.23$, $p = 0.177$). In contrast, the number of completed practical days

correlated significantly with the increase in practical knowledge ($r = 0.37$, $p = 0.039$). After applying the Bonferroni correction, this association was no longer significant. The correlation between the number of videos watched (two or three) and the increase in objective theoretical knowledge was also significant ($r = 0.28$, $p = 0.050$), but not after Bonferroni correction. The number of videos watched (two or three) did not correlate significantly with the increase in subjective theoretical knowledge ($r = 0.13$, $p = 0.459$) or practical knowledge ($r = 0.30$, $p = 0.106$).

Interest and previous experience with MI

In the total sample, interest in learning MI was, on average, high to very high ($M = 2.92$; $SD = 1.00$; 0 [none] to 4 [very high]). Prior to the start of the study, 83.7% of the subjects had participated in one or two general communication training sessions offered as part of their medical training. With regard to MI in particular, 98% of participants reported that they had received no training or input in this area prior to the start of their studies. In line with this, students rated their theoretical knowledge ($M = 0.24$; $SD = 0.48$; 0 [none] to 4 [very high]) and practical skills in MI ($M = 0.37$; $SD = 0.64$; 0 [none] to 4 [very high]) as rather low.

Knowledge growth

Subjective theoretical knowledge growth

A two-factor analysis of variance (group \times time) with repeated measures revealed a main effect of measurement time ($F(1,47) = 126.85$, $p < 0.001$, $\eta^2 = 0.73$). Both groups showed significantly more subjective theoretical knowledge at T2 ($M = 1.53$, $SD = 0.84$) than at T0 ($M = 0.24$, $SD = 0.48$). Prior to attending the MI curriculum (T0), students in the intervention group (IG) reported significantly lower subjective theoretical knowledge than students in the control group (CG), with $M = 0.17$, $SD = 0.38$, T2: $M = 1.86$, $SD = 0.60$. Due to variance heterogeneity, an additional Mann–Whitney U test was performed. This test showed no significant difference between the two groups at T0 (IG: $Mdn = 0$, CG: $Mdn = 0$, $U = 196.50$, $z = -1.48$, $p = 0.186$). The interaction between group and time was significant ($F(1,47) = 63.97$, $p < 0.001$, $\eta^2 = 0.58$). Students in the IG experienced a significantly greater enhancement in subjective theoretical knowledge than students in the CG (see Figure 3A).

Subjective practical knowledge growth in general

A two-factor analysis of variance (group \times time) with repeated measures revealed a main effect of measurement time ($F(1,43) = 54.01$, $p < 0.001$, $\eta^2 = 0.56$). Both groups showed significantly more subjective practical knowledge at T2 ($M = 1.36$, $SD = 0.80$) than at T0 ($M = 0.40$, $SD = 0.65$). The main effect of group assignment was not significant ($F(1,43) = 1.50$, $p = 0.227$, $\eta^2 = 0.03$). The expected interaction between group and time point reached significance ($F(1,43) = 35.01$, $p < 0.001$, $\eta^2 = 0.45$). Students in the IG reported a significantly greater increase in subjective practical knowledge than students in the CG. Due to the lack of homogeneity of variance and normal distribution, an additional Mann–Whitney U test was performed and showed no difference between the two

groups at T0 (IG: $Mdn = 0$, CG: $Mdn = 0$, $U = 178.00$, $z = -1.16$, $p = 0.246$), but a significant difference at T2 (IG: $Mdn = 2$, CG: $Mdn = 1$, $U = 93.50$, $z = -3.25$, $p < 0.001$; see Figure 3B).

Analysis of specific therapeutic competencies

Here, only the interaction effects are reported.

- (i) *Practice of the therapeutic stance of MI*. There was an interaction effect ($F(1,46) = 29.05$, $p < 0.001$, $\eta^2 = 0.39$) whereby participants in the IG (T0: $M = 0.59$, $SD = 0.78$, T2: $M = 2.00$, $SD = 0.55$) showed a greater increase in subjective knowledge of basic therapeutic attitudes than participants in the CG (T0: $M = 0.86$, $SD = 1.10$, T2: $M = 0.71$, $SD = 0.83$).
- (ii) *Basic interview skills based on Miller and Rollnick*. An interaction effect was found ($F(1,46) = 18.13$, $p < 0.001$, $\eta^2 = 0.28$) indicating that the IG (T0: $M = 1.74$, $SD = 0.90$, T2: $M = 2.38$, $SD = 0.65$) reported a greater subjective improvement in their MI-specific interviewing skills than the CG (T0: $M = 2.14$, $SD = 0.95$, T2: $M = 1.43$, $SD = 1.16$).
- (iii) *Eliciting change talk*. Following an interaction effect ($F(1,46) = 20.43$, $p < 0.001$, $\eta^2 = 0.31$), participants in the IG (T0: $M = 0.76$, $SD = 0.70$, T2: $M = 1.79$, $SD = 0.54$) reported a greater enhancement in subjective skills related to eliciting change talk than participants in the CG (T0: $M = 1.50$, $SD = 0.86$, T2: $M = 1.36$, $SD = 0.75$).
- (iv) *Rolling with resistance*. There was an interaction effect ($F(1,46) = 8.48$, $p = 0.006$, $\eta^2 = 0.16$) whereby participants in the IG (T0: $M = 1.12$, $SD = 0.69$, T2: $M = 1.71$, $SD = 0.63$) reported a greater increase in subjective ability to deal with resistance than the CG (T0: $M = 1.50$, $SD = 0.65$, T2: $M = 1.21$, $SD = 0.89$).

Objective theoretical knowledge growth

There was a main effect of time ($F(1,47) = 15.15$, $p < 0.001$, $\eta^2 = 0.24$) showing that the score on the MI knowledge test increased significantly in both groups from time T0 ($M = 4.80$, $SD = 2.24$) to time T2 ($M = 7.00$, $SD = 2.68$). There was a trend toward a main effect of the groups ($F(1,47) = 3.87$, $p = 0.055$, $\eta^2 = 0.08$). The expected interaction effect ($F(1,47) = 19.86$, $p < 0.001$, $\eta^2 = 0.30$) showed that participants in the IG (T0: $M = 4.66$, $SD = 2.24$, T2: $M = 7.83$, $SD = 2.36$) achieved a greater increase in objective knowledge than participants in the CG (T0: $M = 5.14$, $SD = 2.14$, T2: $M = 4.93$, $SD = 2.34$). Figure 4 provides a graphical illustration.

Curriculum evaluation

Total

The 35 students in the intervention group rated the curriculum with a mean score of $M = 2.80$, $SD = 0.90$.

Importance for later professional activity

Most students (62.86%) agreed or strongly agreed that the content of the curriculum was very relevant to their later professional work as doctors. Evaluated in school grades, the relevance of the lecture videos received a mean rating of 3.12 ($SD = 1.25$), the relevance of the therapy

videos a mean rating of 2.80 ($SD=1.39$) and the relevance of the practical exercises a mean rating of 2.41 ($SD=1.19$).

Follow-up of the curriculum

The majority of students (65.72%) thought that the curriculum should be maintained.

Comprehensibility of teaching materials

Evaluated in school grades, the lecture videos received a mean rating of 1.89 ($SD=0.93$), the therapy videos a mean rating of 1.74 ($SD=0.78$) and the practical exercises a mean rating of 2.00 ($SD=1.02$). There were no significant differences between the mean scores of the three teaching formats regarding comprehensibility ($F(2,62)=2.03$, $p=0.139$, $\eta^2=0.06$).

Qualitative feedback

In order to gain a deeper understanding of the students' needs and desires for the MI curricula, their free-text responses were qualitatively evaluated.

They reported the following benefits of the curricula:

- (i) The topic in general/the theoretical background/learning conversation techniques
- (ii) The practical relevance and the exercises with the simulated patients
- (iii) The information from the videos
- (iv) The practical orientation

Students suggested the following changes to the curricula:

- (i) There should be more practical exercises with (simulation) patients and more feedback on the exercises.
- (ii) The MI curriculum should be taught in one block/semester and should be more integrated with other courses.
- (iii) The videos should be replaced or supplemented by a live performance by teachers with patients in the lessons.

Discussion

To the best of our knowledge, this is the first study to examine the implementation of a blended format motivational interviewing (MI) curriculum in a German human medicine curriculum. The results of the variance analysis show that participation in the curriculum was successful in terms of MI. Students who participated in the curriculum improved their subjective and objective knowledge of MI. Improvements were also shown in the subcategories regarding the MI-specific techniques of "basic therapeutic attitude," "basic interview skills," "eliciting change talk," and "rolling with resistance" (Miller and Rollnick, 2012). Despite the rather small sample size, the effects were robust with high effect sizes. The curriculum used was shown to be effective in increasing students' subjective skills and objective knowledge compared to a control group.

After completing the entire curriculum, students rated the curriculum with an average grade of 2.8. The results showed that after the first component MI 1 after the 6th semester (Keifenheim et al., 2019), the students seemed to be slightly more satisfied with the curriculum than after completing all three components of the

curriculum. Medical students rated the curriculum with a grade of 2.2 regarding satisfaction after the first MI, and one of the reasons for this could be the videos: Compared to the survey in T1 (cf. Keifenheim et al., 2019), the videos lost popularity in the quantitative evaluation in T2. Both lecture videos were rated "good" (2.26) at T2 in terms of their relevance for learning MI and "satisfactory" (3.12) after T2. The therapy videos also dropped one point in relevance, from 1.83 to 2.80. In comparison, the practical exercises declined less.

The qualitative results (free-form text responses) showed that the videos were rated well by many students, but ambivalently to negatively by others. Students felt that the patient videos lacked authenticity and that the lecture videos should be replaced by a "real" lecture. Students in subsequent semesters (6th vs. 8th and 9th semesters) assessed the relevance of MI at least equally important for their later professional career. Possibly, authentic patient contact, where students experienced MI as helpful, may have resulted in this assessment (see Nortvig et al., 2018). However, it should be noted that the videos in MI 1 were watched at home, whereas in MI 2 and MI 3 they were watched together with the lecturers in the face-to-face course to ensure that the students were familiar with the content. This lack of "voluntariness" and the implementation of the curriculum in the compulsory course could possibly explain the decrease in satisfaction toward the three modules.

Another explanation could be that the anticipated advantages of the videos, such as the possibility of repeated viewing or increased time for practical exercises (see Phillips et al., 2016), were not considered by the students to be as important as the advantages of a live lecture. Ultimately, this means that an in-person lecture and sufficient time for practice are desirable, but this would require more staff and also more teaching time.

The participants' wish for more authentic videos of example conversations might reflect, that this group of people is not yet accustomed to learn from schematic and complexity reduced interaction sequences. Possibly, this, for teaching reasons, intended gap between the video interactions and reality, reduced the credibility of the effectiveness of MI ("Can it even work in real situations?") in the students' perception. This, in turn, might have downgraded the evaluation of the videos and the extent to which at least some of the students were able to learn from them. Still, in our opinion, complexity reduced examples are, as in numerous other fields of teaching, common and helpful for a step by step training of complex abilities. Considering the feedback of the participants in our study we would suggest, to make this purpose of schematic videos more transparent for the students. In addition, students should be asked for more specific feedback concerning the videos, so that more specific improvements can be derived.

In summary, the results indicate that there are different groups with different needs in terms of the specific design of the MI curriculum. For the overall group of medical students, it may be more appropriate to offer an introduction as a compulsory seminar with reduced content and time. For students with greater interest and commitment, further seminars could be offered on a voluntary basis to facilitate the deepening of knowledge and practical skills in MI.

Several authors have discussed how MI teaching can best be implemented. Fuhrmann et al. (2022) investigated interactive learning content where students could choose between different responses or answers. This led to a natural development of patient-doctor communication and could be a useful option for implementation

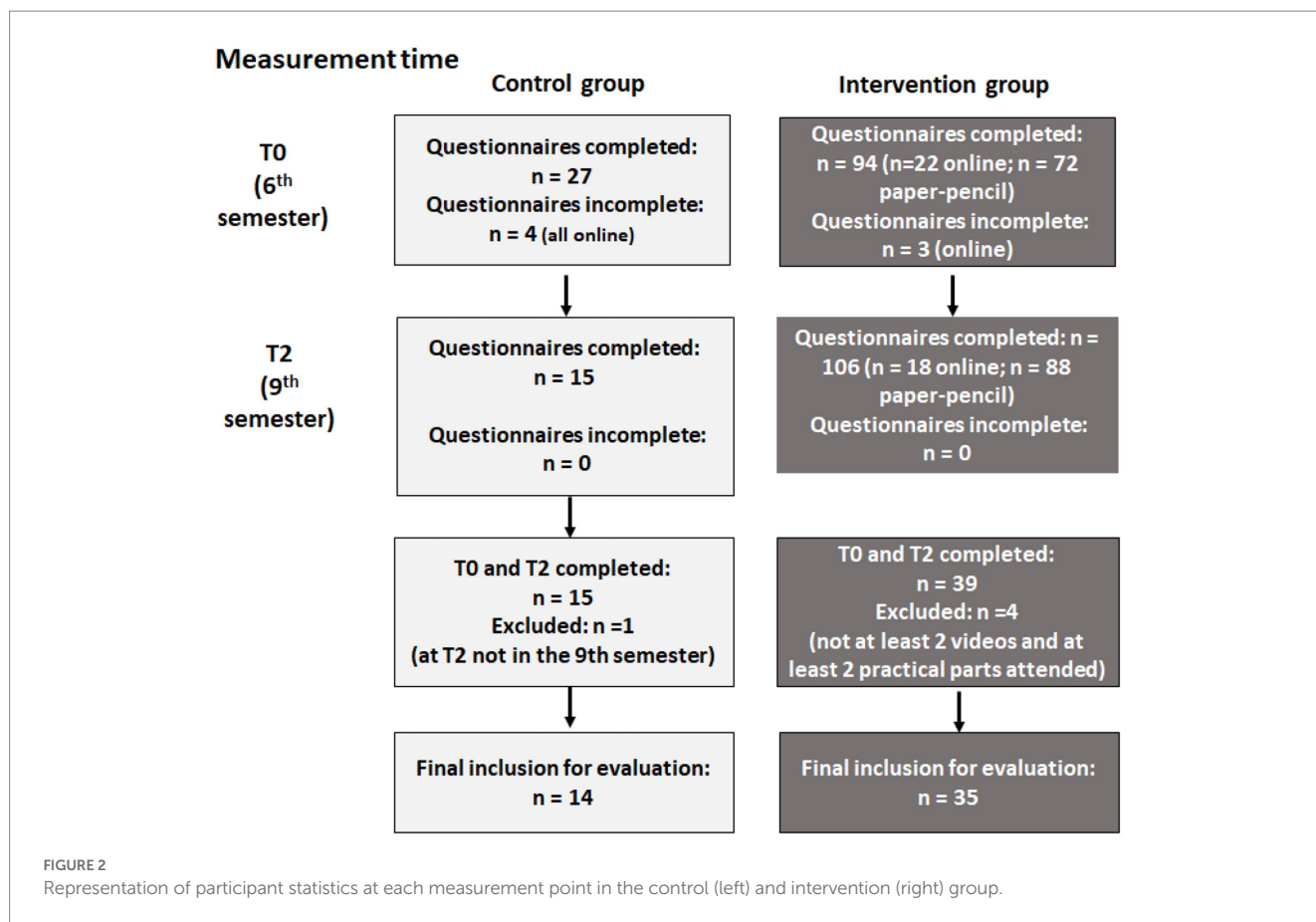


TABLE 3 Characteristics of the total sample at T0: demographics, number of semesters attended and general interest and prior experience with MI.

Characteristics	Control group (CG)	Intervention group (IG)	p
Age, <i>M</i> (<i>SD</i>)	27.3 (3.69)	24.5 (2.76)	0.006
Sex (female)	n = 10	n = 21	0.541
Semester	6th: n = 13 7th: n = 1	7th: n = 35	Not applicable
Ever heard of MI	n = 11: no n = 3: yes	n = 30: no n = 5: yes	0.541
Interest in MI, <i>M</i> (<i>SD</i>)	2.57 (0.85)	3.06 (1.03)	0.124

in the MI curriculum. Despite all the benefits described, developing an online format is time consuming and often an organizational challenge (Phillips et al., 2016). For future synergy, it is thus essential that higher education institutions network in order to exchange experiences and share learning content. As suggested by Hurlocker et al. (2020), a methodologically sound instrument is necessary to assess MI competencies. The use of the same assessment system in all higher education institutions would allow valid comparisons.

In the present study, initial interest and satisfaction did not influence knowledge growth. Neither knowledge growth nor interest had a significant effect on satisfaction. It is possible that learning outcomes and satisfaction are more dependent on individual values or goals, as these are also reflected in later subject choices (Bexelius et al., 2016). Further research should address individual differences in order to better tailor the curriculum to students and achieve even higher learning outcomes and satisfaction.

This study provides evidence that could be applied to the durability and transferability of learned skills into clinical

practice. To date, there is limited and mixed evidence in the current literature on MI (Kaltman and Tankersley, 2020). According to a meta-analytic finding, MI skills tend to decline approximately 6 months after training (Schwalbe et al., 2014); however, Miller and Rollnick (2004) have shown robust skill gains up to 12 months after training. This has implications for whether booster sessions should be used and when the use of boosters might be most useful (Fu et al., 2015; Schechter et al., 2021). Due to the therapeutic impact of MI on common chronic diseases in modern society that place a heavy burden on the healthcare system, introducing medical students to this topic is proving to be highly relevant (Rubak et al., 2009; Armstrong et al., 2011; Lundahl et al., 2013).

As a final note, the term “resistance” was critically discussed and deemed misleading in the third edition of Motivational Interviewing – Helping People Change (Miller and Rollnick, 2012). When designing the curriculum, we discussed this issue thoroughly and decided to mention the term “resistance” because the respective

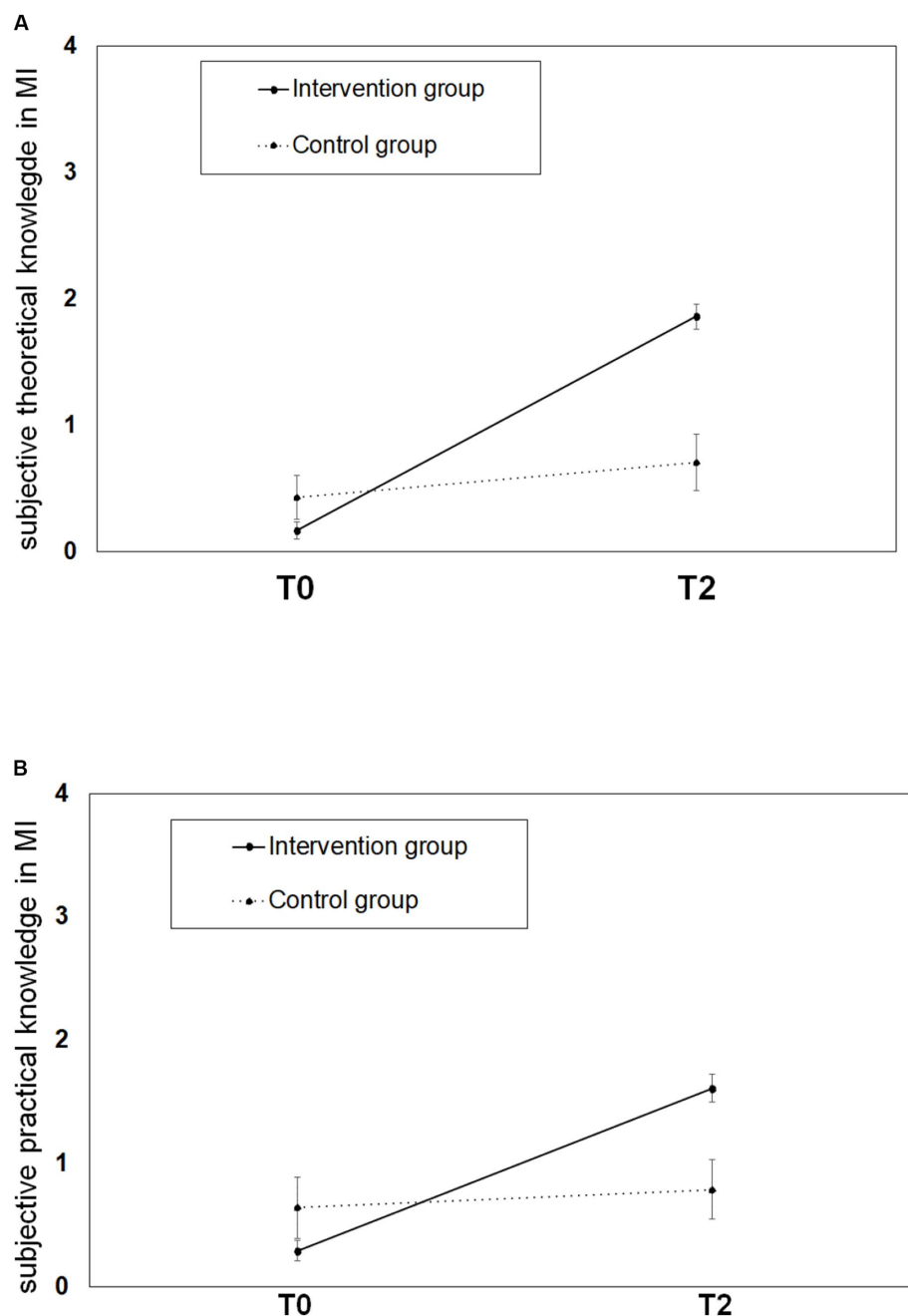


FIGURE 3

Illustration of student's subjective theoretical and practical knowledge growth on MI in the IG and the CG before and after participation in the MI-curriculum.

(A) Shows the growth in *subjective theoretical knowledge* assessed by questionnaire within IG and CG. Measurement points T0 and T2 are plotted on the x-axis. (B) Shows the growth in *subjective practical knowledge* within IG and CG. Measurement points T0 and T2 are plotted on the x-axis.

interactions are often perceived in that way, especially by non-experienced clinicians. In order to explain and evaluate the phenomenon of (perceived) resistance in line with what [Miller and Rollnick \(2012\)](#) outline, we added the expression “dealing with difficult situations,” and we pointed out that patient behaviors that cause a feeling of resistance in the interviewer can have different reasons. For instance, the change in question may seem unreachable for the patient, the positive consequences of change may seem too far away or too insecure, the patient may feel general hopelessness as a consequence of many unsuccessful attempts and, last but not least, the interviewer may exhibit inadequate behavior.

Limitations

There were also some limitations to this study. One limitation relates to the measurement tools used. As the questionnaires were not validated, but developed in-house, psychometric data on validity has limited interpretability. In addition, no objective assessment of practical skills was made. The authors are aware of the limited sample size in the control group, and future studies should pay attention to the selection of appropriate measurement instruments and assessment forms in general and also for raters such as the MITI or the MI-SCOPE ([Hannöver et al., 2012](#); [Kitzmann et al., 2019](#)).

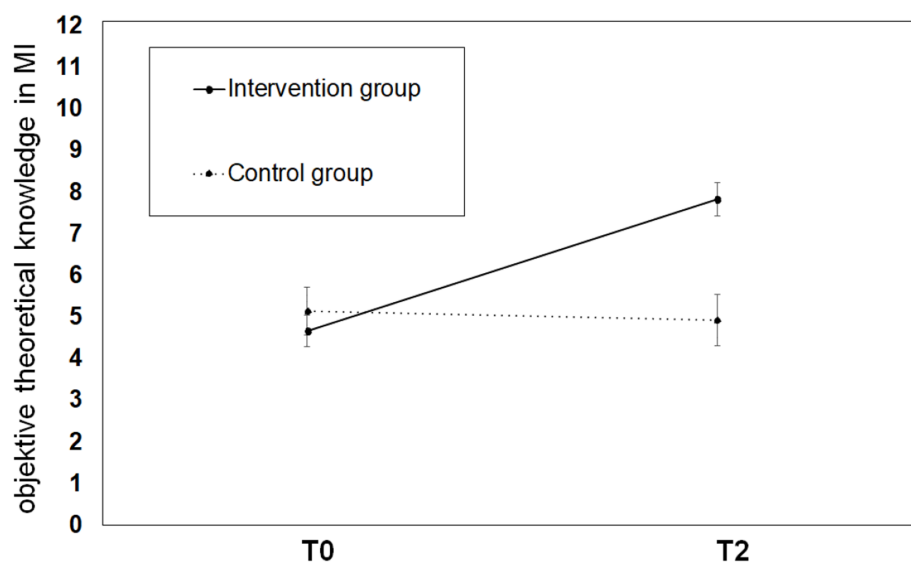


FIGURE 4

Illustration of student's objective knowledge growth on MI in the IG and the CG before and after participation in the MI-curriculum. Different levels of objective theoretical knowledge growth assessed by a knowledge test within IG and CG are plotted on the y-axis, measurement points T0 and T2 are plotted on the x-axis.

Conclusion and further directions

This study provides evidence that teaching practical and theoretical knowledge of MI via a three-part curriculum in a blended learning format as part of mandatory medical courses can be successful. However, the results show that despite their learning success, students were only moderately satisfied with the curriculum. Therefore, there is still potential for future improvement, especially regarding the video formats, possibly through future inter-university exchanges. Further, the results of this study suggest that in the obligatory mode, a shorter and more basic training might be more appropriate while more in-depth training should be offered to students with a particular interest in MI.

BF: data acquisition, data analysis, interpretation of data, creating figures, and tables, substantial input to the first draft, the revisions of the manuscript and prepares a medical thesis in German language based on the presented data. TF-W: data interpretation and critical revision of manuscript. AH-W: study design, data interpretation, and critical revision of manuscript. KEK: study design, data acquisition, interpretation of data, and critical revision of manuscript. AJF: coordination and critical revision of manuscript. SZ: study design, coordination, and critical revision of manuscript. KV-S: study design, data acquisition, interpretation of data, and critical revision of manuscript. All authors contributed to study design, analysis and writing, and approved the final manuscript.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors upon reasonable request, subject to data protection requirements.

Ethics statement

The study was approved by the local ethics committee (No. 038/2016BO2). All participants gave informed consent to participate. As an incentive, six book vouchers worth €20 each were raffled among all participants at each measurement.

Author contributions

RE: data analysis, data interpretation, revision of figures and tables, and writing the first draft and all revisions of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Armstrong, M. J., Mottershead, T. A., Ronksley, P. E., Sigal, R. J., Campbell, T. S., and Hemmelgarn, B. R. (2011). Motivational interviewing to improve weight loss in overweight and/or obese patients: a systematic review and Meta-analysis of randomized controlled trials. *Obes. Rev.* 12, 709–723. doi: 10.1111/j.1467-789x.2011.00892.x
- Barbosa, H. C., De Queiroz Oliveira, J. A., Da Costa, J. M., De Melo Santos, R. P., Miranda, L. G., De Carvalho Torres, H., et al. (2021). Empowerment-oriented strategies to identify behavior change in patients with chronic diseases: an integrative review of the literature. *Patient Educ. Couns.* 104, 689–702. doi: 10.1016/j.pec.2021.01.011
- Bexelius, T. S., Olsson, C., Jarnbert-Pettersson, H., Parmskog, M., Ponzer, S., and Dahlin, M. (2016). Association between personality traits and future choice of specialisation among Swedish doctors: a cross-sectional study. *Postgrad. Med. J.* 92, 441–446. doi: 10.1136/postgradmedj-2015-133478
- Britt, E., and Blampied, N. M. (2010). Motivational interviewing training: a pilot study of the effects on practitioner and patient behaviour. *Behav. Cogn. Psychother.* 38, 239–244. doi: 10.1017/S135246580999053
- Bundesministerium Für Gesundheit, R., Hochdruckliga, D., and Diabetes-Hilfe, D. (2021). "Gesundheitsorientierung Und Informationsverhalten Chronisch Kranker" in *Sekundäranalyse In Zusammenarbeit Mit Dem Institut Für Demoskopie Allensbach*. ed. S. Gesundheitswissen (Berlin: Stiftung Gesundheitswissen)
- Cassin, S. E., Von Ranson, K. M., Heng, K., Brar, J., and Wojtowicz, A. E. (2008). Adapted motivational interviewing for women with binge eating disorder: a randomized controlled trial. *Psychol. Addict. Behav.* 22, 417–425. doi: 10.1037/0893-164x.22.3.417
- Delialioğlu, O., and Yildirim, Z. (2007). Students' perceptions on effective dimensions of interactive learning in a blended learning environment. *J. Educ. Technol. Soc.* 10, 133–146.
- Dunhill, D., Schmidt, S., and Klein, R. (2014). Motivational interviewing interventions in graduate medical education: a systematic review of the evidence. *J. Grad. Med. Educ.* 6, 222–236. doi: 10.4300/Jgme-D-13-00124.1
- Evangelini, M., Engelbrecht, S.-K., Swartz, L., Turner, K., Forsberg, L., and Soka, N. (2009). An evaluation of a brief motivational interviewing training course for HIV/AIDS counsellors in Western Cape Province, South Africa. *AIDS Care* 21, 189–196. doi: 10.1080/09540120802002471
- Ford, E. S., Bergmann, M. M., Kröger, J., Schienkiewitz, A., Weikert, C., and Boeing, H. (2009). Healthy living is the best revenge: findings from the European prospective investigation into Cancer and nutrition-Potsdam study. *Arch. Intern. Med.* 169, 1355–1362. doi: 10.1001/Archinternmed.2009.237
- Frost, H., Campbell, P., Maxwell, M., O'carroll, R. E., Dombrowski, S. U., Williams, B., et al. (2018). Effectiveness of motivational interviewing on adult behaviour change in health and social care settings: a systematic review of reviews. *PLoS One* 13:e0204890. doi: 10.1371/journal.pone.0204890
- Fu, S. S., Roth, C., Battaglia, C. T., Nelson, D. B., Farmer, M. M., Do, T., et al. (2015). Training primary care clinicians in motivational interviewing: a comparison of two models. *Patient Educ. Couns.* 98, 61–68. doi: 10.1016/j.pec.2014.10.007
- Fuhrmann, S., Kitzmann, J., Isailov-Schöchl, M., Vach, K., Fabry, G., Schulz, C., et al. (2022). Can motivational interviewing for dental settings be taught online? Results of an uncontrolled interventional trial. *Eur. J. Dent. Educ.* 26, 254–262. doi: 10.1111/Eje.12698
- Gelis, A., Cervello, S., Rey, R., Llorca, G., Lambert, P., Franck, N., et al. (2020). Peer role-play for training communication skills in medical students: a systematic review. *Simul. Healthc.* 15, 106–111. doi: 10.1097/Sih.0000000000000412
- Geller, J., and Dunn, E. C. (2011). Integrating motivational interviewing and cognitive behavioral therapy in the treatment of eating disorders: tailoring interventions to patient readiness for change. *Cogn. Behav. Pract.* 18, 5–15. doi: 10.1016/j.cbpra.2009.05.005
- Güthlin, C., Köhler, S., and Dieckelmann, M. (2020). Chronisch Krank Sein In Deutschland. Zahlen, Fakten Und Versorgungserfahrungen. Frankfurt Am Main: Goethe-Universität, Frankfurt Am Main, Institut Für Allgemeinmedizin. Urn: Nbn:De:Hebis:30:3-550450
- Habib, S., Morrissey, S., and Helmes, E. (2005). Preparing for pain management: a pilot study to enhance engagement. *J. Pain* 6, 48–54. doi: 10.1016/j.jpain.2004.10.004
- Hannöwer, W., Blaut, C., Kniesch, C., Martin, T., and Hannich, H.-J. (2012). *Motivational Interviewing – Sequentielle Codierung Zur Prozessbeobachtung. Deutsche Übersetzung (Mi-Scope;D) Manual Für Kodierer [Online]* Available at: http://www2.Medizin.Uni-Greifswald.De/Medpsych/Fileadmin/User_Upload/Dokumente/Miles/Mi-Scope_Manualuebersetzung.Pdf.
- Hettema, J., Steele, J., and Miller, W. R. (2005). Motivational interviewing. *Annu. Rev. Clin. Psychol.* 1, 91–111. doi: 10.1146/Annurev.Clinpsy.1.102803.143833
- Hoebel, J., Kuntz, B., Kroll, L. E., Schienkiewitz, A., Finger, J. D., Lange, C., et al. (2019). Socioeconomic inequalities in the rise of adult obesity: a time-trend analysis of National Examination Data from Germany, 1990–2011. *Obes. Facts* 12, 344–356. doi: 10.1159/000499718
- Hu, F. B., and Willett, W. C. (2002). Optimal diets for prevention of coronary heart disease. *JAMA* 288, 2569–2578. doi: 10.1001/jama.288.20.2569
- Hurlocker, M. C., Madson, M. B., and Schumacher, J. A. (2020). Motivational interviewing quality assurance: a systematic review of assessment tools across research contexts. *Clin. Psychol. Rev.* 82:101909. doi: 10.1016/j.cpr.2020.101909
- Jacobi, F., Höfler, M., Strehle, J., Mack, S., Gerschler, A., Scholl, L., et al. (2014). Psychische Störungen In Der Allgemeinbevölkerung. *Nervenarzt* 85, 77–87. doi: 10.1007/S00115-013-3961-Y
- Jacobs, N. N., Calvo, L., Dieringer, A., Hall, A., and Danko, R. (2021). Motivational interviewing training: a case-based curriculum for preclinical medical students. *Mededportal* 17:11104. doi: 10.15766/Mep_2374-8265.11104
- Johnston, B. D., Rivara, F. P., Driesch, R. M., Dunn, C. W., and Copass, M. K. (2002). Behavior change counseling in the emergency department to reduce injury risk: a randomized, controlled trial. *Pediatrics* 110, 267–274. doi: 10.1542/Peds.110.2.267
- Kaltman, S., and Tankersley, A. (2020). Teaching motivational interviewing to medical students: a systematic review. *Acad. Med.* 95, 458–469. doi: 10.1097/Acm.0000000000003011
- Kaplonyi, J., Bowles, K. A., Nestel, D., Kiegaldie, D., Maloney, S., Haines, T., et al. (2017). Understanding the impact of simulated patients on health care learners' communication skills: a systematic review. *Med. Educ.* 51, 1209–1219. doi: 10.1111/Medu.13387
- Keifenheim, K., Velten-Schurian, K., Fahse, B., Erschens, R., Loda, T., et al. (2019). "A change would Do you good": training medical students in motivational interviewing using a blended-learning approach—a pilot evaluation. *Patient Educ. Couns.* 102, 663–669. doi: 10.1016/j.pec.2018.10.027
- Kitzmann, J., Ratka-Krueger, P., Vach, K., and Woelber, J. P. (2019). The impact of motivational interviewing on communication of patients undergoing periodontal therapy. *J. Clin. Periodontol.* 46, 740–750. doi: 10.1111/jcpe.13132
- Li, C., He, J., Yuan, C., Chen, B., and Sun, Z. (2019). The effects of blended learning on knowledge, skills, and satisfaction in nursing students: a Meta-analysis. *Nurse Educ. Today* 82, 51–57. doi: 10.1016/j.nedt.2019.08.004
- Lundahl, B., Moleni, T., Burke, B. L., Butters, R., Tollefson, D., Butler, C., et al. (2013). Motivational interviewing in medical care settings: a systematic review and Meta-analysis of randomized controlled trials. *Patient Educ. Couns.* 93, 157–168. doi: 10.1016/j.pec.2013.07.012
- Madson, M. B., Loignon, A. C., and Lane, C. (2009). Training in motivational interviewing: a systematic review. *J. Subst. Abuse. Treat.* 36, 101–109. doi: 10.1016/j.jsat.2008.05.005
- Mannino, D. M., and Buist, A. S. (2007). Global burden of Copd: risk factors, prevalence, and future trends. *Lancet* 370, 765–773. doi: 10.1016/S0140-6736(07)61380-4
- Mayring, P., and Fenzl, T. (2010). Qualitative inhaltsanalyse [Qualitative content analysis]. *Qualitative Forschung Ein Handbuch (Qualitative Research: A Handbook)*, 468–475
- Miller, W. R., and Moyers, T. B. (2006). Eight stages in learning motivational interviewing. *J. Teach. Addict.* 5, 3–17. doi: 10.1300/J188v05n01_02
- Miller, W., and Rollnick, S. (1991). *Motivational interviewing: Preparing people to change addictive behavior*. New York, NY, US: Guilford Press.
- Miller, W., and Rollnick, S. (2004). *Motivierende Gesprächsführung*, Freiburg Im Breisgau: Lambertus-Verlag. ISBN: 978-3-7841-2545-9
- Miller, W. R., and Rollnick, S. (2012). *Motivational interviewing: Helping people change*, New York: Guilford Press.
- Miller, W. R., Yahne, C. E., Moyers, T. B., Martinez, J., and Pirritano, M. (2004). A randomized trial of methods to help clinicians learn motivational interviewing. *J. Consult. Clin. Psychol.* 72, 1050–1062. doi: 10.1037/0022-006x.72.6.1050
- Morton, C. E., Saleh, S. N., Smith, S. F., Hemani, A., Ameen, A., Bennie, T. D., et al. (2016). Blended learning: how can we optimise undergraduate student engagement? *BMC Med. Educ.* 16:195. doi: 10.1186/S12909-016-0716-Z

- Moyers, T. B., Martin, T., Manuel, J. K., Hendrickson, S. M., and Miller, W. R. (2005). Assessing competence in the use of motivational interviewing. *J. Subst. Abus. Treat.* 28, 19–26. doi: 10.1016/J.Jsat.2004.11.001
- Naar-King, S., Lam, P., Wang, B., Wright, K., Parsons, J. T., and Frey, M. A. (2008). Brief report: maintenance of effects of motivational enhancement therapy to improve risk behaviors and Hiv-related health in a randomized controlled trial of youth living with Hiv. *J. Pediatr. Psychol.* 33, 441–445. doi: 10.1093/Jpepsy/Jsm087
- Nortvig, A.-M., Petersen, A. K., and Balle, S. H. (2018). A literature review of the factors influencing E-learning and blended learning in relation to learning outcome, student satisfaction and engagement. *Electr. J. E-Learn.* 16, 46–55.
- Phillips, J. A., Schumacher, C., and Arif, S. (2016). Time spent, workload, and student and faculty perceptions in a blended learning environment. *Am. J. Pharm. Educ.* 80:102. doi: 10.5688/Ajpe806102
- Poirier, M. K., Clark, M. M., Cerhan, J. H., Pruthi, S., Geda, Y. E., and Dale, L. C. Teaching motivational interviewing to first-year medical students to improve counseling skills in Health behavior change. Mayo Clinic Proceedings, (2004). Elsevier, 327–331.
- Rathmann, W., Bongaerts, B., Carius, H.-J., Kruppert, S., and Kostev, K. (2018). Basic characteristics and representativeness of the German disease analyzer database. *Int. J. Clin. Pharmacol. Ther.* 56, 459–466. doi: 10.5414/Cp203320
- Rubak, S., Sandbæk, A., Lauritzen, T., Borch-Johnsen, K., and Christensen, B. (2009). General practitioners trained in motivational interviewing can positively affect the attitude to behaviour change in people with type 2 Diabetes: one year follow-up of an Rct, addition Denmark. *Scand. J. Prim. Health Care* 27, 172–179. doi: 10.1080/02813430903072876
- Ryan, R. M., and Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*, New York: Guilford Publications.
- Schechter, N., Butt, L., Jacocks, C., Staguin, E., Castillo, R., and Wegener, S. T. (2021). Evaluation of an online motivational interviewing training program for rehabilitation professionals: a pilot study. *Clin. Rehabil.* 35, 1266–1276. doi: 10.1177/02692155211002958
- Schwalbe, C. S., Oh, H. Y., and Zweben, A. (2014). Sustaining motivational interviewing: a Meta-analysis of training studies. *Addiction* 109, 1287–1294. doi: 10.1111/Add.12558
- Smedslund, G., Berg, R. C., Hammerstrøm, K. T., Steiro, A., Leiknes, K. A., Dahl, H. M., et al. (2011). Motivational interviewing for substance abuse. *Campbell Syst. Rev.* 2011, 1–126. doi: 10.1002/14651858.Cd008063.Pub2
- Smith, S., Hanson, J. L., Tewksbury, L. R., Christy, C., Talib, N. J., Harris, M. A., et al. (2007). Teaching patient communication skills to medical students: a review of randomized controlled trials. *Eval. Health Prof.* 30, 3–21. doi: 10.1177/0163278706297333
- Statistisches Bundesamt. (2017). Available at: https://www.statistischebibliothek.de/mir/receive/Deheft_Mods_00071575 (accessed 27 December, 2022).
- Teufel, M., Becker, S., Rieber, N., Stephan, K., and Zipfel, S. (2011). Psychotherapie und Adipositas. *Nervenarzt* 82, 1133–1139. doi: 10.1007/S00115-010-3230-2
- Treasure, J. L., Katzman, M., Schmidt, U., Troop, N., Todd, G., and De Silva, P. (1999). Engagement and outcome in the treatment of bulimia nervosa: first phase of a sequential design comparing motivation enhancement therapy and cognitive behavioural therapy. *Behav. Res. Ther.* 37, 405–418. doi: 10.1016/S0005-7967(98)00149-1
- Vainio, H., Kaaks, R., and Bianchini, F. (2002). Weight control and physical activity in Cancer prevention: international evaluation of the evidence. *Eur. J. Cancer Prev.* 11, S94–S100.
- Vallée, A., Blacher, J., Cariou, A., and Sorbets, E. (2020). Blended learning compared to traditional learning in medical education: systematic review and Meta-analysis. *J. Med. Internet Res.* 22:E16504. doi: 10.2196/16504
- Van Dorsten, B. (2007). The use of motivational interviewing in weight loss. *Curr. Diab. Rep.* 7, 386–390. doi: 10.1007/S11892-007-0063-X
- Walters, S. T., Vader, A. M., Nguyen, N., Harris, T. R., and Eells, J. (2010). Motivational interviewing as a supervision strategy in probation: a randomized effectiveness trial. *J. Offender Rehabil.* 49, 309–323. doi: 10.1080/10509674.2010.489455
- Weinstein, P., Harrison, R., and Benton, T. (2006). Motivating mothers to prevent caries: confirming the beneficial effect of counseling. *J. Am. Dent. Assoc.* 137, 789–793. doi: 10.14219/Jada.Archive.2006.0291
- Westerlaken, M., Christiaans-Dingelhoff, I., Filius, R. M., De Vries, B., De Bruijne, M., and Van Dam, M. (2019). Blended learning for postgraduates; an interactive experience. *BMC Med. Educ.* 19:289. doi: 10.1186/S12909-019-1717-5
- Westra, H. A., Aviram, A., and Doell, F. K. (2011). Extending motivational interviewing to the treatment of major mental health problems: current directions and evidence. *Can. J. Psychiatry* 56, 643–650. doi: 10.1177/070674371105601102
- Wissing, F. (2018). Nationaler Kompetenzbasierter Lernzielkatalog Medizin Und Zahnmedizin (Nklm/Nklz). *Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz* 61, 170–170. doi: 10.1007/S00103-018-2688-0



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The influence of Big Five personality traits on college students' key competencies: the mediating effect of psychological capital

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Background: In recent years, both society and employers have put forward higher requirements for the comprehensive quality of college students in the new era. Based on the conservation of resources theory and life-cycle approach, this study aimed to examine the relationship between the Big Five personality traits, the psychological capital, and the key competencies among college students and analyzed the mediating role of the psychological capital in this link.

Methods: A total of 1,132 Chinese undergraduates (67.40% girls; 48.67% from key universities) participated. Participants completed self-report questionnaires that evaluated the five key characteristics of personality, psychological capital, and key competencies.

Results: There were extremely significant university-type differences in key competencies of college students. And the mediating role of psychological capital in the link between Big Five personality traits and key competencies was validated according to PROCESS model 4. Psychological capital serves as a partial mediator in the relationships between neuroticism and critical thinking, openness and creativity, conscientiousness and creativity, openness and communication, conscientiousness and communication, extraversion and collaboration, as well as openness and collaboration. The proportion of mediating effects for the above models was 5.97, 10.89, 11.82, 12.24, 11.98, 12.39, and 22.72%, respectively.

Discussion: The findings provide a better understanding of the key competencies of college students from the perspectives of the Big Five personality traits and psychological capital and suggest a greater emphasis to focusing on personality and improving psychological capital.

KEYWORDS

Big Five personality traits, psychological capital, key competencies, college students, higher education

1. Introduction

The term “key competency” was first recognized and defined by the DeSeCo Project in 1997 as a pivotal concept in human resource management, education, and psychology, serving as a foundational framework for successful living and social functioning (Rychen and Salganik, 2003). The Chinese government, since the 18th CPC National Congress in 2012, has emphasized

the cultivation of key competencies in college students, initiating curriculum reforms in 2014 and focusing on accelerating high-quality education system construction, as underscored by President Xi Jinping in 2022, to foster lifelong and social adaptability in students. “Higher education has become the new star ship in the policy fleet for governments which undertakes the mission of talent cultivation” (Olssen and Peters, 2005). To occupy the high ground of global competition in global technological revolution and industrial change, countries around the world are striving to cultivate talents that can meet the needs of society and have key competencies in the international arena (Lin, 2017).

A great deal of research has been conducted on key competencies of students, which focuses on its connotation, composition, and promotion path. And most of them were based on the background of civic education (Veugelaers, 2011), putting forward countermeasure suggestions such as adjusting the talent cultivation system (Scheerens, 2011) and reforming the curriculum system (Banks, 2008). However, in the current field of pedagogy, scholars have focused on the primary and secondary education phase (Pepper, 2011; Ángel De-Juanas and Martín, 2016; Brečka and Valentová, 2017). Numerous studies have focused on the development of key competencies in specific areas or disciplines such as information skills (Martinez-Abad et al., 2016), English as a foreign language (Sun and Zhu, 2023), digital competences (Gorghiu et al., 2018; Zhao et al., 2021), etc. In summary, there is a gap in research on key competencies at the higher education level. In this context, an in-depth study of college student key competencies and a more targeted approach to the cultivation and promotion of key competencies are of great value and significance for adapting to the current higher education reform and increased demand for social talents, improving the employment situation of college students and improving the quality of college employment of students.

Trait activation is the process by which “dormant” traits that are latent within individuals are awakened in appropriate contexts and manifest specific behaviors (Tett and Guterman, 2000). The specific behaviors resulting from trait activation are called “trait-expressive behavior” (TEB). As an innate personality trait, the Big Five personality traits (hereafter abbreviated as BFPT) is considered stable and unchangeable (McCrae and Costa, 1994; Caspi et al., 2005; Roberts et al., 2006), while psychological capital (commonly abbreviated in academia as PsyCap) is a positive psychological force that can be measured, nurtured, and developed through intervention (Luthans et al., 2008). Psychological study has shown that intellectual factors usually account for only 20% of the conditions that promote individual success, while nonintellectual factors account for 80% (Wang and Song, 2011). As a foundational personality trait, BFPT has an innate influence on key competencies. In the “traits to competencies” process, PsyCap may be a trait-related cue (Tett and Burnett, 2003) that mediates the stimulation and expression of traits.

Hence, the objectives of the paper are tripartite. Firstly, explore possible differences in key competencies at the gender or institutional level; Secondly, examine the correlation between the dimensions of BFPT, PsyCap and college students’ key competencies; Thirdly, examine the mediating role of PsyCap between BFPT and key competencies. Therefore, this study has the following research questions: what is the relationship between BFPT and key competencies? How does PsyCap mediate the said relationship?

To achieve these objectives, this study is divided into six parts. The first part introduces the research background, research objectives, and questions. The second part theoretically constructs the process mechanism model of “BFPT→PsyCap→key competencies” and puts forward relevant research hypotheses. The third part introduces the data sources and research methods and explains the reliability of the measurement scale of related variables. The fourth section presents the results of difference test, correlation test and bootstrap mediation effect test to verify and test the hypotheses. The fourth part further discusses the results of the study. The fifth section gives the conclusions of this paper. The sixth section presents the points where the article could be improved.

2. Development of theory and hypotheses

2.1. Key competencies of college students

There has not come to a consensus on the concept of key competencies. We have summarized the representative concepts given by some organizations and scholars, as illustrated in Table 1. Given that the subjects of our study are Chinese university students, we would adhere to the definition and viewpoints of Lin (2016), especially the goal of cultivating key competencies “in order to meet the needs of their lifelong development and the development of society,” which is more in line with the current development of Chinese society and the background of the development of Chinese higher education.

A review of the literature reveals that research on key competencies defined the growth and development of students mainly from the perspective of skills and abilities, and that several different terminologies were used. For instance, basic skills (Ishikawa and Ryan, 2002), 21st century skills (Trilling and Fadel, 2009), soft skills (Abdul Karim et al., 2012), generic skill (Yin, 2018), employability skills (Suleman, 2018). The most widely known connotation framework is the framework for 21st century learning announced by the American Partnership for 21st Century Skills (Partnership for 21st Century Skills, 2011). Academics are increasingly recognizing that the literacies described in the P21 framework have become integral to the success of all students around the world, which contain critical thinking, creativity, communication, and collaboration (Keane et al., 2016). Moreover, we believe that these four competencies are highly consistent with Lin’s (2016) statement of “facilitating lifelong development and adapting to social development.” Therefore, we adopted the 4Cs key competencies framework proposed by P21 which contains critical thinking, creativity, communication, collaboration.

As educational reforms continue, college students are gradually showing less gender-specific differences in their key competencies, breaking down old gender stereotypes. Additionally, gender meta-analyses have revealed that both sexes have similar levels in most psychological variables (Hyde, 2005). Based on this, our paper proposes the following.

Hypothesis 1. There are no significant gender differences in the key competencies of college students.

TABLE 1 Definitions of key competencies.

Scholars/organizations	Definition
OECD (2005)	Key competencies consist of three core elements: (i) it brings benefits to society and individuals; (ii) it helps individuals meet important needs they face in a variety of contexts; and (iii) it is important to everyone
European Communities (2006)	The qualities that all individuals need to achieve personal fulfillment and development, become active citizens, to integrate into society, and be successful employed
UNESCO (2015)	The ability to explore, research, experiment and create, the ability to express and communicate verbally, and the higher-order skills involved in problem solving such as logical thinking, analysis, synthesis, deduction, reasoning, induction, and hypothesis
Rieckmann (2012)	Key competencies represent an extension of specific competencies, are transversal, multifunctional, and contextual, are essential for the achievement of social goals (e.g., sustainability), personal development, and require individuals to have strong reflective skills
Ministry of Education of the People's Republic of China (2014)	Key competencies are more complex than skills and refer to the competencies that people should have and continue to develop in their learning and life today and in the future, including knowledge, skills, attitudes and values that can guide their actions
Lin (2016)	The essential character and key competencies that students gradually develop in the course of their education at the appropriate level to meet the needs of their lifelong development and the development of society. It is a combination of knowledge, skills, emotions, attitudes, and values that students need

Formed from the corresponding literature in the table.

Standardized tests like the China College Entrance Examination or the SAT in the United States may play a role in the selection process, reflecting differences in the key competencies of college students across institution types. Apart from this, there may be different educational philosophies and teaching approaches in resources and opportunities (Bowen et al., 2005), Peer influence (Sacerdote, 2001), expectations and standards (Bowen et al., 2009). These differences in training models can lead to gaps in key competencies of students. Therefore, we proposed the following hypotheses:

Hypothesis 2a (2b, 2c, 2d). There is a significant difference in critical thinking (creativity, communication, collaboration) for college students from different tiers of university.

2.2. BFPT and key competencies

Personality is a notable measurement of non-cognitive abilities, and psychologists have conceptualized personality traits primarily using self-esteem, internal locus of control, assertiveness, and anxiety (Feingold, 1994). After decades of scholarly efforts, the BFPT model was established and this has contributed to the dramatic growth of personality research since the 1980s (Digman, 1990). The Big Five framework enjoys considerable support and has become the most widely used and extensively researched model of personality (McCrae and Costa, 1994). The Big Five refers to the five dimensions that represent personality at the broadest level of abstraction; these five dimensions are typically labeled as extraversion, openness, agreeableness, neuroticism, and conscientiousness. According to the definition in Costa and McCrae's NEO-PI-R test manual, which is the most commonly accepted definition nowadays, the brief explanation of each trait is as follows: (1) neuroticism pertains to emotional instability, marked by anxiety, hostility, depression, self-consciousness, impulsivity, and vulnerability. (2) Extraversion embodies sociability and outgoingness, characterized by warmth, gregariousness, assertiveness, activity, a penchant for excitement, and positive emotions. (3) Openness indicates receptivity to new experiences,

ideas, and feelings, defined by imagination, aesthetic sensitivity, emotional depth, adventurousness, intellectual curiosity, and a propensity to challenge conventional wisdom. (4) Agreeableness measures interpersonal harmony and cooperation, characterized by trust, straightforwardness, altruism, compliance, modesty, and tenderness. (5) Conscientiousness represents organizational skills, responsibility, and thoroughness, indicated by competence, orderliness, dutifulness, a drive for achievement, self-discipline, and careful consideration. (Costa and McCrae, 2008).

Numerous academics have conducted research on the correlation between BFPT and key competencies, such as perceived stress (You et al., 2020), perception of competencies development and personal preferences (López-López et al., 2020), global competencies and achievement in learning English (Cao and Meng, 2020), cognitive competencies (Cerni et al., 2021). Previous meta-analysis has found that among BFPT, neuroticism was the only trait negatively correlated with personal competencies (Poropat, 2009), while studies have revealed that extraversion (Barrick et al., 2001), openness (Chamorro-Premuzic and Furnham, 2003), agreeableness (Avey et al., 2010) and conscientiousness (Judge et al., 2007) were positively related to key competencies in academic and work areas. Due to a lack of data, there is currently no existing research using Chinese university students as a sample to study the relationship between BFPT and key competencies. Consequently, we formulate the following hypothesis.

Hypothesis 3. There are significant correlations between BFPT and key competencies. More specifically, neuroticism is negatively correlated, while extraversion, openness, agreement, and conscience are positively correlated.

2.3. The mediating role of Psyscap

BFPT factors are found to be substantially influenced by genetic factors, largely formed during early childhood, and remarkably stable during young adulthood (Caspi et al., 2005). Building on the foundational work of Seligman (2002) in positive psychology, the

concept of PsyCap was conceived, which Luthans (2002) later incorporated into the realm of management studies. Separately, Seligman's theory of learned optimism has provided strategies to promote optimism and thus improve PsyCap (Seligman, 2006). Luthans (2002) found that PsyCap is a positive psychological force that can positively motivate positive attitudes and behaviors, promote physical and mental growth, academic and employment development, and enhance one's competitive advantage. As a positively-oriented, renewable, and non-scarce key resource, PsyCap denotes the evolving positive mental state of an individual (Luthans and Youssef, 2004). Its effective development and management significantly impact key competencies (Luthans et al., 2007). Notably, PsyCap can be invested in and developed through psychological capital interventions (PCI) to unlock individual potential (Luthans et al., 2007). High PsyCap people have enough key resources to clearly position and maximize the strengths of personality traits (Xing et al., 2023). According to conservation of resources theory (COR), high psychological capitalists can continuously create more psychological resources through the resource gain spiral effect (Hobfoll, 2002). In summary, the study of PsyCap has important and far-reaching value for a comprehensive and in-depth understanding of the positive forces in individual traits (Xiong and Ye, 2014), positioning it as a strategic asset for maintaining long-term talent competitiveness (Ren et al., 2013). PsyCap is measurable, developable and cultivable and consists of four core elements: optimism, resilience, self-efficacy, and hope. The Luthans approach to this dimension of PsyCap has gained wide acceptance and has been highly cited in the academic community. As defined by Luthans et al. (2007): (1) self-efficacy refers to the confidence in one's skills to successfully tackle tasks and attain goals. It underlines an individual's belief in their capability to manage and perform in diverse situations. (2) Optimism is the positive anticipation of future outcomes. It showcases an individual's tendency to view success as a product of enduring, universal factors and setbacks as temporary, situational incidents. (3) Hope encompasses the persistent drive to fulfill aspirations and the adaptability to modify strategies in the face of challenges. It signifies both grit in pursuing goals and flexibility when faced with hurdles. (4) Resilience represents the capacity to recover from and thrive amidst adversity. It underscores the ability to bounce back from distressing experiences and leverage adversity to fuel personal growth and success.

BFPT and PsyCap are interrelated, but do not overlap (Hong et al., 2020). PsyCap provides a unique perspective beyond stable personality traits in predicting individual performance (Luthans et al., 2007). PsyCap, with its state-like essence, offers a distinctive malleability (Luthans and Youssef, 2004), it's not only subject to change but can be actively cultivated and enhanced through targeted interventions (psychological capital interventions, PCI) (Luthans et al., 2007). Contrastingly, BFPT serve as robust markers of an individual's innate character, with meta-analyses underscoring their pronounced stability (Roberts and DelVecchio, 2000), particularly during adulthood (McCrae and Costa, 1994). Thus, While PsyCap offers a fluid and evolvable pathway for individual growth, BFPT provide a relatively stable and enduring representation of an individual's inherent disposition.

The mediating role of PsyCap has been convinced between BTPT and subjective well-being (Luthans et al., 2007), academic performance (Luthans et al., 2019), career adaptability (Selma, 2022), investment performance (Akhtar and Das, 2020), which are representations of key

competencies in career-oriented or learning-focused scenarios. Thus, we conjecture that PsyCap acts as a mediatorial bridge between BFPT and key competencies. Therefore, a theoretical model of "BTPT→PsyCap→key competencies" was developed (see Figure 1, below), and the hypotheses were proposed as follows:

Hypothesis 4. There are significant correlations between BFPT and PsyCap. Neuroticism is negatively correlated, while extraversion, openness, agreeableness, and conscientiousness are positively correlated.

Hypothesis 5. PsyCap mediates the relationship between BFPT and key competencies.

3. Materials and methods

3.1. Study design

This cross-sectional study was conducted in universities in China using convenience sampling. The questionnaires were distributed online and all participants were informed of the details of the study and could withdraw from participation at any time, either temporarily or permanently. Ethical approval was obtained from Beijing Forestry University.

3.2. Participants

A total of 1,253 undergraduate students participated in the study. After excluding invalid samples, we finally collected 1,132 valid questionnaires with an effective response rate of 90.34%. The exclusion of "invalid questionnaires" in this study was based on the following: Firstly, questionnaires that contain a multitude of unanswered questions or where key items are left blank were classified as invalid. Secondly, if the respondents chose the same option for all items, indicating a lack of engagement or careful consideration, the questionnaire was usually deemed invalid. Lastly, if the questionnaire was filled out in a time frame that is implausibly short, it may suggest rushed, non-thoughtful responses, rendering it invalid. The

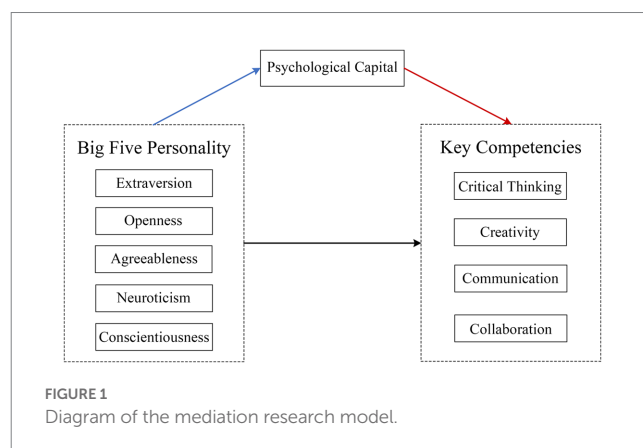


TABLE 2 Sample distribution statistics of the questionnaire.

Basic characteristics		Number of samples	Percentage
Gender	Male	369	32.60%
	Female	763	67.40%
Type of universities	Key universities	551	48.67%
	General universities	581	51.33%

participants included 369 (32.60%) boys and 763 (67.40%) girls. Of the participants, 551 (48.67%) were from key universities¹ and 581 (51.33%) were from general universities.² Table 2 summarizes the distribution of valid questionnaires.

3.3. Measures

At the beginning of this study, we made sure to convey the scholarly intention and the confidentiality assurance of the questionnaire. This was done with the objective of mitigating the responses' apprehensions and thus collecting more authentic data. The main questionnaire contained two main parts: the first part was a background information, containing information on the type of universities, individual gender, etc. The second part includes the BFPT inventory, the PsyCap inventory and the college students' key competencies inventory. The questionnaire responses were measured using a 5-point Likert scale (1 = very non-conformist, 5 = very conformist).

BFPT was measured using the Chinese version of the 10-item BFPT Inventory (TIPI-C), which was translated and developed by Li (2013) based on the 10-item BFPT Inventory (TIPI) developed by Gosling et al. (2003), which included five dimensions: (1) extraversion, (2) agreeableness, (3) consciousness, (4) neuroticism, (5) openness. TIPI-C was revealed to be reliable and valid to measure BFPT among Chinese university students, with a Cronbach's alpha (α) of 0.863 in our study. The Cronbach's alpha (α) coefficients of the five personality traits subscales reached 0.785, 0.709, 0.850, 0.820 and 0.700, respectively.

The PsyCap of the students was assessed using the positive PsyCap questionnaire (PPQ) developed by Zhang et al. (2010), which included four dimensions: hope, effectiveness, resilience, and optimism. Cronbach's alpha (α) for this scale in this study was 0.874, with good reliability. This approach is widely accepted in existing research. Many researchers have used similar or identical methods to measure overall levels of PsyCap. It should be noted that in the follow-up study, PsyCap was expressed as a weighted average of four dimensions calculated using principal component analysis to indicate its overall level, this approach is widely accepted in existing research, and many researchers have used similar or identical methods to measure overall levels of PsyCap (Sui et al., 2012; Baron et al., 2016). Thus, the use of the weighted average of these four dimensions as a representation of the overall PsyCap is theoretically justified.

We selected four dimensions of key competencies for an in-depth study: critical thinking, creativity, communication, and collaboration. Given that there is no directly usable "key competencies assessment scale for college students" (with multiple dimensions), but only separate scales that distinguish between competency points, we aggregated the subscales of the four competency points to collectively measure the key competencies of college students. The four competencies were evaluated using the critical thinking inventory, creativity inventory, communication inventory and collaboration inventory developed by Gan et al. (2020), Kang et al. (2020), Ma et al. (2020) and Xu et al. (2020), respectively. The creators of the scale are very authoritative in the field of key competencies education for Chinese college students, so the scale has a high degree of recognition. The overall Cronbach's alpha (α) for this scale in this study was 0.925, with good reliability. The Cronbach's alpha (α) coefficients of the four competencies subscales reached 0.759, 0.942, 0.925, and 0.921, respectively. In addition, in order to test whether the collected data functioned according to the way these four sub-points are structured, a validation factor analysis was conducted using Mplus 8.0 for the scale items of the key competencies, which resulted in a fit index of ($\chi^2/df = 2.963 < 3$, CFI = 0.952 > 0.9, TLI = 0.945 > 0.9, RMSEA = 0.048 < 0.08) for the four-factor model, proving a high discriminant validity and a acceptable fit between critical thinking, creativity, communication, and collaboration.

3.4. Statistical analyses

Data were analyzed using SPSS 23.0 and PROCESS Model 4 (Hayes, 2013). The reliability of all the measurement instruments in this study was calculated using Cronbach's alpha (α). Before analysis, normality, homoscedasticity, and linearity were examined and found to be supported. The correlation between each variable was derived from the Pearson bivariate product-moment correlation coefficient (r). Standard regression and the bootstrap method were used to test the mediation hypothesis. Compared to traditional stepwise testing (Baron and Kenny, 1986) and the Sobel method (Sobel, 1982), bootstrap is less demanding on the sample and more sensitive in determining the model. In this study, 5,000 bootstrap samples were used. BFPT served as a predictor, PsyCap as mediator, and key competencies of college students as the outcome variable. Age, sex, type of universities, and the other 4 dimensions of BFPT except for the independent variable X were set as covariates based on previous studies (González-Morales et al., 2012). Direct and indirect effects were calculated to determine the results of the mediation model. Confidence intervals (CI) that did not contain 0 were considered significant. Statistical significance was established at $p < 0.05$.

4. Results

4.1. Descriptive analysis and variance analysis of key competencies

4.1.1. Descriptive analysis of key competencies of college students

Table 3 reports the results of the descriptive analysis. The results indicated that the overall level of key competencies among Chinese

¹ Refers to Chinese universities in the list of Project 211 and Project 985.

² Refers to Chinese universities outside the list of Project 211 and Project 985.

college students was high, with a mean score of 4.543 (maximum score of 5). Moreover, the overall levels of all four of these subdimensions were relatively high. Dimension 3, communication, had the highest level (4.567 ± 0.086), followed by dimension 4, collaboration (4.555 ± 0.089) and dimension 1, critical thinking (4.542 ± 0.101), and lower levels for dimension 2, creativity (4.501 ± 0.095) in comparison. The consistency of these scores was notable, with all means and medians quite similar. This suggested that students tend to be balanced in their competencies, without extreme strengths or weaknesses in these four areas.

4.1.2. Variance analysis of key competencies in gender and university type

Independent sample *t*-test analysis was performed with key competencies as the dependent variable and gender and type of university as the independent variables. Table 4 reports the results of the gender difference test. It was found that both boys and girls showed consistency in all four dimensions of the key competencies, and there were no differences. Therefore, Hypothesis 1 was supported.

There were significant differences in key competencies by type of university, as indicated in Table 4. There were significant differences in the key competencies of 2 aspects of critical thinking and creativity ($\text{Sig} < 0.05$). In terms of critical thinking, the scores of the students from key universities (4.55 ± 0.67) were significantly higher than those of the students from general universities (4.53 ± 0.14), while in terms of the creativity, the scores of students from key universities (4.51 ± 0.81) were significantly higher than those of the students from general universities (4.49 ± 0.12). These differences may be related to the way student thinking is guided or nurtured in different schools. However, in terms of communication and collaboration, there was no significant difference between major and general universities, which did not have sufficient.

4.2. Correlation analysis among BFPT, Pyscap, and key competencies

The results of the correlation between BFPT and key competencies of college students are shown in Table 5. There was a negative correlation between neuroticism and the four subdimensions of key competencies and the total score, showing that the higher the score of neuroticism, the lower the level of college students in all aspects. There were significant positive correlations between the dimensions of extraversion, openness, agreeability, conscientiousness, and the four subdimensions of key competencies and the total score, which revealed that the higher the

score of these four dimensions, the higher the level of key competencies of college students in all aspects. The results therefore supported Hypothesis 3.

The results of the correlation between BFPT and PsyCap are shown in Table 6. The results demonstrated that there were significant negative correlations between neuroticism and the four dimensions of PsyCap: optimism, resilience, self-efficacy, and hope. There were significant positive correlations between the other four dimensions of BFPT and the four dimensions of PsyCap. Therefore, Hypothesis 4 was accepted.

Table 5 reports the results of the correlation analysis between the four dimensions of PsyCap and the key competencies. There were significant positive correlations between the four dimensions of PsyCap and the four dimensions of key competencies and the total score, showing that the higher the score of PsyCap, the higher the level of key competencies.

4.3. Mediating effects of Pyscap between BFPT and key competencies

The mediating effect of pscap in the relationship between BFPT and key competencies was examined according to the mediating effect procedure recommended by Wen and Ye (2014), controlling for the type of universities, gender, and the other four dimensions of BFPT except for the independent variable *X*. And model 4 of PROCESS (Hayes, 2013) was used to examine the possible mediating effect. Analysis was carried out using the nonparametric percentile bootstrap method (with a sampling size of 5,000). Confidence intervals (CI) that did not contain 0 were considered significant.

This section examined the relationship between the five dimensions of BFPT and the four dimensions of key competencies, using the weighted average of PsyCap as the mediating variable, with a total of seven significant mediation models resulting from the analysis.

To test the possible mediating effect of PsyCap between the five dimensions of BFPT and the four dimensions of key competencies, we constructed the following mediating effect model based on stepwise regression.

$$Y_i = \alpha_0 + \alpha_1 X_j + \gamma_0 \text{Control}$$

$$M = \beta_0 + \beta_1 X_j + \gamma_1 \text{Control}$$

$$Y_i = \delta_0 + \delta_1 X_j + \delta_2 M + \gamma_2 \text{Control}$$

In the formula: *Y* is key competencies, *X* is BFPT, *M* is PsyCap, and Control is the control variable (gender, type of university, and the other 4 dimensions of BFPT except for the independent variable *X*). *i* (=1, 2, 3, 4) indicates the 4 dimensions of key competencies (critical thinking, creativity. Communication and collaboration), and *j* (=1, 2, 3, 4, 5) marks the 5 dimensions of BFPT (extraversion, openness, acceptableness, neuroticism, and conscientiousness). α_0 , β_0 , and δ_0 are constant terms.

TABLE 3 Results of the descriptive analysis of key competencies of college students.

Dimension	Mean value	Standard deviation	Median value
Critical Thinking	4.542	0.101	4.536
Creativity	4.501	0.095	4.492
Communication	4.567	0.086	4.559
Collaboration	4.555	0.089	4.547

TABLE 4 t-test analysis of gender and university type differences in core competencies.

Dimension	Gender ($M \pm SD$)		T	Type of universities ($M \pm SD$)		T
	Female ($N = 763$)	Male ($N = 369$)		Key univ. ($N = 551$)	General univ. ($N = 581$)	
Critical Thinking	4.54 \pm 0.11	4.54 \pm 0.09	−0.056	4.55 \pm 0.67	4.53 \pm 0.14	−2.458*
Creativity	4.50 \pm 0.10	4.50 \pm 0.07	−0.485	4.51 \pm 0.81	4.49 \pm 0.12	−2.225*
Communication	4.57 \pm 0.08	4.57 \pm 0.07	−0.161	4.57 \pm 0.68	4.56 \pm 0.11	−1.552
Collaboration	4.55 \pm 0.10	4.55 \pm 0.07	0.208	4.56 \pm 0.70	4.55 \pm 0.11	−1.747

*Means 0.05, **means 0.01, ***means 0.001. The same as below.

TABLE 5 Correlations between BFPT and key competencies, PsyCap and key competencies.

Dimension	Critical thinking	Creativity	Communication	Collaboration
Extraversion	0.073**	0.145***	0.143***	0.119***
Openness	0.139***	0.180***	0.211***	0.199***
Agreeableness	0.175***	0.193***	0.210***	0.192***
Neuroticism	−0.02	−0.070**	−0.082***	−0.061**
Conscientiousness	0.191***	0.231***	0.284***	0.278***
Optimism	0.273***	0.246***	0.246***	0.285***
Resilience	0.187***	0.159***	0.147***	0.218***
Self-efficacy	0.325***	0.306***	0.266***	0.326***
Hope	0.338***	0.307***	0.311***	0.324***

4.3.1. Principal component analysis of PsyCap

Using SPSS 23.0 statistical analysis software, a factor analysis was performed at the PsyCap level of Chinese university students. To eliminate possible adverse effects due to differences in magnitude, we have standardized the raw data.

The KMO was 0.768 (>0.7) and the Sig was less than 0.05, indicating that the analysis of the data supported the principal components. Meanwhile, a common factor was extracted according to the principle that the eigenvalue is greater than one, and the cumulative variance contribution was 73.370%. As a result, a common factor was extracted to reflect 73.370% of the variance of the original variable, as shown in Table 7.

This study employed the variance contribution of the principal components as weights. The normalization of the weighted average of the coefficients in the linear combination of each principal component for this index was executed. The weights of the indices were calculated using the principal component analysis method.

First, the coefficients of the linear combination were calculated using the formula.

$$w_i = \frac{F_i}{\mu}$$

In the above equation, w_i is the coefficient in the linear combination corresponding to component 1 of the i th indicator, F_i is the component matrix value corresponding to component 1 of the i th indicator, and μ is the square root of the eigenvalue of component 1; $i = 1, 2, 3, 4$. This results in a composite score model.

$$Y = w_1X_1 + w_2X_2 + w_3X_3 + w_4X_4$$

This gave the formula for calculating the level of PsyCap.

$$\text{PsyCap} = 0.4886 X_1 + 0.4670 X_2 + 0.5281 X_3 + 0.5141 X_4$$

4.3.2. Mediated influence pathways test of critical thinking

In this section, the mediating paths of BFPT through PsyCap influencing critical thinking were tested, yielding a significant mediating model 1: neuroticism-PsyCap-critical thinking. The result indicates that neuroticism reduces performance in critical thinking partially by diminishing PsyCap.

The results of the mediation analysis of model 1 are presented in Table 8. After controlling for the type of universities, gender, and the other 4 dimensions of BFPT, we first found that neuroticism negatively predicted critical thinking, $B = -0.134$, $p < 0.001$ (Eq. 1). Second, neuroticism negatively predicted PsyCap, $B = -0.359$, $p < 0.1$ (Eq. 2). Third, after putting both independent and mediating variables in the equation, neuroticism negatively predicted critical thinking, $B = -0.126$, $p < 0.001$, PsyCap positively predicted critical thinking, $B = 0.022$, $p < 0.001$ (Eq. 3). The bias-corrected bootstrapping mediation test indicated that the process by which neuroticism predicted critical thinking through PsyCap was significant, indirect effect = −0.008, 95% CI = (−0.016, −0.002), which are presented in the Table 9. The ratio of direct and mediated effects to the total effect was 94.03% and 5.97%, respectively, which was a partially mediated model. The mediated path diagram of model 1 is shown in Figure 2.

4.3.3. Mediated influence pathways test of creativity

In this section, the mediating paths of BFPT through PsyCap influencing creativity were tested, yielding 2 significant mediating models: the model 2 was openness-PsyCap-creativity, the model 3 was conscientiousness-PsyCap-creativity. The results indicate that

TABLE 6 Correlations between BFPT and PsyCap.

Dimension	Extraversion	Openness	Agreeableness	Neuroticism	Conscientiousness
Optimism	0.216***	0.265***	0.229***	−0.131***	0.344***
Resilience	0.262***	0.290***	0.408***	−0.389***	0.371***
Self-efficacy	0.265***	0.291***	0.278***	−0.184***	0.361***
Hope	0.243***	0.319***	0.354***	−0.264***	0.404***

TABLE 7 Total variance explained.

Ingredients	Initial eigenvalue			Extraction of sum of squares of loads		
	Total	Percentage variance	Cumulative percentage	Total	Percentage variance	Cumulative percentage
1	2.935	73.370	73.370	2.935	73.370	73.370
2	0.551	13.773	87.143			
3	0.305	7.617	94.760			
4	0.210	5.240	100.000			

openness and conscientiousness both improve performance in creativity partially by enhancing PsyCap.

The results of the mediation analysis of model 2 are presented in Table 10. After controlling for the type of universities, gender, and the other 4 dimensions of BFPT, we first found that openness positively predicted creativity, $B = 0.257$, $p < 0.001$ (Eq. 1). Second, openness positively predicted PsyCap, $B = 0.919$, $p < 0.001$ (Eq. 2). Third, after putting both the independent and the mediating variables in the equation, openness positively predicted creativity, $B = 0.229$, $p < 0.001$, PsyCap positively predicted creativity, $B = 0.030$, $p < 0.001$ (Eq. 3). The bias-corrected bootstrapping mediation test indicated that the process by which openness predicted creativity through PsyCap was significant, indirect effect = 0.028, 95% CI = (0.010, 0.050), which are presented in Table 9. The ratio of direct and mediated effects to the total effect was 89.11% and 10.89% respectively, which was a partially mediated model. The mediated path diagram of model 2 is shown in Figure 2.

The results of the mediation analysis of model 3 are presented in Table 10. After controlling for type of university, gender and the other four dimensions of BFPT, we first found that conscientiousness positively predicted creativity, $B = 0.220$, $p < 0.001$ (Eq. 1). Second, conscientiousness positively predicted PsyCap, $B = 0.872$, $p < 0.001$ (Eq. 2). Third, after putting both independent and mediating variables into the equation, conscientiousness positively predicted creativity, $B = 0.194$, $p < 0.001$, PsyCap positively predicted creativity, $B = 0.030$, $p < 0.001$. The bias-corrected bootstrapping mediation test indicated that the process by which conscientiousness predicted creativity through PsyCap was significant, indirect effect = 0.026, 95% CI = (0.007, 0.049), which are presented in Table 9. The ratio of direct and mediated effects to the total effect was 88.18% and 11.82%, respectively, which was a partially mediated model. The mediated path diagram of model 3 is shown in Figure 2.

4.3.4. Mediated influence pathways test of communication

In this section, the mediating paths of BFPT through PsyCap influencing communication were tested, yielding 2 significant mediating models: the model 4 was openness-PsyCap-communication, the model 5 was conscientiousness-PsyCap-communication. The

results suggest that openness and conscientiousness both improve performance in communication partially by enhancing PsyCap.

The results of the mediation analysis of model 4 are presented in Table 11. After controlling for the type of universities, gender, and the other 4 dimensions of BFPT, we first found that openness positively predicted communication, $B = 0.196$, $p < 0.001$ (Eq. 1). Second, openness positively predicted PsyCap, $B = 0.924$, $p < 0.001$ (Eq. 2). Third, after integrating both independent and mediating variables into the equation, openness positively predicted communication, $B = 0.171$, $p < 0.001$, PsyCap positively predicted communication, $B = 0.027$, $p < 0.001$ (Eq. 3). The bias-corrected bootstrapping mediation test indicated that the process by which openness predicted communication through PsyCap was significant, indirect effect = 0.024, 95% CI = (0.009, 0.044), which are presented in Table 9. The ratio of direct and mediated effects to total effect was 87.76% and 12.24%, respectively, which was a partially mediated model. The mediated path diagram of model 4 is shown in Figure 2.

The results of the mediation analysis of model 5 are presented in Table 11. After controlling for the type of university, gender and the other 4 dimensions of BFPT, we first found that conscientiousness positively predicted communication, $B = 0.192$, $p < 0.001$ (Eq. 1). Second, conscientiousness positively predicted PsyCap, $B = 0.873$, $p < 0.001$ (Eq. 2). Third, after adding the independent and mediating variables into the equation, conscientiousness positively predicted communication, $B = 0.169$, $p < 0.001$, PsyCap positively predicted communication, $B = 0.027$, $p < 0.001$ (Eq. 3). The bias-corrected bootstrapping mediation test indicated that the process by which conscientiousness predicted communication through PsyCap was significant, indirect effect = 0.023, 95% CI = (0.007, 0.043), which are presented in the Table 9. The ratio of direct and mediated effects to total effect was 88.02% and 11.98%, respectively, which was a partially mediated model. The mediated path diagram of model 4 is shown in Figure 2.

4.3.5. Mediated influence pathways test of collaboration

In this section, the mediating paths of BFPT through PsyCap influencing collaboration were tested, yielding 2 significant mediating

TABLE 8 Mediation model 1 test: neuroticism-PsyCap-critical thinking.

Predictors	Equation 1 (explicit variable: critical thinking)		Equation 2 (explicit variable: PsyCap)		Equation 3 (explicit variable: critical thinking)	
	<i>B</i>	<i>t</i>	<i>B</i>	<i>t</i>	<i>B</i>	<i>t</i>
PsyCap					0.022	3.926***
Neuroticism	−0.134	−6.227***	−0.359	−3.092*	−0.126	−5.876***
Gender	−0.050	−1.554	0.143	0.821	−0.050	−1.554
Type of universities	0.130	4.383***	0.285	1.766	0.130	4.383***
Extraversion	−0.070	−2.161*	0.353	2.019*	−0.070	−2.161*
Openness	0.021	0.516	0.922	4.107***	0.021	0.516
Agreeableness	0.136	3.608***	0.436	2.126*	0.136	3.608***
Conscientiousness	0.089	1.929	0.875	3.491***	0.089	1.929
<i>R</i> ²	0.163		0.238		0.175	
<i>F</i>	30.601		49.127		29.053	

The variables in the model are added to the regression equation using standardized variables. The same as below.

TABLE 9 Bia-corrected bootstrapping test in mediating effect of models 1–7.

Pathways	Effect	Boot SE	95% confidence interval		Percentage
			Boot LLCI	Boot ULCI	
Model 1: total effect	−0.134	0.021	−0.176	−0.092	
Neuroticism-PsyCap-critical thinking	−0.008	0.004	−0.016	−0.002	5.97%
Neuroticism-critical thinking	−0.126	0.021	−0.168	−0.084	94.03%
Model 2: total effect	0.257	0.047	0.165	0.349	
Openness-PsyCap-creativity	0.028	0.010	0.010	0.050	10.89%
Openness-creativity	0.229	0.047	0.138	0.321	89.11%
Model 3: total effect	0.220	0.052	0.118	0.323	
Conscientiousness-PsyCap-creativity	0.026	0.010	0.007	0.049	11.82%
Conscientiousness-creativity	0.194	0.052	0.092	0.296	88.18%
Model 4: Total effect	0.196	0.043	0.112	0.279	
Openness-PsyCap-communication	0.024	0.009	0.009	0.044	12.24%
Openness-communication	0.172	0.042	0.088	0.255	87.76%
Model 5: Total effect	0.192	0.047	0.099	0.286	
Conscientiousness-PsyCap-communication	0.023	0.009	0.007	0.043	11.98%
Conscientiousness-communication	0.169	0.047	0.077	0.262	88.02%
Model 6: total effect	0.113	0.028	0.058	0.168	
Extraversion-PsyCap-collaboration	0.014	0.007	0.001	0.028	12.39%
Extraversion-collaboration	0.099	0.027	0.045	0.153	87.61%
Model 7: total effect	0.110	0.036	0.040	0.181	
Openness-PsyCap-collaboration	0.025	0.010	0.006	0.047	22.72%
Extraversion-collaboration	0.085	0.035	0.016	0.155	77.27%

Boot SE, Boot LLCI and Boot ULCI refer to the standard error, lower bound and upper bound of the 95% confidence interval of the indirect effect estimated by the bia-corrected bootstrapping test, respectively; all values are rounded to retain two decimal places by rounding, as below.

models: the model 6 was extraversion-PsyCap-collaboration, the model 7 was openness-PsyCap-collaboration. The results suggest that extraversion and openness both improve performance in collaboration partially by enhancing PsyCap.

The results of the mediation analysis of model 6 are presented in Table 11. After controlling for type of university, gender and the other

4 dimensions of BFPT, we first found that extraversion positively predicted collaboration, $B = 0.113$, $p < 0.001$ (Eq. 1). Second, extraversion positively predicted PsyCap, $B = 0.443$, $p < 0.05$ (Eq. 2). Third, after putting both independent and mediating variables in the equation, extraversion positively predicted collaboration, $B = 0.099$, $p < 0.001$, PsyCap positively predicted collaboration, $B = 0.032$, $p < 0.001$.

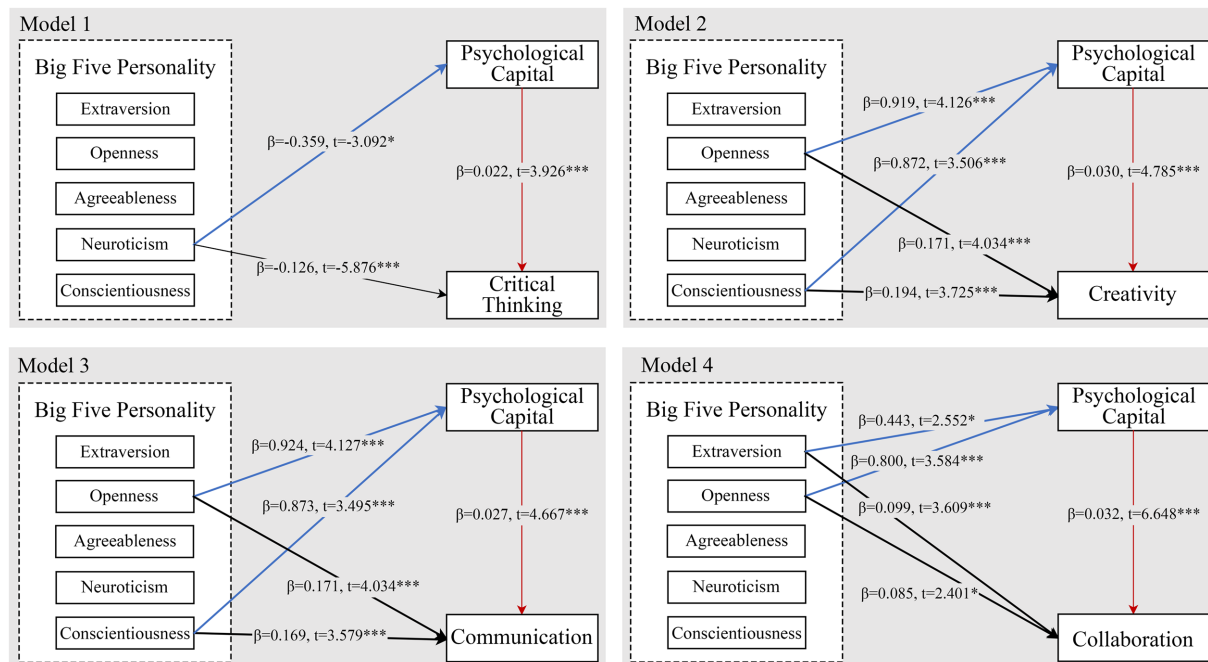


FIGURE 2
Mediating effect paths for models 1–7.

TABLE 10 Mediation model 2 test: openness-PsyCap-creativity and model 3 test: conscientiousness-PsyCap-creativity.

Predictors	Equation 4 (explicit variable: creativity)		Equation 5 (explicit variable: PsyCap)		Equation 6 (explicit variable: creativity)	
	B	t	B	t	B	t
PsyCap					0.030	4.785***
Openness	0.257	9.792***	0.919	4.126***	0.229	4.904***
Conscientiousness	0.220	4.212***	0.872	3.506***	0.194	3.725***
Gender	0.084	2.289*	0.189	1.089	0.078	2.153*
Type of universities	0.245	7.258***	0.263	1.637	0.237	7.085***
Extraversion	0.096	2.627**	0.350	2.018*	0.085	2.357*
Neuroticism	-0.020	-0.838	-0.359	-3.119**	-0.009	-0.393
Agreeableness	-0.096	-2.240*	0.442	2.172*	-0.109	-2.571**
R ²	0.246		0.242		0.261	
F	50.776		49.818		48.181	

0.001 (Eq. 3). The bias-corrected bootstrapping mediation test indicated that the process by which extraversion predicted collaboration through PsyCap was significant, indirect effect = 0.014, 95% CI = (0.001, 0.028), which are presented in Table 9. The ratio of direct and mediated effects to the total effect was 87.61 and 12.39%, respectively, which was a partially mediated model. The mediated path diagram of model 6 is shown in Figure 2.

The results of the mediation analysis of model 7 are presented in Table 12. After controlling for the type of universities, gender, and the other 4 dimensions of BFPT, we first found that openness positively predicted collaboration, $B = 0.111$, $p < 0.005$ (Eq. 1). Second, openness positively predicted PsyCap, $B = 0.800$, $p < 0.001$ (Eq. 2). Third, after integrating both independent and mediating variables into the

equation, openness positively predicted collaboration, $B = 0.085$, $p < 0.05$, PsyCap positively predicted collaboration, $B = 0.032$, $p < 0.001$ (Eq. 3). The bias-corrected bootstrapping mediation test indicated that the process by which openness predicted collaboration through PsyCap was significant, indirect effect = 0.014, 95% CI = (0.001, 0.028), which are presented in Table 9. The ratio of direct and mediated effects to the total effect was 87.61% and 12.39%, respectively, which was a partially mediated model. The mediated path diagram of model 2 is shown in Figure 2.

Taken together, these findings lead to the following BFPT-PsyCap-key competencies that mediate the effect pathways, as shown in Figure 2. Models 1–7 are partially mediated models. In summary, our findings provide an affirmation for Hypothesis 5.

TABLE 11 Mediation model 4 test: openness-PsyCap-communication and model 5 test: conscientiousness-PsyCap-communication.

Predictors	Equation 7 (explicit variable: communication)		Equation 8 (explicit variable: PsyCap)		Equation 9 (explicit variable: communication)	
	<i>B</i>	<i>t</i>	<i>B</i>	<i>t</i>	<i>B</i>	<i>t</i>
PsyCap					0.027	4.667***
Openness	0.196	4.603***	0.924	4.127***	0.171	4.034***
Conscientiousness	0.192	4.053***	0.873	3.495***	0.169	3.579***
Gender	0.019	0.581	0.138	0.795	0.016	0.474
Type of universities	0.230	7.534***	0.285	1.772	0.223	7.345***
Extraversion	0.110	3.322***	0.356	2.044*	0.101	3.060**
Neuroticism	−0.038	−1.714	−0.358	−3.089**	−0.028	−1.290
Agreeableness	−0.071	−1.832	0.436	2.129*	−0.083	−2.144*
<i>R</i> ²	0.239		0.239		0.254	
<i>F</i>	49.627		49.465		46.980	

TABLE 12 Mediation model 6 test: extraversion-PsyCap-collaboration and model 7 test: openness-PsyCap-collaboration.

Predictors	Equation 10 (explicit variable: collaboration)		Equation 11 (explicit variable: PsyCap)		Equation 12 (explicit variable: collaboration)	
	<i>B</i>	<i>t</i>	<i>B</i>	<i>t</i>	<i>B</i>	<i>t</i>
PsyCap					0.032	6.648***
Extraversion	0.113	4.053***	0.443	2.552*	0.099	3.609***
Openness	0.111	3.076**	0.800	3.584***	0.085	2.401*
Gender	0.038	1.377	0.126	0.736	0.034	1.256
Type of universities	0.226	8.837***	0.258	1.625	0.217	8.673***
Conscientiousness	0.071	1.779	1.091	4.375***	0.037	0.925
Neuroticism	−0.014	−0.788	−0.329	−2.888**	−0.004	−0.222
Agreeableness	0.023	0.687	0.363	1.764	0.011	0.345
<i>R</i> ²	0.201		0.249		0.233	
<i>F</i>	39.319		51.745		41.291	

5. Discussion

Based on previous relevant studies, this study was carried out on a random sample of university undergraduates in the form of a questionnaire, and statistical methods such as independent sample *t*-test, correlation analysis, and bootstrap-mediated effects analysis were used to systematically explore the relationship between the key competencies of BFPT, PsyCap, and college students, the following conclusions were obtained.

5.1. Strengthening the focus and cultivation of key competencies among college students

Key competencies influence all aspects of the college student career development lifecycle, including well-being (Austin et al., 2005), academic achievement (O'Boyle et al., 2011), and job performance (Petrides et al., 2004), and physical fitness (Martins et al., 2010). The results of the descriptive analysis showed that Chinese college students were generally at a high level, with the highest to

lowest scores being communication, collaboration, critical thinking and creativity. Compared to communication and collaboration, there is still room for improvement in critical thinking and creativity. The Chinese higher education system, with its excessive emphasis on examination-oriented education, can be considered as one of the factors that inhibits critical thinking (Baser et al., 2016) and inhibits creativity abilities (Ke and Liang, 2023). Critical thinking education is a topic that is currently receiving a lot of attention in university education worldwide, and creativity education is a topic that is receiving even more attention in countries that are focused on innovation-driven development. To meet the high-quality development requirements of China, the education system needs to focus more on nurturing the critical thinking and creativity of college students.

The results also showed that there was no significant difference in the key competencies of college students in terms of gender (Hyde, 2005), while there were significant differences in the key competencies of critical thinking and creativity of college students in terms of the type of university. Research has shown that both boys and girls have the same potential to develop their key competencies, and the results can challenge past gender stereotypes and encourage a more open

attitude towards the abilities and potential of both men and women. Since gender does not have a significant effect on key competencies in college students, personality traits may be a more accurate predictor of individual behavior and competence than gender (Barrick et al., 2001). This may lead researchers to further explore the relationship between personality and competence. The differences in key competencies revealed by university type indicate that key universities may prioritize nurturing critical and innovative thinking in students, while general institutions might focus more on the transmission of knowledge and skill training. Furthermore, the results could be related to social and employment pressures, as these traits are considered key factors in a competitive job market.

5.2. Utilizing inherent personality traits as catalysts for individual development

Pearson's correlation analysis was used to study the relationship between BFPT, PsyCap, and key competencies of college students; the results showed that there were significant correlations between the three. Significant correlations suggested that PsyCap may be a crucial contributing factor to the development of key competencies.

According to the study findings, except for neuroticism, which was a significant negative predictor of the key competencies of college students, the other dimensions of extraversion, openness, agreeableness, and conscientiousness were all significant positive predictors of the key competencies, highlighting the importance of mental health support in educational settings (Kutcher et al., 2016). For example, in alignment with extant literature which identifies academic specific anxiety as a significant negative predictor of performance (Credé and Kuncel, 2008), the present investigation further revealed that students who tend to experience emotional instability or negative emotions such as anxiety and depression may face more challenges in developing key competencies. Educators could design different strategies or resources for students with different personality traits, aiming to minimize the potential drawbacks of traits such as neuroticism and maximize the benefits of traits such as conscientiousness, extraversion, agreeableness, and openness. In summary, these results can pave the way for more research into personalized education strategies based on personality traits.

5.3. Unveiling the interwoven pathways of personality, PsyCap, and key competencies

A regression analysis was conducted to investigate the influence of BFPT, PsyCap, and key competencies among college students. The specific effects between the three variables were examined by mediation. According to research findings, PsyCap played a partially mediating influence effect between BFPT and key competencies. Therefore, strengthening the development of PsyCap is of positive significance for the enhancement of key competencies of college students.

More specifically, the mediating effects revealed that PsyCap served as a partial mediator in the relationships between neuroticism and critical thinking, openness and creativity, conscientiousness and creativity, openness and communication, conscientiousness and communication, extraversion and collaboration, as well as openness and collaboration.

As for why the mediating effect of PsyCap between BFPT and key competencies exists? We believe that the relationship between these three can be understood in greater depth in conjunction with the conservation of resources theory (COR). Hobfoll (1989) has asserted that individuals seek to acquire, maintain, and protect the resources that are valuable to them, and that both the loss and acquisition of these resources have important psychological and behavioral effects on individuals. Specifically, the Big Five's contribution to PsyCap can be described on the basis of COR: openness in individuals often leads to a willingness to explore new knowledge and experiences, facilitating the acquisition of new skills. Conscientiousness, with its heightened sense of responsibility, can pave the way for superior resource management and organizational skills. Extraversion often correlates with resourcefulness in social interactions, enabling such individuals to gain more social support. Agreeableness tends to enhance one's ability to foster positive relationships, increasing their social resources. Conversely, while high neuroticism suggests lower emotional stability, those with low neuroticism typically have better coping strategies and demonstrate resilience. BFPT can be viewed as initial resources or mediators of resource acquisition, which directly and indirectly influence an individual's PsyCap. PsyCap, as a comprehensive psychological resource, promotes the development of key competencies. Individuals with high PsyCap are more likely to adopt positive strategies to cope with challenges and are more willing to learn and adapt, thus accumulating and enhancing their core competencies. This process is closely linked to the resource gain spiral effect (Hobfoll, 2002) in COR theory, in which the initial acquisition of resources facilitates the accumulation of further resources.

On the other hand, in conjunction with the life-cycle approach (LCA) (Roberts et al., 2006), personality traits may also be modifiable. BFPT are fundamentally innate and manifest early in life. They inherently influence an individual's PsyCap and competency development, providing a foundational framework from which individual behaviors and capacities emerge. LCA posit that, contrary to previous assumptions, personality traits are not rigid. Throughout the lifecycle, individuals can actively work to mitigate negative traits and accentuate positive ones. This dynamic nature of personality implies adaptability and the potential for growth at various life stages. Recognizing the potential for personality evolution, one can deduce a mediated pathway where alterations in BFPT, whether naturally occurring or through intentional interventions, can impact PsyCap. This, in turn, influences the growth and refinement of competencies. In essence, as personality evolves, so does the nature and magnitude of its influence on psychological resources and capabilities.

The data suggested a significant influence of PsyCap as a mediator between BFPT and key competencies, with varying degrees of mediation effects. In particular, the highest mediation effect was found in the relationship between openness and collaboration (22.72%), indicating that PsyCap plays a substantial role in these areas. Furthermore, both openness and conscientiousness demonstrated considerable mediation effects on creativity, which implied meaningful interactions between these traits and PsyCap. In contrast, neuroticism presented a lower mediation effect (5.97%) on critical thinking, which may underscore the lesser influence of neuroticism or the mitigating role of PsyCap. In conclusion, enhancing PsyCap, tailored to specific personality traits, could be a strategic approach to fostering key competencies in students. Within the existing body of research,

investigators have discovered that PsyCap and BFPT serve as individual predictors of the development of key competencies in university students (Luthans et al., 2007; Poropat, 2009). However, our study takes this understanding a step further. We found that PsyCap not only predicts competency development but also performs a partial mediating role between BFPT and key competencies, effectively bridging the two. This offers implications for the development of personalized education interventions.

6. Limitations and prospects

Due to the limitations of the research method and sample collection, the following shortcomings still exist. In terms of collecting research data, only undergraduate students were selected as the research sample, and variables such as their grade and major were not collected, which limits the generalizability of the findings. Therefore, in future studies, samples with richer characteristics can be selected to make the findings more generalizable. Furthermore, this article adopts a cross-sectional approach, while key competencies and PsyCap are a continuous process of change, so a longitudinal approach can be considered in future research to explore the factors influencing key competencies of college students in greater depth.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by The Ethics Committee at the Beijing Forestry University. The studies were conducted in accordance with the local legislation and institutional

requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

AH: writing-original draft, formal analysis, methodology, investigation; XL: validation, visualization, software, data analysis; HS: led the idea for this article and worked on writing-review & editing, funding acquisition, supervision, project administration. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Abdul Karim, A. M., Abdullah, N., Abdul Rahman, A. M., Noah, S. M., Wan Jaafar, W. M., Othman, J., et al. (2012). A nationwide comparative study of soft skills of private and public university students. *Asia Pac. Educ. Rev.* 13, 541–548. doi: 10.1007/s12564-012-9205-1
- Akhtar, F., and Das, N. (2020). Investor personality and investment performance: from the perspective of psychological traits. *Qual. Res. Financ. Mark.* 12, 333–352. doi: 10.1108/QRFM-11-2018-0116
- Ángel De-Juanas, O., and Martín, R. (2016). Teaching competences necessary for developing key competences of primary education students in Spain: teacher assessments. *Teach. Dev.* 20, 123–145. doi: 10.1080/13664530.2015.1101390
- Austin, E. J., Saklofske, D. H., and Egan, V. (2005). Personality, well-being and health correlates of trait emotional intelligence. *Pers. Individ. Differ.* 38, 547–558. doi: 10.1016/j.paid.2004.05.009
- Avey, J. B., Luthans, F., and Youssef, C. M. (2010). The additive value of positive psychological capital in predicting work attitudes and behaviors. *J. Manag.* 36, 430–452. doi: 10.1177/0149206308329961
- Banks, J. A. (2008). Diversity, group identity, and citizenship education in a global age. *Educ. Res.* 37, 129–139. doi: 10.3102/0013189X08317501
- Baron, R. A., Franklin, R. J., and Hmieleski, K. M. (2016). Why entrepreneurs often experience low, not high, levels of stress: the joint effects of selection and psychological capital. *J. Manag.* 42, 742–768. doi: 10.1177/0149206313495411
- Baron, R. M., and Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182. doi: 10.1037/0022-3514.51.6.1173
- Barrick, M. R., Mount, M. K., and Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: what do we know and where do we go next? *Int. J. Sel. Assess.* 9, 9–30. doi: 10.1111/1468-2389.00160
- Baser, J. A., Saion, R., Manap, S. S. A., Hasan, A., and Abdul Razzaq, A. R. (2016). Barriers of inculcating critical thinking skills in teaching and learning process. *Adv. Sci. Lett.* 22, 4004–4006. doi: 10.1166/asl.2016.8151
- Bowen, W. G., Chingos, M. M., and McPherson, M. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton: Princeton University Press.
- Bowen, W. G., Kurzweil, M. A., Tobin, E. M., and Pichler, S. C. (2005). *Equity and excellence in American higher education*. Charlottesville: University of Virginia Press.
- Brečka, P., and Valentová, M. (2017). Model of the students' key competences development through interactive whiteboard in the subject of technology. *Inform. Educ.* 16, 25–38. doi: 10.15388/infedu.2017.02
- Cao, C., and Meng, Q. (2020). Exploring personality traits as predictors of English achievement and global competence among Chinese university students: English learning motivation as the moderator. *Learn. Individ. Differ.* 77:101814. doi: 10.1016/j.lindif.2019.101814
- Caspi, A., Roberts, B. W., and Shiner, R. L. (2005). Personality development: stability and change. *Annu. Rev. Psychol.* 56, 453–484. doi: 10.1146/annurev.psych.55.090902.141913
- Cerni, T., Di Benedetto, A., and Rumiati, R. I. (2021). The contribution of personality and intelligence toward cognitive competences in higher education. *Front. Psychol.* 12:621990. doi: 10.3389/fpsyg.2021.621990

- Chamorro-Premuzic, T., and Furnham, A. (2003). Personality predicts academic performance: evidence from two longitudinal university samples. *J. Res. Pers.* 37, 319–338. doi: 10.1016/S0092-6566(02)00578-0
- Costa, P. T., and McCrae, R. R. (2008). “The revised NEO personality inventory (NEO-PI-R),” in *The SAGE handbook of personality theory and assessment*. ed. G. J. Boyle (Thousand Oaks, CA: SAGE Publications Ltd.), 2, 179–198.
- Crédé, M., and Kuncel, N. R. (2008). Study habits, skills, and attitudes: the third pillar supporting collegiate academic performance. *Perspect. Psychol. Sci.* 3, 425–453. doi: 10.1111/j.1745-6924.2008.00089.x
- Digman, J. M. (1990). Personality structure: emergence of the five-factor model. *Annu. Rev. Psychol.* 41, 417–440. doi: 10.1146/annurev.ps.41.020190.002221
- European Communities. (2006). Key competences for lifelong learning: European reference framework. Available at: <https://www.britishcouncil.org/sites/default/files/youth-in-action-keycomp-en.pdf> (Accessed December 30, 2006).
- Feingold, A. (1994). Gender differences in personality: a meta-analysis. *Psychol. Bull.* 116, 429–456. doi: 10.1037/0033-2909.116.3.429
- Gan, Q., Xinwen, B., Jian, L., Rui, W., Lihong, M., Guanxing, X., et al. (2020). Creativity competence: part III of the 5Cs framework for twenty-first century key competences. *J. East China Norm. Univ. (Educ. Sci.)* 38, 57–70. doi: 10.16382/j.cnki.1000-5560.2020.02.006
- González-Morales, M. G., Peiró, J. M., Rodríguez, I., and Bliese, P. D. (2012). Perceived collective burnout: a multilevel explanation of burnout. *Anxiety Stress Coping* 25, 43–61. doi: 10.1080/10615806.2010.542808
- Gorghiu, G., Gorghiu, L. M., and Pascale, L. (2018). Enriching the ICT competences of university students—a key factor for their success as future teachers. *J. Sci. Arts* 18, 183–190.
- Gosling, S. D., Rentfrow, P. J., and Swann, W. B. Jr. (2003). A very brief measure of the Big-Five personality domains. *J. Res. Pers.* 37, 504–528. doi: 10.1016/S0092-6566(03)00046-1
- Hayes, A. (2013). Introduction to mediation, moderation, and conditional process analysis. *J. Educ. Meas.* 51, 335–337. doi: 10.1111/jedm.12050
- Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *Am. Psychol.* 44, 513–524. doi: 10.1037/0003-066X.44.3.513
- Hobfoll, S. E. (2002). Social and psychological resources and adaptation. *Rev. Gen. Psychol.* 6, 307–324. doi: 10.1037/1089-2680.6.4.307
- Hong, M., Dyakov, D. G., and Zheng, J. (2020). Self-esteem and psychological capital: their mediation of the relationship between Big Five personality traits and creativity in college students. *J. Psychol. Afr.* 30, 119–124. doi: 10.1080/14330237.2020.1744286
- Hyde, J. S. (2005). The gender similarities hypothesis. *Am. Psychol.* 60, 581–592. doi: 10.1037/0003-066X.60.6.581
- Ishikawa, M., and Ryan, D. (2002). Schooling, basic skills and economic outcomes. *Econ. Educ. Rev.* 21, 231–243. doi: 10.1016/S0272-7757(01)00005-X
- Judge, T. A., Jackson, C. L., Shaw, J. C., Scott, B. A., and Rich, B. L. (2007). Self-efficacy and work-related performance: the integral role of individual differences. *J. Appl. Psychol.* 92, 107–127. doi: 10.1037/0021-9010.92.1.107
- Kang, C., Xu, G., Wei, R., Liu, J., Zheng, Y., Liu, Y., et al. (2020). Communication competence: part IV of the 5Cs framework for twenty-first century key competences. *J. East China Norm. Univ. (Educ. Sci.)* 38, 71–82. doi: 10.16382/j.cnki.1000-5560.2020.02.007
- Ke, Z., and Liang, C. (2023). Research on the relationship between exam-oriented education and students' creativity. *J. East China Norm. Univ. (Educ. Sci.)* 41:72. doi: 10.16382/j.cnki.1000-5560.2023.04.006
- Keane, T., Keane, W. F., and Blicblau, A. S. (2016). Beyond traditional literacy: learning and transformative practices using ICT. *Educ. Inf. Technol.* 21, 769–781. doi: 10.1007/s10639-014-9353-5
- Kutcher, S., Wei, Y., and Coniglio, C. (2016). Mental health literacy: past, present, and future. *Can. J. Psychiatry* 61, 154–158. doi: 10.1177/0706743715616609
- Li, J. D. (2013). Psychometric properties of ten-item personality inventory in China. *China J. Health Psychol.* 21, 1688–1692. doi: 10.13342/j.cnki.cjhp.2013.11.008
- Lin, C. D. (2016). *A study of core literacies for student development in the 21st century*. Beijing: Beijing Normal University Publishing Group.
- Lin, C. D. (2017). The research of core competencies and values for students in China. *Stud. Psychol. Behav.* 15, 145–154.
- López-López, M. J., Navarro-Abal, Y., Climent-Rodríguez, J. A., and Gómez-Salgado, J. (2020). Healthcare students' personality traits and competence-based learning methodologies. *Medicine* 99:e19812. doi: 10.1097/MD.00000000000019812
- Luthans, F. (2002). Positive organizational behavior: developing and managing psychological strengths. *Acad. Manag. Perspect.* 16, 57–72. doi: 10.5465/AME.2002.6640181
- Luthans, F., Avey, J. B., and Patera, J. L. (2008). Experimental analysis of a web-based training intervention to develop positive psychological capital. *Acad. Manag. Learn. Educ.* 7, 209–221. doi: 10.5465/AME.2008.32712618
- Luthans, F., Avolio, B. J., Avey, J. B., and Norman, S. M. (2007). Positive psychological capital: measurement and relationship with performance and satisfaction. *Pers. Psychol.* 60, 541–572. doi: 10.1111/j.1744-6570.2007.00083.x
- Luthans, K. W., Luthans, B. C., and Chaffin, T. D. (2019). Refining grit in academic performance: the mediational role of psychological capital. *J. Manag. Educ.* 43, 35–61. doi: 10.1177/1052562918804282
- Luthans, F., and Youssef, C. M. (2004). Human, social, and now positive psychological capital management: investing in people for competitive advantage. *Organ. Dyn.* 33, 143–160. doi: 10.1016/j.orgdyn.2004.01.003
- Luthans, F., Youssef, C. M., and Avolio, B. J. (2007). *Psychological capital: developing the human competitive edge*. New York: Oxford University Press.
- Ma, L., Wei, R., Liu, J., Liu, Y., and Gan, Q. L. (2020). Critical thinking: part II of the 5Cs framework for twenty-first century key competences. *J. East China Norm. Univ. (Educ. Sci.)* 38, 45–56. doi: 10.16382/j.cnki.1000-5560.2020.02.005
- Martínez-Abad, F., Torrijos-Fincias, P., and Rodríguez-Conde, M. J. (2016). The eAssessment of key competences and their relationship with academic performance. *J. Inf. Technol. Res.* 9, 16–27. doi: 10.4018/JITR.2016100102
- Martins, A., Ramalho, N., and Morin, E. (2010). A comprehensive meta-analysis of the relationship between emotional intelligence and health. *Pers. Individ. Differ.* 49, 554–564. doi: 10.1016/j.paid.2010.05.029
- McCrae, R. R., and Costa, P. T. Jr. (1994). The stability of personality: observations and evaluations. *Curr. Dir. Psychol. Sci.* 3, 173–175. doi: 10.1111/1467-8721.ep10770693
- Ministry of Education of the People's Republic of China. (2014). The MOE's suggestions on deepening curriculum reform thoroughly and realizing the basic task of building moral character and cultivating humanity. Available at: http://www.moe.gov.cn/srcsite/A26/cjy_kcjcgh/201404/t20140408_167226.html (Accessed April 8, 2014).
- O'Boyle, E. H. Jr., Humphrey, R. H., Pollack, J. M., Hawver, T. H., and Story, P. A. (2011). The relation between emotional intelligence and job performance: a meta-analysis. *J. Organ. Behav.* 32, 788–818. doi: 10.1002/job.714
- OECD. (2005). Definition and selection of key competencies: Executive summary. Available at: <http://www.oecd.org/pisa/35070367.pdf> (Accessed May 27, 2005).
- Olssen, M., and Peters, M. A. (2005). Neoliberalism, higher education and the knowledge economy: from the free market to knowledge capitalism. *J. Educ. Policy* 20, 313–345. doi: 10.1080/02680930500108718
- Partnership for 21st Century Skills. (2011). P21 common core toolkit: a guide to aligning the common core state standards with the framework for 21st century skills. Available at: <https://files.eric.ed.gov/fulltext/ED543030.pdf>. ERIC Clearinghouse.
- Pepper, D. (2011). Assessing key competencies across the curriculum—and Europe. *Eur. J. Educ.* 46, 335–353. doi: 10.1111/j.1465-3435.2011.01484.x
- Petrides, K. V., Frederickson, N., and Furnham, A. (2004). The role of trait emotional intelligence in academic performance and deviant behavior at school. *Pers. Individ. Differ.* 36, 277–293. doi: 10.1016/S0191-8869(03)00084-9
- Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychol. Bull.* 135, 322–338. doi: 10.1037/a0014996
- Ren, H., Wen, Z. L., and Chen, Q. S. (2013). The effect of psychological capital on corporate employees' career success: the mediating effect of career commitment. *Psychol. Sci.* 36, 960–964. doi: 10.16719/j.cnki.1671-6981.2013.04.035
- Rieckmann, M. (2012). Future-oriented higher education: which key competencies should be fostered through university teaching and learning? *Futures* 44, 127–135. doi: 10.1016/j.futures.2011.09.005
- Roberts, B. W., and DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: a quantitative review of longitudinal studies. *Psychol. Bull.* 126, 3–25. doi: 10.1037/0033-2909.126.1.3
- Roberts, B. W., Walton, K. E., and Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: a meta-analysis of longitudinal studies. *Psychol. Bull.* 132, 1–25. doi: 10.1037/0033-2909.132.1.1
- Rychen, D. S., and Salganik, L. H. (2003). *Key competencies for a successful life and well-functioning society*. Göttingen: Hogrefe Publishing GmbH.
- Sacerdote, B. (2001). Peer effects with random assignment: results for Dartmouth roommates. *Q. J. Econ.* 116, 681–704. doi: 10.1162/00335530151144131
- Scheerens, J. (2011). Indicators on informal learning for active citizenship at school. *Educ. Assess. Eval. Acc.* 23, 201–222. doi: 10.1007/s11092-011-9120-8
- Seligman, M. E. (2002). Authentic happiness: using the new positive psychology to realize your potential for lasting fulfillment. *Horizons* 30, 170–172. doi: 10.1017/S0360966900000426
- Seligman, M. E. (2006). *Learned optimism: how to change your mind and your life*. New York: Vintage.
- Selma, A. (2022). The career adaptability of psychology students: the roles of demographic variables, personality, and positive psychological capital. *Stud. Psychol.* 42, 427–471. doi: 10.26650/SP2022-997542
- Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociol. Methodol.* 13, 290–312. doi: 10.2307/270723
- Sui, Y., Wang, H., Yue, Y. N., and Luthans, F. (2012). The effect of transformational leadership on follower performance and satisfaction: the mediating role of psychological capital and the moderating role of procedural justice. *Acta Psychol. Sin.* 44, 1217–1230.

- Suleman, F. (2018). The employability skills of higher education graduates: insights into conceptual frameworks and methodological options. *High. Educ.* 76, 263–278. doi: 10.1007/s10734-017-0207-0
- Sun, X., and Zhu, P. (2023). Implementing project-based language teaching to develop EFL high school students' key competences. *Sustainability* 15:1658. doi: 10.3390/su15021658
- Tett, R. P., and Burnett, D. D. (2003). A personality trait-based interactionist model of job performance. *J. Appl. Psychol.* 88, 500–517. doi: 10.1037/0021-9010.88.3.500
- Tett, R. P., and Guterman, H. A. (2000). Situation trait relevance, trait expression, and cross-situational consistency: testing a principle of trait activation. *J. Res. Pers.* 34, 397–423. doi: 10.1006/jrpe.2000.2292
- Trilling, B., and Fadel, C. (2009). *21st century skills: learning for life in our times*. Hoboken: John Wiley & Sons.
- UNESCO. (2015). *Rethinking education: towards a global common good?* Paris: UNESCO Publishing.
- Veugelers, W. (2011). The moral and the political in global citizenship: appreciating differences in education. *Glob. Soc. Educ.* 9, 473–485. doi: 10.1080/14767724.2011.605329
- Wang, J. Z., and Song, J. Q. (2011). The mechanism of psychological capital on college students' career development. *J. Liaoning Univ. (Philos. Soc. Sci. Edit.)* 39, 116–121.
- Wen, Z. L., and Ye, B. J. (2014). Analyses of mediating effects: the development of methods and models. *Adv. Psychol. Sci.* 22, 731–745. doi: 10.3724/SPJ.1042.2014.00731
- Xing, C., Zheng, L., Li, Y. Z., Wu, X. Y., Peng, Y., and Yu, X. Y. (2023). Psychological influences on college students' employment: the mediating role of general self-efficacy. *China J. Health Psychol.* 31, 413–417. doi: 10.13342/j.cnki.cjhp.2023.03.018
- Xiong, M., and Ye, Y. F. (2014). Psychological capital: theory, measurement, influencing factors and role. *J. East China Norm. Univ. (Educ. Sci.)* 32, 84–92. doi: 10.16382/j.cnki.1000-5560.2014.03.004
- Xu, G., Wei, R., Liu, J., Li, J. Y., Kang, C. P., Ma, L. H., et al. (2020). Collaboration competence: part V of the 5Cs framework for twenty-first century key competences. *J. East China Norm. Univ. (Educ. Sci.)* 38, 83–96. doi: 10.16382/j.cnki.1000-5560.2020.02.008
- Yin, H. (2018). What motivates Chinese undergraduates to engage in learning? Insights from a psychological approach to student engagement research. *High. Educ.* 76, 827–847. doi: 10.1007/s10734-018-0239-0
- You, M., Laborde, S., Dosseville, F., Salinas, A., and Allen, M. S. (2020). Associations of chronotype, Big Five, and emotional competences with perceived stress in university students. *Chronobiol. Int.* 37, 1090–1098. doi: 10.1080/07420528.2020.1752705
- Zhang, K., Zhang, S., and Dong, Y. H. (2010). Positive psychological capital: measurement and relationship with mental health. *Stud. Psychol. Behav.* 8, 58–64.
- Zhao, Y., Sánchez Gómez, M. C., Pinto Llorente, A. M., and Zhao, L. (2021). Digital competence in higher education: students' perception and personal factors. *Sustainability* 13:12184. doi: 10.3390/su132112184



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Towards a competency-based doctoral curriculum at the University of Zambia: lessons from practice

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We describe a collaborative, iterative, and participatory process that we undertook to develop and adopt a competency-based doctoral curriculum framework at the University of Zambia. There needs to be more than the traditional unstructured apprenticeship of PhD training in a knowledge-based economy where PhD graduates are expected to contribute to industry problem-solving. The lack of industry-driven competencies and, to some extent, limited skills possessed by PhD graduates relative to the demands of employers has led to the misclassification of doctoral degrees as mere paper certificates. Further, under traditional PhD training without specific core competencies, it has led to criticisms of such PhD studies as a waste of resources. The calls to rethink doctoral development in broader employment contexts led many countries to redesign their PhD programs. Training has increasingly introduced industrial linkages and industry-defined research projects to increase the attractiveness of doctoral students. Whereas developed countries have made significant reforms towards competency-based PhD training, little or nothing has been done in developing countries, especially in sub-Saharan Africa. This against the demands that Africa needs more than 100,000 PhDs in the next decade to spur economic development. Against this background, the University of Zambia has developed an industry-driven structured competency-based PhD curriculum framework. The framework will guide and support the development of standardized program-specific PhD curricula, delivery, and assessment of competencies at the University of Zambia, ensuring that doctoral students acquire skills and demonstrate core competencies that are transferable and applicable in industry settings. This framework focuses on the development of specific competencies that are necessary for successful PhD completion. The competencies are divided into three main categories: research, teaching, and professional development. Each category is then broken down into ten core competencies from which respective doctoral programs will develop sub-competencies. It is from these core competencies and sub-competencies that learning outcomes, assessment methods, and teaching activities are developed.

It is envisioned that this new competency-based doctoral curriculum framework will be a helpful tool in training a cadre of professionals and researchers who benefit the industry and contribute to economic and societal development.

KEYWORDS

competency-based framework, curriculum development, formative and summative evaluation, doctoral training, iterative participatory process

1. Introduction

The Doctor of Philosophy degree (PhD) was first introduced in 1810 in Germany and was then incorporated into higher educational institutions into the United States of America (USA) in 1862, Canada in 1900, the United Kingdom (UK) in 1917, and Denmark in 1989, and then more globally (Mulvany, 2013). It was initially meant for academia, but the narrative has changed over the years with the belief that applying PhD knowledge and acquired skills can solve society's problems and contribute towards better economies (Cloete et al., 2016). This has called for building competencies in PhD graduates beyond their academic career to be able to solve problems for the industry and society at large. Traditionally PhDs were unstructured with the belief that a candidate would pick up the skills during an academic journey under the supervision of an advising professor, with participation in conferences, workshops, seminars, and publications not being obligatory but a thesis (monograph) as an end product (Mulvany, 2013). Many institutions in many countries worldwide have continued with the traditional unstructured apprenticeship way of PhD training despite most graduates going into the industry to contribute towards a knowledge-based economy without requisite industry-driven competencies (Mulvany, 2013; Fredua-Kwarteng, 2023). Doctoral graduates are critical players in knowledge production, dissemination, application, and innovation in a knowledge-based economy (Bryan and Guccione, 2018). This has led to criticisms that PhD studies are a waste of resources because they train people “clones” who overspecialize with little or no generic or transferable skills to address industry problems beyond academia (The Economist, 2010; Taylor, 2011). Many scholars argue that universities are producing too many graduates for too few academic jobs, and graduates lack skills that enable them to be productive in jobs outside academia or in a broader economic sector, a term which the authors called a “PhD crisis” (Cyranoski et al., 2011; Taylor, 2011; Cuthbert and Molla, 2015). Taylor (2011) argues that there should be reforms to the traditional unstructured apprenticeship “middle age” model of PhD training towards industry-driven competency-based PhD training because doctoral graduates are no longer restricted to the walls of academia. These calls to rethink doctoral development in broader employment contexts led many countries to redesign their PhD programs (Bryan and Guccione, 2018). Training has increasingly introduced industrial linkages and industry-defined research projects to increase the attractiveness of doctoral students (McGagh et al., 2016).

Developed countries have made significant reforms to address these problems. For instance, Europe started these reforms using the Salzburg recommendations from the Bologna Seminar on Doctoral Programs for the European Knowledge Society (Christensen, 2005).

The Salzburg recommendations state that reforms must: “prepare doctorates for academic and non-academic employment; build transferable skills of graduates and institutionalizing career development opportunities; and achieving critical mass through interdisciplinary, institutional, intersectoral, regional and international collaboration (Christensen, 2005).” The United States and Australia are the other developed countries that have moved towards competency-based PhD training (Cuthbert and Molla, 2015). Universities in the developing world, especially in Africa, predominantly use the traditional apprenticeship PhD training model, which has faced much criticism (Cloete et al., 2016; Fredua-Kwarteng, 2023), as hinted earlier. South Africa realized early that the apprenticeship model was inadequate for the country's needs and developed five PhD models (Cloete et al., 2016). There has been debates for Africa to train more than 100,000 high-quality competency-based PhD in a decade to yield the research the continent needs for accelerated development through job creation and opportunities as well as addressing challenges it faces in areas such as climate change, diseases, food security and political instability (Waruru, 2022; Fredua-Kwarteng, 2023). This paper presents the practical collaborative, iterative, and participatory process of developing a structured competency-based PhD curriculum framework to reform PhD training at the University of Zambia (UNZA).

Competency-based training has been around for quite a while but implementing it widely in PhD training is a relatively new idea (Kim, 2015). This is because, unlike bachelors and masters training with professional bodies and associations that ensure that core competencies are included in a program to respond to economic and social systems, a PhD program often lacks accrediting bodies that require specific competencies (Mulvany, 2013; Cuthbert and Molla, 2015). Competency-based curriculum means learning and assessment based on generic and transferable skills (Loisy, 2018). This is learning organized around prescribed competencies or abilities over a long list of knowledge objectives (Frank et al., 2010; Iobst et al., 2010). In a competency-based training system, the progression unit is mastery of specific knowledge and skills and is learner-based or self-paced learning which builds independence and self-reliance (Watson, 1990; Sullivan and McIntosh, 1996). According to the Rhode Island Department of Education (RIDE), “a curriculum is a standard-based sequence of planned experiences where students practice and achieve proficiency in content and applied learning skills.” In our context, a structured competency-based PhD curriculum framework is a document that will guide the development of standardized program-specific PhD curricula, delivery, and assessment of competencies at the UNZA. This means that a PhD program must demonstrate that the doctoral student has acquired skills and can demonstrate all

aspects of the core competencies in the curriculum without prescribing the learning theory to teachers. Teachers can use any learning theory, whether behaviorist, cognitive constructivist, or social constructivist, provided the outcomes are assessable (Iobst et al., 2010).

2. Methodology

2.1. Rationale for developing a competence-based PhD curriculum framework

The University of Zambia's PhD programs have been offered in various schools since its founding in 1965 (UNZA, 2018). The structure of these programs has varied among schools, in some instances departments, even within the same school. Furthermore, most PhD programs were research-based with no structure or formal curriculum document guiding the learning to ensure the learner acquired the key competencies. The process has had varied outcomes regarding basic competencies required of PhD candidates depending on factors that include: the program, supervisor, student, department, institution, and funder. These factors are global, as highlighted by Verderame et al. (2018). There have been arguments that the quality of PhD training needs to be improved because some students are not effectively guided, resulting in a high attrition rate and some candidates taking a longer duration of completion. Even some who graduated lack computation, analytical, and other general and transferable skills, making it challenging to conduct independent research and survive in the industry. The factors affected the enrolment levels as candidates shunned the local qualification in preference to foreign universities. This has impacted the training of 21st-century independent researchers who should stand beyond their supervisors. To address these challenges and those highlighted by other researchers in the introduction section, the University of Zambia developed and adopted a Structured doctoral curriculum framework to guide uniform discipline-specific competency-based learning.

2.1.1. Historical perspective of the process towards the curriculum framework

The journey towards a structured PhD curriculum model at the UNZA began in 2016 supported by a five-year (2015–2020) NIH grant No. 5D43 TW009744 between the UNZA and Vanderbilt University in the United States. It started with a training needs assessment which identified a need to develop a structured PhD program with standard, year-long research, and other core skills. Several school meetings in 2017 generated a four-year program structure incorporating didactic coursework in the first year based on guidance from the needs assessment. This was championed by the four health science-based schools, including Health Sciences, Public Health, Nursing Sciences, and Medicine.

In 2018, another force emerged with a presentation of a position paper to the School of Veterinary Medicine Board of Graduate Studies by the first author, having been trained through a similar process at the Norwegian University of Life Sciences. After approval of the position paper by the school, it was submitted to the Senate Board of Graduate Studies (an arm of the Senate in charge of graduate studies) for further approval. Senate appointed an *ad-hoc* committee comprising senior professors and assistant deans-postgraduate studies

from science-based schools to oversee the implementation of the proposed framework. The *ad-hoc* committee proceeded for a one-week retreat to consider the position paper and develop modalities for implementing a structured PhD curriculum. However, the *ad-hoc* committee approved the position paper and revised the guidelines without providing a curriculum framework making implementation of a competency-based PhD training challenging.

In 2019, the team from Health Sciences, Public Health, Nursing Sciences, and Medicine with Vanderbilt University held a workshop to develop a curriculum for a structured PhD. They invited the team from the School of Veterinary Medicine, which had already presented the position paper to the Senate. It was agreed from the workshop that all health science-based schools should put their efforts together and develop a structured competency-based PhD curriculum framework which would guide curriculum developments in various schools, departments, institutes, and units since the Higher Education Authority (HEA), which is the regulatory body of higher education in Zambia did not have a framework making implementation of a competency-based PhD training challenging. The UNZA/Vanderbilt team had already conducted a training needs assessment which the workshop adopted to move to the next level. This exercise taught us the importance of collaboration and sharing common resources within and between schools, universities, and research institutions to achieve similar goals. The Salzburg recommendation highlights the importance of institutionalizing career development opportunities; and achieving critical mass through interdisciplinary, institutional, intersectoral, regional, and international collaboration toward efforts to reform PhD training (Christensen, 2005).

In August 2020, the collaborative process of developing a competency-based structured doctoral curriculum framework started with a six-day workshop with 22 participants from schools of Health Sciences, Medicine, Nursing Sciences, Public Health, and Veterinary Medicine.

2.2. The iterative participatory process of developing the competency-based PhD curriculum framework

We followed principles of Competency-Based Education (CBE) recommended by several authors (Foyster, 1990; Watson, 1990; Johnstone and Soares, 2014; Kim, 2015; Pinto et al., 2023), which include the identification of core competencies by the stakeholders, mapping competencies to courses, and developing competency-based assessments for training doctoral students as shown in Figure 1.

2.2.1. Identification of core-competences

According to Johnstone and Soares (2014), “core competencies in programs should align with both industry and academic expectations, with the process by which they are developed being explicit and transparent. Program-level competencies should reflect the skills and knowledge students need at the following stages of their development, whether it be further education or employment.”

To respond to these recommendations, the first workshop started with a plenary session of a gap analysis exercise by the participants (divided into five random groups) which identified the current challenges in PhD training at the UNZA. Each group identified challenges based on their experience teaching and apprenticeship.

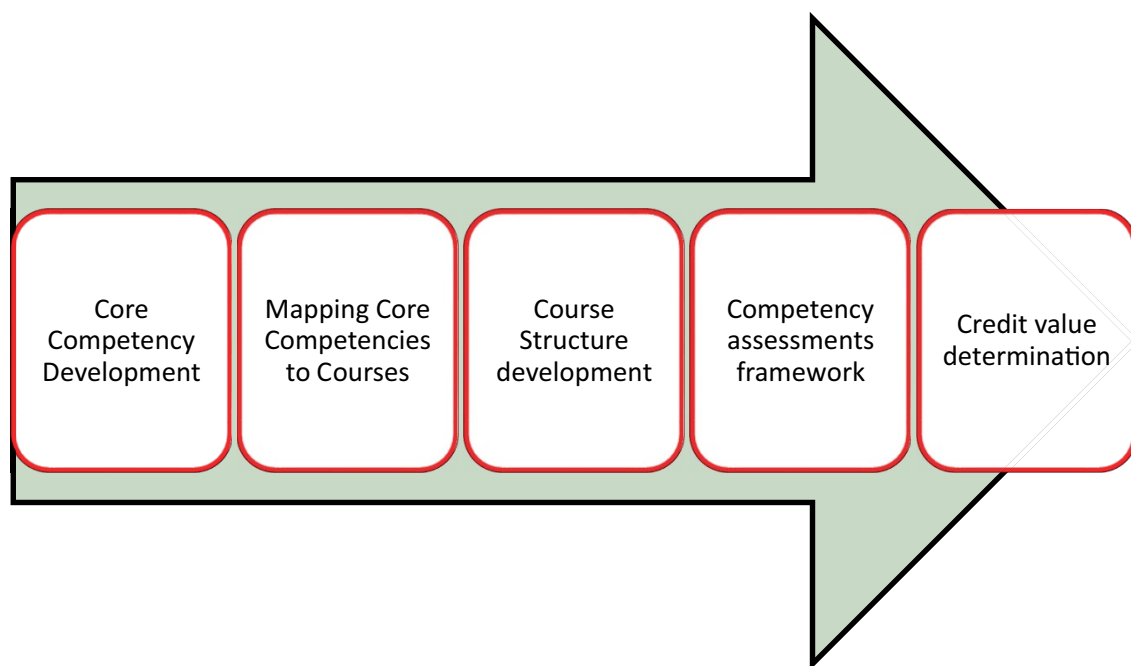


FIGURE 1

Summary of steps followed in developing a competence-based doctoral curriculum framework at the University of Zambia.

This was followed by a presentation of the training needs assessment report from the industry stakeholders for a comparison with the gaps the workshop participants identified. This information was used to identify the PhD tracks that would inform the development of a competency-based curriculum framework. For instance, the PhD tracks for the School of Veterinary Medicine included Veterinary Clinical Sciences, Veterinary Biomedical Sciences, Veterinary Epidemiology and Economics, Food Safety and Risk Analysis, One Health Microbiology, and Parasitology.

After identifying the PhD tracks, the participants went into a plenary session to develop a list of core competencies that would respond to filling the gaps identified by industry stakeholders and experts in various disciplines in life sciences. The selection of discipline-specific industry stakeholders was fully controlled by the respective schools through their departments. The groups made presentations of the core competencies they had identified, which were then compiled after discussing those not common in various groups. There was consensus to eliminate those competencies, which did not satisfy the identified gaps and required skill sets for doctoral graduates as guided by the Salzburg recommendations. The core competencies by [Verderame et al. \(2018\)](#) showed prominence and guided the plenary session.

2.2.2. Mapping core competencies to courses

According to [Johnstone and Soares \(2014\)](#), after establishing competency framework, academic teams need to translate them into topics that can be formulated into courses of the appropriate length and complexity. Curriculum mapping is a process used in education to align courses, assessments, and learning objectives with the overall goals of a program ([Johnstone and Soares, 2014](#)).

To respond to this, the first workshop in 2020 ended with a plenary session to identify the courses that would impart those core

competencies to all doctoral graduates in life sciences at the UNZA, depending on the identified PhD tracks. A PhD track allows students the flexibility and structure to obtain further specialized training in selected topic areas in addition to the core education provided by their program area requirements. Each group was formed based on expertise within each PhD track and presented the courses they identified and identified persons to coordinate and teach each course depending on expertise in each PhD track. The participants then grouped courses into mandatory, discipline-specific, and electives. There was consensus to eliminate courses believed to be outside the required core competencies. The participants identified the courses offered at different levels and those that needed development. After concluding the workshop, representatives from each School were charged with developing the course syllabi. A smaller group was tasked to compile a curriculum framework. It was agreed that the next workshop would be called when all groups, according to schools and PhD tracks, submit their respective assignments.

2.2.3. Development of competency-based assessments

According to [Johnstone and Soares \(2014\)](#), Assessments are an essential component of the teaching and learning process, as they provide students with feedback on their progress and help educators determine whether learning objectives have been achieved. However, to be effective, assessments must be carefully designed and tested to ensure their validity and reliability. By involving subject-matter experts and conducting pilot testing, educators can ensure that their assessments are fair, reliable, and valid measures of student learning ([Johnstone and Soares, 2014](#)). This, in turn, helps to ensure that students are adequately prepared for the challenges they will face in their future academic and professional endeavors.

TABLE 1 Stakeholder composition.

Organization represented	Number of participants
Academia	14
Regulatory authority	2
Professional associations	1
Policy makers (Government Ministries)	2
Technical colleges	1
International donor organizations	1
Public practice	1
Private practice	1
Student representatives (undergraduate)	1
Student representative (postgraduate)	1
Industry, cooperatives	3
Research institutions	2

To respond to this, a second five-day workshop with 28 participants was organized in June 2021 to complete the curriculum framework. This workshop started with a presentation on the curriculum development process by the second author, who specialized in Medical Education. This changed the approach to concentrating on finetuning the core competencies, identifying the required skill set, identifying the required category of courses, allocating credit points to them, and then providing the assessment methods for core competencies. Reference was made to the Higher Education Authority PhD guidelines. We used assessment rubrics developed by [Verderame et al. \(2018\)](#) to construct different assessment methods. There was an emphasis on course-based assessments to aid teaching and learning as opposed to a traditional way of grade-based assessments. Grades are evaluations that represent the student's overall proficiency but do not tell you about the student's performance on individual learning competencies ([Stassen et al., 2001](#)). Participants were divided into groups, given the rubric metrics and core competencies, and asked to develop assessments verifying that the candidate had acquired the generic and transferable skills. Another group worked on grouping courses into categories of mandatory, discipline-specific, and electives. A careful apportionment of credit points to each category was done depending on the different types of doctorates, e.g., taught, part taught, and research, defined in the results section. This workshop developed a draft ready for the industry and other stakeholders. An online survey was then developed based on the identified PhD tracks, core competencies, and assessment methods in the draft competency-based curriculum framework. These were sent to industry stakeholders as a second training needs assessment tool to assess if they were responding to the gaps which they had identified initially. This validation process is essential in developing a competency-based curriculum, as guided by [Johnstone and Soares \(2014\)](#).

A third one-day workshop for all stakeholders (30 participants) indicated in [Table 1](#) was conducted. The draft document was sent to stakeholders 4 weeks before the workshop with a weekly reminder. All stakeholders were requested to present their input on the competency-based PhD framework. The workshop and

Training Needs Assessment survey comments were compiled and used to develop the curriculum framework, which was now ready for submission to Senate for approval. The draft curriculum framework was sent to the Senate Board of Graduate Studies for approval, but the board declined to approve it in the spirit of leaving no one behind (collaborative). The Senate Board recommended that the framework get a university-wide acceptance before approval by the full Senate. This meant getting input from all 13 schools (faculties) and disciplines in the University of Zambia instead of the initial approach of involving science-based schools only.

A fourth five-day workshop with 38 participants was organized for all assistant deans-postgraduate studies and deans from all 13 schools (faculties), institutes, directorates, and units in the University. The draft curriculum framework was sent to all the identified participants 4 weeks before the workshop. Each school was tasked to have departmental meetings to consult all academic members of staff and the school board of graduate studies to give input to the doctoral curriculum framework and revised postgraduate guidelines for presentation at the workshop. The workshop extensively revised the competency framework, course categories, course structure, and competency assessment framework and determined credit value for each PhD type, as summarized in [Figure 1](#). The four authors (first, second, third, and last) facilitated the big university-wide workshop and consolidated the final doctoral curriculum framework and postgraduate guidelines for final senate approval. The curriculum framework was approved by Senate and circulated to guide the development of various PhD curricula in different schools and disciplines at UNZA.

3. Results

All schools approved and adopted the competency based doctoral curriculum framework which was initially developed by the science-based school. Each school provided a list of programs ([Supplementary Tables S1–S3](#)) which they would structure into the three types of doctoral using the competency-based curriculum framework.

3.1. Types of doctorate degrees

Three doctoral programs were identified and recommended in the competency-based doctoral framework to guide PhD curriculum development, delivery, and assessment of core competencies at the UNZA. These include the traditional PhD by Research, PhD by coursework and research (part-taught), and professional doctorates with limited research rigor (taught). Professional doctorates are thus not called Doctor of Philosophy but Doctor of a specific Discipline. The following section describes the three types of doctorate degrees to be offered at UNZA.

3.1.1. PhD by research

This is a PhD in which an individual undertakes original research and publishes three (3) peer-reviewed papers in an indexed and peer review journal as guided by the University of

Zambia postgraduate guidelines and regulations. This study model may also be referred to as a PhD by publications. Minimal courses will be included to ensure that the general competence framework for a doctorate candidate is achieved. Figure 2 illustrates the pathway to three types of doctorate degrees at the University of Zambia.

3.1.2. PhD by coursework and research (part-taught)

This is an integrated PhD that exposes individuals to a combination of taught materials, practical experience, and advanced research. This allows the candidates to learn subject-specific methodologies while building the transferable skills that will enable an individual to become a leader in their chosen profession. The candidate must publish two (2) peer-reviewed papers in an indexed and reputable peer-reviewed journal, guided by the UNZA postgraduate (PG) guidelines and regulations. This may also be referred to as a Part-Taught PhD. Figure 2 illustrates the pathway to three types of doctorate degrees at the UNZA.

3.1.3. Professional doctorates (taught and professional research project)

A professional doctorate focuses on applying research to practical problems, formulating solutions to complex issues, and designing effective professional practices within your field. Broad categories include examples of these degrees include Doctor of Business Administration (DBA), Doctor of Nursing Practice (DNP), etc. Figure 2 illustrates the pathway to three types of doctorate degrees at the UNZA.

This implies that any of the 13 schools (faculties) developing a doctorate degree curriculum at the UNZA must classify the program under one of the three types provided in the competency-based curriculum framework regarding the progression/pathway, competence framework, course structure, and assessments.

3.2. Competency framework

To develop the competency framework, we looked at the 2005 Salzburg recommendations (Christensen, 2005). Cuthbert and Molla (2015) summarized Salzburg's recommendation's reforms toward a competence-based PhD curriculum in three categories:

- Prepare doctorates for academic and non-academic employment.
- Build transferable skills of graduates and institutionalize career development opportunities.
- Achieving critical mass through interdisciplinary, institutional, intersectoral, regional, and international collaboration.

Having considered the Salzburg recommendations, we studied the competency rubric by Verderame et al. (2018) and the general competency framework based on the Zambia Qualifications Framework Level 10 requirements and standards (ZAQA, 2021). These competencies are divided into three main categories: research, teaching, and professional development. We developed ten core competencies from which program-specific sub-competencies can be developed in each curriculum for different programs. Upon successful completion of their respective doctoral programs, students will be able to:

- Create, conceptualize, design, and implement an investigation to generate new knowledge and/or adjust the design of the investigation in light of unforeseen problems. This means that the student must demonstrate Broad Conceptual Knowledge of a scientific discipline to engage in productive discussion and collaboration with colleagues across a discipline.
- Employ expert judgments on complex issues in specialized fields, often without complete data, and communicate ideas and conclusions clearly and effectively to specialist and non-specialist audiences. This means the candidate must demonstrate deep Knowledge of a specific field by understanding the historical

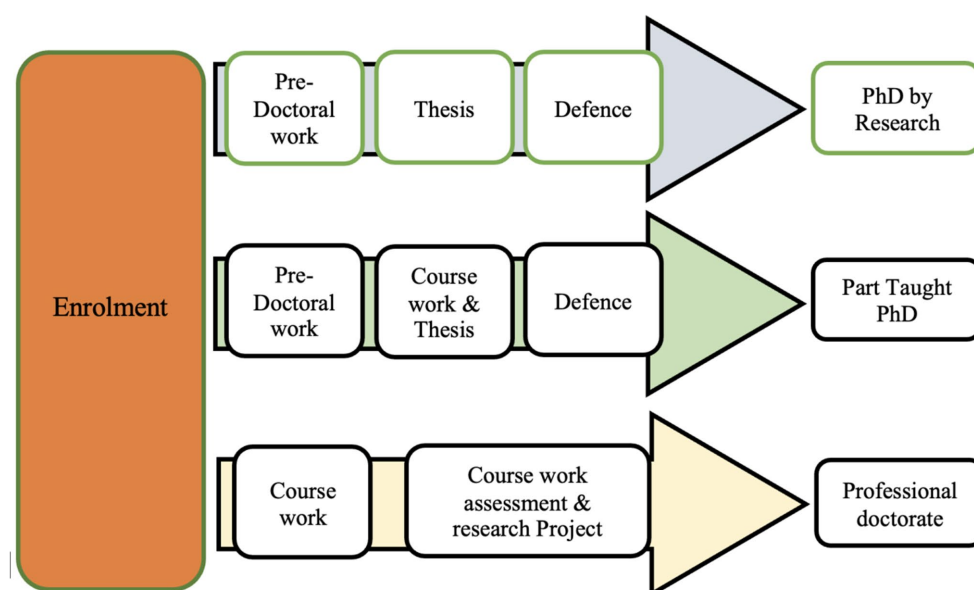


FIGURE 2
Pathways for three types of doctoral degrees at the University of Zambia.

TABLE 2 Credit allocation for UNZA PhD.

PhD Type	Courses	Credits	Total Credits
PhD by Research	University Mandatory PhD Courses	60	360
	Elective Courses	20	
	Scholarship	20	
	Research Thesis	260	
Part Taught PhD	University Mandatory PhD Courses	60	360
	Discipline-Specific Courses	80	
	Elective Courses	20	
	Scholarship	20	
	Research Thesis	180	
Professional Doctorate	Coursework (including practice, i.e., clinical)	240	360
	Workshop/ seminar/ Conferences/ Journal Clubs	60	
	Research Report	60	

context, the current state of the art, and relevant experimental approaches for a specific field such as bioinformatics.

- iii. Undertake research and development at an advanced level, contributing substantially to developing new techniques, ideas, or approaches. Computational Skills encompass relevant statistical analysis methods and informatics literacy.
- iv. Employ qualities, ethics, and transferable skills necessary for utilization in varied contexts requiring the exercise of full personal responsibility and largely autonomous initiative in complex and unpredictable situations.
- v. Exhibit intellectual independence, authoritative judgment, adaptability, and responsibility as an expert and leading practitioner or scholar.
- vi. Undertake extended learning with a view to the continuous generation of new knowledge.
- vii. Develop and implement characteristics that sustain careers, such as motivation, perseverance, adaptability, participation in professional development activities, networking, and innovation skills. These are survival skills that every candidate must demonstrate to survive in a knowledge-based economy.
- viii. Demonstrate leadership and management skills, including formulating a research vision, managing group dynamics and communication, organizing and planning, making decisions, solving problems, and managing conflicts. Doctoral graduates take up leadership positions in and outside academia but mostly need to gain these skills because they were not taught

through a structured course that teaches leadership and management skills.

- ix. Demonstrate collaboration and team science skills, including openness to collaboration, self and disciplinary awareness, and integrating information across disciplines.
- x. Demonstrate communication skills, including oral and written communication skills and communication with different stakeholders.

3.3. Assessment methods

Unlike traditional training systems' assessment methods, which involve administering knowledge-based tests, competency-based training emphasizes evaluation based on mastering skills. Therefore, evaluation is based on recognizing the performance of a skill as satisfactory based on competencies set by the program (Sullivan and McIntosh, 1996). Therefore, the emphasis should not be on grade-based but on course-based assessments because the latter encourages mastery of individual competencies as opposed to overall proficiency of student performance in the course (Stassen et al., 2001). Assessments in the new paradigm of college teaching should be criterion-referenced or grading to predefined competencies through the use of performances and portfolios; continuous assessment of instruction (Fink and Fink, 2013).

In this curriculum framework, we used a combination of formative assessment in the first part and summative in the second part of a PhD program, otherwise referred to as the combination of the American and European systems as posited by Barnett et al. (2017). In formative assessment, the students are given continuous instruction or guidance on targeted competencies. In summative assessment, the focus is on the outcome or product of the candidate, which is primarily a thesis, a paper, and a defense, whereas formative assessment evaluates and summarizes the candidate's performance over time. We adopted the recommendation by Mulvany (2013), which states that "the ultimate best practice would encompass structured formative assessment at defined periods during the doctoral program, as well as an impartial final summative assessment." We allocated credit points to each type of a PhD to be provided at the University of Zambia, as indicated in Table 2. The credit points are based on notional hours with a minimum of 1,200 notional hours per year. One credit equals 10 hours as per the required standards by the Zambia Qualifications Authority (ZAQA, 2021).

The PhD by research has more weight on the thesis, which is more suitable for those who work in research institutions. However, they also do the mandatory courses, which include Research methodology, Philosophy, Ethics and Integrity in Science, Scientific Writing and Communication, Scholarship, and Leadership, Management, and Governance. These would be taken by all PhD candidates trained at the University of Zambia so that they all develop a standardized competency. Scholarship refers to a course designed to equip the candidate with lifelong learning skills and independent thinking. This competence is a necessary requisite for a PhD scholar, which allows the scholar to be aware of developments within their field of study and how to apply the emerging technology to their context. We designated elective courses that could be customized according to individual student focus during doctoral training. For instance, if the candidate

TABLE 3 Rubric for assessing competencies.

Core-Competence	Assessment tool/type
Broad conceptual knowledge of a scientific discipline	Public lecture
Deep knowledge of a scientific field	Thesis defense
	Publications
Critical thinking skills	Tests
	Assignments
Experimental skills	Midterm evaluation
	Seminar presentations.
	Logbooks
	Portfolio
Computation skills	Tests
	Assignments
Collaboration and team skills	Supervisor reports
Responsible conduct of research and ethics	Ethical clearance of protocol by IRB
	Supervisor reports and thesis defense.
Communication skills	Policy briefs
	Press statements
	Seminar & conference presentations
Leadership skills	Conference presentations and organization
Survival skills	Assignments
	Practical demonstrations

requires an extra course to conduct gene sequencing, they would do the program physically or virtually from a recognized institution and submit the content and duration of the course or module to assess credit units. A credit transfer policy was developed by the University management to guide the transfer of credits within and between institutions.

A taught PhD has an equal allocation of credit points divided between coursework and research, as shown in Table 2. Note the inclusion of discipline-specific courses, which carry more points to cater for additional competencies for the industry. We define competencies in line with the economic and societal needs of the industry rather than at the individual level, as recommended by Foyster (1990). For instance, for a PhD in food Safety and risk analysis, the discipline-specific courses include food safety management, risk analysis, quality management systems, food safety at primary production, etc. This means that for a Ph.D. candidate to graduate, they should have skills in conducting a food safety risk assessment.

A professional doctorate like a Doctor of Nursing emphasizes discipline-specific coursework that imparts critical thinking and evidence-based practical skills to graduates. They conduct low-depth research and write a short research report examined as a course and not a thesis, as shown in Table 2. Mandatory courses and scholarship will not be required here, but candidates may be required to sit for them depending on the area of specialty. Special discipline-specific courses such as clinical rotation will include hours for practice (e.g., clinical, legal, pharmacy).

After mapping courses to competencies and allocating credits on which assessments would be done, we adopted Verderame's rubric against a checklist of assessment tools for each competency shown in Table 3 (Verderame et al., 2018). Assessing competencies is a critical component of competence-based training, and it is essential to ensure that the assessment methods are valid, cost-effective, and inclusive of various methods (Foyster, 1990). Effective record-keeping and maintenance of assessment standards are also important to ensure that learners can demonstrate their competencies and achieve the required qualifications. For this framework, assessments tools will include attendance and completion of assignments/tests for workshops/seminars, Written, Portfolio (Logbooks and Reflective assessment/learning), Assignments, Practical tasks, Presentations/Lectures, 360 evaluations, Thesis/dissertation, Publications, and Student reports.

4. Discussion

4.1. Learning outcomes of the collaborative, iterative, and participatory process of developing competence-based doctoral curriculum framework

From this five-year exercise of structuring our doctoral training, we learn that a collaborative, iterative, and participatory approach is a rigorous and effective way of developing a standardized competency-based curriculum framework that responds to societal needs (Wittmann-Price, 2020; Pinto et al., 2023). This is because it is a bottom-up approach involving all key stakeholders in the industry, thus developing society-based competencies instead of individual-based ones (Foyster, 1990). In the university context, this approach creates awareness and motivation among the stakeholders taking part in this curriculum framework-making process, which improves a buy-in from all schools or faculties to develop their curricula in line with the core-competencies in the framework (Mumba et al., 2017; Wittmann-Price, 2020). A case in point is the School of Veterinary Medicine, which developed six curricula for structured PhD programs in Epidemiology and Economics, Veterinary Biomedical Sciences, Veterinary Clinical Sciences, Veterinary Parasitology, Food Safety and Risk Analysis, and One Health Microbiology following this framework. The schools of Nursing Sciences developed four structured PhD curricula; Clinical Nursing, Public Health Nursing, Mental Health and Psychiatric Nursing and Midwifery. Each of the four main disciplines have specific specialized tracks. The School of Health Sciences also developed structured PhD curricula in Biomedical Sciences. This is opposed to the previous unstructured PhD system, which proved difficult due to the absence of a structure and lack of a standardized competency framework that schools or faculties could follow. We, therefore, learned that to transform PhD programs in line with the Salzburg recommendations (Cuthbert and Molla, 2015), the university needs a competency-based curriculum framework, which should guide the development of respective program-specific curricula, which in turn guides the development of postgraduate guidelines for a successful implementation of graduate training.

We also learned that the main challenge of this process is the high expenses in bringing stakeholders together and the long time it takes to complete the reforms from traditional PhD training to a

competency-based model. It took us 5 years and an estimated cost of US\$120,000 in workshops to complete the process. The long time was mainly because some collaborators and stakeholders would take a long time to complete their tasks in bureaucratic systems of different institutions in the iterative process. Documents would go missing in some offices, rendering the previous input a waste of resources because the lead person or team would have to start afresh. Change of management in schools or faculties, directorates, and institutes and at top management delayed the process. Getting the new office bearers to quickly adopt the reform from the traditional PhD training to a competency-based model was a delay in the feedback system of the policy change.

Another lesson we learned was that there is a need for a robust and knowledgeable person to lead and explain the benefits of reform to schools or faculty and articulate the vision of the final product to faculty and management, as stated by Wittmann-Price (2020). Without such a leader, the process can be frustrated by a bureaucratic system in universities and institutions and affect change. Another lesson we learned was the need for active and extensive communication so that all academic members of staff are informed of the process and the changes since they are the ones that will implement the structured doctoral training. Our lapses in communication at the beginning affected the approval process as other schools and units felt that they needed to be consulted and informed despite the initial plan of restricting the structured curriculum framework to life science-based schools. The delay was, however, necessary as it engaged all academic staff in each department, schools/faculty, directorates, and institutes in the university and improved a buy-in by over 800 academic members of staff.

4.2. Implications of implementing a structured competency-based curriculum framework

Implementing a structured competency-based PhD curriculum framework at the University of Zambia has implications for teaching and learning. The development of respective curricula should have some of the following key considerations that will successfully link competency to the curriculum:

4.2.1. Clear understanding of competencies

Before implementing a Competency Based Training (CBT) system, it is important to understand the competencies required for each role in the school (Wittmann-Price, 2020). This will involve conducting a thorough job analysis and identifying the skills, knowledge, and behaviors required for success in each role.

4.2.2. Assessment of current skills

The individual schools must assess their employees' current skills and competencies to identify gaps and determine where training is needed.

4.2.3. Design and delivery of training

The schools must design and deliver training programs aligned with the competencies required for each role. This may involve developing new training materials or modifying existing ones (Fink, 2005). The question the developers must ask is, what content is needed

to support the development of competency in the curriculum? What instructional strategies and methods are most effective in developing competency? (Kim, 2015).

4.2.4. Evaluation of training effectiveness

The schools will need to evaluate the effectiveness of their training programs to ensure that they are achieving their intended outcomes. This may involve assessing or evaluating employee performance before and after training.

4.2.5. Integration with performance management

A CBT system should be integrated with the University of Zambia's performance management system to ensure that employees are being evaluated on the competencies that are relevant to their roles. This will help to identify areas where further training may be needed.

4.2.6. Ongoing support and development

Finally, the schools must provide their employees with ongoing support and development opportunities to ensure they continue developing their skills and competencies over time (Watson, 1990).

4.3. Implication of the design of courses for a structured competency-based curriculum

From the preceding, it is clear that competency-based training (CBT) requires more planning and management than a traditional training system. Competency-based training (CBT) requires a more structured and intentional approach to planning and management than traditional education (Fink and Fink, 2013). The following must be observed when designing courses for a structured doctoral curriculum:

4.3.1. Clear learning outcomes

In CBT, learning outcomes are clearly defined in terms of skills and competencies that the learner is expected to acquire. This requires careful planning and alignment between the learning objectives, assessment strategies, and instructional methods. This means that course development in the curricula should take a backward design approach to ensure mastery of skills in the competency framework instead of a content-centered approach. Backward design, or backward planning, is an instructional design process that involves starting with the desired learning outcomes and working backward to design the curriculum, instructional activities, and assessments to help students achieve those outcomes (Bowen, 2017). A content-centered approach to instructional design focuses primarily on the content or subject matter that needs to be taught with little attention to what students might learn beyond content knowledge (Fink, 2005).

4.3.2. Personalized learning

CBT is designed to meet the individual needs of learners, which means that instruction must be tailored to each student's strengths, weaknesses, and learning preferences. This requires ongoing progress monitoring and frequent adjustments to instruction (Watson, 1990).

4.3.3. Assessment and feedback

CBT places a strong emphasis on assessment and feedback, which requires careful planning and management to ensure that assessments are aligned with learning outcomes and that feedback is timely, specific, and actionable. We encourage the use of forward-looking assessment with a procedure that will allow frequent, immediate, discriminating (based on clear criteria and standards) and lovingly (empathetically) delivered as guided by [Fink \(2005\)](#).

The curriculum framework we developed also guided the revision of postgraduate guidelines. Then to facilitate the smooth delivery of a competency-based PhD curriculum, we developed the postgraduate school handbook and logbooks.

4.4. Opportunities should this doctoral training model be well implemented

Implementing competency-based doctoral training presents several opportunities, which include:

4.4.1. Improving innovation and commercialization of research output

Due to a lack of a guided approach, improving innovation and commercialization of research is currently missing in most doctoral graduates, mostly in developing countries ([Cloete et al., 2016](#); [Fredua-Kwarteng, 2023](#)). Innovation from research is the process of taking knowledge, discoveries, and ideas generated from research activities and transforming them into new or improved products, services, or processes that have practical applications and create value for society. Research can lead to new technologies, treatments, and products that can transform industries, create new businesses, and improve people's lives ([Fredua-Kwarteng, 2023](#)). Doctoral candidates should be given innovation skills and research outputs to achieve this.

4.4.2. Improving the quality of supervision and research output

Publication output from research in a traditional PhD training model has been more on the thesis, with doctoral graduates failing to publish their work due to poor quality of supervision and a lack of scientific writing and communication skills ([Cloete et al., 2016](#)). The competency-based model provides an opportunity to increase publication outputs in reputable peer-reviewed journals to generate and disseminate knowledge for national development ([Waruru, 2022](#); [Fredua-Kwarteng, 2023](#)).

4.4.3. Obtaining skills from anywhere in the world through online platforms

Doctoral candidates can obtain skills from online programs anywhere in the world, thus improving networking with highly skilled individuals from the diaspora and better employment opportunities. Many universities now offer online doctoral programs that are competency-based. These programs allow students to complete coursework and assessments from anywhere worldwide on their own schedule. Students can earn certifications in specific competencies from anywhere and transfer credit into their doctoral program.

4.4.4. Improving linkages with industry

This model of doctoral training would improve linkages with industry and funding for research from the government and private sector. The graduate will also obtain practical skills in grant writing through guided mentorship. In addition, professional doctorates will be more attractive to those candidates with more interest in industry than academia and output of such will add more value and evidence base for industry problem-solving.

5. Conclusions and recommendations

In this paper, we presented lessons from the practice of a collaborative, iterative, and participatory process using several workshops, physical and virtual meetings, and email communication, which we used to develop and adopt a doctoral competency-based curriculum framework to transform PhD training at the UNZA. The steps followed in the doctoral curriculum framework included: Planning, competency framework development, mapping competencies to courses, course structure development, competence assessment framework, and credit value determination. We argue that a traditional unstructured apprenticeship way of PhD training does not give graduates the requisite industry-driven competencies that will lead to innovation and commercialization of research and development. We urge universities to start a conversation towards competency-based doctoral training and improve on this approach. We also recommend the nationalization of competency-based doctoral training through Higher Education Regulatory Authorities and relevant policy making bodies beyond the University of Zambia.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

Ethical approval was not required for the studies involving human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in the studies was not required from the participants in accordance with the national legislation and the institutional requirements.

Author contributions

CM: conceptualization, involvement in workshops, generation of information, facilitation of workshops, development of a curriculum framework, and manuscript development. JS, JM, SM, and GK: involvement in workshops, generation of information, facilitation of workshops, development of a curriculum framework, and manuscript development. MM, MS, AP, WM, MHM, DH, KN, WN, PK-M, and

BH'o: involvement in workshops, development of a curriculum framework, and manuscript development. MH: development of Manuscript and provision of workspace and internet. ES, BH'o, and JM: funding workshops, information generation, and manuscript development. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2023.1224075/full#supplementary-material>

References

- Barnett, J. V., Harris, R. A., and Mulvany, M. J. (2017). A comparison of best practices for doctoral training in Europe and North America. *FEBS Open Bio* 7, 1444–1452. doi: 10.1002/2211-5463.12305
- Bowen, R. S. (2017). Understanding by Design. Vanderbilt University Center for Teaching. Available at: <https://cft.vanderbilt.edu/guides-sub-pages/understanding-by-design/> (accessed March 8, 2023).
- Bryan, B., and Guccione, K. (2018). Was it worth it? A qualitative exploration into graduate perceptions of doctoral value. *High. Educ. Res. Dev.* 37, 1124–1140. doi: 10.1080/07294360.2018.1479378
- Christensen, K. K. (2005). Bologna seminar: Doctoral programs for the European knowledge society. General Rapporteur's report. Available at: http://www.eua.be/eua/jsp/en/upload/Salzburger_Report_final.1129817011146.pdf
- Cloete, N., Mouton, J., and Sheppard, C. (2016). *Doctoral Education in South Africa*. Cape Town: African Minds.
- Cuthbert, D., and Molla, T. (2015). PhD crisis discourse: a critical approach to the framing of the problem and some Australian 'solutions'. *High. Educ.* 69, 33–53. doi: 10.1007/s10734-014-9760-y
- Cyranoski, D., Gillbert, N., Heidi, L., Anjali, N., and Mohammed, Y. (2011). The PhD factory: the world is producing more PhDs than ever before. Is it time to stop? *Nature* 472, 276–279. doi: 10.1038/472276a
- Fink, D. L. (2005). Integrated course design. IDEA Paper #42. University of Oklahoma. Available at: https://ideacontent.blob.core.windows.net/content/sites/2/2020/01/Idea_Paper_42.pdf (accessed March 7, 2023).
- Fink, D. L., and Fink, L. D. (2013). *Creating Significant Learning Experiences: An Integrated Approach to Designing College Courses*. 2nd. San Francisco: John Wiley & Sons Ltd
- Foyster, J. (1990). Getting to grips with competency-based training and assessment. Leabrook, S. Aust.: TAFE National Centre for Research and Development, Leabrook Australia. Available at: <https://eric.ed.gov/?id=ED317849>
- Frank, J. R., Snell, L. S., Ten Cate, O., Holmboe, E. S., Carraccio, C., Swing, S. R., et al. (2010). Competency-based medical education: theory to practice. *Med. Teach.* 32, 638–645. doi: 10.3109/0142159X.2010.501190
- Fredua-Kwarteng, E. (2023). Africa needs more PhDs, but they must be of high quality. University World News. Available at: <https://www.universityworldnews.com/post.php?story=20230412130513149> (accessed May 16, 2023).
- Iobst, W. F., Sherbino, J., Cate, O. T., Richardson, D. L., Dath, D., Swing, S. R., et al. (2010). Competency-based medical education in postgraduate medical education. *Med. Teach.* 32, 651–656. doi: 10.3109/0142159X.2010.500709
- Johnstone, S. M., and Soares, L. (2014). Principles for developing competency-based education programs. *Change Magaz. Higher. Learn.* 46, 12–19. doi: 10.1080/00091383.2014.896705
- Kim, J. (2015). Competency-based curriculum: an effective approach to digital curation education. *JELIS* 56, 283–297. doi: 10.12783/issn.2328-2967/56/4/2
- Loisy, C. (2018). *Competence and Program-Based Approach in Training: Tools for Developing Responsible Activities*. Hoboken, NJ: ISTE Ltd/John Wiley and Sons Inc.
- McGagh, J., Marsh, H., Western, M., Thomas, P., Hastings, A., Mihailova, M., et al. (2016). Review of Australia's research training system. Report for the Australian Council of Learned Academies. Available at: <https://www.voced.edu.au/content/ngv:73236> (accessed April 21, 2023).
- Mulvany, M. J. (2013). Biomedical PhD education - an international perspective. *Basic Clin. Pharmacol. Toxicol.* 112, 289–295. doi: 10.1111/bcpt.12063

- Mumba, C., Skjerve, E., Rich, M., and Rich, K. M. (2017). Application of system dynamics and participatory spatial group model building in animal health: a case study of East Coast fever interventions in Lundazi and Monze districts of Zambia. *PLoS One* 12:e0189878. doi: 10.1371/journal.pone.0189878
- Pinto, J., Dissanayake, R. B., Dhand, N., Rojo-Gimeno, C., Falzon, L. C., Akwar, H., et al. (2023). Development of core competencies for field veterinary epidemiology training programs. *Front. Vet. Sci.* 10:1143375. doi: 10.3389/fvets.2023.1143375
- Stassen, M. L. A., Doherty, K., and Poe, M. (2001). *Course Based Review and Assessment: Methods for Understanding Student Learning*. University of Massachusetts. Boston, MA
- Sullivan, R., and McIntosh, N. (1996). The competency-based approach to training. *Med. J. Indones.* 95:95. doi: 10.13181/mji.v5i2.853
- Taylor, M. (2011). Reform the PhD system or close it down. *Nature* 472:261. doi: 10.1038/472261a
- The Economist (2010). The disposable academic: why doing a PhD is often a waste of time. Available at: <https://www.economist.com/christmas-specials/2010/12/16/the-disposable-academic>
- UNZA (2018). *The University of Zambia 2018–2022 Strategic Plan*. The University of Zambia. Lusaka.
- Verderame, M. F., Freedman, V. H., Kozlowski, L. M., and McCormack, W. T. (2018). Competency-based assessment for the training of PhD students and early-career scientists. *eLife* 7:e34801. doi: 10.7554/eLife.34801
- Waruru, M. (2022). Universities must strive to produce 100,000 PhDs in a decade. *University World News*. Available at: <https://www.universityworldnews.com/post.php?story=20221108133427840> (accessed May 16, 2023).
- Watson, A. (1990). *Competency-Based Vocational Education and Self-Paced Learning*. Technology University, Sydney, Australia.
- Wittmann-Price, R. A. (2020). “Competency-based curriculum development” in *Fast Facts About Competency-Based Education in Nursing*, eds. R. A. Wittmann-Price and K. K. Gittings (New York, NY: Springer Publishing Company).
- ZAQA (2021). *Zambia Qualifications Authority. Guidelines for the registration and Accreditation of Qualifications on the Zambia Qualifications Framework*. Lusaka. ZAQA.



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Transformational leadership of physical education instructors and university students' satisfaction with online classes

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This study examined the relationship between the transformational leadership of PE instructors and students' satisfaction in an online PE class. In particular, it aimed to investigate whether the PE instructors' transformational leadership behaviors could predict students' satisfaction toward the class, their PE teacher, and their health and fitness. Furthermore, this study explored these relationships in male and female students. A total of 448 university students (male = 228; female = 220) between the ages of 18 and 22 participated in the study. The results revealed a positive relationship between the transformational leadership behaviors of PE instructors and students' satisfaction with online PE classes. Moreover, male and female students' satisfaction with the teaching of their PE instructor, feelings of fun and enjoyment, and perception of improved health and fitness in their online PE classes varied greatly as they perceived specific behaviors of transformational leadership from their PE instructors. These findings demonstrate that PE instructors play an important role as (online) classroom leaders in enhancing students' satisfaction with online learning. Therefore, PE instructors should be mindful to demonstrate transformational leadership to improve their effectiveness when conducting online classes.

KEYWORDS

online physical education, university students, transformational leadership theory, physical education teacher, Philippines, student learning outcome

1. Introduction

Teachers are regarded as classroom leaders. They plan and conduct appropriate lessons, effectively communicate the curriculum content, and provide appropriate support and encouragement for students to achieve their learning goals (Nadelson et al., 2020). In physical education (PE), aside from these general responsibilities, PE instructors teach and demonstrate fundamental movement and sports-related skills, games, and fitness exercises that are generally conducted in schools' indoor or outdoor facilities (Shirotriya and Beighle, 2022). They also motivate students to be active not only during the PE period but also outside PE hours. Indeed, PE teachers have distinctive functions and responsibilities that exemplify their leadership position when teaching. However, because of the unprecedented global impact of the COVID-19 pandemic, face-to-face PE classes have shifted to online instruction (Cruz et al., 2022). This change in online educational instruction has made teaching PE lessons more challenging (Chan et al., 2021; Korcz et al., 2021; Yu and Jee, 2021), particularly when teaching games, exercises, and sports that require specific equipment and/or facilities and interactions among classmates (Chan et al., 2021; Kim et al., 2021). While the majority

of schools have reverted to face-to-face PE classes, a number of academic institutions still conduct PE classes in an online format. Therefore, this topic requires continuous examination. In particular, PE teachers' leadership approaches in teaching online PE classes and how these leadership behaviors affect class-related outcomes in students merit further research. Understanding the impact of transformational leadership and student outcomes in an online setting could help PE teachers improve their teaching and leadership approaches. Such improvement will enable them to effectively guide and motivate their students in learning PE concepts and movement skills even in an online PE classroom environment.

The role of PE teachers as leaders who could facilitate students' class-related outcomes can be viewed using the transformational teaching approach. Transformational teaching is a contemporary approach to classroom learning instruction (Slavich and Zimbardo, 2012). It promotes students' learning attitudes, values, skills, and beliefs and develops their personal growth by establishing dynamic interrelationships among teachers, students, and a shared body of knowledge. Grounded in transformational leadership (Bass, 1998), transformational teaching emphasizes the role of instructors as motivational leaders who influence students by displaying positive traits and behaviors inside and outside the classroom (idealized influence) and conveying clear and realistic goals that students acknowledge as meaningful (inspirational motivation). Transformational teaching also underscores teachers who stimulate students' intellectual capacity by challenging them to find solutions to problems from various perspectives (intellectual stimulation), listening to students' needs and concerns, and providing support when needed (individualized consideration). Therefore, when PE teachers demonstrate the important elements of transformational behaviors, such as acting as role models for students, sharing the goals and objectives of each PE lesson with students, stimulating students' cognitive skills through games and sports, and providing social support and positive reinforcement, students' personal growth and learning outcomes (i.e., beliefs and attitudes) could potentially be enhanced.

Several studies have examined the relationship between teachers' transformational behaviors and class-related outcomes. For instance, Noland and Richards (2014) found that transformational teaching significantly predicts student learning outcomes. In particular, all four elements of transformational teaching show significant relationships with students' affective learning. They concluded that transformational leadership practices in the classroom positively influence students' positive attitudes toward the subject. Harvey et al. (2003) found that students' trust, respect, and satisfaction toward their instructors are positively associated with the instructors' transformational behaviors. Harrison (2011) examined university instructors' leadership behaviors and their impacts on student outcomes and found that instructors' transformational leadership behaviors are significant predictors of students' perceptions of instructor credibility, cognitive learning, and affective learning. Moreover, in a study conducted in PE settings, Beauchamp et al. (2014) found that transformational teaching has a direct effect on students' affective attitudes, suggesting that students' enjoyment of PE can be enhanced when their PE teachers demonstrate

transformational behaviors. Wei and Jianhao (2023) revealed that the transformational leadership of PE teachers is positively associated with students' exercise adherence and physical efficacy. Cho et al. (2013) examined the influence of PE teachers' transformational leadership on teacher trust and class satisfaction and found that charisma and intellectual stimulation are positive predictors of teacher trust. They also revealed that students' satisfaction with class evaluations and sense of accomplishment are positively predicted by teachers' transformational leadership.

Overall, the results of these previous studies highlight the influence of teachers' transformational leadership on students' learning outcomes. However, knowledge is still scarce regarding the relationship between transformational leadership and students' learning outcomes in an online education setting, especially in online PE environment. Given the changes in the educational landscape to online education in general and PE in particular because of the COVID-19 pandemic, the role of PE teachers in facilitating student learning has become increasingly pertinent. Therefore, efforts must be exerted to expand the knowledge on how PE teachers can be more effective in enhancing students' learning outcomes in an online PE environment, especially when face-to-face classes are not viable.

Accordingly, the current study aims to examine the relationship between PE teachers' transformational leadership and students' satisfaction in an online PE class. In particular, we investigate the elements of transformational leadership that could predict students' satisfaction toward the class, their PE teacher, and their health and fitness. We also analyze these relationships in male and female students.

2. Materials and methods

2.1. Participants

A total of 448 university students participated in this study. Specifically, the participants comprised 228 (50.9%) male students and 220 (49.1%) female students, and their ages ranged from 18 to 22 years. They were recruited from a private university located in the second-largest metropolitan area in the Philippines during the second semester of 2022–2023. The students were enrolled in different PE courses, such as traditional Filipino games, modern dance, line dance, movement enhancement, and fitness exercises.

2.2. Assessment tools

2.2.1. Transformation leadership

The transformational leadership behaviors of PE instructors, as perceived by students, were assessed using the Transformational Teaching Questionnaire (TTQ) (Beauchamp et al., 2010). The TTQ comprises 16 items divided into 4 subscales: idealized influence (e.g., My PE instructor treats me in ways that build my respect), inspirational motivation (e.g., My PE instructor demonstrates that s/he believes in me), intellectual stimulation (e.g., My PE instructor creates lessons that encourage me to think), and individualized consideration (e.g., My PE instructor tries to help students who

might be struggling). The survey used a 5-point Likert scale with response ratings of 0, “not at all”; 1, “once in a while”; 2, “sometimes”; 3, “fairly often”; and 4, “frequently.” Previous studies have supported the measurement tool’s psychometric properties (Beauchamp et al., 2010; Rezaei Sharif and Ebrahimkhani, 2018; Trigueros et al., 2020; Wei and Jianhao, 2023). The internal reliability scores for this study were 0.805, 0.893, 0.824, and 0.826 for individualized influence, inspirational motivation, intellectual stimulation, and individualized consideration, respectively.

2.2.2. PE class satisfaction

The students’ satisfaction with their PE class, PE teacher, and perceived health and fitness improvement were measured using selected items from the Physical Activity Class Satisfaction Questionnaire (PASC SQ) (Cunningham, 2007), which was adapted for use in online PE classes for this study. The students were asked to rate their level of satisfaction with the aspects of their online PE class, namely, fun and enjoyment (e.g., My overall enjoyment in the online class), teaching (e.g., The clarity of the PE instructor’s lessons), and improvement of health and fitness (e.g., The physical workout I receive in this online PE class). The survey had 14 items and used an 8-point Likert scale ranging from 1 (not satisfied) to 8 (very satisfied). The psychometric properties of this tool have been supported in previous studies (Cunningham, 2007; Filippou et al., 2021; La Rotta et al., 2021). The internal reliability scores for this study were 0.929, 0.947, and 0.954 for teaching, fun and enjoyment, and improvement of health and fitness, respectively.

2.3. Procedure

This study used a quantitative cross-sectional design, and the respondents were recruited using convenience sampling. The primary author contacted PE instructors, explained the study’s purpose, and requested permission to involve their students in the survey. Upon obtaining approval, students enrolled in various PE courses received a QR code and were asked to complete an online survey using Google Forms. The survey included an introduction to the study, information about their rights as participants, assurances of anonymity and confidentiality, and informed consent to participate in the study. Only students who provided informed consent (by clicking on the “Agree” option) were able to proceed to the series of questionnaires on transformational leadership, PE satisfaction, and demographic information. Data were collected near the end of the second semester (April 2023) to ensure that students had acquired sufficient knowledge and experience to assess their PE instructors’ behavior during online sessions and their online PE class. The survey took ~15–20 mins to complete. This study complied with the American Psychological Association’s ethical standards for human treatment and the ethical guidelines of the appropriate ethics committee in the Philippines.

TABLE 1 Descriptive statistics of relevant variables.

Variable	Mean	SD
Transformational leadership		
Idealized influence	3.30	0.69
Inspirational motivation	3.41	0.70
Intellectual stimulation	3.12	0.79
Individualized consideration	3.30	0.72
Satisfaction		
Teaching	6.90	1.11
Fun and enjoyment	6.67	1.35
Health and fitness	6.52	1.30

2.4. Data analysis

The students’ responses were recorded in Excel. Data screening was conducted to remove missing, duplicate, incorrect, and incomplete data. Out of the 498 collected survey forms, 448 were deemed valid. Descriptive statistics and multiple regression analyses were performed to respectively examine the nature of the data and to determine which transformational leadership behaviors would best predict PE satisfaction. Next, the data were stratified by sex, and a multiple linear regression was performed again to identify which transformational leadership behaviors would best predict PE satisfaction in male and female students. IBM SPSS statistical software version 28 was used to perform the relevant analyses, and the statistical significance was set at $p < 0.05$.

3. Results

Table 1 shows the means and standard deviations of PE teachers’ transformational leadership and students’ PE satisfaction. The mean scores for transformational leadership behavior were consistently above 3.00, suggesting that the university students perceived their PE teachers to display transformational leadership behaviors fairly often when conducting online PE classes. Meanwhile, the mean scores for the dimensions of PE satisfaction were above 6.00, suggesting that the students were moderately satisfied with the teaching of their PE instructors, the pleasure and enjoyment they experienced in the online PE class, and the belief that the online PE class helped improve their health and fitness.

Table 2 shows the regression analyses of transformational leadership behaviors and different dimensions of PE satisfaction. Teaching satisfaction was regressed on the four elements of transformational leadership. The overall regression was significant: $F_{(4, 443)} = 43.365$, $p < 0.001$. The model explained ~28% of the variance in teaching satisfaction (adjusted $R^2 = 0.275$). Table 2 provides information on the regression coefficients of the predictors. Idealized influence and individualized consideration were significant predictors with a positive relationship with teaching satisfaction.

Fun and enjoyment was regressed on the four elements of transformational leadership. The overall regression was significant:

TABLE 2 Multiple regression analysis of transformational leadership predicting PE satisfaction.

Variable	95% CI			β	t	p
	B	LB	UB			
Satisfaction—teaching						
Idealized influence	0.445	0.171	0.718	0.274	3.195	0.001**
Inspirational motivation	0.247	−0.016	0.509	0.155	1.847	0.065
Intellectual stimulation	−0.064	−0.283	0.155	−0.045	−0.573	0.567
Individualized consideration	0.270	0.027	0.514	0.175	2.181	0.030*
Satisfaction—fun and enjoyment						
Idealized influence	0.284	−0.067	0.634	0.144	1.591	0.112
Inspirational motivation	−0.032	−0.368	0.304	−0.016	−0.185	0.853
Intellectual stimulation	0.270	−0.011	0.551	0.157	1.891	0.059
Individualized consideration	0.372	0.060	0.684	0.198	2.345	0.019*
Satisfaction—health and fitness						
Idealized influence	0.319	−0.021	0.658	0.168	1.847	0.065
Inspirational motivation	−0.117	−0.443	0.208	−0.063	−0.708	0.479
Intellectual stimulation	0.349	0.077	0.622	0.211	2.524	0.012*
Individualized consideration	0.267	−0.035	0.569	0.148	1.735	0.083

CI, confidence interval; LB, lower bound; UB, upper bound; * $p < 0.05$; ** $p < 0.01$.

$F_{(4, 443)} = 28.521$, $p < 0.001$. The model explained $\sim 21\%$ of the variance in teaching satisfaction (adjusted $R^2 = 0.198$). Table 2 provides information on the regression coefficients of the predictors. Individualized consideration was the only significant predictor with a positive relationship with fun and enjoyment.

Health and fitness improvement satisfaction was regressed on the four elements of transformational leadership. The overall regression was significant: $F_{(4, 443)} = 26.506$, $p < 0.001$. The model explained $\sim 19\%$ of the variance in teaching satisfaction (adjusted $R^2 = 0.186$). Table 2 provides information on the regression coefficients of the predictors. Intellectual stimulation was the only significant predictor with a positive relationship with health and fitness improvement.

Table 3 shows the regression analyses of transformational leadership behaviors and the different dimensions of PE satisfaction among male and female students. The teaching satisfaction of male and female students was regressed on the four elements of transformational leadership. The regression results were significant for both sexes (males: $F_{(4, 223)} = 28.244$, $p < 0.001$; females: $F_{(4, 215)} = 16.887$, $p < 0.001$). The models explained ~ 34 and 24% of the variances in teaching satisfaction among male and female students, respectively. Based on the regression coefficients, idealized influence and individualized consideration were significant predictors with a positive relationship with teaching satisfaction in males. As for females, only idealized influence was a significant positive predictor of teaching satisfaction.

Male and female students' fun and enjoyment was regressed on the four elements of transformational leadership. The regression results were significant for both sexes (males: $F_{(4, 223)} = 16.949$, $p < 0.001$; females: $F_{(4, 215)} = 13.740$, $p < 0.001$). The models explained

~ 23 and 20% of the variances in teaching satisfaction among male and female students, respectively. Based on the regression coefficients, only individualized consideration was a significant predictor with a positive relationship with fun and enjoyment in males. As for females, only intellectual stimulation was a significant positive predictor of fun and enjoyment.

The male and female students' health and fitness satisfaction was regressed on the four elements of transformational leadership. The regression results were significant for both sexes (males: $F_{(4, 223)} = 13.512$, $p < 0.001$; females: $F_{(4, 215)} = 17.106$, $p < 0.001$). The models explained ~ 20 and 24% of the variances in health and fitness satisfaction in male and female students, respectively. Based on the regression coefficients, only individualized consideration was a significant predictor with a positive relationship with health and fitness satisfaction in males. As for females, inspirational motivation and intellectual stimulation were significant and positive predictors of health and fitness satisfaction.

4. Discussion

This study examined the relationship between the transformational leadership of PE teachers and students' satisfaction with online PE classes. In particular, we investigated the elements of transformational leadership that could predict students' satisfaction toward the class, their PE teachers, and their overall health and fitness. We also examined these relationships in male and female students. Overall, the results showed that the university students who attended online PE courses perceived their PE instructors as demonstrating transformational behaviors fairly

TABLE 3 Multiple regression analysis for transformational leadership predicting PE satisfaction in male and female students.

	95% CI			β	t	p
	B	LB	UB			
Satisfaction—teaching						
Male						
Idealized influence	0.494	0.102	0.886	0.286	2.485	0.014*
Inspirational motivation	0.298	−0.072	0.669	0.182	1.587	0.114
Intellectual stimulation	−0.284	−0.607	0.039	−0.188	−1.730	0.085
Individualized consideration	0.534	0.200	0.868	0.318	3.149	0.002**
Female						
Idealized influence	0.438	0.054	0.821	0.292	2.250	0.025*
Inspirational motivation	0.171	−0.209	0.551	0.111	0.886	0.377
Intellectual stimulation	0.130	−0.166	0.426	0.100	0.868	0.386
Individualized consideration	0.021	−0.343	0.384	0.015	0.114	0.910
Satisfaction—fun and enjoyment						
Male						
Idealized influence	0.240	−0.278	0.757	0.113	0.912	0.363
Inspirational motivation	0.234	−0.255	0.723	0.116	0.944	0.346
Intellectual stimulation	−0.027	−0.454	0.399	−0.015	−0.127	0.899
Individualized consideration	0.614	0.173	1.055	0.298	2.746	0.007*
Female						
Idealized influence	0.347	−0.124	0.818	0.193	1.452	0.148
Inspirational motivation	−0.372	−0.839	0.095	−0.201	−1.570	0.118
Intellectual stimulation	0.534	0.170	0.898	0.341	2.895	0.004**
Individualized consideration	0.195	−0.252	0.641	0.115	0.858	0.392
Satisfaction—health and fitness						
Male						
Idealized influence	0.329	−0.189	0.848	0.158	1.251	0.212
Inspirational motivation	0.163	−0.327	0.653	0.083	0.656	0.513
Intellectual stimulation	−0.042	−0.470	0.386	−0.023	−0.194	0.846
Individualized consideration	0.506	0.064	0.948	0.251	2.257	0.025*
Female						
Idealized influence	0.321	−0.108	0.749	0.191	1.474	0.142
Inspirational motivation	−0.475	−0.901	−0.050	−0.275	−2.204	0.029*
Intellectual stimulation	0.704	0.373	1.035	0.482	4.194	0.001**
Individualized consideration	0.098	−0.309	0.504	0.062	0.475	0.635

CI, confidence interval; LB, lower bound; UB, upper bound; * $p < 0.05$; ** $p < 0.01$.

often. They also reported that they were relatively satisfied with the conduct of their online PE classes.

4.1. PE instructors' transformational leadership and students' satisfaction in online PE classes

The regression analysis revealed a significant positive relationship between transformational leadership and PE class satisfaction. In other words, during online PE classes, students

who perceive that their PE instructors care for them, demonstrate movement skills well, encourage every student to do their best to achieve class objectives, and let students think of different strategies to solve tactical-related activities are more likely to feel satisfied with the teaching of their PE instructors, consider the online PE class fun and enjoyable, and perceive that the class can help improve their health and fitness. This finding supports those of previous studies that found a positive relationship between the transformational leadership of PE teachers and student outcomes (Beauchamp et al., 2014; Jiang and Jia, 2018; Castillo et al., 2020; Wei and Jianhao, 2023). It also extends the knowledge not only in the education literature but also in the PE teaching

literature by examining PE teachers' transformational leadership teaching and how it affects class-related outcomes in students in an online environment. Moreover, the results showed that the distinct elements of transformational leadership significantly predicted PE satisfaction. In particular, idealized influence and individualized consideration were significant positive predictors of teaching satisfaction while individualized consideration and intellectual stimulation were significant positive predictors of fun and enjoyment and health and fitness satisfaction, respectively. This finding suggests that when students perceive that their PE instructor attends to their individual needs and considers their strengths and weaknesses, they are more likely to enjoy and have fun in their online PE classes. In addition to prior leadership behavior, when students observe that their PE teacher behaves in an ethical way and guides them through actions, they tend to feel more satisfied with their instructor's level of teaching. Finally, when students perceive that their PE instructor creates new learning opportunities and develops their critical thinking skills through PE lessons, they are more likely to perceive that their health and fitness is enhanced because of their participation in the online PE class. This result partially supports the previous findings (Cho et al., 2013) that the distinct transformational leadership behaviors of PE teachers significantly affect the PE satisfaction of students. The difference in the results may be due to the measurement tools used, the study participants, and the PE setting (online PE vs. traditional PE classes). As the present study only assessed three dimensions of satisfaction of the PASCSSQ, other dimensions of this satisfaction scale should be examined to gain a better understanding of how the transformational leadership of PE teachers affects students' satisfaction in online settings. Nevertheless, the findings are in accordance with the concept of transformational teaching, in which positive learning outcomes would be expected from students when teachers demonstrate transformational behavior.

4.2. PE instructors' transformational leadership and male and female students' satisfaction in online PE classes

In addition to examining the association between PE instructors' transformational leadership and students' satisfaction in general, we investigated how the transformational leadership behaviors of PE instructors affect male and female students' levels of satisfaction with their online PE classes. Based on the regression analyses, male students' satisfaction with the fun and enjoyment of their PE classes and their perceived health and fitness were significantly affected only by the individualized consideration element of transformational leadership. These findings indicate that when PE instructors support and encourage students and foster open communication, male students would tend to feel more joyful and experience more fun in online PE classes and think that their health and fitness have improved as a result of perceiving this transformational leadership behavior. Meanwhile, individualized consideration and idealized influence significantly affected the male students' teaching satisfaction. That is, male students would tend to report higher levels of satisfaction with the

PE instructor's teaching behaviors when they perceive that their PE instructor acts as a role model, treats students in ways that build respect and trust, and cares about knowing every student in the class.

According to the regression analyses of female students, certain elements of transformational leadership had significant effects on female students' PE satisfaction. Idealized influence was the sole significant predictor of teaching satisfaction while intellectual stimulation was the only predictor of fun and enjoyment. Meanwhile, inspirational motivation and intellectual stimulation were significant predictors of satisfaction with health and fitness. These findings suggest that female students' satisfaction levels are likely to increase when they observe that their PE instructors frequently demonstrate these transformational behaviors. That is, female students would tend to be more satisfied with the PE instructor's teaching when they perceive that the instructor creates a PE class with a shared vision and personifies a skilled and knowledgeable PE educator. In addition, female students are more likely to think that their PE classes are fun and enjoyable when they perceive that their PE instructors provide challenging tasks and encourage multiple perspectives to solve problems. Finally, female students are likely to experience improvement in their health and fitness as a result of attending their online PE classes when they perceive that their PE instructors motivate them to think out of the box, promote creativity and curiosity in the class, and inspire them to achieve PE lessons' goals and objectives.

Overall, the findings demonstrate that similarities and differences in male and female students' appraisals of their learning outcomes (e.g., satisfaction) in online PE classes could be affected by the PE instructors' display of transformational leadership behaviors and how the students perceive these behaviors. This notion is in accordance with the multidimensional model of sports leadership (Chelladurai, 2007), which states that desired outcomes (e.g., satisfaction) are expected when the perceived behaviors of the leader that are deemed appropriate for a certain situation are congruent with the preferences of the followers. Moreover, these actual, required, and preferred leadership behaviors are influenced by various characteristics of the situation, coach, and members. In line with this model, the male and female students' degree of satisfaction with certain dimensions of their PE experiences appeared to be the result of their perceptions of certain leadership behaviors that matched their personal preferences for these specific behaviors. In studies conducted in sports, it was found that males reported stronger preferences for training and instruction, autocratic behavior and social support (Horn, 2002; Witte, 2011) while females expressed higher preferences for democratic decision-making style, positive feedback and situational consideration (Horn, 2002; Witte, 2011). Following this idea in the present study, when PE instructors frequently displayed the appropriate teaching behaviors when conducting online PE class, and these behaviors were congruent with the preferences of male and female students, students tended to feel satisfied with their online PE experiences. Therefore, this result highlights that learning outcomes, that is, satisfaction with online PE, can result from the interaction among the characteristics of the PE instructor, student, and class context. Moreover, this

finding emphasizes students' sex as a potential variable in the transformational leadership–satisfaction relationship in the PE context. A previous study in the sports context supports this claim (Kim and Cruz, 2022).

This study also underscores the importance of PE teachers' demonstration of transformational leadership behaviors in enhancing student satisfaction in online PE classes. This is achieved by altering students' beliefs and attitudes toward the classes and fostering positive and dynamic relationships among students, and in turn contributing to their personal growth. Considering that studies conducted in traditional PE environment have shown that transformational leadership of teachers is positively related to other learning outcomes in students, such as motivation (Jiang and Jia, 2018; Castillo et al., 2020), expectancy value in PE (Kim et al., 2017), exercise adherence (Wei and Jianhao, 2023), and physical activity participation (Beauchamp and Morton, 2011; Castillo et al., 2020), it is plausible that these learning outcomes could also be facilitated in an online environment and therefore worthy to be explored in future investigations.

4.3. Theoretical contributions and implications

To the best of our knowledge, this study is the first to examine the relationship between PE teachers' transformational leadership and student outcomes (PE satisfaction) in an online setting as well as to investigate this relationship between male and female students. Hence, the findings extend the body of knowledge in the domains of physical education, leadership, and online teaching by providing empirical evidence of the effectiveness of transformational leadership and its elements in enhancing students' satisfaction with their online PE experiences. The findings can also contribute to the academic community, especially for the professional development of physical education instructors who have difficulties in creating an effective and engaging online PE environment for students. Learning the principles of transformational leadership by attending leadership seminars or training workshops can assist PE instructors on how to incorporate appropriate leadership strategies into their teaching approaches, and in turn, lead to better student motivation and engagement in an online PE classroom setting. From a practical perspective, PE instructors should employ effective strategies when teaching and managing their students' learning by frequently demonstrating transformational leadership and teaching behaviors to sustain university students' attention and motivation and to further enhance their satisfaction with their online PE courses. For instance, given individualized consideration being a significant predictor of students' fun and enjoyment, PE instructors should be mindful of students' individual concerns and challenges when attending online PE classes and try to assist them whenever possible. In the Philippines, for example, technological literacy and competency, learning environment, and physical discomfort have been identified as challenges that university students experience during online learning (Barrot et al., 2021). Therefore, PE instructors should be more considerate when students cannot attend synchronous sessions due to internet connection issues.

They should also consider extending the submission dates of projects/activity logs for students who may struggle to complete tasks because of a lack of space or equipment to perform such tasks at home. Meanwhile, for PE instructors aiming to create a pleasurable online PE experience for female students, they should focus on innovative and interesting online activities that would stimulate female students' curiosity and learning because the intellectual stimulation element of transformational behavior was found to greatly affect female students' fun and enjoyment. Some activities in the movement enhancement PE classes may include finding things in the house that can be used as alternative equipment for developing muscular endurance or utilizing movement analysis software to provide constructive feedback on movement performance.

4.4. Limitations

This study has several limitations. First, student satisfaction is considered one of the main outcomes of education and can be measured in various ways. As the present study assessed only three dimensions of satisfaction (PE instructor's teaching, fun and enjoyment, and health and fitness), we suggest that other dimensions of satisfaction, such as social interaction and cognitive development, be examined to gain a better understanding of how the transformational leadership of PE teachers affects the other dimensions of satisfaction among students attending online PE classes. Second, we recognize the presence of potential response and sampling biases in our data collection process, which may be attributed to the chosen survey. To mitigate potential response bias, we took measures to ensure the clarity and comprehensibility of the questionnaire instructions, maintained participant anonymity, and adapted item statements from validated measurement tools to elicit accurate and honest responses from the participants. Additionally, it is important to note that our sample consisted solely of university students, which limits the generalizability of our study's findings to a broader population. Therefore, we recommend expanding the scope of future studies by including participants from different age groups or educational levels. Third, other personal and situational factors that may mediate or moderate the relationship between PE instructors' transformational leadership and student satisfaction were not examined in the present study. Hence, future studies should consider these variables such as PE instructors' teaching experience, technological ability, and gender as well as students' fitness level, self-efficacy, and academic workload. Finally, because the study adopted a cross-sectional approach, causal relationships could not be claimed; therefore, longitudinal studies should be conducted in the future to supplement the findings of the present investigation.

4.5. Conclusion

The current study found that when university students perceived their PE instructors to demonstrate transformational leadership behaviors when conducting online PE classes, they felt relatively satisfied with their online PE experience. Furthermore,

the transformational leadership of PE instructors, particularly their individualized consideration, idealized influence, and intellectual stimulation, promoted the university students' PE satisfaction in the online learning setting. Finally, the male and female students' satisfaction with the teaching of their PE instructor, feelings of fun and enjoyment, and perception of improved health and fitness in their online PE classes varied greatly as they perceived specific behaviors of transformational leadership from their PE instructors. Overall, the findings confirm the positive effects of transformational leadership behaviors on students' affective learning outcomes. Thus, PE instructors are encouraged to demonstrate transformational leadership to improve their effectiveness when conducting online PE classes.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the studies involving humans because relevant officials and PE instructors reviewed and approved the study protocol. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AC: Conceptualization, Formal analysis, Writing—original draft, Writing—review and editing. H-DK:

Conceptualization, Writing—original draft, Writing—review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Barrot, J. S., Llenares, I. I., and Del Rosario, L. S. (2021). Students' online learning challenges during the pandemic and how they cope with them: the case of the Philippines. *Educ. Inf. Technol.* 26, 7321–7338. doi: 10.1007/s10639-021-10589-x
- Bass, B. M. (1998). *Transformational Leadership: Industrial, Military, and Educational Impact*. Mahwah, NJ: Erlbaum.
- Beauchamp, M. R., Barling, J., Li, Z., Morton, K. L., Keith, S. E., and Zumbo, B. D. (2010). Development and psychometric properties of the transformational teaching questionnaire. *J. Health Psychol.* 15, 1123–1134. doi: 10.1177/1359105310364175
- Beauchamp, M. R., Liu, Y., Morton, K. L., Martin, L. J., Wilson, A. H., Wilson, A. J., et al. (2014). Transformational teaching and adolescent physical activity: multilevel and mediational effects. *Int. J. Behav. Med.* 21, 537–546. doi: 10.1007/s12529-013-9321-2
- Beauchamp, M. R., and Morton, K. L. (2011). Transformational teaching and physical activity engagement among adolescents. *Exer. Sport Sci. Rev.* 39, 133–139. doi: 10.1097/JES.0b013e31822153e7
- Castillo, I., Molina-García, J., Estevan, I., Queralt, A., and Álvarez, O. (2020). Transformational teaching in physical education and students' leisure-time physical activity: the mediating role of learning climate, passion and self-determined motivation. *Int. J. Environ. Res. Public Health*. 17, 4844. doi: 10.3390/ijerph17134844
- Chan, W., Leung, K. I., Hoc, C. K., Wuc, W., Lam, K. Y., Wong, N. L., et al. (2021). Effectiveness of online teaching in physical education during Covid-19 school closures: A survey study of frontline physical education teachers in Hong Kong. *J. Phys. Educ. Sport*. doi: 10.7752/jpes.2021.04205
- Chelladurai, P. (2007). "Leadership in sports," in *Handbook of Sport Psychology*, eds G. Tenenbaum and R. C. Eklund (Hoboken, NJ: Wiley), 113–135.
- Cho, T. S., Jeon, Y. B., and Mun, S. H. (2013). Influence of physical education teacher's transformational leadership on trust and class satisfaction. *J. Fish. Mar. Sci.* 25, 526–537. doi: 10.13000/JFMSE.2013.25.2.526
- Cruz, A. B., Cando, J. M., and Kim, H. (2022). Physical activity, sedentary behavior, and health states of university students during the first wave of COVID-19 community quarantine in the Philippines. *Front. Educ.* 7, 848273. doi: 10.3389/feduc.2022.848273
- Cunningham, G. B. (2007). Development of the physical activity class satisfaction questionnaire (PACSQ). *Meas. Phys. Educ. Exer. Sci.* 11, 161–176. doi: 10.1080/10913670701326443
- Filippou, F., Rokka, S., Douka, S., Pitsi, A., Koupani, A., Masadis, G., et al. (2021). Adaption and validity of the "physical activity class satisfaction questionnaire" (PACSQ) in Greek educational dancing context. *Cuad. Psicol. Deporte*. 21, 13–23. doi: 10.6018/cpd.421821
- Harrison, J. L. (2011). Instructor transformational leadership and student outcomes. *Emerg. Leadersh. Journeys*. 4, 82–136.
- Harvey, S., Royal, M., and Stout, D. (2003). Instructor's transformational leadership: university student attitudes and ratings. *Psychol. Rep.* 92, 395–402. doi: 10.2466/pr0.2003.92.2.395
- Horn, T. S. (2002). "Coaching effectiveness in the sport domain," in *Advances in Sport Psychology 2nd ed.* ed. T. Horn (Champaign, IL: Human Kinetics), 309–365.
- Jiang, Z., and Jia, Z. (2018). Effects of Physical Education teachers' leadership styles and classroom climate on learning motivation for basketball course. *EURASIA J. Math. Sci. Tech. Ed.* 14, 1351–1357. doi: 10.29333/ejmste/81296

- Kim, H. D., and Cruz, A. B. (2022). Gender differences in the relationships between coach transformational leadership and player satisfaction and commitment: a meta-analytic review. *Front. Psychol.* 13, 915391. doi: 10.3389/fpsyg.2022.915391
- Kim, M., Hushman, G., Holzberg, L., and So, H. (2017). The effect of transformational leadership on middle school students' intrinsic motivation and expectancy-value in physical education. *Eur. J. Educ. Sci.* 04, 22–31. doi: 10.19044/ejes.v4no2a2
- Kim, M., Yu, H., Park, C. W., Ha, T., and Baek, J. (2021). Physical education teachers' online teaching experiences and perceptions during the Covid-19 pandemic. *J. Phys. Educ. Sport.* 21, 2049–2056. doi: 10.7752/jpes.2021.s3261
- Korcz, A., Krzysztozek, J., Łopatka, M., Popeska, B., and Podnar, H., Filiz, B., et al. (2021). Physical education teachers' opinion about online teaching during the COVID-19 pandemic—comparative study of European countries. *Sustainability.* 13, 11730. doi: 10.3390/su132111730
- La Rotta, D. R., Ferriz, R., and Lara, D. (2021). Validation of the Satisfaction Questionnaire with physical education classes (CSCEF) in the Latin American context. *J. Hum. Sport Exer.* 16, 627–639. doi: 10.14198/jhse.2021.163.12
- Nadelson, L. S., Booher, L., and Turley, M. (2020). Leaders in the classroom: Using teaching as a context for measuring leader identity. *Front. Educ.* 5, 525630. doi: 10.3389/educ.2020.525630
- Noland, A., and Richards, K. (2014). The relationship among transformational teaching and student motivation and learning. *J. Effect. Teach.* 14, 5–20.
- Rezaei Sharif, A., and Ebrahimkhani, M. R. (2018). Validation of the transformational teaching questionnaire (TTQ). *J. Sch. Psychol.* 7, 54–71. doi: 10.22098/jsp.2018.693
- Shirotriya, A. K., and Beighle, A. E. (2022). Physical education teachers as leaders of comprehensive school physical activity programs: AS. *J. Phys. Educ. Recreat. Dance.* 93, 33–38. doi: 10.1080/07303084.2022.2120127
- Slavich, G. M., and Zimbardo, P. G. (2012). Transformational teaching: Theoretical underpinnings, basic principles, and core methods. *Educ. Psychol. Rev.* 24, 569–608. doi: 10.1007/s10648-012-9199-6
- Trigueros, R., Padilla, A., Aguilar-Parra, J. M., Mercader, I., López-Liria, R., and Rocamora, P. (2020). The influence of transformational teacher leadership on academic motivation and resilience, burnout and academic performance. *Int. J. Environ. Res. Public Health.* 17, 7687. doi: 10.3390/ijerph17207687
- Wei, K., and Jianhao, H. (2023). Relationship between Chinese college students' perceived transformational leadership by physical education teachers and their exercise adherence: the mediating role of physical self-efficacy. *Educ. Res. Rev.* 18, 173–180. doi: 10.5897/ERR2023.4336
- Witte, K. (2011). Coaching leadership preferences: Insight from the national collegiate athletic association division III athlete. *J. Coach. Educ.* 4, 73–108. doi: 10.1123/jce.4.2.73
- Yu, J., and Jee, Y. (2021). Analysis of online classes in physical education during the COVID-19 pandemic. *Educ. Sci.* 11, 3. doi: 10.3390/educsci11010003



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The influence of challenge research stressors on research creativity among Chinese doctoral students: a mediated moderation model

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The research creativity of doctoral students is not solely fueled by their intrinsic motivation, but also thrives in an environment that offers challenging research opportunities, substantial support, and feedback from significant others. Based on the job demands-resources model, this study aims to explore the impact of challenge research stressors on the research creativity of Chinese doctoral students. A mediated moderation model was constructed to examine the mediating effect of achievement motivation and the moderating effect of supervisor developmental feedback on the relationship between challenge research stressors and research creativity. A total of 538 valid questionnaires were collected from doctoral students using convenience sampling and snowball sampling. The questionnaires included the Challenge Research Stressors Scale, the Research Creativity Scale, the Achievement Motivation Scale, and the Supervisor Developmental Feedback Scale. Regression analyses, bootstrap testing, and simple slope analyses were used to estimate the various relationships. The findings indicated that challenge research stressors had a positive effect on doctoral students' research creativity. Supervisor developmental feedback positively moderated the impact of challenge research stressors on the achievement motivation and research creativity of doctoral students. Achievement motivation partially mediated the influence of challenge research stressors on doctoral students' research creativity, and further fully mediated the interaction effect of challenge research stressors and supervisor developmental feedback on doctoral students' research creativity. These findings contribute not only to our understanding of the mechanisms and boundary conditions through which challenge research stressors impact the research creativity of doctoral students, but also provide valuable insights into how to stimulate and maintain their research creativity.

KEYWORDS

challenge research stressors, research creativity, achievement motivation, supervisor developmental feedback, doctoral students

Introduction

As the “tip of the pyramid” of the national education system, doctoral education bears the vital mission of generating original scientific research outcomes, nurturing high-level innovative talents, and contributing to the nation's scientific and technological self-reliance and innovation. Its significance and role in national revitalization through science, education,

talent empowerment, and innovation-driven development have become increasingly prominent (Li and Xue, 2021). Among these innovative talents, doctoral students serve as a vital reserve and driving force in building an innovative nation. Thus, enhancing the research creativity of doctoral students has emerged as a top-priority training objective across numerous nations and academic institutions (Whitelock et al., 2008; Brodin, 2018; Breslin, 2019). Nevertheless, in recent years, due to the continuous expansion of doctoral enrolment in China, the quality of doctoral graduate training has seen a significant decline (Zhang et al., 2023). More specifically, the lack of research creativity among doctoral students has not been able to keep up with the demands of social development (Su et al., 2021). Yuan and Yan (2009) discovered that the main issue affecting the quality of China's postgraduate education is the lack of innovative ability, particularly in terms of originality. In their three separate surveys evaluating the quality of postgraduate education in China, nearly one-third of doctoral students rated their creativity as "average" or "poor." Given this challenging scenario, it is of substantial practical significance to explore the factors that influence the research creativity of doctoral students and the underlying mechanisms. This exploration aims to improve the quality of doctoral student development and ignite their passion for and commitment to innovation.

Previous research has primarily focused on examining the factors that impact the research creativity of doctoral students from various perspectives, including supervisors, doctoral students themselves, and organizational climate. The supervisor level focuses on factors such as supervisor support (Fan et al., 2019; Zeng and Zhang, 2022; Zhang et al., 2023), supervisor mentoring style (Su et al., 2021; Zeng and Zhang, 2022; Zhang et al., 2023), supervisor competence (Zheng et al., 2022), and supervisor-student relationship (Ma et al., 2019; Zhao et al., 2021). The individual perspective focuses on the impact of doctoral students' research experience (Brodin, 2014; Yin et al., 2018), personality traits (Wu et al., 2018; Su and Zhang, 2020), role identity (Yin et al., 2016; Frick and Brodin, 2020), research self-efficacy (Pan and Gu, 2022; Xie et al., 2023), and academic emotions (Yin et al., 2016) on their research creativity. The organizational climate perspective focuses on factors such as the climate for error management (Yin et al., 2018), the academic interaction atmosphere (Wu et al., 2019), and the organizational innovative environment (Liu et al., 2023) on doctoral students' research creativity. Although the above studies have comprehensively discussed the factors influencing the research creativity of doctoral students, they have neglected to include the characteristics of the scientific research work that doctoral students are facing.

In recent years, with the continuous expansion of doctoral enrolment, doctoral students are facing increased academic and employment competition, where "no publication means elimination" (Horta and Li, 2022). Challenge research stressors, such as time constraints, substantial responsibilities, heavy research workloads, and research complexity, prevail in the doctoral research environment (McCauley and Hinojosa, 2020; Acharya et al., 2023; Bran et al., 2023). Especially with the increasing expectations of the country on the quality of doctoral education, various institutions have raised the bar for the research and innovative abilities of doctoral students. Most universities in China require doctoral students to publish high-quality academic papers in order to

be eligible for graduation, which adds to the already significant research pressure faced by doctoral students. As an inevitable and significant contextual factor in doctoral research, research stressors have a profound impact on the psychological cognition and behavioral outcomes of doctoral students during their research activities (El-Ghoroury et al., 2012). For example, existing studies have begun to examine the impact of research stressors on doctoral students' anxiety (Yao and Ma, 2021), knowledge-sharing behaviors (Li et al., 2018), academic misconduct behaviors (Zhang et al., 2013), and research performance (Gu and Chang, 2021). However, there remains a gap in understanding the mechanisms through which research stressors affect the research creativity of doctoral students. Since previous studies on the impact of work stressors on individual creativity have mainly focused on the field of business management, little is known about how research stressors in academic organizations affect the creativity of graduate students. Therefore, it is of great significance to explore the relationship between research stressors and the research creativity of doctoral students in academic organizations.

Based on existing literature, scholars generally classify stressors into challenge stressors and hindrance stressors based on the two-dimensional stressors framework proposed by Cavanaugh et al. (2000). It has been found that hindrance stressors cannot be overcome by individuals in the short term and positively predict cognitive resource depletion, emotional exhaustion (Sawhney and Michel, 2022), and reduced self-efficacy (Sun et al., 2019; Yang and Li, 2021), thus exerting a negative effect on individual creativity (Horan et al., 2020; LePine, 2022). However, regarding the impact of challenge stressors on individuals' creativity, scholars have reached inconsistent research conclusions, finding both positive (Sacramento et al., 2013), negative (Binnewies and Wörnlein, 2011; Wijaya et al., 2022), and nonlinear relationships (Baer and Oldham, 2006) between them. In light of this, drawing upon insights from the management field, this study focuses on investigating the influence of challenge research stressors in the field of doctoral education on the research creativity of doctoral students and the specific mechanisms involved.

Early studies have indicated that challenge stressors not only directly impacted individual creativity, but also exerted their influence through various mediating mechanisms (Lepine et al., 2005). For example, existing studies have predominantly explored and tested the mediating effects of variables such as self-efficacy (Sun et al., 2019), challenge appraisal (Ohly and Fritz, 2010), organizational commitment (Montani et al., 2017), regulatory focus (Wu et al., 2021) and emotions (Rodell and Judge, 2009) on the relationship of challenge stressors and individual creativity. However, according to Amabile's componential theory of creativity (Amabile and Pratt, 2016), individual creativity is primarily derived from intrinsic motivation. This includes a strong interest and engagement in work, as well as a sense of curiosity, pleasure, or challenge associated with the work (Amabile et al., 1994). In essence, the willingness of individuals to engage in creative work and sustain this state hinges predominantly on their intrinsic motivation. Intrinsic motivation stands as a pivotal personal characteristic for enhancing creativity (Schoen, 2015). Based on this, the study posits that the research creativity of doctoral students primarily stems from their intrinsic identification with, strong interest in, and passion for academic research. That is, the intrinsic

motivation of doctoral students plays a critical role in the formation and development of their research creativity. Drawing from achievement motivation (Weiner, 1985), achievement motivation represents a type of intrinsic motivation that drives individuals to pursue desired goals and overcome challenges in their pursuit of achievement. It includes the desire for success (a feeling of competence and accomplishment upon achieving goals) and the avoidance of failure (a strong aversion to taking risks and experiencing failure) (Collins et al., 2004). The inclination to pursue success exerts a positive influence on problem-solving and creativity (Story et al., 2009) and ranks among the most relevant individual factors associated with creativity (Schoen, 2015). Moreover, Yao and Ma (2021) have highlighted that challenge research stressors, such as time constraints, high research innovation requirements, and substantial research workloads, can positively predict postgraduates' achievement motivation. Hence, based on this rationale, we propose that achievement motivation may act as a mediator in the relationship between challenge research stressors and doctoral students' research creativity.

Furthermore, the Job Demands-Resources (JD-R) model theory suggests that achieving a balance between job demands and job resources is essential for generating positive outcomes (Bakker et al., 2007). Specifically, individuals who have access to sufficient job resources tend to exhibit higher levels of work motivation, enthusiasm, engagement, and a willingness to explore new things when confronted with high levels of job demands (Lesener et al., 2020). This, in turn, increases work creativity. Conversely, individuals lacking external resources, such as social support and feedback, are more likely to experience emotional exhaustion and anxiety when facing increased job demands (Han et al., 2020), which will hinder them from generating creative ideas and engaging in innovative behavior (Bakker and Demerouti, 2007). Based on the above, this study proposes that supervisors, as the primary individuals responsible for doctoral training, play a crucial role in providing support and feedback to help doctoral students effectively cope with demanding research requirements. Early studies have also shown that supervisors' support and guidance are significant factors in predicting the innovative ability of doctoral students in research (Zheng et al., 2022). Therefore, it is worthwhile to explore whether supervisors' feedback, especially the developmental feedback that focuses on students' future growth and offers valuable insights (Zhou, 2003), can help doctoral students deal with challenge research stressors and enhance their intrinsic motivation for research and then improve their research creativity. Specifically, can supervisor developmental feedback positively moderate the impact of challenge research stressors on doctoral students' achievement motivation and research creativity?

To summarize, this study aims to develop a mediated moderation model that examines the role of supervisor developmental feedback as a moderator and achievement motivation as a mediator in the relationship between challenge research stressors and research creativity among doctoral students. The purpose of this study is to provide strategies and recommendations to doctoral students, supervisors and doctoral training institutions on how to effectively manage challenge research stressors while also fostering and maintaining the research creativity among doctoral students.

Literature review and hypotheses development

Challenge research stressors and doctoral students' research creativity

Creativity is a complex and diverse concept (Kandler et al., 2016), encompassing over 60 definitions within psychology alone (Elshout, 1990). Among the numerous definitions, Amabile's proposal is widely accepted in academia, defining creativity as the ability to generate novel and appropriate ideas, products, processes, services, or methods (Amabile et al., 1996; Amabile, 1997). This definition has received extensive citation in research on individual-level creativity (Tierney et al., 1999; Zhou and George, 2001; Farmer et al., 2003). Existing studies have shown that individual creativity in the workplace is influenced by personal characteristics, organizational contextual factors, and their interaction (Oldham and Cummings, 1996; Shalley et al., 2004). When environmental characteristics align harmoniously with personal attributes, it tends to stimulate heightened levels of individual creativity (Woodman et al., 1993; Oldham and Cummings, 1996). In this study, creativity is referred to as research creativity, which pertains to the ability of doctoral students to systematically apply theoretical knowledge, creatively solve problems, and generate new insights. It also emphasizes the novelty and practicality of research questions, methodologies, processes, and perspectives (Yin et al., 2016).

The cognitive appraisal theory of stress suggests that stress is a psychological and physiological response produced by individuals after perceiving specific environmental demands and making either challenge or threat appraisals (Lazarus, 1993). Building upon this theory, Cavanaugh proposed a two-dimensional stressors framework comprising challenge stressors and hindrance stressors (Cavanaugh et al. 2000). Challenge stressors, such as time constraints, workload, job responsibilities, and task complexity, have the potential to foster personal growth and future development. In the specific research context of doctoral students, their research stress mainly comes from challenge research stressors, such as high research assessment requirements, substantial workload, tight deadlines, and the complexities of innovative research tasks. These stressors have the potential to reward doctoral students by improving their research abilities and fostering future academic growth. Once these stressors are overcome, doctoral students will experience positive rewards and a sense of accomplishment in relation to their research outcomes. This, in turn, will ignite their enthusiasm and intrinsic motivation for academic research. Based on this, we define challenge research stressors as research demands that fall within the acceptable range for doctoral students but require significant efforts to meet. These demands serve as motivators, prompting doctoral students to increase their commitment to research, and to propose and solve problems creatively.

Lepine et al. (2005) point out that coping with challenge stressors can elicit negative emotions such as tension and anxiety. However, once successfully managed, these stressors can provide opportunities for personal growth, learning, and future benefits. Meta-analyses investigating the challenge-hindrance stressors framework also consistently demonstrate that challenge stressors significantly and positively predict positive attitudes and behaviors in employees, including job satisfaction, organizational

commitment, and job performance (Podsakoff et al., 2007; Horan et al., 2020; LePine, 2022). Based on this, it is hypothesized in this study that challenge research stressors positively predict the research creativity of doctoral students. Firstly, challenge research stressors contain attainable research objects and high research expectations (Podsakoff et al., 2007), which serve as motivating factors that inspire doctoral students to actively participate in research activities. This active engagement fosters a sense of achievement and efficacy (Sacramento et al., 2013), thereby fulfilling their psychological needs for competence. Self-determination theory suggests that satisfying individuals' basic psychological need for competence in a certain activity will enhance their intrinsic motivation to engage in that activity (Ryan and Deci, 2000). Therefore, the sense of research efficacy derived from overcoming challenge research stressors will enhance doctoral students' academic enthusiasm to actively seek resources, identify connections between concepts, and generate novel ideas (Farmer et al., 2003), ultimately promoting their research creativity. Secondly, although meeting the requirement of challenge research stressors demands significant effort from doctoral students, these challenge research stressors contain potential rewards for enhancing their research abilities and future academic growth. Therefore, doctoral students can gain a sense of control over challenging research requirements, which then help meet their psychological needs for autonomy. A meta-analysis by Hammond et al. (2011) indicates that autonomy is an important factor influencing individual innovative behavior. Individuals with higher autonomy have stronger adaptability and initiative in creative activities (De Spiegelaere et al., 2016). This is particular evident when research autonomy is granted to doctoral students, enabling them to independently select research topics and explore different research methods. As a result, they are able to generate more creative ideas. Based on these analyses, this study proposes the following hypothesis:

H1: Challenge research stressors have a positive impact on the research creativity of doctoral students.

The mediating role of achievement motivation

Achievement motivation, as an important intrinsic trait, drives individuals to tackle meaningful, valuable, and challenging tasks with interest, enjoyment, and high self-confidence, cultivating inner motivation for successful outcomes (Wigfield and Eccles, 2000). It acts as an internal force propelling individuals toward success, reflecting their belief in self-development (Schoen, 2015). Individuals with high achievement motivation demonstrate greater proactivity and resilience when facing obstacles. They willingly take on more demanding tasks, invest substantial effort in achieving their goals (Wigfield and Eccles, 2000), and are more inclined to embrace risks and propose innovative solutions when confronted with problems. Moreover, they tend to positively evaluate associated risks, fostering a creative approach to their work (Dweck, 1986). Additionally, individuals with a strong need

for achievement do not adhere to traditional solutions but instead focus on situations where existing solutions are inadequate. They consider these situations as opportunities to learn new knowledge and engage in challenging work (Shalley, 1995). Therefore, they are often seen as creative (Fodor and Carver, 2000), in alignment with the core tenet of the componential theory of creativity: creativity stems from intrinsic motivation rooted in their interest, enjoyment, or sense of challenge, with intrinsic motivation serving as the primary predictor of individual creativity (Amabile et al., 1996). Hence, the presence of achievement motivation significantly contributes to fostering individual creativity (Amabile, 1988; Shalley and Oldham, 1997). Building upon these insights, this study proposes that doctoral students' achievement motivation can also positively predict their research creativity.

On the other hand, achievement motivation is also influenced by contextual factors. According to cognitive appraisal theory, organizational contextual factors can be classified as either informative or controlling. Informative contextual factors have a positive impact on intrinsic motivation, whereas controlling contextual factors have negative effects (Deci et al., 1989). Although challenge research stressors sometimes bring about negative emotions such as tension and anxiety, these stressors have the potential to reward doctoral students by improving their research abilities and fostering future academic growth (Lepine et al., 2005). Therefore, challenge stressors are deemed informative, providing doctoral students with relevant information to enhance their research abilities, thereby boosting intrinsic motivation and research creativity (Crawford et al., 2010). For instance, Wallace et al. (2009) found that challenge work stressors can serve as catalysts for individuals' motivation to successfully complete tasks. Similarly, challenge research stressors, as an informative situational factor, will help ignite enthusiasm and subjective initiative among doctoral students, ultimately enhancing their commitment to research and intense passion for research innovation. Overcoming these challenges subsequently promotes a sense of competence and satisfaction, which in turn enhances motivation to achieve desired outcomes. Lepine et al. (2004) further noted a similar influence in college students who faced challenge academic stressors, with these stressors positively impacting their motivation to learn. Therefore, our study proposes that challenge research stressors serve as positive predictors of the achievement motivation experienced by doctoral students.

Given the above analysis, which is based on the componential theory of creativity and the cognitive appraisal theory of stress, individuals' perception of work characteristics can influence their intrinsic motivation for task performance, subsequently impacting their creativity (Shalley et al., 2004). Specifically, in this study, challenge research stressors continually stimulate the desire for exploration and achievement among doctoral students. This stimulation enhances their intrinsic motivation for achievement, which, in turn, improves their curiosity, cognitive flexibility, adventurous spirit, and perseverance (Utman, 1997). Consequently, this promotes the development of their research creativity. Thus, we propose the following hypothesis:

H2: Achievement motivation mediates the relationship between challenge research stressors and doctoral students' research creativity.

The moderating role of supervisor developmental feedback

Feedback, in organizational contexts, serves as both a motivator and a corrective tool (Amabile et al., 2004; Christensen-Salem et al., 2018). Different from traditional results-oriented feedback or control-oriented feedback, which focuses on assessing behaviors and performance, developmental feedback provides valuable guidance for future learning, growth, and advancement (Zhou, 2003; Li et al., 2011). Therefore, developmental feedback is forward-looking and aims to facilitate improvement. This study defines developmental feedback from academic supervisors as the act of providing doctoral students with useful and valuable feedback information to enhance their learning, development, and improvement based on the idea of developmental feedback in organizational behavior.

Supervisors are critically important in guiding and supporting doctoral students throughout their academic socialization process (Gill and Burnard, 2008). Their developmental feedback significantly impacts the research cognition and behavior of doctoral students (Shang et al., 2023). The Conservation of Resources (COR) theory suggests that individuals with more resources are less affected by resource loss and can acquire additional resources (Hobfoll, 1989), potentially leading to a spiral of resource gain (Hobfoll, 2011). When doctoral students encounter challenge research stressors, receiving developmental feedback from their supervisors can potentially equip them with additional resources and mitigate the associated risks (Bakker et al., 2007). Firstly, in challenging research situations, constructive advice from supervisors enhances the research efficacy and self-confidence of doctoral students (Shang et al., 2023). This positive reinforcement leads to a more optimistic outlook on research challenges, inspiring proactive responses and boosting intrinsic motivation for demanding research tasks. Ultimately, it enhances research creativity. Previous studies have shown that supervisor developmental feedback strongly correlates with doctoral students' intrinsic motivation and research creativity (Su et al., 2022). Notably, supervisors' feedback carries greater influence on students' research cognition and behavior compared to other sources of feedback (Gemme and Gingras, 2012). Secondly, supervisor developmental feedback primarily focuses on learning and improvement, emphasizing the provision of guiding advice for students' future growth and progress (George and Zhou, 2007). Through receiving developmental feedback, doctoral students are able to gain insight into their strengths and research challenges. They also have access to valuable resources and information that contribute to their own academic growth (Zhou, 2003), which, in turn, stimulates their intrinsic motivation to pursue research achievements (Dweck, 1986), leading them to actively seek challenges, persevere, and generate creative ideas. As a result, their research creativity is enhanced. Additionally, supervisor developmental feedback, as an informative feedback approach, is not outcome-oriented, which helps alleviate the research stress of doctoral students and stimulates their interest in research (Joo and Park, 2010). That is, developmental feedback fosters a relaxed research environment that encourages divergent thinking and ultimately cultivates higher research creativity (Runco and Acar, 2012). Moreover, supervisors' timely developmental feedback conveys relevant information about doctoral students' future research, reflecting supervisors' expectations, encouragement, and support. According to the Pygmalion effect, individuals who have higher

positive external expectations tend to have stronger intrinsic motivation for success (Tierney and Farmer, 2004), which enhances their creative problem-solving abilities. Based on the above analysis, we propose the following hypotheses:

H3: Supervisor developmental feedback positively moderates the relationship between challenge research stressors and doctoral students' achievement motivation, such that the positive relationship is stronger when supervisor developmental feedback is higher.

H4: Supervisor developmental feedback positively moderates the relationship between challenge research stressors and doctoral students' research creativity, such that the positive relationship is stronger when supervisor developmental feedback is higher.

Integrating H2–H4, the present study further proposes the mediated moderating effect of supervisor developmental feedback. In other words, the interaction between supervisor developmental feedback and challenge research stressors affects doctoral students' research creativity through the mediation of achievement motivation. Specifically, the more developmental feedback supervisors provide, the more instrumental and emotional support doctoral students will receive, and the better they will be able to recognize the positive aspects of challenge research stressors. This will stimulate the intrinsic motivation of doctoral students to pursue success in scientific research, which in turn will enhance their creativity in scientific research to a greater extent. Conversely, doctoral students may perceive a lack of care and support when they receive limited developmental feedback from supervisors. This perception can hinder their ability to recognize the positive aspects of challenge research stressors, ultimately reducing their confidence and motivation to achieve research goals. As a result, the effectiveness of challenge research stressors in stimulating research creativity through enhanced achievement motivation is weakened. In view of this, the following hypotheses are proposed:

H5: The positive moderating effect of supervisor developmental feedback on the relationship between challenge research stressors and doctoral students' research creativity is mediated by achievement motivation.

In summary, this study developed a mediated moderation model (Figure 1) with challenge research stressors as the independent variable, research creativity as the dependent variable, achievement motivation as the mediator, and supervisor developmental feedback as the moderator.

Materials and methods

Participants and procedure

In this study, we imported the prepared questionnaire into the Questionnaire Star platform to generate an electronic questionnaire. Then, we distributed the electronic questionnaire to doctoral students who are currently studying through convenient sampling and

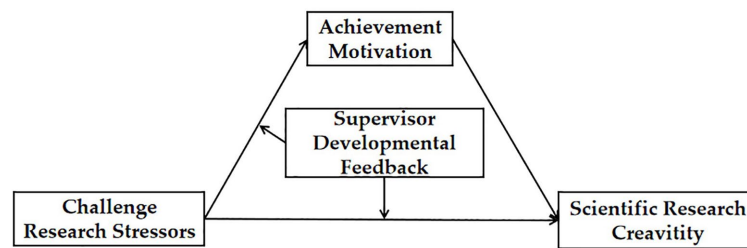


FIGURE 1
Proposed model.

snowball sampling methods with the help of social media such as WeChat. The data were collected from October 2022 to November 2022. A total of 605 doctoral students from 25 universities in mainland China participated in this survey voluntarily. After excluding invalid questionnaires with missing or contradictory information, 538 valid questionnaires were retained, resulting in an effective recovery rate of 88.9%.

Regarding the demographics of the valid sample, there were 246 (45.7%) male students and 292 (54.3%) female students. In terms of age, there were 189 (35.1%) doctoral students under 27 years old, 222 (41.3%) doctoral students between 28 and 33 years old, and 127 (23.8%) doctoral students over 34 years old. In terms of academic disciplines, 34.1% were from the humanities, 24.5% were from the social sciences, and 41.4% were from science, technology, agriculture, and medical science. In terms of university level, 349 students (64.9%) were from “double first-class” universities (refer to universities selected into first-class universities or first-class discipline construction universities in China), while 189 (35.1%) doctoral students were from “non-double first-class” universities. Regarding supervisor characteristics, male supervisors constituted 70.1%, while female supervisors made up the remaining 29.9%. In terms of the academic titles of supervisors, associate professors accounted for 19.4%, while professors comprised 80.6% of the sample.

Measures

To ensure the content validity of the study, the concepts of challenge research stressors, achievement motivation, research creativity, and supervisor developmental feedback used in this study were derived from mature scales developed by scholars. The English version questionnaire was translated into Chinese through translation-back-translation. While avoiding distortion of the questionnaire, appropriate modifications were made to the wording and language order of the questionnaire to ensure that the questionnaire used in this survey conforms to Chinese linguistic habits. Prior to the formal survey, a pre-survey was conducted with relevant personnel from the target population. The questionnaire was adjusted and modified according to the opinions of the respondents, in order to improve the accuracy of the language used in the questionnaire and the standardization of its design, thereby further enhancing the content validity of the study. The details of the measurement items of the four variables are presented in [Supplementary Appendix 1](#). All scale questions were measured in the form of a five-point Likert scale, ranging from 1 (strongly

disagree) to 5 (strongly agree). Higher numbers indicated higher levels of agreement.

Research creativity was assessed using a scale adapted from [Zhou and George \(2001\)](#), with slight modifications to better suit the context of doctoral education. The final scale consisted of six items, including “I can propose original and practically significant research questions” and “I can interpret the research questions from a new perspective.” The Cronbach’s α coefficient of this scale in this study was 0.878.

Challenge research stressors were measured using a scale adapted from [Cavanaugh et al. \(2000\)](#), with slight adjustments made to account for specific challenge stressors experienced by doctoral students. The final scale consisted of five items, including “I have a large amount of research tasks to complete” and “I often feel the pressure of time in my research work.” The Cronbach’s α coefficient of this scale in this study was 0.877.

Achievement motivation was measured using a scale developed by [Man et al. \(1994\)](#), with minor modifications made to align it with the research context of doctoral students. The final scale consisted of six items, such as “I like novel and difficult research tasks and am willing to take risks” and “I will be attracted to research projects where the outcome of success is uncertain.” The Cronbach’s α coefficient of this scale in this study was 0.876.

Supervisor developmental feedback was assessed using a scale adapted from [Zhou \(2003\)](#), with slight modification to align with the characteristics of academic supervisors. The final scale consisted of three items, such as “My supervisor provides me with useful information on how to improve my research performance” and “While giving me feedback, my supervisor focuses on helping me to learn and improve.” The Cronbach’s α coefficient of this scale in this study was 0.766.

Control variables: Previous research has shown that personal characteristics of doctoral students, such as gender, age, disciplinary categories, university level, as well as the gender and academic title of their supervisors, may influence their research creativity. This study also included them as control variables.

Data analysis

This study primarily utilized SPSS 26.0 and Mplus 7.4 software for data analysis. SPSS26.0 software is used for reliability and validity testing, descriptive statistics, correlation analysis, hierarchical regression analysis, and common method biases testing. The Mplus software is used for conducting confirmatory factor analysis (CFA), including estimating the standardized factor loadings of each item,

testing convergent validity and discriminant validity of the four variables, and also examining the fit of the hypothetical model. Additionally, the bias-corrected non-parametric percentile bootstrap test method was used with the help of Mplus software to test the significance of the mediation effects and mediated moderation effects of the hypothetical model.

Results

Common method biases testing and confirmatory factor analysis

Considering that the data was obtained from teachers' self-reports, there was a potential for common method bias. Therefore, this study utilized an anonymous questionnaire survey. An exploratory factor analysis was subsequently conducted on all scale items using Harman's single-factor test. The results revealed that there were four factors with eigenvalues greater than one, and the first factor only explained 22.69% of the variance, which is significantly below the 40% threshold. Additionally, the results of the one-factor model confirmatory factor analysis presented in Table 1, indicated a poor model fit with $X^2/DF=4.393$, RMSEA = 0.123, IFI = 0.758, TLI = 0.727, CFI = 0.756, GFI = 0.697. These results suggest that common method bias was not a serious concern in the current study.

Additionally, as shown in Table 1, the fit index of the proposed four-factor model ($X^2/DF=1.557$; SRMR = 0.038; RMSEA = 0.050; IFI = 0.962; TLI = 0.955; CFI = 0.961; GFI = 0.901) significantly outperformed those of the other three alternative models, indicating that the hypothesized model is a better fit for the data in this study and the concepts of the four factors are mutually independent and have good discriminant validity.

Reliability and validity testing

In this study, we assessed the reliability of the scale using SPSS 26.0 (Table 2). The Cronbach's α coefficients of the four scales exceeded 0.7, indicating a high level of internal consistency. The KMO values, which exceeded 0.7 ($p < 0.001$), confirmed their suitability for factor analysis. Second, the standardized factor loadings of each item in the four variables exceeded 0.5, ranging from 0.533 to 0.825; the CR values of the four variables were all greater than 0.7; the AVE values were all greater than 0.5, demonstrating that the four scales have good convergent validity. In addition, the square root of AVE for each variable was higher than the Pearson correlation coefficient between variables (Table 3), which indicates a strong discriminant validity among the four constructs again.

Descriptive statistics and correlation analysis

Table 3 presents the means, standard deviations, and correlation coefficients of the variables. The results show that the mean value of challenge research stressors is 3.77, which is higher than the median value of 3. This signifies that doctoral students typically experience high research pressure. Additionally, the research creativity score has a mean value of 3.58, indicating a relatively high level of self-assessed creativity among doctoral students. The mean value of achievement motivation is 3.55, which is higher than the median value of 3. This suggests potential for improvement in students' motivation levels. Additionally, the mean value of supervisors' developmental feedback is 4.21, which is significantly higher than the median value of 3, indicating that doctoral students generally receive more extensive developmental feedback from their supervisors. In addition, there is a significant positive correlation between challenge research stressors, research creativity, achievement motivation, and supervisor developmental feedback. This correlation provides data support for the subsequent hypothesis testing.

Hypothesis testing

Main effect and mediating effect testing

Before conducting hierarchical regression analysis, we performed a normality test on the data and found that the data is generally normally distributed (see Supplementary Appendix 1), making it suitable for regression analysis. The regression results are presented in Table 4. Challenge research stressors had a significant positive effect on research creativity (Model 5, $\beta = 0.536$, $p < 0.001$), supporting H1. Moreover, Challenge research stressors were found to have a significant positive effect on achievement motivation of doctoral students (Model 2, $\beta = 0.592$, $p < 0.001$). When achievement motivation was introduced as a mediator alongside challenge research stressors, the predictive effect of challenge research stressors on research creativity (Model 6, $\beta = 0.188$) decreased compared to Model 5 ($\beta = 0.538$), but it remained statistically significant. Additionally, achievement motivation significantly and positively predicted research creativity (Model 6, $\beta = 0.586$, $p < 0.001$), providing preliminary support for H2. To further evaluate the significance of the mediating effect, this study utilize the bias-corrected non-parametric percentile Bootstrap estimation method with 5,000 random samples to test the 95% confidence interval. If the confidence interval does not contain 0, the mediating effect is considered significant. As shown in Table 5, the direct effect of challenge research stressors on research creativity was 0.189, with a 95% confidence interval of [0.068, 0.288], excluding 0, indicating the significance of the direct effect. Meanwhile,

TABLE 1 Results of confirmatory factor analysis of hypothetical and competing models.

Models	X^2	DF	X^2/DF	SRMR	RMSEA	IFI	CFI	TLI	GFI
four-factor model CRS, RC, AM, SDF	255.4	164	1.557	0.038	0.050	0.962	0.961	0.955	0.901
three-factor model CRS, RC + AM, SDF	349.1	167	2.090	0.044	0.069	0.924	0.923	0.912	0.850
two-factor model CRS + SDF + AM, RC	622.3	169	3.682	0.065	0.109	0.810	0.808	0.784	0.746
one-way model CRS + RC + AM + SDF	746.6	170	4.393	0.071	0.123	0.758	0.756	0.727	0.697

N = 538. CRS stands for Challenge Research Stressors, RC stands for Research Creativity, AM stands for Achievement Motivation, and SDF stands for Supervisor Developmental Feedback.

TABLE 2 Results of reliability and validity test.

Variables	Factor loadings	<i>p</i> -value	CR	AVE	Cronbach's α	KMO
Challenge Research Stressors	CRS1	0.697	0.88	0.59	0.874	0.860
	CRS2	0.807				
	CRS3	0.749				
	CRS4	0.815				
	CRS5	0.773				
Research Creativity	RC1	0.770	0.88	0.55	0.878	0.899
	RC2	0.757				
	RC3	0.664				
	RC4	0.694				
	RC5	0.731				
	RC6	0.817				
Achievement Motivation	AM1	0.752	0.88	0.55	0.876	0.868
	AM2	0.790				
	AM3	0.801				
	AM4	0.796				
	AM5	0.731				
	AM6	0.533				
Supervisor Developmental Feedback	SDF1	0.825	0.79	0.56	0.788	0.700
	SDF2	0.746				
	SDF3	0.663				

N = 538. CR: composite reliability; AVE: average variance extracted.

TABLE 3 Descriptive statistics and inter-correlations.

Variables	Means	SD	1	2	3	4
1. Challenge research stressors	3.77	0.75	0.77			
2. Research creativity	3.58	0.71	0.558***	0.74		
3. Achievement motivation	3.55	0.71	0.615***	0.720***	0.74	
4. Supervisor developmental feedback	4.21	0.68	0.373***	0.289*	0.329**	0.75

N = 538. *** indicates $p < 0.001$, ** indicates $p < 0.01$, * indicates $p < 0.05$ (two-tailed test). The bold number is the square root of AVE.

achievement motivation exhibited a mediating effect of 0.347, with a 95% confidence interval of [0.261, 0.444], which does not include 0, indicating a significant mediating role of achievement motivation between challenge research stressors and doctoral students' research creativity. The mediating effect accounts for 64.74% of the total effect (0.536), providing further statistical support for H2.

Moderating effect of supervisor developmental feedback testing

To avoid multicollinearity issues, we mean-centered the variables of challenge research stressors and supervisor developmental feedback, and then created their interaction term. We sequentially included control variables, independent variable, moderator variable, and interaction term in the multilevel linear regression analysis with achievement motivation and research creativity as dependent variables, respectively. The results in Table 4 demonstrate that the interaction terms of challenge research stressors and supervisors' developmental feedback had a significant and positive effect on the doctoral students' achievement motivation (Model 4, $\beta = 0.151$,

$p < 0.01$) and research creativity (Model 8, $\beta = 0.140$, $p < 0.05$), supporting H3 and H4.

To examine the moderating impact of different levels of supervisor developmental feedback on the relationship between challenge research stressors and the achievement motivation and research creativity of doctoral students, a simple slope test was conducted and graphed. Supervisor developmental feedback was dichotomized into high and low groups based on one standard deviation above and below the mean, following the approach recommended by Preacher et al. (2006). As showed in Figure 2, the positive impact of challenge research stressors on the achievement motivation of doctoral students was significantly greater in the presence of high supervisor developmental feedback ($\beta = 0.643$, $p < 0.001$) compared to low supervisor developmental feedback ($\beta = 0.369$, $p < 0.001$). This finding suggests that supervisor developmental feedback effectively moderates the relationship between challenge research stressors and doctoral students' achievement motivation, providing further support for H3. Similarly, as shown in Figure 3, the positive effect of challenge research stressors on doctoral students' research creativity was significantly

TABLE 4 Results of regression analysis.

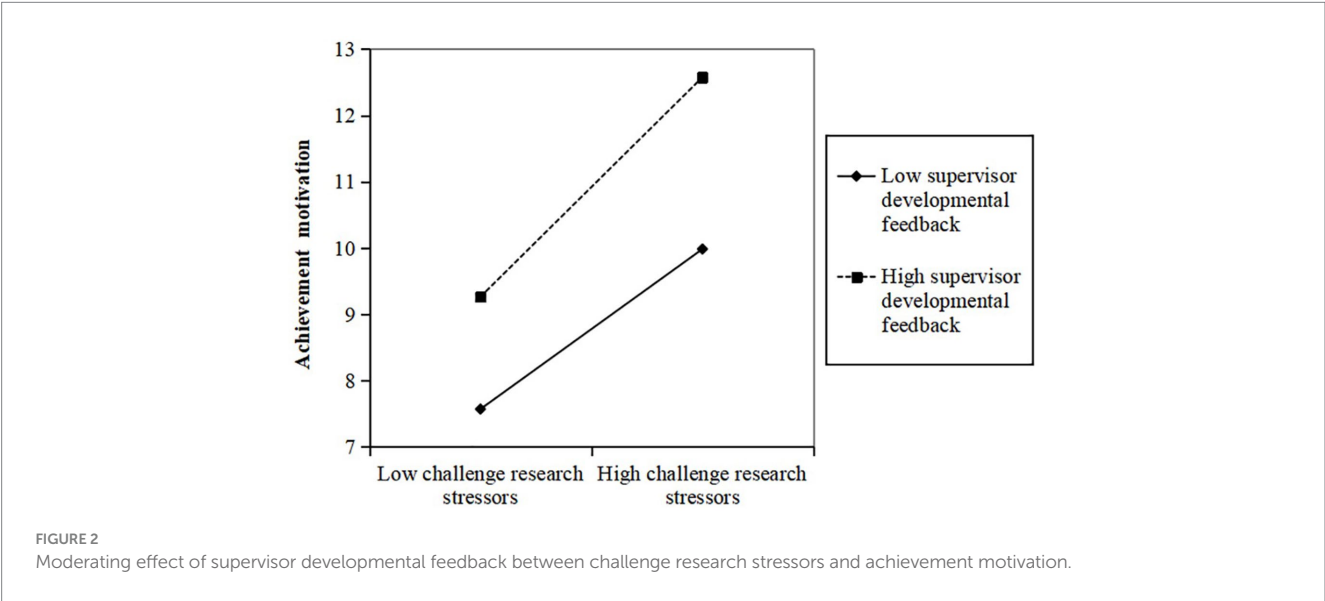
Variables	Achievement Motivation				Research creativity				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Gender	−0.060	−0.065	−0.062	−0.052	−0.004	0.031	−0.009	0.000	0.029
Age	0.232**	0.133*	0.139*	0.141*	0.113	0.022	0.105	0.107	0.027
Discipline	0.075	0.045	0.049	0.044	0.060	0.027	0.056	0.052	0.027
Institution level	−0.057	−0.066	−0.089	−0.090	−0.056	−0.013	−0.072	−0.073	−0.022
Gender of supervisor	−0.073	−0.107	−0.107*	−0.095	−0.040	0.022	−0.047	−0.036	0.017
Academic title of supervisor	−0.059	−0.070	−0.073	−0.092	−0.047	−0.006	−0.054	−0.072	−0.019
Challenge research stressors		0.592***	0.541***	0.536***	0.536***	0.188**	0.494***	0.489***	0.185**
Supervisor developmental feedback			0.136*	0.184**			0.112	0.156*	0.052
Achievement Motivation						0.586***			0.567***
Challenge research stressors* supervisor developmental feedback				0.151**				0.140*	0.055
R ²	0.100	0.437	0.452	0.472	0.352	0.546	0.363	0.380	0.549
Adjusted R ²	0.071	0.416	0.430	0.448	0.329	0.527	0.336	0.351	0.526
△R ²	0.100	0.337	0.015	0.020	0.276	0.194	0.286	0.017	0.169
F	3.467**	21.144***	19.908***	19.321***	14.827***	28.995***	13.726***	13.238***	23.831***

N = 538.

TABLE 5 Bootstrap test for mediating effects.

	Model paths	Estimated effect	Standard error	95% Confidence intervals	Effect size
Challenge research stressors → Achievement motivation → Research creativity	Total effect	0.536	0.053	[0.402, 0.609]	
	direct effect	0.189	0.056	[0.068, 0.288]	35.26%
	Indirect effect	0.347	0.047	[0.261, 0.444]	64.74%

N = 538.



more pronounced in the context of high supervisor developmental feedback ($\beta = 0.589$, $p < 0.001$) compared to low supervisor developmental feedback ($\beta = 0.334$, $p < 0.001$). This outcome indicates that supervisors' developmental feedback positively moderates the relationship between challenge research stressors and doctoral students' research creativity, further supporting H4.

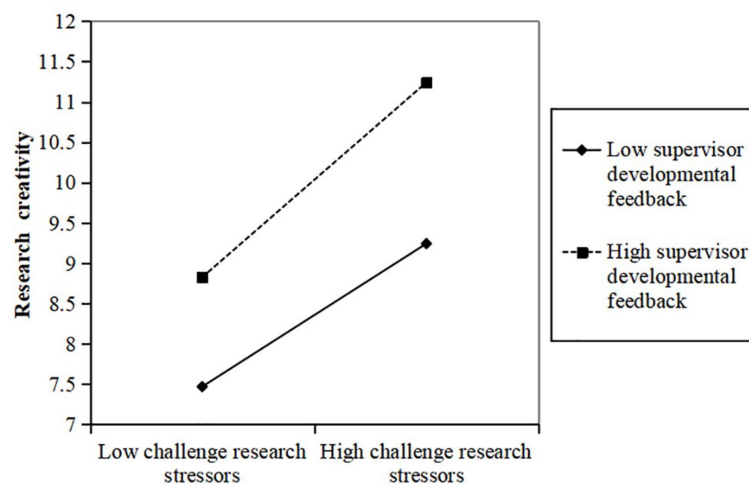


FIGURE 3
Moderating effect of supervisor developmental feedback between challenge research stressors and research creativity.

TABLE 6 Bootstrap test for mediated moderation effects.

	Supervisor developmental feedback	Estimated effect	Standard error	95% Confidence intervals
Challenge research stressors	M-1SD	0.216	0.058	[0.117, 0.342]
→ Achievement motivation	M + 1SD	0.377	0.061	[0.268, 0.510]
→ Research creativity	The difference	0.161	0.072	[0.024, 0.303]

N = 538.

Mediated moderation effect of supervisor developmental feedback testing

The present study applies the sequential test of the mediated moderation effect proposed by Edwards and Lambert (2007). Firstly, we assessed the significance of the regression coefficient of the interaction term (challenge research stressors * supervisor developmental feedback) in relation to research creativity. Then we tested whether the coefficient of the interaction term on the mediator (achievement motivation) was significant. The above two steps have been supported by H3 and H4. Finally, we tested whether the coefficient for the mediator variable (achievement motivation) remained significant when added to the model exploring the moderating effect of supervisor developmental feedback on the relationship between challenge research stressors and research creativity. As shown in model 9 of Table 4, we observed that a significant and positive effect of achievement motivation on doctoral students' research creativity ($\beta = 0.567$, $p < 0.001$). However, the interaction term (challenge research stressors*supervisor developmental feedback) no longer showed a significant effect on research creativity ($\beta = 0.05$, $p > 0.055$). These findings suggest that the moderating effect of supervisor developmental feedback on the relationship between challenge research stressors and doctoral students' research creativity was fully mediated by achievement motivation. Therefore, H5 was supported.

To further examine the significance of achievement motivation as a mediator in the moderating effect of supervisors'

developmental feedback on the relationship between challenge research stressors and doctoral students' research creativity, this study utilized the Bootstrap method. The sample was randomly replicated 5,000 times using Mplus7.4 software to analyze the overall model. We evaluated the 95% confidence intervals for the mediated moderation effect, deeming it significant if these intervals did not include 0. The results of this analysis showed that the indirect effect of the interaction of challenge research stressors and supervisor developmental feedback on doctoral students' research creativity through achievement motivation was 0.297 ($p < 0.001$). The 95% confidence interval was [0.217, 0.401], which did not include 0, suggesting that achievement motivation mediates the interaction effect of challenge research stressors and supervisor developmental feedback on doctoral students' research creativity, providing additional support for H5. As indicated in Table 6, the mediating effect of achievement motivation on the relationship between challenging research pressure and doctoral students' research creativity was found to be significant at both high levels of supervisor developmental feedback (effect value = 0.377, 95% confidence interval [0.268, 0.510]) and low levels of supervisor developmental feedback (effect value = 0.216, 95% confidence interval [0.117, 0.342]). Furthermore, the difference between high and low levels was significant, with a 95% confidence interval of [0.024, 0.303]. This result confirms the validity of the mediated moderation model proposed in this study.

Discussion

Based on the Job Demands-Resources Model and achievement motivation theory, this study explores the relationship between challenge research stressors and doctoral students' research creativity, as well as the underlying mechanism. Using a sample of 538 Chinese doctoral students, we found that challenge research stressors, supervisor developmental feedback, achievement motivation, and research creativity form a mediated moderation model. Challenge research stressors have a direct impact on the research creativity of doctoral students, and this influence is moderated by supervisor developmental feedback and partially mediated by achievement motivation. Moreover, doctoral students' achievement motivation fully mediates the interaction effect of supervisor developmental feedback and challenge research stressors on the research creativity of doctoral students.

First, the present study found that challenge research stressors significantly and positively predicted doctoral students' research creativity, which was consistent with the prior research (Ohly and Fritz, 2010; Wang et al., 2014; Gu and Chang, 2021). The Expectancy-Value Theory highlights how an individual's motivation for completing a task depends on their perception of the likelihood of success and the value of task. In other words, the higher an individual perceives the likelihood of achieving a goal, the greater the incentive value derived from it, and the stronger their motivation becomes to accomplish the task (Wigfield and Eccles, 2000). When doctoral students encounter stressors associated with challenging research demands, they carefully assess the effort required to cope with these stressors and the potential rewards (Lazarus and Folkman, 1986). They are likely to respond positively to challenge research stressors because these stressors are manageable and achievable research tasks. This allows them to successfully cope with stressors through their own efforts (Crawford et al., 2010). Overcoming such stressors will lead to beneficial research outcomes, such as academic growth or improved research capabilities (Lepine et al., 2004). Therefore, doctoral students' sense of competence and control increases during the process of dealing with challenge research stressors. This, in turn, enhances their intrinsic motivation and dedication to academic research, ultimately stimulating them to propose innovative topics and address research problems creatively. Furthermore, based on the categorization of stressors as "good" or "bad" by Cavanaugh et al. (2000) and Rodell and Judge (2009), challenge stressors are classified as the "good." Doctoral students' positive perception of challenge research stressors elicits positive emotions and enhances their research self-efficacy (Travis et al., 2020), which, in turn, promotes cognitive flexibility and encourages the pursuit of novel problem-solving approaches, ultimately enhancing their research creativity.

Second, the results of the present study showed that doctoral students' achievement motivation partially mediated the relationship between challenge research stressors and research creativity. This result is in line with the previous study highlighting intrinsic motivation's key role in mediating the impact of external environmental factors on individuals' creativity (Svensson, 2015; Gao et al., 2020). Meanwhile, the finding that challenge research stressors positively predicted doctoral students' achievement motivation was consistent with the previous study (Yao and Ma,

2021), and also validated the motivational activation characteristics of challenge stressors proposed by Lepine et al. (2004). It is generally believed that challenge research stressors can be overcome through hard work and can ultimately lead to positive results (LePine, 2022). Therefore, challenge stressors are likely to stimulate the intrinsic motivation of doctoral students to achieve their research goals. Additionally, our finding that achievement motivation significantly predicted doctoral students' research creativity was also consistent with the conclusion of existing research (Schoen, 2015). Doctoral students with high achievement motivation tend to enjoy more challenging tasks, set higher goals, and be more persistent in the face of risky and uncertain creative activities (Dweck, 1986). Therefore, they are more likely to prioritize learning new knowledge and skills related to the tasks, and employ divergent thinking to propose solutions to problems (Gao et al., 2020).

Third, this study found that supervisor developmental feedback, as a supportive contextual resource, positively moderated the impact of challenge research stressors on doctoral students' achievement motivation. That is, the more developmental feedback received from supervisors, the greater positive impact of challenge research stressors on students' achievement motivation. This result is consistent with previous research findings (Vansteenkiste et al., 2009; Dupont et al., 2015), which indicate that accurate feedback and advice from supervisors can enhance students' perceived competence and academic engagement, as well as intrinsic motivation. At the same time, this result validated the fundamental hypothesis of the job demands-resources model: in high-demand situations, sufficient job resources, such as supervisor feedback, can mitigate the negative impact of job demands and enhance individuals' work engagement and motivation levels (Demerouti and Bakker, 2011). Specifically, when challenge research stressors become routines that doctoral students must confront, supervisor developmental feedback not only imparts valuable research insights but also signifies encouragement and support (Shang et al., 2023). This instrumental support and emotional support bolster doctoral students' sense of meaning, efficacy, and belonging in research, and also serve as a counterbalance to the depletion of cognitive and emotional resources triggered by challenging demands (Bakker et al., 2007), which helps students effectively manage challenge research stressors and consequently enhance their intrinsic research motivation and academic engagement (Crawford et al., 2010).

Meanwhile, this study also found that supervisor developmental feedback moderated the impact of challenge research stressors on doctoral students' research creativity. In other words, the more developmental feedback doctoral students received from their supervisors, the greater positive influence of challenge research stressors on their research creativity. On one hand, supervisor developmental feedback not only provides doctoral students with valuable research resources that equipped them to cope with challenging research demands, but also motivates doctoral students to put forward novel ideas and address complex research tasks creatively (Shang et al., 2023). On the other hand, supervisor developmental feedback, as non-performance-oriented informational feedback, helps to alleviate students' perceived stress and foster a relaxed research atmosphere (Li et al., 2011). This environment encourages

doctoral students to engage in research out of their genuine interest in science (Joo and Park, 2010). As a result, it enhances doctoral students' divergent thinking and improves their research creativity (Runco and Acar, 2012).

Fourth, this study further found that achievement motivation fully mediated the interaction effect of supervisor developmental feedback and challenge research stressors on doctoral students' research creativity. This finding further validated the hypothesis of the JD-R model theory: the interaction effect of high job demands and high job resources has the most significant motivational effect on individuals (Bakker et al., 2007). Under high challenging research demands, doctoral students who had access to abundant research resources were more proactive in their engagement in research work and exhibited higher level of academic enthusiasm, which triggered a "motivation activation process" (Bakker and Demerouti, 2014). In other words, doctoral students facing challenge research stressors are eager to obtain more resources, the valuable information resources provided by their supervisors' developmental feedback can better stimulate their intrinsic motivation to pursue academic achievements, thus promoting their engagement in research activities creatively. Therefore, the positive moderating effect of supervisor developmental feedback on the relationship between challenge research stressors and doctoral students' research creativity was completely mediated by achievement motivation.

Theoretical contributions

This study has certain theoretical contributions. Firstly, it clarifies the relationship between challenge research stressors and research creativity from a new theoretical perspective. Previous research has predominantly examined the relationship between challenge stressors and individual creativity from the perspectives of organizational support, emotion, job involvement, and cognitive evaluation, often overlooking the role of individual intrinsic motivation. Based on achievement motivation theory, this study introduces the mediating effect of achievement motivation. It reveals that achievement motivation is a crucial psychological mechanism for explaining the influence of challenge research stressors on the research creativity of doctoral students. Therefore, this finding deepens our understanding of the specific pathway through which challenge stressors affect individual creativity. Moreover, from the perspective of achievement motivation, this study considers challenge research stressors as a beneficial aspect of the research environment and confirms their positive influence on the research creativity of doctoral students, specifically in the Chinese context. This extension of stressors research effectively prompts the academic community to reconsider the impact of challenge research stressors.

Secondly, this study contributes to the existing research on the influence of supervisor behavior on the research creativity of doctoral students. Previous research has primarily focused on various supervisory guidance styles, such as paternalistic (Su et al., 2021), inclusive (Zhang et al., 2023), and abusive styles (Cohen and Baruch, 2022). However, these studies have overlooked the significance of supervisor developmental feedback in stimulating doctoral students' research creativity, particularly

in the context of challenge research stressors. In today's context where diverse supervisory styles coexist, it is essential to recognize the distinctive role of supervisor developmental feedback compared to the above supervisory styles, since feedback implies communication and interaction between doctoral students and supervisors, which will facilitate the emergence of innovative ideas, thus enhancing the creativity of doctoral students.

Thirdly, this study provides additional empirical evidence to support and validate the underlying principles of the JD-R Model, which confirms that the development and maintenance of doctoral students' research creativity are influenced by the interaction of environmental, supervisor, and individual factors. Moreover, this study expands the scope of the JD-R Model by demonstrating its relevance and applicability in the context of doctoral education.

Practice implications

Based on the above conclusions and discussions, this study presents the following practical recommendations. First, our findings show that challenge research stressors are positively related to doctoral students' achievement motivation and research creativity. Consequently, supervisors should properly assign diverse and challenging tasks to doctoral students based on their research abilities and interests. They should also set reasonable and challenging research demands that provide rewarding research experiences. This can be achieved by controlling the completion time of research tasks, increasing the workload of research, and raising the innovation requirements of research. However, when setting research demands, supervisors should provide timely research support to create a "high demands-high support" motivating and support mechanism, which is important in order to avoid causing anxiety to doctoral students due to excessively challenging research requirements. Moreover, supervisors should acknowledge the individual variations in stress management abilities of doctoral students. They should pay attention to the emotional fluctuations and behavioral responses of these students, and particularly focus on satisfying their basic psychological needs for research efficacy, belonging, and autonomy. By doing so, supervisors can stimulate the academic motivation and research creativity of doctoral students. Furthermore, since encountering challenge research stressors is inevitable for doctoral students in their research work, it is crucial to promote a proper understanding of these stressors and enhance students' psychological resilience. Academic institutions should provide regular psychological counseling and psycho-educational courses to help doctoral students learn how to actively cope with challenge research stressors.

Second, since achievement motivation positively predicts the research creativity of doctoral students, supervisors and departments can take steps to enhance it. Previous studies have shown that a supportive academic atmosphere and learning environment are key elements in enhancing students' achievement motivation (Baeten et al., 2013; Huang et al., 2022). Therefore, it is important to create a supportive and tolerant academic environment in which doctoral students are encouraged to address research challenges. For example, creating an inclusive climate for choosing research topics, establishing novel evaluation methods

that are appropriate for innovative research, recognizing and supporting individuals who are willing to confront challenges in scientific research, even in the face of setbacks. Moreover, providing various forms of research support, including academic, interpersonal, and emotional support, can help doctoral students alleviate the stress associated with their research. Excessive research pressure can erode feelings of competence and diminish motivation. However, positive social support can fulfill individuals' basic psychological needs for competence, autonomy, and belonging, and then stimulate their motivation to achieve research goals (Chen et al., 2019). Therefore, establishing a learning support system consisting of teachers, counselors, senior teaching assistants, and classmates would be very helpful in alleviating stress among doctoral students and promoting their achievement motivation. In addition, helping doctoral students gain a sense of achievement by providing them with opportunities for success. For example, providing additional encouragement, recognition, and guidance in their presentation and implementation of creative ideas can empower doctoral students to actively engage in creative activities and enhance their research creativity through practical experience.

Third, supervisor developmental feedback is a crucial external resource for maintaining the achievement motivation of doctoral students and fostering their research creativity in a highly competitive and challenging research environment. Therefore, supervisors should provide timely academic guidance and professional feedback, offering valuable insights to enhance doctoral students' research abilities, which will bolster their self-confidence and reinforce their drive for success. In addition, supervisors should provide timely emotional feedback, such as emotional care and psychological support, to help alleviate the confusion and uncertainty caused by academic pressure in doctoral students. This will also help strengthen their psychological resilience and foster a sense of belonging within a team. Consequently, their intrinsic academic motivation is strengthened, ultimately driving their enthusiastic involvement in research endeavors. Furthermore, academic institutions should prioritize enhancing emotional intelligence and interpersonal skills training for supervisors, and also optimize and improve the feedback methods used by supervisors. This will effectively help doctoral students cope with academic pressure, stay committed to their academic aspirations, and maintain their passion for academia.

Limitations and future direction

Although this study contributes to the existing research on the relationship between research stressors and research creativity of doctoral students, there are also some limitations. Firstly, it uses a cross-sectional design and data, which limits its ability to establish causality. Future research could employ longitudinal methods to further explore the topic. Secondly, this study analyses challenge stressors from an integration paradigm perspective. In other words, this study examines the various dimensions of challenge stressors as a whole. However, some scholars in the academic community argue that the dimensions of challenge stressors, such as time pressure and workload, should be discussed separately (Qin et al., 2022). Therefore, future research can explore the mechanisms and boundary conditions

of different types of challenge stressors on individual creativity. Lastly, since all variables in this study were assessed by the doctoral students themselves, there's a potential for social desirability bias and common method bias. Future studies could incorporate more objective measures, such as supervisor evaluations, to improve rigor and credibility.

Conclusion

The current study shows that challenge research stressors faced by doctoral students have a positive influence on their research creativity. Particularly, this influence is moderated by supervisor developmental feedback. Moreover, our results suggest a mediated moderation model, in that, achievement motivation not only partially mediates the influence of challenge research stressors on the research creativity of doctoral students, but also fully mediates the interaction effect of supervisor developmental feedback and challenge research stressors on doctoral students' research creativity.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Ethical Approval of Hunan Normal University Biomedical Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

CL: Writing – original draft, Conceptualization, Data curation, Formal analysis, Methodology. MW: Writing – review & editing, Investigation, Software, Supervision. XG: Project administration, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1290342/full#supplementary-material>

References

- Acharya, V., Rajendran, A., and Prabhu, N. (2023). Challenge and hindrance demands of doctoral education: conceptualization, scale development and validation. *J. Appl. Res. High. Educ.* doi: 10.1108/JARHE-10-2022-0330
- Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Res. Organ. Behav.* 10, 123–167.
- Amabile, T. M. (1997). Motivating creativity in organizations: on doing what you love and loving what you do. *Calif. Manag. Rev.* 40, 39–58. doi: 10.2307/41165921
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., and Herron, M. (1996). Assessing the work environment for creativity. *Acad. Manag. J.* 39, 1154–1184. doi: 10.5465/256995
- Amabile, T. M., Hill, K. G., Hennessey, B. A., and Tighe, E. M. (1994). The work preference inventory: assessing intrinsic and extrinsic motivational orientations. *J. Pers. Soc. Psychol.* 66, 950–967. doi: 10.1037//0022-3514.66.5.950
- Amabile, T. M., and Pratt, M. G. (2016). The dynamic componential model of creativity and innovation in organizations: making progress, making meaning. *Res. Organ. Behav.* 36, 157–183. doi: 10.1016/j.riob.2016.10.001
- Amabile, T. M., Schatzel, E. A., Moneta, G. B., and Kramer, S. J. (2004). Leader behaviors and the work environment for creativity: perceived leader support. *Leadersh. Q.* 15, 5–32. doi: 10.1016/j.leaqua.2003.12.003
- Baer, M., and Oldham, G. R. (2006). The curvilinear relation between experienced creative time pressure and creativity: moderating effects of openness to experience and support for creativity. *J. Appl. Psychol.* 91, 963–970. doi: 10.1037/0021-9010.91.4.963
- Baeten, M., Dochy, F., and Struyven, K. (2013). The effects of different learning environments on students' motivation for learning and their achievement. *Br. J. Educ. Psychol.* 83, 484–501. doi: 10.1111/j.2044-8279.2012.02076.x
- Bakker, A. B., and Demerouti, E. (2007). The job demands-resources model: state of the art. *J. Manag. Psychol.* 22, 309–328. doi: 10.1108/02683940710733115
- Bakker, A. B., and Demerouti, E. (2014). Burnout and work engagement: the JD – R approach. *Annu. Rev. Organ. Psych. Organ. Behav.* 1, 389–411. doi: 10.1146/annurev-orgpsych-031413-091235
- Bakker, A. B., Hakanen, J. J., Demerouti, E., and Xanthopoulou, D. (2007). Job resources boost work engagement, particularly when job demands are high. *J. Educ. Psychol.* 99, 274–284. doi: 10.1037/0022-0663.99.2.274
- Binnewies, C., and Wörlein, S. C. (2011). What makes a creative day? A diary study on the interplay between affect, job stressors, and job control. *J. Organ. Behav.* 32, 589–607. doi: 10.1002/job.731
- Bran, A., Lopes, N., and Lafon, M. (2023). PhD graduates' appraisals of work demands: challenging, hindering, and not very threatening. *Stud. High. Educ.* 1–17, 1–17. doi: 10.1080/03075079.2023.2244963
- Breslin, D. (2019). Group creativity and the time of the day. *Stud. High. Educ.* 44, 1103–1118. doi: 10.1080/03075079.2017.1413082
- Brodin, E. M. (2014). Critical and creative thinking nexus: learning experiences of doctoral students. *Stud. High. Educ.* 41, 971–989. doi: 10.1080/03075079.2014.943656
- Brodin, E. M. (2018). The stifling silence around scholarly creativity in doctoral education: experiences of students and supervisors in four disciplines. *High. Educ.* 75, 655–673. doi: 10.1007/s10734-017-0168-3
- Cavanaugh, M. A., Boswell, W. R., Roehling, J. W., and Boudreau, J. W. (2000). An Empirical Examination of Self-Reported Work Stress Among U.S. Managers. *J. Appl. Psychol.* 85, 65–74. doi: 10.1037//0021-9C10.85.1.65
- Chen, C., Elliot, A. J., and Sheldon, K. M. (2019). Psychological need support as a predictor of intrinsic and external motivation: the mediational role of achievement goals. *Educ. Psychol.* 39, 1090–1113. doi: 10.1080/01443410.2019.1618442
- Christensen-Salem, A., Kinicki, A., Zhang, Z., and Walumbwa, F. O. (2018). Responses to feedback: the role of acceptance, affect, and creative behavior. *J. Leadersh. Organ. Stud.* 25, 416–429. doi: 10.1177/1548051818757691
- Cohen, A., and Baruch, Y. (2022). Abuse and exploitation of doctoral students: a conceptual model for traversing a long and winding road to academia. *J. Bus. Ethics* 180, 505–522. doi: 10.1007/s10551-021-04905-1
- Collins, C. J., Hanges, P. J., and Locke, E. A. (2004). The relationship of achievement motivation to entrepreneurial behavior: a Meta-analysis. *Hum. Perform.* 17, 95–117. doi: 10.1207/s15327043hup1701_5
- Crawford, E. R., LePine, J. A., and Rich, B. L. (2010). Linking job demands and resources to employee engagement and burnout: a theoretical extension and meta-analytic test. *J. Appl. Psychol.* 95, 834–848. doi: 10.1037/a0019364
- Deci, E. L., Connell, J. P., and Ryan, R. M. (1989). Self-determination in a work organization. *J. Appl. Psychol.* 74, 580–590. doi: 10.1037/0021-9010.74.4.580
- Demerouti, E., and Bakker, A. B. (2011). The job demands-resources model: challenges for future research. *SA J. Ind. Psychol.* 37, 1–9 doi: 10.4102/sajip.v37i2.974
- De Spiegelaere, S., Van Gyes, G., and Van Hooft, G. (2016). Not all autonomy is the same. Different dimensions of job autonomy and their relation to Work Engagement & Innovative Work Behavior. *Hum. Factor. Ergon. Man.* 26, 515–527. doi: 10.1002/hfm.20666
- Dupont, S., Galand, B., and Nils, F. (2015). The impact of different sources of social support on academic performance: intervening factors and mediated pathways in the case of master's thesis. *Eur. Rev. Appl. Psychol.* 65, 227–237. doi: 10.1016/j.erap.2015.08.003
- Dweck, C. S. (1986). Motivational processes affecting learning. *Am. Psychol.* 40, 1040–1048. doi: 10.1037/0003-066x.41.10.1040
- Edwards, J. R., and Lambert, L. S. (2007). Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychol. Methods* 12, 1–22. doi: 10.1037/1082-989X.12.1.1
- El-Ghoroury, N. H., Galper, D. I., Sawadeh, A., and Bufka, L. F. (2012). Stress, coping, and barriers to wellness among psychology graduate students. *Train. Educ. Profess. Psychol.* 6, 122–134.
- Elshout, J. J. (1990). The nature of creativity: contemporary psychological perspectives. *Acta Psychol.* 75, 92–95. doi: 10.1016/0001-6918(90)90069-r
- Fan, L., Mahmood, M., and Uddin, M. A. (2019). Supportive Chinese supervisor, innovative international students: a social exchange theory perspective. *Asia Pac. Educ. Rev.* 20, 101–115. doi: 10.1007/s12564-018-9572-3
- Farmer, S. M., Tierney, P., and Kung-Mcintyre, K. (2003). Employee creativity in TAIWAN: an application of role identity theory. *Acad. Manag. J.* 46, 618–630. doi: 10.5465/30040653
- Fodor, E. M., and Carver, R. A. (2000). Achievement and power motives, performance feedback, and creativity. *J. Res. Pers.* 34, 380–396. doi: 10.1006/jrpe.2000.2289
- Frick, B. L., and Brodin, E. M. (2020). A return to wonderland: exploring the links between academic identity development and creativity during doctoral education. *Innov. Educ. Teach. Int.* 57, 209–219. doi: 10.1080/14703297.2019.1617183
- Gao, Q., Chen, P., Zhou, Z., and Jiang, J. (2020). The impact of school climate on trait creativity in primary school students: the mediating role of achievement motivation and proactive personality. *Asia Pac. J. Educ.* 40, 330–343. doi: 10.1080/02188791.2019.1707644
- Gemme, B., and Gingras, Y. (2012). Academic careers for graduate students: a strong attractor in a changed environment. *High. Educ.* 63, 667–683. doi: 10.1007/s10734-011-9466-3
- George, J. M., and Zhou, J. (2007). Dual tuning in a supportive context: joint contributions of positive mood, negative mood, and supervisory behaviors to employee creativity. *Acad. Manag. J.* 50, 605–622. doi: 10.5465/AMJ.2007.25525934
- Gill, P., and Burnard, P. (2008). The student-supervisor relationship in the PhD/doctoral process. *Br. J. Nurs.* 17, 668–671. doi: 10.12968/bjon.2008.17.10.29484
- Gu, J., and Chang, Q. (2021). Research on the relationship between doctoral Students' stressors and research performance. *High. Educ. Expl.* 37, 40–46.

- Hammond, M. M., Neff, N. L., Farr, J. L., Schwall, A. R., and Zhao, X. (2011). Predictors of individual-level innovation at work: a meta-analysis. *Psychol. Aesthet. Creat. Arts* 5, 90–105. doi: 10.1037/a0018556
- Han, J., Yin, H., Wang, J., and Bai, Y. (2020). Challenge job demands and job resources to university teacher well-being: the mediation of teacher efficacy. *Stud. High. Educ.* 45, 1771–1785. doi: 10.1080/03075079.2019.1594180
- Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *Am. Psychol.* 44, 513–524. doi: 10.1037/0003-066X.44.3.513
- Hobfoll, S. E. (2011). Conservation of resource caravans and engaged settings. *J. Occup. Organ. Psychol.* 84, 116–122. doi: 10.1111/j.2044-8325.2010.02016.x
- Horan, K. A., Nakahara, W. H., DiStaso, M. J., and Jex, S. M. (2020). A review of the challenge-hindrance stress model: recent advances, expanded paradigms, and recommendations for future research. *Front. Psychol.* 11:560346. doi: 10.3389/fpsyg.2020.560346
- Horta, H., and Li, H. (2022). Nothing but publishing: the overriding goal of PhD students in mainland China, Hong Kong, and Macau. *Stud. High. Educ.* 48, 263–282. doi: 10.1080/03075079.2022.2131764
- Huang, J., Qiao, T., Song, Z., and Yan, J. (2022). How does the social support influence junior college students' occupational identity in pre-school education? *Front. Psychol.* 13:884606. doi: 10.3389/fpsyg.2022.884606
- Joo, B. K. B., and Park, S. (2010). Career satisfaction, organizational commitment, and turnover intention. *Leadersh. Organ. Dev. J.* 31, 482–500. doi: 10.1108/01437731011069999
- Kandler, C., Riemann, R., Angleitner, A., Spinath, F. M., Borkenau, P., and Penke, L. (2016). The nature of creativity: the roles of genetic factors, personality traits, cognitive abilities, and environmental sources. *J. Pers. Soc. Psychol.* 111, 230–249. doi: 10.1037/pspp0000087
- Lazarus, R. S. (1993). From psychological stress to the emotions: a history of changing outlooks. *Annu. Rev. Psychol.* 44, 1–22. doi: 10.1146/annurev.ps.44.020193.000245
- Lazarus, R. S., and Folkman, S. (1986). Cognitive theories of stress and the issue of circularity. *Dynam. Stress.* doi: 10.1007/978-1-4684-5122-1_4
- LePine, J. A., LePine, M. A., and Jackson, C. L. (2004). Challenge and hindrance stress: relationships with exhaustion, motivation to learn, and learning performance. *J. Appl. Psychol.* 89, 883–891. doi: 10.1037/0021-9010.89.5.883
- Lepine, J. A., Podsakoff, N. P., and Lepine, M. A. (2005). A Meta-analytic test of the challenge stressor–hindrance stressor framework: an explanation for inconsistent relationships among stressors and performance. *Acad. Manag. J.* 48, 764–775. doi: 10.5465/AMJ.2005.18803921
- LePine, M. A. (2022). The challenge-hindrance stressor framework: an integrative conceptual review and path forward. *Group Org. Manag.* 47, 223–254. doi: 10.1177/10596011221079970
- Lesener, T., Gusy, B., Jochmann, A., and Wolter, C. (2020). The drivers of work engagement: a meta-analytic review of longitudinal evidence. *Work Stress.* 34, 259–278. doi: 10.1080/02678373.2019.1686440
- Li, J., and Xue, E. (2021). Characterizing graduate education development for creating world-class universities: evidence from doctoral education in China. *Educ. Philos. Theory* 54, 1878–1886. doi: 10.1080/00131857.2021.1948834
- Li, N., Harris, T. B., Boswell, W. R., and Xie, Z. (2011). The role of organizational insiders' developmental feedback and proactive personality on newcomers' performance: an interactionist perspective. *J. Appl. Psychol.* 96, 1317–1327. doi: 10.1037/a0024029
- Liu, F., Qu, S., Fan, Y., Chen, F., and He, B. (2023). Scientific creativity and innovation ability and its determinants among medical postgraduate students in Fujian province of China: a cross sectional study. *BMC Med. Educ.* 23:444. doi: 10.1186/s12909-023-04408-9
- Li, Z., Dai, Y., Han, X., and Li, R. (2018). Impact of challenge-hindrance scientific stress on knowing sharing behavior. *Chin. J. Clin. Psych.* 26, 363–366. doi: 10.16128/j.cnki.1005-3611.2018.02.032
- Man, F., Nygard, R., and Gjesme, T. (1994). The achievement motives scale (AMS): theoretical basis and results from a first try - out of a Czech form. *Scand. J. Educ. Res.* 38, 209–218. doi: 10.1080/0031383940380304
- Ma, Y., Wu, D., and Liu, X. (2019). The influence of supervisor-students relationship on doctoral Students' creativity: the mediating role of academic interest. *Tsinghua J. Educ.* 40, 117–125. doi: 10.14138/j.1001-4519.2019.06.011709
- McCauley, K. D., and Hinojosa, A. S. (2020). Applying the challenge-hindrance stressor framework to doctoral education. *J. Manag. Educ.* 44, 490–507. doi: 10.1177/1052562920924072
- Montani, F., Courcy, F., and Vandenberghe, C. (2017). Innovating under stress: the role of commitment and leader-member exchange. *J. Bus. Res.* 77, 1–13. doi: 10.1016/j.jbusres.2017.03.024
- Ohly, S., and Fritz, C. (2010). Work characteristics, challenge appraisal, creativity, and proactive behavior: a multi-level study. *J. Organ. Behav.* 31, 543–565. doi: 10.1002/job.633
- Oldham, G. R., and Cummings, A. (1996). Employee creativity: personal and contextual factors at work. *Acad. Manag. J.* 39, 607–634. doi: 10.5465/256657
- Pan, B., and Gu, J. (2022). What are the factors that affect Postgraduates' innovation ability in the training process. *Jiangsu High. Educ.* 38, 74–81. doi: 10.13236/j.cnki.jshe.2022.02.010
- Podsakoff, N. P., LePine, J. A., and LePine, M. A. (2007). Differential challenge stressor–hindrance stressor relationships with job attitudes, turnover intentions, turnover, and withdrawal behavior: a meta-analysis. *J. Appl. Psychol.* 92, 438–454. doi: 10.1037/0021-9010.92.2.438
- Preacher, K. J., Curran, P. J., and Bauer, D. J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *J. Educ. Behav. Stat.* 31, 437–448. doi: 10.3102/10769986031004437
- Qin, L., Lu, J., Zhou, Y., Wijaya, T. T., Huang, Y., and Fauziddin, M. (2022). Reduction of academic burnout in preservice teachers: PLS-SEM approach. *Sustainability* 14:13416. doi: 10.3390/su142013416
- Rodell, J. B., and Judge, T. A. (2009). Can “good” stressors spark “bad” behaviors? The mediating role of emotions in links of challenge and hindrance stressors with citizenship and counterproductive behaviors. *J. Appl. Psychol.* 94, 1438–1451. doi: 10.1037/a0016752
- Runco, M. A., and Acar, S. (2012). Divergent thinking as an Indicator of creative potential. *Creat. Res. J.* 24, 66–75. doi: 10.1080/10400419.2012.652929
- Ryan, R. M., and Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am. Psychol.* 55, 68–78. doi: 10.1037//0003-066x.55.1.68
- Sacramento, C. A., Fay, D., and West, M. A. (2013). Workplace duties or opportunities? Challenge stressors, regulatory focus, and creativity. *Organ Behav Hum Decis Process.* 121, 141–157. doi: 10.1016/j.obhdp.2013.01.008
- Sawhney, G., and Michel, J. S. (2022). Challenge and hindrance stressors and work outcomes: the moderating role of day-level affect. *J. Bus. Psychol.* 37, 389–405. doi: 10.1007/s10869-021-09752-5
- Schoen, J. L. (2015). Effects of implicit achievement motivation, expected evaluations, and domain knowledge on creative performance. *J. Organ. Behav.* 36, 319–338. doi: 10.1002/job.1982
- Shalley, C. E. (1995). Effects of coaction, expected evaluation, and goal setting on creativity and productivity. *Acad. Manag. J.* 38, 483–503. doi: 10.5465/256689
- Shalley, C. E., and Oldham, G. R. (1997). Competition and creative performance: effects of competitor presence and visibility. *Creat. Res. J.* 10, 337–345. doi: 10.1207/s15326934crj1004_5
- Shalley, C. E., Zhou, J., and Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: where should we go from Here? *J. Manag.* 30, 933–958. doi: 10.1016/j.jm.2004.06.007
- Shang, Y., Xu, J., and Liu, H. (2023). Supervisor developmental feedback and postgraduate student creativity: a relationship quality perspective. *High. Educ.* doi: 10.1007/s10734-023-01012-0
- Story, P. A., Hart, J. W., Stasson, M. F., and Mahoney, J. M. (2009). Using a two-factor theory of achievement motivation to examine performance-based outcomes and self-regulatory processes. *Personal. Individ. Differ.* 46, 391–395. doi: 10.1016/j.paid.2008.10.023
- Su, F., and Zhang, J. (2020). Proactive personality and innovative behavior: a moderated mediation model. *Soc. Behav. Personal. Int. J.* 48, 1–12. doi: 10.2224/sbp.8622
- Su, H., Bai, L., and Zhang, J. (2021). On the influence of Supervisors' paternalistic guidance style on Postgraduates' creative behaviors. *Academic Degrees & Graduate Education*, 38, 57–66. doi: 10.16750/j.adge.2021.06.009
- Sun, Y., Hu, X., and Ding, Y. (2019). Learning or relaxing: how do challenge stressors stimulate employee creativity? *Sustainab. Basel* 11:1779. doi: 10.3390/su11061779
- Su, W., Qi, Q., and Yuan, S. (2022). A moderated mediation model of academic supervisor developmental feedback and postgraduate student creativity: evidence from China. *Behav. Sci.* 12:484. doi: 10.3390/bs12120484
- Svensson, N. (2015). Subjective experiences of creative work after negative feedback. *Think. Skills Creat.* 15, 26–36. doi: 10.1016/j.tsc.2014.11.002
- Tierney, P., and Farmer, S. M. (2004). The Pygmalion process and employee creativity. *J. Manag.* 30, 413–432. doi: 10.1016/j.jm.2002.12.001
- Tierney, P., Farmer, S. M., and Graen, G. B. (1999). An examination of LEADERSHIP and employee creativity: the relevance of traits and relationships. *Pers. Psychol.* 52, 591–620. doi: 10.1111/j.1744-6570.1999.tb00173.x
- Travis, J., Kaszycki, A., Geden, M., and Bunde, J. (2020). Some stress is good stress: the challenge-hindrance framework, academic self-efficacy, and academic outcomes. *J. Educ. Psychol.* 112, 1632–1643. doi: 10.1037/edu0000478
- Utman, C. H. (1997). Performance effects of motivational state: a Meta-analysis. *Personal. Soc. Psychol. Rev.* 1, 170–182. doi: 10.1207/s15327957pspr0102_4
- Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., and Lens, W. (2009). Motivational profiles from a self-determination perspective: the quality of motivation matters. *J. Educ. Psychol.* 101, 671–688. doi: 10.1037/a0015083
- Wallace, J. C., Edwards, B. D., Arnold, T., Frazier, M. L., and Finch, D. M. (2009). Work stressors, role-based performance, and the moderating influence of organizational support. *J. Appl. Psychol.* 94, 254–262. doi: 10.1037/a0013090
- Wang, X., Lin, S., and Chen, L. (2014). The influence mechanism of challenge-hindrance academic stressor on academic performance: the mediating effects of academic anxiety and achievement motivation. *Sci. Sci. Manag. ST* 35, 23–30.

- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychol. Rev.* 92, 548–573. doi: 10.1007/978-1-4612-4948-1_6
- Whitelock, D., Faulkner, D., and Miell, D. (2008). Promoting creativity in PhD supervision: tensions and dilemmas. *Think. Skills Creat.* 3, 143–153. doi: 10.1016/j.tsc.2008.04.001
- Wigfield, A., and Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemp. Educ. Psychol.* 25, 68–81. doi: 10.1006/ceps.1999.1015
- Wijaya, T. T., Rahmadi, I. F., Chotimah, S., Jailani, J., and Wutsqa, D. U. (2022). A case study of factors that affect secondary school mathematics achievement: teacher-parent support, stress levels, and students' well-being. *Int. J. Environ. Res. Public Health* 19:16247. doi: 10.3390/ijerph192316247
- Woodman, R. W., Sawyer, J. E., and Griffin, R. W. (1993). Toward a theory of organizational creativity. *Acad. Manag. Rev.* 18, 293–321. doi: 10.5465/amr.1993.3997517
- Wu, D., Ma, Y., and Yang, Y. (2019). The Influence of supervisor-student relationship and peer learning community on doctoral Students' creativity. *Acad. Degr. Grad. Educ.*, 36, 55–60. doi: 10.16750/j.adge.2019.10.010
- Wu, S., Gao, W., and Quan, Y. (2021). The impact of work pressure on Employees' Creativity--the chain mediating effect of regulatory focus and creative self-efficacy. *Sci. Technol. Progr. Policy* 38, 132–140. doi: 10.6049/kjbydc.2020070800
- Wu, Y., Wei, Y., Shi, Y., and Li, M. (2018). The influence of Tutor's guidance style on the innovative ability of graduate students with different levels of Initiative: an investigation of nine universities. *Fudan Educ. Forum* 16, 74–79. doi: 10.13397/j.cnki.fef.2018.03.012
- Xie, L., Jin, H., Wang, Z., Ye, Q., and Yang, X. (2023). The effect of supervisor-induced ostracism on scientific research: mediation roles of research self-efficacy and scientific anxiety. *Psychol. Dev. Educ.* 39, 833–841. doi: 10.16187/j.cnki.issn1001-4918.2023.06.09
- Yang, Y., and Li, X. (2021). The impact of challenge and hindrance stressors on thriving at work double mediation based on affect and motivation. *Front. Psychol.* 12:613871. doi: 10.3389/fpsyg.2021.613871
- Yao, H., and Ma, L. (2021). The influence of challenge-obstacle scientific research stress on postgraduate psychological anxiety: the mediating role of achievement motivation and self-efficacy. *China High. Educ. Res.* 37, 79–85. doi: 10.16298/j.cnki.1004-3667.2021.05.11
- Yin, K., Sun, J., Xing, L., and Yang, X. (2016). The effect of graduate Students' research role identification on research Creativity: role of Mentor's Inclusive Leadership and error management culture. *Psychol. Dev. Educ.* 32, 557–564. doi: 10.16187/j.cnki.issn1001-4918.2016.05.06
- Yin, K., Xu, Y., Song, H., and Xing, L. (2018). Research experiences, error management climate and enhancement of research creativity. *Sci. Res. Manag.* 39, 169–176. doi: 10.19571/j.cnki.1000-2995.2018.09.019
- Yuan, B., and Yan, J. (2009). Analyses of Present Condition of the Graduates' Innovative Capability and Its Influencing factors: Based on Three Large-scale Quality Surveys of Graduate Education in China. *Peking Univ. Educ. Res.* 7, 12–20. doi: 10.19355/j.cnki.1671-9468.2009.02.003
- Zeng, J., and Zhang, G. (2022). Research on the influence mechanism of free explorative Supervisors' guidance styles on doctoral Students' innovation behavior. *J. Northeastern Univ.* 24, 117–125. doi: 10.15936/j.cnki.1008-3758.2022.06.015
- Zhang, J., Tang, J., Xie, K., and Zhang, Y. (2023). The influence of inclusive supervisor on graduate students' research creativity: the mediating effect of cognitive flexibility and the moderating effect of openness to experience. *Psychol. Res.* 16, 354–363. doi: 10.19988/j.cnki.issn.2095-1159.2023.04.008
- Zhang, Y., Liao, J., and Zhao, J. (2013). The impact of research stress on the academic misconduct of PhD candidates. *Sci. Res. Manag.* 34, 99–107. doi: 10.19571/j.cnki.1000-2995.2013.04.013
- Zhao, D., Wu, J., and Gu, J. (2021). Can high leader-member exchange spark low creativity among graduate students? The role of stress and personal initiative. *Curr. Psychol.* 40, 4488–4499. doi: 10.1007/s12144-019-00389-5
- Zheng, Y., Li, Z., and Xiao, M. (2022). How can Supervisors' ability improve Postgraduates' research performance: based on the Furvey of five "double first-class" universities. *J. Grad. Educ.* 37, 43–52. doi: 10.19834/j.cnki.yjsjy2011.2022.06.06
- Zhou, J. (2003). When the presence of creative coworkers is related to creativity: role of supervisor close monitoring, developmental feedback, and creative personality. *J. Appl. Psychol.* 88, 413–422. doi: 10.1037/0021-9010.88.3.413
- Zhou, J., and George, J. M. (2001). When job dissatisfaction leads to creativity: encouraging the expression of voice. *Acad. Manag. J.* 44, 682–696. doi: 10.5465/3069410



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Integrated laboratory classes to learn physiology in a psychology degree: impact on student learning and experience

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Physiology is a fundamental discipline to be studied in most Health Science studies including Psychology. Physiology content is perceived by students as rather difficult, who may lack vision on how to relate it with their professional training. Therefore, identifying novel active and more engaging pedagogical strategies for teaching physiology to psychology students may help to fill this gap. In this pilot study, we used the PBL methodology developed around a clinical case to evaluate psychology students' experience and learning in two laboratory classes modalities. The aim of this study was to compare the undergraduates' preference for laboratory classes taught either independently (cohort 1, $n = 87$ students) or integrated into the PBL-oriented clinical case (cohort 2, $n = 92$ students) for which laboratory classes were transformed into Integrated Laboratory Classes (ILCs). The students' academic performance was also evaluated to look for quantitative differences between cohorts. We found similar overall academic scores for the Physiology course between cohorts. Interestingly, when we compared the academic scores obtained in the theoretical content from each cohort, we found a significant improvement ($p < 0.05$) in cohort 2 where the students achieved better results as compared to cohort 1. A subset of students was asked to fill a questionnaire assessment on their experience and found that 78.9% of them preferred integrated laboratory classes over laboratory classes alone. They consistently reported a better understanding of the theoretical content and the value they gave to ILCs for learning. In conclusion, our pilot study suggests that integrating laboratory classes into PBL-oriented clinical contexts help to retain core physiology contents and it can be considered as an engaging learning activity worth implementing in Psychology teaching.

KEYWORDS

physiology teaching, PBL methodology, clinical cases, laboratory classes, integrated laboratory classes, academic performance

1. Introduction

Physiology is considered a challenging discipline in most Health Science studies. Psychology students in particular usually consider physiology as a less relevant part of their professional training even though it provides an essential scientific understanding of the biological processes underlying human behavior and cognition (Vanags et al., 2012; Lloyd et al., 2019). Understanding physiology entails successful comprehension, integration and application of several complex concepts (Rehan et al., 2016). The very nature of the discipline, the way it is taught and the student's preconceptions have all been described to contribute to this perceived intrinsic difficulty (Michael, 2007; Slominski et al., 2019). Finding new pedagogical strategies for teaching physiology to psychology students is thus important to enhance their understanding of the biological underpinnings of human behavior and to foster interdisciplinary connections within the Health Science field.

The ability to make predictions about how external and internal changes affect the state of a biological system is central to physiology (Zohar, 1995). Active methodologies are defined by educational researchers as any activity that 'involves students in doing things and thinking about the things they are doing' by engaging them cognitively and meaningfully with the materials (Bodemer and Ploetzner, 2004; Goodman et al., 2018), leading to a better understanding of complex ideas and mastering difficult skills (Chi, 2009). Research suggests that active teaching methodologies with multiple and interactive external interactions are required for effective students' engaging students (Bodemer and Ploetzner, 1998). It has been discussed that those who actively relate sources of information are able to create mental representations that are more coherent when it comes to content application than those who do not make these connections (Cakir, 2008; Anwar, 2019). Under this perspective, for learning to be effective, students must develop the capacity to evaluate and use information. New concepts that fit within preexisting mental structures are better retained and understood.

All this suggest that students would be better able to handle with difficulties if they actively engage in the cognitive processes required to build connections amongst separate information pieces (Hopper, 2016). This will not only help in their learning but for physiology teaching in particular, it may be an opportunity for them to handle with difficulties in understanding. Anwar states that in active learning: "students' participation differs from more traditional learning environments in their level of participation and collaboration." Hopper (2016) emphasizes that "the more students participate in activities that are designed to improve learning and competence development (such writing, evaluating, synthesizing, analyzing, and thinking) the more competent they will become." Thus, active learning pedagogies help to develop and assess mental models which need to be used in order to understand newly introduced concepts (Graffam, 2007). This in turn enables students to generate new ideas which go beyond the learning material (Chi and Wylie, 2014).

In recent decades, the importance of teaching basic sciences such as Physiology in an integrated manner has been emphasized (Sánchez et al., 2020; Tun et al., 2020). This advocates for a clinical perspective to be included from the initial formative

years to better equip students with the ability to navigate the complexities of psychology. This is especially true for laboratory classes which represent a major step in most Health Science curricula. Different methodologies such as activity-based learning (ABL) and problem-based learning (PBL) have been previously used in integrated curricula. PBL is a methodology in which the starting point is a problem that enables students to develop a hypothesis and identify their own learning needs. PBL is typically taught using small groups (usually around 8–10 students) with a tutor who guide students to keep on track of learning objectives of the task (Trullàs et al., 2022). PBL methodology obtained a high level of satisfaction, especially among students (Trullàs et al., 2022).

Using PBL methodologies can thus help to better engage Psychology students in learning physiology concepts, especially in relation to more real case scenarios. Integration of laboratory classes into the PBL framework has been shown to significantly improve understanding, leading to the development of critical thinking and other major competences (Matsuo et al., 2011; Azer et al., 2013). By providing coherence and contextualization of the laboratory classes, this approach enable students to gain a deeper understanding of the content (Hammerness, 2006; Canrinus et al., 2019). Based on this approach, we have recently introduced workstation learning activities (WSLA) as an active methodology where the students organized in groups of 5–6 students rotate across different stations to work in an integrated manner the basic scientific aspects of a particular clinical case (González-Soltero et al., 2017). We demonstrated its effectiveness in more interactive and constructive knowledge for medical students (Sánchez et al., 2022). Such a framework may be particularly useful to teach practical aspects of Physiology to psychology students, as well.

Here, we investigate the effectiveness of integrating Physiology teaching with PBL-based laboratory classes by evaluating the impact on academic performance and students' perception in the first year of the Psychology undergraduate program. Our hypothesis is that students in which the laboratory classes are contextualized into PBL develop a better knowledge as compared to those who did not have the experience. To address this hypothesis, we developed a pilot study using a PBL-oriented clinical case on Parkinson's disease using WSLA as an example. We compare a first group (academic year 2018–2019) in which laboratory classes were taught separately from the clinical case with an experimental group (year 2019–2020) for which laboratory classes were contextualized into the PBL and transformed into Integrated Laboratory Classes (ILCs) (Azer et al., 2013). Our study demonstrates the value of ILCs for learning, and highlight the strategies used by students for knowledge integration of theoretical concepts.

2. Materials and methods

2.1. Description of the experimental cohorts

In this pilot study, we aimed to assess the impact of academic performance and student's experience of teaching laboratory classes contextualized within the PBL applied to Physiology teaching in

the first-year degree of Psychology. Two cohorts from consecutive academic years were selected: cohort 1 ($n = 87$) from 2018/19, which was considered the control group, and cohort ($n = 92$) during 2019/2020 as the experimental group. Cohort 1 was organized in three homogeneous group of students each of 25–30 students. Cohort 2 was organized in four heterogeneous group of students, two of them composed by 30 students and the other two of less than 30 students. The students of both cohorts aged between 18 and 25 years. In both cohorts there were similar distribution per gender, with 69–77% women and 23–31% men.

The methodology used to teach the subject's content consisted in lectures (theory block), laboratory classes (practical block), and problem-based learning (PBL block). The PBL block was taught through a clinical case that integrates different learning activities using WSLA. The theoretical block was delivered in the same way in both cohorts. The main difference between cohort 1 and cohort 2, was that in the first one (2018/19), the laboratory classes were conducted independently of the PBL block. As for the second cohort (2019/20), the practices were contextualized with PBL as an additional workstation and named Integrated Laboratory Classes (ILCs) in order to provide a meaningful context.

Five clinical cases were completed in PBL blocks throughout the course. The cases consisted of a clinical scenario, a description of the patients, and various situations that students must solve in groups. Students had to rotate through different workstation learning activities. In each workstation, they worked with different aspects of the clinical case through learning activities such as bibliographic research, audiovisual material production, visiting external institutions, etc.

To illustrate our approach, we here describe the example associated to the clinical case named 'Practical Case: Parkinson's disease' (Figure 1). After traditional lectures about the nervous system were taught (black boxes), different aspects of motor control were addressed through PBL through different workstations for both cohorts (orange boxes; Figures 1A, B).

The clinical case considered a protagonist, Peter, who suffered uncontrollable motor symptoms, such as shaking, stiffness, and difficulty with balance and coordination. He was worried and decided to talk to his nephew who was a Ph.D. student. Peter was about to visit a Parkinson's disease association. Understanding the case required students to integrate information from different activities conducted across different workstation:

Station 1: Students performed two external visits associated activities. In activity 1, they interviewed a neuropsychologist and a Parkinson's patient (PD), both from the PD Association of Madrid. Previously, the students had worked on designing the interview questions. In activity 2, students visited an animal research laboratory at the Brain Mapping Center of Universidad Complutense de Madrid (UCM) where microPET imaging is used for translational research. They also visited the 'Affective Neurolinguistics and Cognition Group' of the UCM working with electroencephalography on human experimental subjects. Students solved problems through neuroimaging analysis, based on the training they received during these visits.

Station 2: Students were exposed to theoretical explanations relevant to the clinical case.

Station 3: For evaluation, students produced audiovisual material (video recordings), integrating all the learning activities worked on in the clinical case.

In cohort 1, the motor reflexes were practiced as independent laboratory classes (blue, cohort 1, Figure 1). In the cohort 2, the laboratory classes were added as an additional workstation, resulting in ILC (station 4; Figure 1, cohort 2). Students exercised the ILCs in the physiology laboratory on motor patellar reflexes and reaction time, where they measured their own different voluntary and involuntary motor responses. This workstation was contextually integrated with the clinical case.

2.2. Quantitative comparison of academic performance between cohorts

To evaluate results quantitatively, academic performance was defined from the results of the exams. The type of exams and their assessment was similar for both cohorts. Exams consisted of two parts. A test with multiple choice questions (30 questions) with 4 options each, for which correct answers to each question were maximally scored and a penalty applied for incorrect answers, giving a partial score from 0 to 8 points. Exams also included two additional short-answers questions, which were scored from 0 to 2 points. The final score (10 points) resulted from the summation of the two parts.

For quantitative analysis, academic scores from each of the different blocks in both cohorts were compared using an inferential non-parametric statistical study. As the two independent cohorts did not follow a normal distribution, a study was conducted using the Mann-Whitney non-parametric test. Academic scores were ranked from 0 to 10.

2.3. Analysis of questionnaire assessment

Additionally, an observational study was conducted by intentionally selecting a group of students of the 2019/20 cohort who also run Physiology in the 2018/19 course ($n = 19$). The rationale behind this decision was to be able to inform comparisons between the two academic experiences. To this purpose, we used a survey comprised of several questions scored with a Likert scale from 1 to 5 (see Supplementary Annex 1). The questionnaires were prepared using Google Form. In a first group of questions, we aimed to evaluate the students' perceptions of learning activities (questions 1 to 4). We then asked students what methodology they considered contributed the most to their learning (laboratory practices alone, PBL+ILC, or none of them) (question 5). In question 6, we asked how they assessed ILC experienced in the 2019/20 academic year.

We also assessed the students' perception about how much the clinical case helped them to learn the theoretical contents (question 7). To know more about what aspects the students remembered the most we also asked them to associate a particular concept learnt in different activities with each clinical case (question 8). Concepts included academic contents (e.g., patellar reflex, evoked potential)

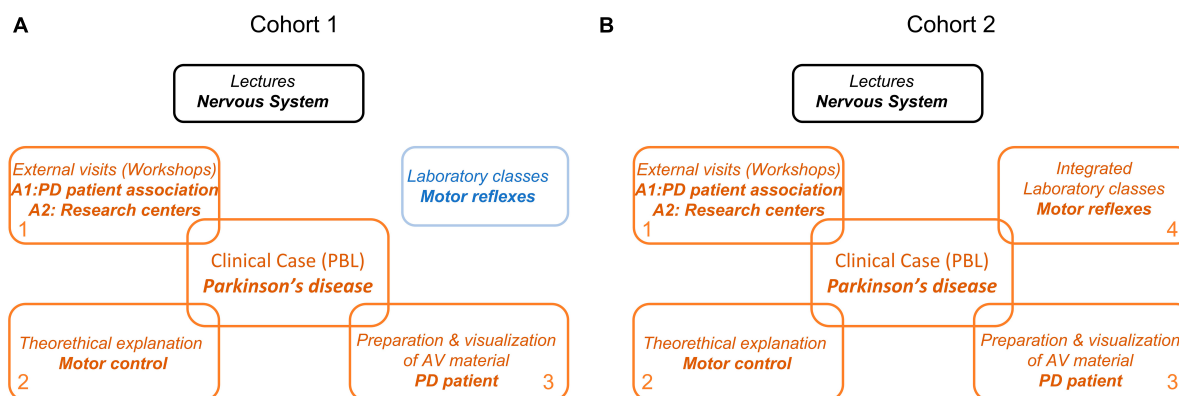


FIGURE 1

Experimental design. Two cohorts of Psychology students were considered in consecutive academic years. Both cohorts received traditional lectures in a theory block (black box). (A) Cohort 1 (2018/19) experienced laboratory classes on the motor reflexes (blue) totally independent of the clinical case Parkinson's disease (PD). The clinical case was conducted using the WSLA methodology consisting of different learning activities developed through workstations (orange). WSLA integrated external visits (workshops) to research institutions relevant to PD (workstation 1) and theoretical explanations of the clinical case in particular (workstation 2). They were also asked to prepare audiovisual material (AV) of the experience as evaluation activities (workstation 3). Students from cohort 1 experienced the laboratory practices on the motor reflex in an independent block (blue). (B) Instead, students of cohort 2 experienced the laboratory practices on motor reflexes integrated with the clinical case. In this cohort, laboratory classes became another workstation (workstation 4). The aim was providing students with a more holistic view of the content.

as well as some particular characteristics of the clinical case (e.g., the names of the patients and the narrative of the case).

Internal validation was conducted by two experts who reviewed the coherence and consistency of the questionnaire. Additional validation was certified by an expert professor external to the project (Elangovan and Sundaravel, 2021). Results from the questionnaires were analyzed using descriptive statistics of the Likert scale as quantitative measures.

3. Results

3.1. Quantitative study for academic performance

We analyzed the academic results of the theoretical block, common to both cohorts. To compare performance in the two different academic experiences, we looked for differences in the scores of the PBL block (cohort 1) vs. the PBL block in which ILCs were added as a workstation (cohort 2), as well as in laboratory classes (cohort 1) vs. ILCs (cohort 2). We also assessed the overall score of the Physiology course for both cohorts.

As shown in Table 1, we found similar overall academic scores for the Physiology course between cohorts. Interestingly, when we compared the medians obtained in theory blocks from each cohort, a significant improvement ($p < 0.05$) was found in cohort 2 (median = 4.3; $n = 92$), where the students achieved better results as compared to Cohort 1 (median = 2.9; $n = 87$). This trend was also reflected in the scores obtained in PBL+ILCs by cohort 2 (median 6.5) vs. PBL in cohort 1 (median 5.2), although it did not reach significance ($p = 0.18$).

Regarding academic results from ILCs (Cohort 2, median = 6.5), we found them significantly lower than those obtained in laboratory classes alone (Cohort 1, median = 7.4) ($p < 0.05$, Mann-Whitney U -test), suggesting that any

improvement in understanding the relevant concepts may not be resulting from a single factor but at a more integrative level. These differences cannot be explained by external variables such as the temporality of the content explained, different teachers or type of assessment. The content was taught in the same semester (S1) and by the same teacher and even the same internship support teachers in Cohort 1 and 2. Exams in both cohorts were also similar. Moreover, as detailed in methods, both cohorts had similar profile of the students, and we did not face exceptional situations that contribute external variables.

3.2. Analysis of questionnaires

To better understand these differences, we next analyzed the results from the questionnaires. In general, there was variability in the answers of the questionnaires regarding how students valued the different learning activities. First, we found that while many students highly valued external visits (scoring them at 4 and 5 in the Likert scale, 45%), more than half did not score them highly (Figure 2A; mean at 3.5 of the Likert scale). Instead, most of them scored ILCs above 4 in the scales (Figure 2B; 60%). Regarding production of audiovisual material by students during the clinical case there was large dispersion in the answers with no clear preference (Figure 2C), but in general they valued their visualization with 70% of the answers above 4 (Figure 2D).

We next assessed what methodology the students valued the most for learning and found that 78.9% of them preferred PBL+ILC over laboratory classes alone (question 5). Actually, 94.7% rated their opinion of ILCs between 4 and 5 of the Likert scale (Figure 3, question 6).

Regarding the opinion of students on how much the clinical cases helped them to learn (question 7), we found 60% rated between 4 and 5 of the Likert scale, confirming the idea that the integrated PBL block added value to learning.

TABLE 1 Comparison academic scores (median values and ranges are given).

	Cohort 1 (C1)	Cohort 2 (C2)	<i>P</i> (<i>p</i> <0.05)
Overall score of the physiology course	4 (2.6–5.6)	4 (3–6.7)	0.47
Theory block	2.9 (1–5.3)	4.3 (3–7)	<0.001
PBL (Cohort) vs. PBL + ILCs (Cohort 2)	5.2 (3.8–8)	6.5 (5.4–7.5)	0.18
Laboratory classes (Cohort 1) vs. ILCs (Cohort 2)	7.4 (5.7–8.1)	6.5 (5.4–7.5)	0.01 (0.008)

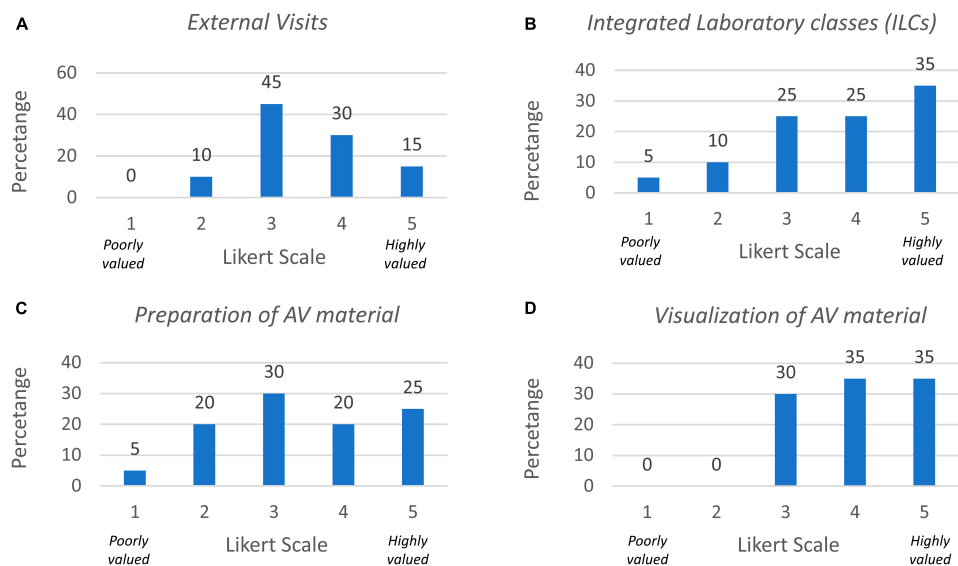


FIGURE 2

Results from questionnaires regarding learning activities in the PBL block. (A) Percentage of responses to questionnaires on external visits. (B) Integrated laboratory classes. (C) Preparation of AV material. (D) Visualization of AV material.

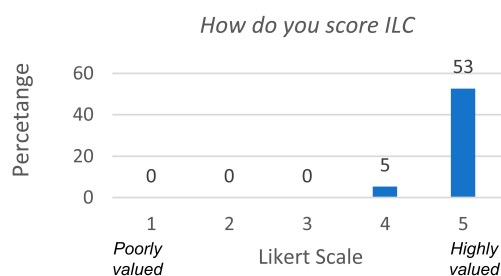


FIGURE 3

Responses to question regarding how student value ILC for their learning process.

Finally, we evaluated whether some concepts and ideas were able to trigger recalling of aspects of interest that were learnt over the course (question 8). With this we wanted to clarify the possible strategies used by students to build connections amongst separate information pieces. Consistent with a constructive perspective of learning, we found this to be strongly dependent on the case under study. For example, for the Clinical Case Parkinson's disease, there was a notable higher percentage of students that answered appropriately to the questions related to the personal characteristics of the case protagonists, such as their names (73%)

or the destination of their trip (68%). Regarding theoretical concepts, 56% of students correctly retrieved the clinical case in association with evoked potentials and only 25% with the concepts of neuroinflammation.

4. Discussion

In this work, we evaluated quantitatively if ILCs impact positively the academic performance of Physiology in first year students of psychology. Our findings show that no significant differences were obtained in the final grade for the subject. However, there was significant improvement of the score of the theoretical block of Cohort 2 students, where laboratory physiology classes were integrated and contextualized into the clinical case. Interestingly, we also found that academic results of the ILCs were significantly lower than for non-integrated laboratory classes. These results may suggest that ILCs are more challenging for students to accomplish than the non-integrated practical lesson. In spite of this difficulty, analysis of the students' perception on questionnaires confirmed the value they give to ILCs for learning and highlight their strategies for knowledge integration of theoretical concepts.

Experimental psychologist Robert Bjork, advocates for the so-called "desirable difficulties" as learning strategies which require

learners to exert an appropriate effort when learning something new. It has been demonstrated that these activities tend to result in enhanced learning (van Merriënboer et al., 2006; Bjork and Bjork, 2011; Lange and Costley, 2018; Kinsey, 2023). In curricular programs which include these planned difficulties, proper scaffolding must be embedded in the design via retrieval cues to facilitate learning the relationship between task difficulty and deep learning has been also described in the context of Health Education (Nelson and Elias, 2023).

Strategies to incorporate 'desirable difficulty' in health education include retrieval practice, spaced practice, and interleaved practice (Bjork and Bjork, 2011; Kinsey, 2023). In addition to the difficulty of the activities, it has been described that it is important to space out the day of the exam, since there are differences in remembering the concepts if the time interval until the exam is not well scheduled (Dobson, 2011). Students of cohort 1 and 2 took the exam being equally spaced and under the same conditions (structure and duration of the exam). In spite of this, the students get better results in the theoretical block having experienced ILCs. Analysis of the questionnaires confirmed this interpretation. This suggests that there was a positive impact of ILCs in spite of their difficulty, which resulted from knowledge integration at a more constructive level.

The counterintuitive idea that more difficult learning processes can enhance learning outcomes supports our results. The ILCs is a learning activity where retrieval practice is included through questions for learners to probe their knowledge. These results suggest that students learn more significantly and are able to recall better the information they learnt through ILCs. Our results add to previous reports demonstrating that retrieval practice enhances the ability to evaluate complex physiology information (Dobson et al., 2018).

In this experience we use five clinical cases each based on a clinical scenario, a description of the patients, and various situations that students must solve in groups, working in an integrated manner through different learning activities. Health Science professionals are expected to integrate content that is traditionally taught in isolation, and this may be particularly challenging in the context of psychology. When combined, active and integrated learning approaches result in an enriched learning environment which encourages students to apply knowledge to real-world scenarios and develop critical thinking skills. By doing so, students are better equipped to understand complex problems, to analyze clinical situations, and to make informed decisions in their future practice (Wood, 2003; Hmelo-Silver, 2004; Lujan and DiCarlo, 2006; Gleason et al., 2011; Parmelee et al., 2012; Thistlethwaite et al., 2012; Tayce et al., 2021; Topperzer et al., 2022). This is especially important for psychology students in order to develop their clinical competences. Our results confirm that 60% of the students consider that clinical cases helped them understand the physiology subject (question 7). Nearly all of them (94.7%) agreed that the ILCs were instrumental for understanding physiological concepts (question 6) consistent with previous experience (Azer et al., 2013).

Contextualization of the clinical case for Psychology students is crucial. All the clinical cases the students had to work with, were real. The protagonist of each case develops an illness related to the psychological and emotional domain, which naturally attracted the interest of psychology students. By feeling that the content they are studying comes close to their professional world, students

gain motivation and engagement (Guilherme Guedert et al., 2022). Consistently, our results demonstrate that students better recalled relationship with the clinical cases when remembered minor details around the narrative than the academic content of the clinical case (question 8). This supports the idea that episodic and emotional cues associated to learning can influence extrinsic motivation (Schunk, 2008). Such strategies may act to stimulate health science students toward academic performance, wellbeing and satisfaction in their professional career (Leadbeater and Gao, 2018).

As for any pilot study, there may be some potential limitation. Our study focused on a particular cohort with a limited sample. Studies in education are usually limited by factors such as the teaching load, institutional policies and logistical constraints. Future studies would include the implementation and evaluation of integrated laboratory classes in other programs and courses with a longitudinal design. Active learning methodologies seldom reach the laboratory component of basic science courses losing an important chance to provide a better learning experience for students that may be less inclined toward laboratory work.

In summary, our study supports that using active learning methodologies to teach laboratory classes within an attractive clinical context has a positive impact on learning and on the overall student's experience. Moreover, ILCs are perceived as a motivating strategy by students which facilitates the understanding of complex physiological concepts. Using real clinical scenarios make students feel the content closer to their professional future and enhances engagement in their own learning process. This pilot study suggests that the ILCs help to retain core physiology content and it can be considered as a learning activity worth implementing in the Health curricula and in particular in Psychology teaching.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee from the European University of Madrid (CIPI/18/060). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

BG: Conceptualization, Investigation, Supervision, Writing – original draft, Writing – review and editing. JS: Formal analysis, Investigation, Methodology, Writing – review and editing. BN-G: Data curation, Investigation, Writing – review and editing. ML: Investigation, Methodology, Writing – review and editing. MR: Formal analysis, Investigation, Methodology, Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

- Anwar, F. (2019). Activity-based teaching, student motivation and academic achievement. *J. Educ. Educ. Dev.* 6, 154–170.
- Azer, S., Hasanato, R., Al-Nassar, S., Somily, A., and AlSaadi, M. (2013). Introducing integrated laboratory classes in a PBL curriculum: impact on student's learning and satisfaction. *BMC Med. Educ.* 13:71. doi: 10.1186/1472-6920-13-71
- Bjork, E., and Bjork, R. (2011). *Making things hard on yourself, but in a good way: Creating desirable difficulties to enhance learning. In: Psychology and the real world: Essays illustrating fundamental contributions to society.* New York, NY: Worth Publishers.
- Bodemer, D., and Ploetzner, R. (1998). Encouraging the active integration of information during learning with multiple and interactive representations. *Rev. Lit. Arts Am.* 40, 1–10.
- Bodemer, D., and Ploetzner, R. (2004). Encouraging the active processing of information during learning with multiple and interactive representations. *Instr. Des. Multimed. Learn.* 2004, 127–138. doi: 10.7717/peerj-cs.429
- Cakir, M. (2008). Constructivist approaches to learning in science and their implications for science pedagogy: A literature review. *Int. J. Environ. Sci. Educ.* 3, 193–206.
- Canrinus, E., Klette, K., and Hammerness, K. (2019). Diversity in coherence: Strengths and opportunities of three programs. *J. Teach. Educ.* 70, 192–205.
- Chi, M. (2009). Active-constructive-interactive: A conceptual framework for differentiating learning activities. *Top. Cogn. Sci.* 1, 73–105. doi: 10.1111/j.1756-8765.2008.01005.x
- Chi, M., and Wylie, R. (2014). The ICAP framework: linking cognitive engagement to active learning outcomes. *Educ. Psychol.* 49, 219–243.
- Dobson, J. (2011). Effect of selected “desirable difficulty” learning strategies on the retention of physiology information. *Adv. Physiol. Educ.* 35, 378–383. doi: 10.1152/advan.00039.2011
- Dobson, J., Linderholm, T., and Perez, J. (2018). Retrieval practice enhances the ability to evaluate complex physiology information. *Med. Educ.* 52, 513–525.
- Elangovan, N., and Sundaravel, E. (2021). Method of preparing a document for survey instrument validation by experts. *MethodsX* 8, 101326.
- Gleason, B., Peeters, M., Resman-Targoff, B., Karr, S., McBane, S., Kelley, K., et al. (2011). An active-learning strategies primer for achieving ability-based educational outcomes. *Am. J. Pharm. Educ.* 75, 186. doi: 10.5688/ajpe759186
- González-Soltero, R., Learte, A., Sánchez, A., and Gal, B. (2017). Work station learning activities: A flexible and scalable instrument for integrating across basic subjects in biomedical education. *BMC Med. Educ.* 17: 236. doi: 10.1186/s12909-017-1084-z
- Goodman, B., Barker, M., and Cooke, J. (2018). Best practices in active and student-centered learning in physiology classes. *Adv. Physiol. Educ.* 42, 417–423. doi: 10.1152/advan.00064.2018
- Graffam, B. (2007). Active learning in medical education: Strategies for beginning implementation. *Med. Teach.* 29, 38–42.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1266338/full#supplementary-material>

- Guilherme Guedert, D., de Lima, P., Souza e Silva, R., and Cláudia Carneiro Girão Carmona, V. (2022). The use of active methodologies for the teaching of human embryology: A systematic review. *Anat. Histol. Embryol.* 51, 332–338.
- Hammerness, K. (2006). From coherence in theory to coherence in practice. *Teach. Coll. Rec.* 108, 1241–1265.
- Hmelo-Silver, C. (2004). Problem-based learning: What and how do students learn? *Educ. Psychol. Rev.* 16, 235–266.
- Hopper, M. (2016). Assessment and comparison of student engagement in a variety of physiology courses. *Adv. Physiol. Educ.* 40, 70–78. doi: 10.1152/advan.00129.2015
- Kinsey, H. (2023). Getting the balance just right: Desirable difficulty in health professions education. *Med. Educ.* 57:110. doi: 10.1111/medu.14989
- Lange, C., and Costley, J. (2018). The moderating effects of intrinsic load on the relationship between self-regulated effort and germane load. *J. Comput. Assist. Learn.* 34, 652–660.
- Leadbeatter, D., and Gao, J. (2018). Engaging oral health students in learning basic science through assessment that weaves in personal experience. *J. Dent. Educ.* 82, 388–398. doi: 10.21815/JDE.018.041
- Lloyd, S., Shanks, R., and Lopatto, D. (2019). Perceived student benefits of an undergraduate physiological psychology laboratory course. *Teach. Psychol.* 46, 215–222.
- Lujan, H., and DiCarlo, S. (2006). Too much teaching, not enough learning: What is the solution? *Am. J. Physiol.* 30, 17–22.
- Matsuo, O., Takahashi, Y., Abe, C., Tanaka, K., Nakashima, A., and Morita, H. (2011). Trial of integrated laboratory practice. *Adv. Physiol. Educ.* 35, 237–240. doi: 10.1152/advan.00047.2010
- Michael, J. (2007). What makes physiology hard for students to learn? Results of a faculty survey. *Am. J. Physiol.* 31, 34–40. doi: 10.1152/advan.00057.2006
- Nelson, A., and Elias, K. (2023). Desirable difficulty: Theory and application of intentionally challenging learning. *Med. Educ.* 57, 123–130. doi: 10.1111/medu.14916
- Parmelee, D., Michaelsen, L., Cook, S., and Hudes, P. (2012). Team-based learning: A practical guide: AMEE Guide No. 65. *Med. Teach.* 34, 275–288. doi: 10.3109/0142159X.2012.651179
- Rehan, R., Ahmed, K., Khan, H., and Rehman, R. (2016). A way forward for teaching and learning of Physiology: Students' perception of the effectiveness of teaching methodologies. *Pakistan J. Med. Sci.* 32, 1468–1473. doi: 10.12669/pjms.326.10120
- Sánchez, J., Andreu-Vázquez, C., Lesmes, M., García-Lecea, M., Rodríguez-Martín, I., Tutor, A., et al. (2020). Quantitative and qualitative evaluation of a learning model based on workstation activities. *PLoS One* 15:e0236940. doi: 10.1371/journal.pone.0236940
- Sánchez, J., Lesmes, M., Azpeleta, C., and Gal, B. (2022). Work station learning activities (WSLA) through the ICAP framework: A qualitative study. *BMC Med. Educ.* 22:748. doi: 10.1186/s12909-022-03794-w
- Schunk, D. (2008). *Motivation in education: theory, research, and applications.* Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.

- Slominski, T., Grindberg, S., and Momsen, J. (2019). Physiology is hard: A replication study of students' perceived learning difficulties. *Adv. Physiol. Educ.* 43, 121–127. doi: 10.1152/advan.00040.2018
- Tayce, J., Saunders, A., Keefe, L., and Korich, J. (2021). The creation of a collaborative, case-based learning experience in a large-enrollment classroom. *J. Vet. Med. Educ.* 48, 14–20. doi: 10.3138/jvme.2019-0001
- Thistlethwaite, J., Davies, D., Ekeocha, S., Kidd, J., MacDougall, C., Matthews, P., et al. (2012). The effectiveness of case-based learning in health professional education. A BEME systematic review: BEME Guide No. 23. *Med. Teach.* 34, e421–e444. doi: 10.3109/0142159X.2012.680939
- Topperzer, M., Roug, L., Andrés-Jensen, L., Pontoppidan, P., Hoffmann, M., Larsen, H., et al. (2022). Twelve tips for postgraduate interprofessional case-based learning. *Med. Teach.* 44, 130–137. doi: 10.1080/0142159X.2021.1896691
- Trullàs, J., Blay, C., Sarri, E., and Pujol, R. (2022). Effectiveness of problem-based learning methodology in undergraduate medical education: A scoping review. *BMC Med. Educ.* 22:104. doi: 10.1186/s12909-022-03154-8
- Tun, S., Wellbery, C., and Teherani, A. (2020). Faculty development and partnership with students to integrate sustainable healthcare into health professions education. *Med. Teach.* 42, 1112–1118. doi: 10.1080/0142159X.2020.1796950
- van Merriënboer, J., Kester, L., and Paas, F. (2006). Teaching complex rather than simple tasks: balancing intrinsic and germane load to enhance transfer of learning. *Appl. Cogn. Psychol.* 20, 343–352. doi: 10.1002/acp.1250
- Vanags, T., George, A., Grace, D., and Brown, P. (2012). Bingo! An engaging activity for learning physiological terms in psychology. *Teach. Psychol.* 39, 29–33.
- Wood, D. (2003). Problem based learning. *BMJ* 326, 328–330.
- Zohar, A. (1995). Reasoning about interactions between variables. *J. Res. Sci. Teach.* 32, 1039–1063.



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An analysis of the psychometric properties of the writing-specific cognitive strategies questionnaire for undergraduate students

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Writing strategies are needed to manage the complexity of writing tasks, especially at university, where writing tasks are for learning, professional, or scientific purposes and are highly demanding. The literature shows that many undergraduate students have defined, stable, writing strategies, although some lack proper strategic development and require explicit instruction in this regard. In both cases, adapting writing tasks to undergraduate students' preferences and instructing them effectively requires understanding their writing strategies, which will encourage optimal learning and writing proficiency. This is why valid, reliable, writing strategy assessment tools are essential. The present study focused on the validation of the Spanish Writing Strategies Questionnaire-Undergraduate Students (WSQ-SU), aimed at measuring undergraduate students' preferences for using different writing strategies. The sample comprised 978 Spanish undergraduates doing degrees in Infant, Primary or Social Education, Pedagogy and Psychology. The data from the questionnaire was explored by means of exploratory and confirmatory analysis, test-retest reliability to analyse temporal stability and convergent validity. Two factors, planning and revising, were identified through exploratory and confirmatory factor analysis, representing different writing strategies and supporting the original model. The results indicated adequate test-retest reliability and temporal stability. The results also showed the questionnaire's convergent validity; a direct, linear correlation between two factors and off-line planning and revising variables. Based on the results, the WSQ for undergraduate students-Spanish version has been shown to be a reliable and valid, scale that can be easily applied in the university context to explore undergraduate students' writing strategies.

KEYWORDS

writing strategies, questionnaire, undergraduate students, psychometrics, validity

1 Introduction

Mastery of written composition is key to people's academic, professional and social success, and during education, writing is a basic tool both for learning other subjects and for demonstrating what has been learned (Graham and Hebert, 2011; Graham et al., 2015). Similarly, in today's information and knowledge society, how people write has an impact on their employment possibilities and advancement, and is essential in qualified professions that require written text (National Commission on Writing, 2005, 2006). In addition, at a social level, people's active participation in the information and communication technology (ICT) society increasingly demands the use of writing as a tool for communication and socialisation (National

Commission on Writing, 2005; Olson and Oatley, 2014). In other words, writing competence is a tool for learning, professional development and socio-personal communication, and is essential for personal development and fulfilment, active citizenship, social inclusion, and employment (National Commission on Writing, 2006; Graham, 2018). Consequently, one of the main purposes of the education systems in the international context, including Spain, is to promote students' written communicative competence, from initial educational stages (Spanish Education Law, LOMLOE, 2020) to university (Castelló and Castell, 2022).

Writing is a problem-solving task that places a lot of cognitive demands on the writer (Hayes, 1996), in other words it is a complex activity that takes effort. Mastering writing, in addition to automating transcription skills, requires self-regulation of high-level cognitive processes (Graham and Harris, 2000). According to the different theoretical writing models, these high-level cognitive processes refer to planning, which involves generating ideas and organising them in a textual structure following an established plan; translating, which involves transforming these ideas into a written text, including transcription skills; and the revision process, which involves reading the text and evaluating it according to the established plan in order to identify errors and edit them through any necessary corrections (Hayes and Flower, 1980; Hayes, 1996, 2011, 2012; Kellogg, 1996; Berninger, 2000; Berninger and Winn, 2006). Self-regulation of high-level cognitive processes is a critical aspect of writing and it is represented by the use of writing strategies (Zeidner et al., 2000; Santangelo et al., 2016; Puranik et al., 2019), since proper activation of planning and textual revision processes contribute to achieving higher quality written texts (Beauvais et al., 2011; Limpo et al., 2014; Limpo and Alves, 2018).

Managing the complexity of a writing task makes a writing strategy necessary (Torrance and Galbraith, 2006). Writing strategies allow writers to regulate the attention they pay to the writing processes and contribute to reducing cognitive overload (Kieft et al., 2006; Beauvais et al., 2011). Empirical research has shown that writers' strategic behaviour during composition strongly predicts the quality of "novices" and "experts" texts (Beauvais et al., 2011; Graham et al., 2017, 2019; Wijekumar et al., 2019). Accordingly, the use of writing strategies has generally been considered a critical individual writing-related variable (Kieft et al., 2008) and is a major focus of research in writing instruction (Harris et al., 2010; Graham and Harris, 2018) from the earliest stages of education (Arrimada et al., 2019) to university (MacArthur et al., 2015; Mateos et al., 2018; Granado et al., 2019; Lammers et al., 2019; MacArthur and Philippakos, 2022).

Writing strategies are understood as the way people tend to organise cognitive processes such as planning or revising (Kieft et al., 2006) or the sequence in which a writer plans, composes, revises and does other writing related activities (Torrance et al., 1999). Two dimensions are usually used to describe the differences between writing strategies. The first is related to how much writers tend to plan before writing, the second is about how much writers tend to rewrite and revise their texts. Students who follow a planning strategy prefer to have clarified their ideas before starting to write, so that they first think about and decide on content and organisation before writing, making a few drafts. Writers who prefer the revising strategy tend to use revision to develop the content of the text. Students with this profile first write a rough draft and then revise it; writing helps them to clarify their ideas and better understand their own arguments. They

are students who think while they write, so they tend to do multiple drafts (Galbraith and Torrance, 2004). There are also writers with a mixed profile, some with similar scores in both types of strategy who plan the content before producing the text, but who change it in subsequent revisions (Torrance et al., 1994). Others make little use of either strategy, producing poor quality texts with little development (Torrance et al., 1999).

University students do a lot of writing. Undergraduates have to write for academic, scientific and professional purposes (Castelló and Castell, 2022). Their writing tasks usually consist of analysing different sources of information on a subject and preparing a new written document from those sources, comparing, transforming and integrating ideas in a connected, organised way. Such synthesis tasks are hybrid activities that require writers to select information, connect it, and organise it within a new textual structure to produce new, original written discourse (Spivey and King, 1989; Spivey, 1997; Perin, 2013). Synthesis is a complex writing task requiring the mediation of planning, monitoring and reviewing strategies throughout the whole process (Flower and Hayes, 1980; Castells et al., 2023; Valenzuela and Castillo, 2023). Consequently, the writing tasks required at university are complex, with high demands on students' processing and cognitive activity. As noted above, to manage the many constraints, writers need to organise the cognitive activities involved in writing and appropriately activate writing strategies. Several studies have attempted to explore how undergraduate students vary in their use of different writing strategies. Those studies have identified differences in the use of writing strategies among undergraduate students and have also confirmed that many undergraduates' strategic writing profiles are relatively well-defined and demonstrate some stability over time and in relation to the different writing tasks (Levy and Ransdell, 1996; Biggs et al., 1999; Torrance et al., 1999, 2000; Robledo et al., 2018). From an applied or pedagogical perspective, it is essential to know what writing strategies undergraduate students use, so that writing tasks can be tailored to their abilities, and thus really contribute to learning. Determining students' writing strategy preferences can be an intermediate step on the way to identifying their (categorical) writing profiles and this is important as offering students writing tasks that match their writing profile may have a positive impact on their domain learning and may help reduce the cognitive load of writing, because planning or revising writing strategies allow the content of the text to be planned free from the demands of constructing well-formed, coherent texts (Torrance and Galbraith, 2006). Apparently, the closer the demands of the written composition task to students' writing strategies, the better their performance (Kieft et al., 2008). There is a clear pedagogic benefit to developing an understanding of undergraduates' writing strategies. However, it is important to bear in mind that a proportion of high school students do not have fully developed, persistent writing strategies when they enter university (Kieft et al., 2006). This complicates their ability to successfully cope with the writing tasks required at this educational stage, and in consequence, many undergraduates have difficulties with writing. This may have an impact on their academic achievement, professional career, and overall participation in society (Boscolo et al., 2007; Mateos and Solé, 2009; Cumming et al., 2016; Konstantinidou et al., 2023). These students require specific, explicit instruction in written composition to help them acquire—or refine and adapt their own—strategies in order to effectively deal with academic, scientific, and professional

writing tasks (MacArthur et al., 2015; Wischgoll, 2017; Graham and Harris, 2018; MacArthur and Philippakos, 2022).

All of this underscores the need to determine what writing strategies undergraduates use and what strategies they lack, especially bearing in mind that they are no longer novice writers, having accumulated considerable experience of writing through schoolwork and exams, but have typically yet to develop expertise to match that of successful professionals (Torrance et al., 2000). Doing that requires valid, reliable assessment tools. Previous studies in this field used data collected through scales or questionnaires, which may have led to biases due to self-reported estimates of writing strategies (Fidalgo and García, 2009). However, researchers using self-reporting showed that it was possible to detect individual differences between writers with self-reporting writing questionnaires (Torrance et al., 1994, 1999, 2000; Galbraith, 1996, 1999; Lavelle et al., 2002). In addition, similar results have been found by comparing questionnaire data with data obtained through online or retrospective measurements, where writers describe their writing activities during the writing process (Torrance et al., 1999). This confirms the functionality of the questionnaires for assessing students' writing strategies. In addition, questionnaires it is a feasible alternative for exploring writing strategies which would allow researchers to collect data from a representative sample size. However, the writing strategy questionnaires found in the literature review have limitations. Some of them assess general cognitive, metacognitive and/or motivational strategies applied to the field of writing, but not specific writing strategies linked directly to the core cognitive processes of writing, such as planning and revision (Lavelle et al., 2002; Raoofi et al., 2017). Other questionnaires have been designed and validated to evaluate writing strategies when writing in a second language, a task that demands the activation of some different cognitive processes from those required by writing in the mother tongue (Petrić and Czár, 2003). In some cases, the scales used have not been subjected to empirical validation processes, or at least these data are not reported in the papers (Torrance et al., 1994, 1999, 2000). Furthermore, previous studies using the questionnaire that the present study assesses—examining two writing specific strategies: *planning* and *revising*—only looked at primary and secondary education (Kieft et al., 2006, 2008; Arias-Gundín et al., 2021). This means that the questionnaire has not been validated in a Spanish-speaking university sample. Furthermore, the data from those studies produced differing results about the factorial structure of the scale, meaning it was not possible to confirm it clearly. This underscores the importance of examining the validity and psychometric properties of writing strategies questionnaires. The benefits of exploring these aspects of questionnaires about writing-specific strategies include the possibility of capturing students strategy preferences non-intrusively, exploring some aspects that remain unclear about undergraduate students' writing abilities (i.e., strategy stability), which will later allow consistent writer profiles to be established based on the core cognitive processes of writing (planning and revision) and the possibility of comparing undergraduate student outcomes according to their writing strategy preference in instructional studies as one key individual feature of adult writers.

Therefore, the main goal of this study is to analyse the validity and the factor structure of a Spanish writing-specific strategies questionnaire for Undergraduate Students (WSQ-SU) (Kieft et al., 2006, 2008), analysing the fit of the proposed factorial model based on

the traditional two-factor model: Planning and Revision (Kieft et al., 2006, 2008). The second goal of the study is to analyse the temporal stability of the questionnaire, analysing test–retest reliability. The third goal of the study is to analyse the questionnaire's convergent validity by examining the correlation between the questionnaire's writing strategy factors and off-line planning and revising measures in a synthesis task. The research question that this study aims to answer is: Does the WSQ-SU questionnaire have stable psychometric properties and a factorial structure that fit the classic cognitive models of writing, allowing valid, reliable identification of planning and revising in Spanish-speaking undergraduate students?

2 Materials and methods

2.1 Participants

The study sample consisted of 978 Spanish undergraduate students from two different Spanish Universities, obtained through convenience sampling. Most of the sample (71.38%) were women ($n=696$) and 28.62% were men ($n=286$). They were studying various degrees: Infant Education ($n=477$), Primary Education ($n=295$), Social Education ($n=138$), Pedagogy ($n=32$) and Psychology ($n=36$). This sample allowed us to address the different study aims in three phases. Table 1 shows the distribution of the sample by gender, degree, and study phase.

In the initial study phase—to analyze the factor validity of the questionnaire—the full sample was used, meaning that 978 undergraduate students were asked to complete the questionnaire during a 15-min period at the beginning of class. One year later, in the second phase of the study, a subsample of 94 Infant Education students (84 women and 10 men) were asked to complete the same questionnaire again. This allowed us to analyze stability of the questionnaire over time. Finally, in the last phase of the study—to analyze the questionnaire's convergent validity—103 university students (73.79% women and 26.21% men) were asked to complete the WSQ-SU and write a synthesis text from two source texts in a 90-min session. The majority (70.80%) were studying for a degree in Primary Education, and 29.29% were studying for a degree in Infant Education.

2.2 Procedure

The method used to translate the questionnaire was translation and back-translation of the original questionnaire by native speakers (Hambleton et al., 2005).

Data was collected with the consent of the teachers in each subject. All students participated voluntarily after providing verbal informed consent. They completed the WSQ-SU in the classroom and personal identifying data was not recorded. One of the study researchers was present during the application of the questionnaire to answer any questions the students may have had. The three phases of the study were conducted following the World Medical Association Code of Ethics (Declaration of Helsinki) (Williams, 2008).

In phase 1, all of the students in the sample were asked to complete the questionnaire during a 15-min period at the beginning of class. In phase 2, a subsample of the initial sample was asked to complete the

TABLE 1 Distribution sample of study 1 by course year, gender, and degree.

	First phase		Second phase		Third phase	
	Male	Female	Male	Female	Male	Female
Infant education	58	174	69	176		
Primary education	79	137			16	63
Social education	11	34	36	57		
Pedagogy					7	25
Psychology					6	30
Total grade	493		238		147	

same questionnaire again 1 year later. Finally, in phase 3 another subsample of the initial sample was asked to complete the WSQ-SU and write a synthesis text from two source texts in a 90-min session.

2.3 Measures

The Writing Strategies Questionnaire (WSQ-SU, see [Supplementary material](#)) is a scale with 26 items ([Kieft et al., 2008](#)). The original version examined two writing strategies with high-school students: *planning* (11 items) and *revising* (15 items). Students rate their agreement with each item on a five-point scale from 1 (*completely disagree*) to 5 (*completely agree*).

In order to assess off-line planning and revising, students were asked to write a synthesis text. They were given a piece of paper for their rough draft, another for their final text, and two source texts with scientific information related to the following topics: “ICT in university education” and “students’ free time.” *Taking notes* was measured using a scale ranging from 0 (there are no notes) to 2 (well-developed notes, whether the notes add new information, transform the ideas of the source texts, synthesise extensive information in keywords...). *Idea generation* analyses how students generate ideas using a scale from 0 (there is no draft) to 3 (the ideas appear in a list without any order and apparently unconnected). *Effective revision* is the number of effective changes made by the student from the draft to the final text. Each variable was scored by two independent raters who had been trained. The reliability of the measure was acceptable (taking notes 0.96; idea generation 0.93; effective revision 0.88).

2.4 Data analysis

In each study phase, kurtosis and skewness were assessed, with indices within ± 1 indicating normal distribution ([Valdés et al., 2019](#)). Data analysis was performed using SPSS and AMOS version 24 software.

2.4.1 Phase 1

Factor validity was determined by exploratory factor analysis (EFA), which supported the original structure of the instrument in the Spanish version. Maximum likelihood estimation methods were used and the input for each analysis was the item covariance matrix.

2.4.2 Phase 2

A test–retest study was conducted to analyse the temporal stability of the questionnaire. The correlations between the mean scores from

the two evaluation timepoints were assessed using Pearson’s correlation. In addition, a confirmatory analysis of the model was performed at test–retest time points. The model’s goodness-of-fit was evaluated using absolute indices—Chi-squared (χ^2) with its degrees of freedom (df) and the Root Mean Square Error of Approximation (RMSEA)—and relative indices—the Comparative Fit Index (CFI) and Incremental Fit Index (IFI). The following rules were used to evaluate the model’s goodness-of-fit: the ratio of chi-squared to degrees of freedom (χ^2/df) is lower than 5; CFI and IFI values above 0.90 are acceptable, and values below 0.08 for RMSEA are indicative of an acceptable fit ([Collier, 2020](#)).

2.4.3 Phase 3

Convergent validity was explored with Pearson’s correlations between the questionnaire’s writing strategies factors and the off-line planning and revising measures in the synthesis task.

3 Results

Results are structured according to the stages of the research process. The findings from phase 1 (Exploratory and Confirmatory Factor Analysis), phase 2 (Temporal Stability), and phase 3 (Convergent Validity) are described below.

3.1 Study phase 1: exploratory factor analyses

As [Table 2](#) indicates, all items demonstrated values within the range of normal distribution. The results from the KMO test, 0.76, and Bartlett’s test of sphericity, $\chi^2(66) = 2030.75$, $p < 0.000$, support the suitability of the data for use in exploratory factor analysis (EFA).

We retained the same two factors as in the original scale. The first factor, *planning strategy* has six items, reliability via Cronbach’s alpha of 0.72, and explains 23.42% of the variance. The second factor, *revising strategy* has five items, a Cronbach’s alpha of 0.70, and explains 17.84% of the variance. Each item only loads on a single factor, no cross-loadings were kept. Fifteen items were excluded because they did not fit the different factors (items 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 19, 20, 24, 25). The resulting 11-item scale had a Cronbach’s alpha of 0.71 and explained 41.26% of the variance. [Table 2](#) shows the factor loading and change in Cronbach’s alpha of the factor and the questionnaire if the item is removed, for each questionnaire item.

TABLE 2 Writing strategies questionnaire item analysis.

Item	<i>M</i>	<i>SD</i>	Min.	Max.	Sk	K	α_F	α_Q	*Factor 1 planning	*Factor 2 revising
1. When I write a text, I spend a lot of time on thinking how to approach it.	3.41	0.85	1	5	0.01	−0.21	0.70	0.66	0.56	
2. I always use an outline before I start to write.	2.44	1.21	1	5	0.47	−0.58	0.66	0.66	0.69	
3. Before writing a text, I jot down some notes on a separate piece of paper. Later, I elaborate on these notes.	3.33	1.11	1	5	−0.25	−0.72	0.63	0.64	0.75	
4. Before I start to write a text, I prefer to write down some thoughts on a separate piece of paper to discover what I think about the topic.	3.00	1.22	1	5	−0.50	−0.97	0.65	0.65	0.70	
*5. Planning a text is not useful for me.	3.98	1.07	1	5	−0.79	−0.20	0.70	0.67	0.59	
11. I have to have my thoughts clear before I'm able to start writing.	3.96	0.86	2	5	−0.46	−0.49	0.71	0.68	0.50	
18. When I reread and rewrite my text, the structure of my text changes a lot.	2.79	0.91	1	5	0.41	−0.08	0.58	0.66		0.74
21. When I rewrite my texts, the content often changes a lot.	2.55	0.84	1	5	0.54	0.30	0.58	0.67		0.77
22. When I reread my texts, sometimes they are very chaotic.	2.47	0.95	1	5	0.41	−0.29	0.60	0.68		0.65
23. I have to reread the texts I wrote, to prevent redundancies.	3.67	1.02	1	5	−0.52	−0.26	0.68	0.68		0.34
26. When I am finished writing, I reread and improve a lot: I might change a lot in my text.	3.18	0.94	1	5	0.02	−0.38	0.59	0.65		0.67

Sk, skewness; K, kurtosis. *Items recoded in the analyses. α_F , change in Cronbach's alpha of the factor the item belongs to if the item is removed; α_Q , change in Cronbach's alpha of the questionnaire if the item is removed. *Factor loadings in EFA.

3.2 Study phase 2: temporal stability

This study used a subsample of Infant Education undergraduates one year after study 1. It produced adequate test–retest reliability indices (see Table 3): planning factor $r = 0.50$ ($p < 0.001$) and revising factor $r = 0.46$ ($p < 0.001$).

In addition, to check that the model's effectiveness was not significantly affected by time, it was subjected to CFA with the sample from the second time point. As Table 4 shows, the model, in the second phase of study, had an acceptable fit to the data according to indexes evaluated, as in the previous phase of study.

3.3 Study phase 3: convergent validity

We calculated Pearson's correlations between the questionnaire's planning and revising factors and off-line measures: notes and idea generation (with planning) and effective review (with revising). The results show a direct, linear correlation between the factors and off-line variables. The planning factor demonstrated moderate correlation with both notes ($r = 0.32$, $p < 0.05$) and idea generation ($r = 0.40$, $p < 0.01$). There was a similar level of correlation between the revising factor and effective revision ($r = 0.34$, $p < 0.05$).

4 Discussion and conclusions

The goal of the present study was to analyse the factor structure and validity of the Spanish Writing Strategies Questionnaire for Undergraduate Students. Two additional goals

were to analyse the temporal stability of the questionnaire and convergent validity.

In terms of factor structure, the first goal of our study, the results were in line with the previous study using the original version of the questionnaire that identified two factors: planning and revising (Kieft et al., 2006, 2008). This bifactorial structure for the WSQ-SU was identified in the initial exploratory analysis with a large sample of undergraduate students and was confirmed by one additional confirmatory factorial analysis—with a different sample, a year after the first study. Therefore, we can conclude that the WSQ-SU presents a clear factorial structure that allows identification of undergraduate students' use of planning strategies or text revision. The factorial model proposed and validated in this study conforms to the classic theoretical assumptions of writing, which recognise the planning and text revision processes as two key core processes for learning and mastering writing (Hayes and Flower, 1980; Hayes, 1996, 2011, 2012; Kellogg, 1996; Berninger, 2000; Berninger and Winn, 2006), the management of which demands self-regulated implementation of writing strategies (Graham and Harris, 2000; Zeidner et al., 2000; Santangelo et al., 2016; Puranik et al., 2019). In addition, the proposed model's bifactorial structure is consistent with previous studies in the field of writing strategies that have identified two common strategic profiles in writers, one of a planning nature and the other of a revising type (Torrance et al., 1994, 1999; Galbraith and Torrance, 2004; Kieft et al., 2006, 2008). However, our study indicates that the WSQ-SU—with 26 items in its original form—is more robust if some items that do not clearly saturate any of the factors are eliminated. The model proposed in our study offers a final scale with 11 items and presents adequate reliability. This is in line with a previous study using the questionnaire in its original English version confirming its efficacy

and functionality with fewer (10) items (Kieft et al., 2006). However, a detailed analysis of both studies would be needed in the future, analyzing the content of the items that do not saturate on any factor to see if they are the same in both linguistic contexts. Furthermore, it would be advisable to restate the theorem that supports the proposal of a bi-factor scale that assesses planning and revising. In this case, it is important to bear in mind the fact that the planning and revising processes are recursive and can occur before or during translation, so they can be split into multiple subprocesses: online and advance planning, post-translation and online revision (Berninger and Swanson, 1994). These subprocesses seem to develop at different rates, so that as writers develop, they are more able to activate the most complex subprocesses (advanced planning and post-translation) (Berninger et al., 1992; Berninger and Swanson, 1994; Berninger et al., 1996). The factorial structure of the questionnaire that was proposed in the theoretical model that supports the present study could be complemented with some other factor that addresses the specific subprocesses within planning and revising, as has been demonstrated in studies with primary students in which the questionnaire exhibits a four-factor structure (Arias-Gundín et al., 2021).

The results related to the second study objective, assessing the temporal stability of the questionnaire, indicate adequate test–retest reliability indices for the planning and revising factors. This confirms that the questionnaire allows valid, reliable and stable identification of undergraduate students' use of planning and revising strategies. This means that there is now a tool for evaluating appropriate writing strategies in the Spanish-speaking context, complementing other versions of the questionnaire that have been validated with students in primary education (Arias-Gundín et al., 2021).

Finally, the results in relation to the third study objective allow us to conclude that the questionnaire presents adequate convergent validity. There was a correlation between the planning and revising indices offered by the questionnaire and the specific planning and revising measures obtained off-line from the analysis of the activation of these processes by students while performing specific writing tasks (in this case, synthesis tasks). These results are in line with results from

previous studies demonstrating the potential of questionnaires to, on the one hand, effectively measure the writing strategies used by students—offering data similar to that offered by other types of off-line and on-line assessment tools (Torrance et al., 1999, 2000)—and on the other hand, detect individual differences between writers with self-reporting writing questionnaires (Torrance et al., 1994, 1999, 2000; Galbraith, 1996, 1999; Lavelle et al., 2002).

Development of reliable measurement tools in all scientific fields has a critical prior step: validation (Muñiz and Fonseca-Pedrero, 2019). The major contribution of this study is the validation of the Spanish Writing Strategies Questionnaire for Undergraduate Students, indicating that it is a suitable tool for reliably and easily assessing undergraduate students' writing strategies. Validation of the Spanish Writing Strategies Questionnaire for Undergraduate Students is a first step toward reliable analysis of undergraduate students' use of writing strategies in the context of university writing tasks. This will continue with the analysis of aspects that have not yet been examined such as the interaction between undergraduates' use of strategies and other key writing-related variables in dealing with writing tasks in the university context, and the moderating effect of writing strategies on synthesis task strategic instruction in university classrooms. In addition, because undergraduate writing behaviour can be adaptive and because undergraduates can vary their strategies or develop progressively more sophisticated strategic profiles depending on demands of tasks or contexts (Torrance et al., 2000), it would also be interesting to analyse how sensitive the WSQ-SU is in identifying possible variations in undergraduates' writing-strategy use considering the different task and contextual variables that may affect the differential activation of these strategies.

Finally, from an educational standpoint, evaluating undergraduates' strategic writing profiles can be important in several ways. Knowing students' writing strategies will allow teachers to propose writing-to-learn tasks tailored to students' abilities, which may help reduce the cognitive load of writing and may therefore have a positive impact on students' domain learning (Torrance and Galbraith, 2006; Kieft et al., 2008). In addition, evaluating undergraduates' writing strategies will

TABLE 3 Writing strategies questionnaire Item analysis at test–retest time-points.

Item	Test					Retest				
	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>K</i>	α_F	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>K</i>	α_F
Planning factor					0.71					
1.	3.14	0.89	0.10	−0.15	0.70	3.63	0.72	0.34	−0.50	0.74
2.	2.64	1.25	0.32	−0.95	0.67	2.55	1.14	0.33	−0.67	0.73
3.	3.38	1.22	−0.23	−0.97	0.61	3.43	1.08	−0.50	−0.23	0.68
4.	3.00	1.23	−0.11	−0.99	0.67	3.24	1.24	−0.22	−1.10	0.70
^a 5.	3.91	1.05	−0.39	−1.19	0.70	4.05	1.08	−0.68	−0.75	0.73
11.	3.89	1.02	−0.70	−0.04	0.68	3.99	0.83	−0.43	−0.47	0.76
Revising factor					0.78					
18.	2.83	1.00	0.22	−0.39	0.71	3.07	0.92	0.36	−0.44	0.68
21.	2.60	0.93	0.41	0.06	0.71	2.69	1.05	0.36	−0.21	0.68
22.	2.64	1.08	0.29	−0.70	0.74	2.54	1.05	0.45	−0.38	0.79
23.	3.69	0.93	−0.50	−0.16	0.82	3.83	1.01	−0.67	−0.05	0.70
26.	3.15	1.03	0.30	−0.40	0.73	3.38	1.03	−0.10	−0.72	0.69

Sk, skewness; *K*, kurtosis. ^aItems recoded in the analyses. α_F , change in Cronbach's alpha of the factor the item belongs to if the item is removed.

TABLE 4 Goodness of fit indexes for model proposed at test–retest time-points.

Model (n)	χ^2/df	CFI	IFI	RMSEA (IC 90%)
Phase 1 (978)	4.68	0.90	0.90	0.06
Phase 2 (94)	2.12	0.90	0.89	0.08

allow identification of poor or poorly defined strategic profiles, which may underlie some students’ writing difficulties (Kieft et al., 2006; Boscolo et al., 2007; Mateos and Solé, 2009; Cumming et al., 2016; Konstantinidou et al., 2023) and complicate how they cope with and succeed in writing tasks. In turn, this will guide the design and implementation of instructional programs that promote students’ strategic writing development (MacArthur et al., 2015; Graham and Harris, 2018; MacArthur and Philippakos, 2022). Thus, the WSQ-SU may be a useful tool that can help give teachers information about their students’ strategies and consequently adapt writing tasks to the students’ writing profiles or help them to adapt writing instruction to their students’ needs. In any case, knowing and considering students’ strategic writing profiles will encourage their academic achievement, as well as their learning and mastery of writing—key elements in academic success, proper socio-personal adjustment, and successful professional careers. In relation to this last point, our study looked at undergraduates studying for degrees in Education, Psychology and Pedagogy. Their professional lives will, in many cases, be aimed at teaching writing. Given those professional profiles, it is even more important and interesting to understand and optimise their writing skills and strategies, since the characteristics or internal variables of future teachers, including their strategic profiles, could mediate their future professional practice when they are teaching novice writers (Graham, 2018; Sánchez-Rivero et al., 2021; Wang and Troia, 2023).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The requirement of ethical approval was waived by Comité de ética University of León for the studies involving humans. The studies were conducted in accordance with the local legislation and institutional requirements. All students agreed to participate voluntarily after verbal informed consent was obtained.

References

Arias-Gundín, O., Real, S., Rijlaarsdam, G., and López, P. (2021). Validation of the writing strategies questionnaire in the context of primary education: a multidimensional measurement model. *Front. Psych.* 12, 1–9. doi: 10.3389/fpsyg.2021.700770

Arrimada, M., Torrance, M., and Fidalgo, R. (2019). Effects of teaching planning strategies to first-grade writers. *Br. J. Educ. Psychol.* 89, 670–688. doi: 10.1111/bjep.12251

Beauvais, C., Olive, T., and Passerault, J. M. (2011). Why are some texts good and others not? Relationship between text quality and management of the writing processes. *J. Educ. Psychol.* 103, 415–428. doi: 10.1037/a0022545

Berninger, V. W. (2000). Development of language by hand and its connections with language by ear, mouth and eye. *Lang. Disord.* 20, 65–84. doi: 10.1097/00011363-200020040-00007

Author contributions

OA-G: Formal analysis, Methodology, Writing – original draft, Writing – review & editing. PR: Conceptualization, Funding acquisition, Investigation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1274478/full#supplementary-material>

Berninger, V. W., and Swanson, H. L. (1994). “Modifying Hayes and flower’s model of skilled writing to explain beginning and developing writing” in *Children’s Writing: Toward a Process Theory of the Development of Skilled Writing*. ed. E. C. Butterfield, vol. 2 (Greenwich, CT: JAI Press), 57–81.

Berninger, V. W., Whitaker, D., Feng, Y., Swanson, H. L., and Abbott, R. D. (1996). Assessment of planning, translating, and revising in junior high writers. *J. Sch. Psychol.* 34, 23–52. doi: 10.1016/0022-4405(95)00024-0

Berninger, V. W., and Winn, W. (2006). “Implications of advancements in brain research and technology for writing development, writing instruction, and educational evolution” in *Handbook of Writing Research*. eds. C. A. MacArthur, S. Graham and J. Fitzgerald (New York: Guilford Press), 96–114.

- Berninger, V. W., Yates, C. M., Cartwright, A. C., Rutberg, J., Remy, E., and Abbott, R. D. (1992). Lower-level developmental skills in beginning writing. *Read. Writ.* 4, 257–280. doi: 10.1007/BF01027151
- Biggs, J., Lai, P., Tang, C., and Lavelle, E. (1999). Teaching writing to ESL graduate students. A model and an illustration. *Br. J. Educ. Psychol.* 69, 293–306. doi: 10.1348/000709999157725
- Boscolo, P., Arfe, B., and Quarisa, M. (2007). Improving the quality of students' academic writing: an intervention study. *Stud. High. Educ.* 32, 419–438. doi: 10.1080/03075070701476092
- Castelló, M., and Castell, L. (2022). *Escribir en la Universidad Española: Entre la Realidad y el Deseo*. Barcelona: Octaedro.
- Castells, N., Minguella, M., and Nadal, E. (2023). Writing a synthesis versus reading: strategies involved and impact on comprehension. *Read. Writ.* 36, 849–880. doi: 10.1007/s11145-022-10341-y
- Collier, J. E. (2020). *Applied Structural Equation Modeling Using Amos. Basic to Advanced Techniques*. New York: Routledge.
- Cumming, A., Lai, C., and Cho, H. (2016). Students' writing from sources for academic purposes: a synthesis of recent research. *J. Engl. Acad. Purp.* 23, 47–58. doi: 10.1016/j.jeap.2016.06.002
- Fidalgo, R., and García, J. N. (2009). Evaluating metacognition in written composition. *Estud. Psicol.* 30, 51–72. doi: 10.1174/021093909787536290
- Flower, L., and Hayes, J. R. (1980). "The dynamics of composing: making plans and juggling constraints" in *Cognitive Processes in Writing*. eds. L. W. Gregg and E. R. Steinberg (New Jersey: Lawrence Erlbaum Associates), 31–49.
- Galbraith, D. (1996). "Self-monitoring, discovery through writing, and individual differences in drafting strategy" In *Theories, Models and Methodology in Writing Research*, (Eds.) G. Rijlaarsdam, Bergh H. van den and M. Couzijn UK: University Press, 121–141.
- Galbraith, D. (1999). "Writing as a knowledge-constituting process," In *Studies in Writing: Knowing What To Write: Conceptual Processes in Text Production*, (Eds.) G. Rijlaarsdam and E. Esperet (Series Eds.), D. Galbraith and M. Torrance (Vol. 4) (UK: University Press), 139–159.
- Galbraith, D., and Torrance, M. (2004). "Revision in the context of different drafting strategies" in *Revision: Cognitive and Instructional Processes. Studies in Writing*. eds. G. Rijlaarsdam, L. Allal, L. Chanquoy and P. Largy (Nederland: Kluwer), 63–85.
- Graham, S. (2018). A revised writer(s)-within-community model of writing. *Educ. Psychol.* 53, 258–279. doi: 10.1080/00461520.2018.1481406
- Graham, S., Collins, A. A., and Rigby-Wills, H. (2017). Writing characteristics of students with learning disabilities and typically achieving peers: a meta-analysis except. *Child* 83, 199–218. doi: 10.1177/0014402916664070
- Graham, S., and Harris, K. R. (2000). The role of self-regulation and transcription skills in writing and writing development. *Educ. Psychol.* 35, 3–12. doi: 10.1207/S15326985EP3501_2
- Graham, S., and Harris, K. (2018). "Evidence-based writing practices: a meta-analysis of existing meta-analysis" in *Design Principles for Teaching Effective Writing: Theoretical and Empirical Grounded Principles*. eds. R. Fidalgo, K. Harris and M. Braaksma (Leiden: Brill Editions), 13–37.
- Graham, S., Harris, K. R., Fishman, E., Houston, J., Wijekumar, K., Lei, P. W., et al. (2019). Writing skills, knowledge, motivation, and strategic behaviour predict students' persuasive writing performance in the context of robust writing instruction. *Elem. Sch. J.* 119, 487–510. doi: 10.1086/701720
- Graham, S., and Hebert, M. (2011). Writing to read: a meta-analysis of the impact of writing and writing instruction on reading. *Harv. Educ. Rev.* 81, 710–744. doi: 10.17763/haer.81.4.t2k0m13756113566
- Graham, S., Hebert, M., and Harris, K. R. (2015). Formative assessment and writing: a meta-analysis. *Elem. Sch. J.* 115, 523–547. doi: 10.1086/681947
- Granado, M., Mateos, M., Martín, E., and Cuevas, I. (2019). Teaching to write collaborative argumentative syntheses in higher education. *Read. Writ.* 32, 2037–2058. doi: 10.1007/s11145-019-09939-6
- Hambleton, R. K., Merenda, P. F., and Spielberger, C. D. (2005). *Adapting Educational and Psychological Tests for Cross-Cultural Assessment*. UK: Lawrence Erlbaum.
- Harris, K. R., Santangelo, T., and Graham, S. (2010). "Metacognition and strategies instruction in writing" in *Metacognition, Strategy Use, and Instruction*. eds. H. S. Waters and W. Schneider (NY: The Guilford Press), 226–256.
- Hayes, J. R. (2011). Kinds of knowledge-telling: modeling early writing development. *J. Writ. Res.* 3, 73–92. doi: 10.17239/jowr-2011.03.02.1
- Hayes, J. R. (2012). Modelling and remodelling writing. *Writ. Commun.* 29, 369–388. doi: 10.1177/0741088312451260
- Hayes, J. R. (1996). "A new framework for understanding cognition and affect in writing" in *The Science of Writing: Theories, Methods, Individual Differences, and Applications*. eds. C. M. Levy and S. Ransdell (New Jersey: Lawrence Erlbaum Associates), 1–27.
- Hayes, J. R., and Flower, L. (1980). "Identifying the organization of writing processes" in *Cognitive Processes in Writing: An Interdisciplinary Approach*. eds. L. Gregg and E. Steinberg (UK: Lawrence Erlbaum Associates), 3–30.
- Kellogg, R. T. (1996). "A model of working memory in writing" in *The Science of Writing: Theories, Methods, Individual Differences and Applications*. eds. C. M. Levy and S. Ransdell (UK: Lawrence Erlbaum Associates), 57–71.
- Kieft, M., Rijlaarsdam, G., and Van den Bergh, H. (2006). Writing as a learning tool: testing the role of students' writing strategies. *Eur. J. Psychol. Educ.* 21, 17–34. doi: 10.1007/BF03173567
- Kieft, M., Rijlaarsdam, G., and van den Bergh, H. (2008). An aptitude treatment interaction approach to writing-to-learn. *Learn. Instruct.* 18, 379–390. doi: 10.1016/j.learninstruc.2007.07.004
- Konstantinidou, L., Madlener-Charpentier, K., Opacic, A., Gautschi, C., and Hoefele, J. (2023). Literacy in vocational education and training: scenario-based reading and writing education. *Read. Writ.* 36, 1025–1052. doi: 10.1007/s11145-022-10373-4
- Lammers, A., Goedhart, M., and Avraamidou, L. (2019). Reading and synthesising science texts using a scientific argumentation model by undergraduate biology students. *Int. J. Sci. Educ.* 41, 2323–2346. doi: 10.1080/09500693.2019.1675197
- Lavelle, E., Smith, J., and O'Ryan, L. (2002). The writing approaches of secondary students. *Br. J. Educ. Psychol.* 72, 399–418. doi: 10.1348/000709902320634564
- Levy, C. M., and Ransdell, S. (1996). "Writing signatures" in *The Science of Writing. Theories, Methods, Individual Differences and Applications*. eds. C. M. Levy and S. Ransdell (UK: Lawrence Erlbaum Associates), 149–161.
- Limpot, T., and Alves, R. (2018). Effects of planning strategies on writing dynamics and final texts. *Act. Psychol.* 188, 97–109. doi: 10.1016/j.actpsy.2018.06.001
- Limpot, T., Alves, R. A., and Fidalgo, R. (2014). Childrens' high level writing skills: development of planning and revising and their contribution to writing quality. *Br. J. Educ. Psychol.* 84, 177–193. doi: 10.1111/bjep.12020
- MacArthur, C. A., and Philippakos, Z. (2022). "Supporting students' writing from sources at college entry" in *Handbook of Research on Writing Instruction Practices for Equitable and Effective Teaching*. ed. T. Hodges (Hershey: IGI Global), 338–358.
- MacArthur, C., Philippakos, Z., and Ianetta, M. (2015). Self-regulated strategy instruction in college developmental writing. *J. Educ. Psychol.* 107, 855–867. doi: 10.1037/edu0000011
- Mateos, M., Martín, E., Cuevas, I., Villalón, R., Martínez, I., and González-Lamas, J. (2018). Improving written argumentative synthesis by teaching the integration of conflicting information from multiple sources. *Cogn. Instr.* 36, 119–138. doi: 10.1080/07370008.2018.1425300
- Mateos, M., and Solé, I. (2009). Synthesizing information from various texts: a study of procedures and products at different educational levels. *Eur. J. Psychol. Educ.* 24, 435–451. doi: 10.1007/BF03178760
- Muñoz, J., and Fonseca-Pedrero, E. (2019). Ten steps for test development. *Psicothema* 31, 7–16. doi: 10.18682/pd.v11i.854
- National Commission on Writing (2005). *Writing: A Powerful Message from State Government*. NY: College Board.
- National Commission on Writing (2006). *Writing and School Reform*. NY: College Board.
- Olson, D., and Oatley, K. (2014). The quotation theory of writing. *Writ. Commun.* 31, 4–26. doi: 10.1177/0741088313515164
- Perin, D. (2013). Literacy skills among academically underprepared students. *Commun. Coll. Rev.* 41, 118–136. doi: 10.1177/0091552113484057
- Petrić, B., and Czár, B. (2003). Validating a writing strategy questionnaire. *System* 31, 187–215. doi: 10.1016/S0346-251X(03)00020-4
- Puranik, C. S., Boss, E., and Wanless, S. (2019). Relations between self-regulation and early writing: domain specific or task dependent? *Early Child Res. Q.* 46, 228–239. doi: 10.1016/j.ecresq.2018.02.006
- Raofi, S., Miri, A., Gharibi, J., and Malaki, B. (2017). Assessing and validating a writing strategy scale for undergraduate students. *J. Lang. Teach. Res.* 8, 624–633. doi: 10.17507/jltr.0803.23
- Robledo, P., Arias-Gundín, O., Palomo, M., Andina, E., and Rodríguez, C. (2018). Perfil escritor y conocimiento metacognitivo de las tareas académicas en los estudiantes universitarios. *Publica* 48, 197–217. doi: 10.30827/publicaciones.v48i1.7335
- Sánchez-Rivero, R., Alves, R. A., Limpot, T., and Fidalgo, R. (2021). Analysis of a survey on the teaching of writing in compulsory education: teachers' practices and variables. *Rev. Españ. Pedag.* 79, 321–340. doi: 10.22550/REP79-2-2021-01
- Santangelo, T., Harris, K., and Graham, S. (2016). "Self-regulation and writing" in *Handbook of Writing Research*. eds. C. A. MacArthur, S. Graham and J. Fitzgerald (2nd ed (New York: Guilford Press), 174–193.
- Spanish Education Law, LOMLOE. (2020). Ley Orgánica 3/2020, de 29 de Diciembre, Por la Que se Modifica la Ley Orgánica 2/2006, de 3 de Mayo, de Educación, BOE Núm. 340. Available at: <https://www.boe.es/buscar/doc.php?id=BOE-A-2020-17264>
- Spivey, N. (1997). *The Constructivist Metaphor: Reading, Writing, and the Making of Meaning*. NY: Academic Press.
- Spivey, N., and King, J. (1989). Readers as writers composing from sources. *Read. Res. Quart.* 24, 7–26. doi: 10.1598/RRQ.24.1.1
- Torrance, M., and Galbraith, D. (2006). "The processing demands of writing" in *Handbook of Writing Research*. eds. C. A. MacArthur, S. Graham and J. Fitzgerald (NY: The Guilford Press), 67–80.
- Torrance, M., Thomas, G. V., and Robinson, E. J. (1994). The writing strategies of graduate research students in the social sciences. *High. Educ.* 27, 379–392. doi: 10.1007/BF03179901

- Torrance, M., Thomas, G. V., and Robinson, E. J. (1999). Individual differences in the writing behaviour of undergraduate students. *Br. J. Educ. Psychol.* 69, 189–199. doi: 10.1348/000709999157662
- Torrance, M., Thomas, G. V., and Robinson, E. J. (2000). Individual differences in undergraduate essay writing strategies. A longitudinal study. *High. Educ.* 39, 181–200. doi: 10.1023/A:1003990432398
- Valdés, A. A., García, F. I., Torres, G. M., Urías, M., and Grijalva, C. S. (2019). *Medición en Investigación Educativa con Apoyo del SPSS y AMOS*. Madrid: Clave Editorial.
- Valenzuela, Á., and Castillo, R. D. (2023). The effect of communicative purpose and reading medium on pauses during different phases of the textualization process. *Read. Writ.* 36, 881–908. doi: 10.1007/s11145-022-10309-y
- Wang, H., and Troia, G. (2023). How students writing motivation, teachers' personal and professional attributes and writing instruction impact students writing achievement: a two level hierarchical linear modelling study. *Front. Psych.* 14:1213929. doi: 10.3389/fpsyg.2023.1213929
- Wijekumar, K., Graham, S., Harris, K. R., Lei, P. W., Barkel, A., Aitken, A., et al. (2019). The roles of writing knowledge, motivation, strategic behaviours, and skills in predicting elementary students' persuasive writing from source material. *Read. Writ.* 32, 1431–1457. doi: 10.1007/s11145-018-9836-7
- Williams, J. R. (2008). Revising the declaration of Helsinki. *World Med. J.* 54, 120–125.
- Wischgoll, A. (2017). Improving undergraduates, and postgraduates' academic writing skills with strategy training and feedback. *Front. Educ.* 2:33. doi: 10.3389/educ.2017.00033
- Zeidner, M., Boekaerts, M., and Pintrich, P. R. (2000). "Self-regulation: directions and challenges for future research" in *Self-regulation: Theory, research, and applications*. eds. P. Boekaerts, R. Pintrich and M. Zeidner (Massachusetts: Academic Press), 749–768.



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The photographic heritage as a motivational resource to learn and teach history

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This article, linked to the research of new methods for teaching history, has as its main objective to analyse the motivation of future primary school teachers regarding the use of photographic heritage in the teaching of historical content. This investigation is based on a teaching experience carried out in the 22/23 academic year with 266 primary education student teachers, in which a key episode in the history of Spain is explored via a series of photographs. Data collection was done through a Likert-type questionnaire, which the students answered after the activity, with a response scale of 1 to 4 with some qualitative open-ended questions. Responses were also examined using the SPSS27 statistical programme. The results show how the analysis and interpretation of the photographs, as well as the activities developed from them, are a motivating resource for most of the participants. The latter consider photographs suitable, on the one hand, for their personal development, and on the other, for their professional training, since it allows them to design innovative and creative history teaching-learning programmes.

KEYWORDS

photography, heritage, teaching-learning, motivation, historical thinking

1 Introduction

One of the most distinctive features of society and, undoubtedly, one of the key characteristics of current lifestyles, is the mass use of photography in both the public and private spheres (Batchen, 2004). It is curious, however, that in our visual world we continue to overlook the fact that the photographic image uses a language that conveys a certain type of information that must be interpreted and decoded (Kossoy, 2014); although they currently play a passive role, photographs could become an active agent in the transformation of our cultural system. Yet, as noted by various authors (Iglesias, 2009; Pantoja, 2010; Rodríguez De Las Heras, 2010; Sáiz, 2013; Gómez and López, 2014; García, 2016), there are as yet few educational programmes that include the study and understanding of the complex phenomenon of the image in real teaching and learning scenarios, at least, in the Spanish educational context, where this study was conducted. However, as we will try to show in this study in the case of history teaching, photographic heritage can be used as a learning resource, as long as teachers have the capacity to provide students with the necessary tools.

The photographer and historian Freund (1974) put forward an argument, of relevance here, about the impact of the image on all spheres of reality, writing that since its inception in the mid-nineteenth century, the influence of photography on our society “lies in the fact that it is not just a creation, but, above all, one of the most effective means of shaping our ideas and

influencing our behaviour” (10). Thus, taking as a starting point this intriguing proposal by Freund which still resonates today, we can argue that photography has gradually modified our behaviour, not only in terms of our relationship with images, but also in terms of how we use them to narrate our past, present, and future (Sontag, 2008; Benjamin, 2013; Kossoy, 2014). It is therefore appropriate to reflect as teachers on the necessity and benefits of incorporating photographic documents into standard classroom practice.

Photography is analysed as a means of artistic expression and, at the same time, as testimony of a context and a culture of production (Pantoja, 2010; Rodríguez De Las Heras, 2010; Kossoy, 2014; García, 2016) that place observers in a specific moment, showing them in a particular manner how and where they can look. Thus, it can be argued that when we work with and analyse a photographic image, we find ourselves before a document—a heritage item and a historical source, as De Las Heras (2015) notes—that certainly ought to be researched, investigated, and contextualised in order for its full iconic and iconological significance to be understood. Furthermore, it may be studied not just as the medium of an image, but also as the medium of memory, given its key feature (distinguishing it from other historical sources) of having the “technical ability to suspend time and centre space in an instant” (Pantoja, 2010, 186), in such a way that allows us to continually recover, or perhaps just evoke, events or moments that we wish to preserve. Visualising these memories in a photograph is, therefore, one more way of remembering, of not forgetting a past that has unobtrusively entered these images, which the person who is aware of this presence can interpret or read.

Thus, photographic heritage undoubtedly has enormous educational potential, arising from its nature as a graphic document and historical source, as Pagès (2021). We therefore believe that history teaching ought to incorporate photography and develop a range of methodologies to respond to the inevitable particularities of each image. Above all, these teaching practices ought to be motivating for students, given that, as described in various studies (Sáiz, 2013; Gómez and López, 2014; Bel, 2017; García-Vera, 2019; Muñoz, 2019; Ponsoda López de Atalaya and Blanes Mora, 2020), it is not enough to simply project a collection of photographs onto the board, or comment briefly on what is depicted in this or that photograph. If the aim is to teach history in the classroom through photographs, what is really meaningful is to ask ourselves what we want from them, how we can make them talk, that is, how our students can activate their knowledge, their experience and their curiosity so that photographs recover their documentary and informative value (Fontcuberta, 2016). Thus, in order to motivate our students to correctly interpret a photograph, and use it in the future as a resource in the classroom, as Pantoja (2010) points out, it is essential to provide them with a previous formative experience where they have had contact with the photographic image in a reflective and active learning context.

For Riego (2019), who has worked on this subject for decades, interpreting a visual source correctly depends on the ability of teachers to get their students to relate the image to the culture that produced it, which ultimately involves visual documents being understood as vestiges or signs of a past that requires appropriate treatment. In this respect, and with a view to making interdisciplinary connections with other educational studies on the use of images in higher education, we adopt the model proposed by Arqué i Bertran (2002) having observed that, in the analysis and contextualisation of photographs in the classroom, it is crucial that the role of the

student—who in this case is an observer—is active. An active role influences students’ motivation when analysing the document, as they will be responsible for accessing the value system that each photo symbolises. The way they view it will determine the decisions made as they interpret both visible and invisible elements, and also the different dialectic relationships that can be identified, such as identity-otherness, change-continuity, and cause-consequence, to reveal the emotional weight that any historical document is capable of transmitting, assuming it has been adequately preserved and, above all, is accessible in order to be interpreted again.

Yet photography, as a mass phenomenon of contemporary culture, has generated a new vernacular language that needs to be labelled in order to be understood, has become saturated—and in many cases eclipsed—by a form of memory that cannot be read critically (Sánchez Moreno, 2011). Its message and even its documentary value has been cancelled out as it has been influenced by new social practices and, of course, by ignorance of the medium itself, by “that cloud of futile instantaneity” (Sánchez Moreno, 2011, 43). Moreover, Didi-Huberman’s (2020) convincing and illustrative description of this context, which ought to put us on our guard, holds that “never has the image suffered so many ruptures, so many contradictory claims, and so many interlinking rejections, immoral manipulations and moralising condemnations” (29). In such a context, as a discipline that subscribes to new forms of critical teaching, the field of social science teaching must ask itself what the meaning of photography is, what we can understand by the photographic act today, and of course, what relationship it has with memory and critical thinking (Sáiz, 2013; Gómez and Miralles, 2015; Muñoz, 2019). Put another way, and in reference to Fontcuberta, (2016) well-known thesis, in our current context shaped by the iconic universe, a minimal understanding of the power of the photographic image is only possible if one adopts a participatory attitude, that is, if we look in order to reflect. Thus, a particularly urgent issue, and one which our students must know how to respond to, does not concern what “we conceive of as fiction, but rather what we perceive as truth” (De la Nuez, 2010, 14).

In this sense, Gudín and Chávarri (2019) find that if historical research is based on a holistic and transversal perspective—whether analysing written or object sources—photography, as described here, ought to be seen as a source to be studied and analysed in the same critical way as other historical sources, that is, applying a rigorous critical reading technique, as described by Burke (2001). It could be argued that the possibility of bringing history closer by means of photographic heritage will depend on how useful this historical document is for the construction of a future historical narrative (De Las Heras, 2015). Seeing and treating the image as a source of memory thus allows a particular approach to the historical events depicted and studied in the image, and, as noted by Santisteban et al. (2010), “puts the student in direct contact with the past” (120). This visualisation of history thus facilitates critical understanding among students, and therefore their motivation may also increase—a key concern of this paper—by allowing them to acquire historical thinking skills since, as already noted, the student will be the main author of this narrative. In reality, the photographic image encourages reflection and analytical and critical thinking (Ponsoda López de Atalaya and Blanes Mora, 2020) when it is used in an interdisciplinary, participative, and active context, as we will attempt to demonstrate here. We agree with Company (2004) that

thinking about photographs “must therefore address the ways in which these different points of view and places are always assimilated, conveyed and combined—consciously and unconsciously—by creators and spectators” (12). Consequently, this research will attempt to relate different studies (Kossoy, 2014; Chicote, 2020; Ponsoda López de Atalaya and Blanes Mora, 2020) with the objective, not only to demonstrate how photographic heritage can be a didactic tool, but also how it can be a motivating resource for the classroom, stimulating creativity and critical and empathetic thinking.

The teaching experience described in the following sections took place in a teacher training context, specifically in a master’s degree programme in primary education. We consider it important to carry out innovative teaching experiences such as these, in which student teachers are given models for reflection and practice that allow them to adequately internalise the methodological knowledge that they will have to apply themselves in the classroom (López Facal et al., 2017). Concepts such as memory or heritage, and familiarity with visual sources, will help them in this important task (Sáiz, 2013; Gómez and Miralles, 2015; Muñoz, 2019; Chicote, 2020; Cotán Fernández et al., 2022). Therefore, we aim to discover how these university students learn and what motivates them to learn, and whether this experience increases or has little impact on their motivation. The great pioneer of photography Mathew Brady suggested that the camera is the “eye of history,” and it will play this role if given a place in the classroom, bringing historical testimony to stand before the eyes of the present. We believe that teachers will use photography correctly and appropriately if they understand its status as a visual source, if they reflect on its characteristics and possibilities for history teaching and, above all, if they look with the intention of understanding both what a photograph shows and its context.

2 Materials and methods

2.1 Objectives and hypothesis

The main objective of this teaching experience is to discover and study the impact of using photographic heritage as a teaching tool on the motivation of student primary school teachers. To meet this objective, four specific objectives (SOs) were developed:

SO 1: To evaluate the motivation of the sample group with regards to the strategies and processes of the training programme.

SO 2: To analyse the motivation of the student teachers when they use photographic heritage as a resource for teaching history.

SO 3: To establish what the student teachers feel is their motivation for using photographic heritage in relation to history learning aims.

SO 4: To highlight the benefits and difficulties associated with the use of photography for history teaching and learning.

This study is based on the hypothesis that photographic heritage is not being used or valued by student primary school teachers as an additional resource for history teaching, that they do not see it as a useful and motivational tool for innovate teaching. Therefore, we ask the following research questions: Do student teachers see photographic heritage as a motivating teaching tool for history lessons? What is their perception of their own motivation to teach using photographic heritage in the social sciences?

2.2 Participants and context

The research presented here is based on a purposive sample selection of third-year student teachers on a bachelor’s degree primary education programme at the University of Alicante.

The sample comprises 266 student primary school teachers ($n=266$) taking the course “Social Science Teaching: History.” We conducted our study in the framework of this course. The sample was made up of 80 men (30.1 percent) and 185 women (69.5 percent), and the average age was 21.1 years.

2.3 An educational programme using photographic heritage to learn history

The aim of our educational experience was for the students to start valuing photographic heritage as a useful and motivating resource for history teaching. To this end, we designed an activity with three distinct phases.

In the first phase, we presented a specific historical context through the use of seven iconic photographs documenting the coup d’état that took place in Spain in 1981, organised in a sequence that the teachers had already seen. The task we proposed was a descriptive and systematic analysis of the images through questions such as: What do you see in each image? What do you see in each image to make you think like that?

Once the visual analysis had been completed, the second phase began, which involved carrying out an investigative discussion-based activity, based on a series of questions focusing particularly on conceptual and historical aspects. The aim in this case was for the students to investigate and reflect not just on the images, but also on the historical, cultural, and political context captured in the photographs. In this way, by analysing this sequence of photographs it was possible to access the deeper meaning of the images. As the photographs were the only historical source available to the students at that moment, they had to critically analyse and interpret them, infer ideas, and read the photographs as historical evidence, as Riego (2019) describes.

The third and final phase of the educational experiment involved participants working individually to narrate the historical events studied in the photographs. Students could choose the perspective they considered best, based of course on the knowledge acquired in preceding phases, and using the photographic sequence they had analysed. The objective was for the students to take an active role in their own learning and appreciate the possible pedagogical benefits of using photographs to teach history in an authentic and meaningful way.

2.4 Instrument design and validation, and the research process

Once the participants had completed the training on using photography as a tool for teaching history, they filled in a questionnaire on the teaching and learning process that had been designed for this study. Both qualitative and quantitative, the questionnaire design is similar to that used in recent studies in the field of social science teaching (Moreno-Vera et al., 2021; Moreno-Vera and Martínez-Leguizamón, 2022).

The questionnaire comprised 22 items divided into three blocks. Blocks 2 and 3, which are quantitative, were based on Likert scales of 1 to 4 (from “not useful at all” to “very useful,” and from “strongly disagree” to “strongly agree”).

The first block, which is qualitative, concerns the training programme, and the second block focuses on the utility of the activity presented. Finally, the third block—which is the focus of the present paper—contains items relating to the motivation of the participants (item 9 and items 13 to 22) with reference to three aspects: motivation in relation to the training programme (SO 1), to the teaching resources (SO 2), and to educational objectives (SO 3).

Here, we list all the items included in the instrument to provide an overview of the study:

- Item 1 (open). Explain why you think this activity has been useful for your training.
- Item 2 (open). Explain why you think this activity has been useful for your professional future.
- Item 3 (open). Explain what you see as the positive aspects of using photography in history teaching and learning.
- Item 4 (open). Explain what you see as the negative aspects of using photography in history teaching and learning.
- Item 5. I think analysis of the photographic sequence has been: 1 – not useful at all, 2 – somewhat useful, 3 – useful, 4 – very useful.
- Item 6. I think the research on the causes and consequences has been: 1 – not useful at all, 2 – somewhat useful, 3 – useful, 4 – very useful.
- Item 7. I think that giving my opinion on the coup d'état (why it failed, what it means, etc.) has been: 1 – not useful at all, 2 – somewhat useful, 3 – useful, 4 – very useful.
- Item 8. I think that narrating the event has been: 1 – not useful at all, 2 – somewhat useful, 3 – useful, 4 – very useful.
- Item 9. The activity analysing the photographic sequence has been motivating.
- Item 10. The activity researching the causes and consequences has been motivating.
- Item 11. The activity giving an opinion on the coup d'état (why it failed, what it means, etc.) has been motivating.
- Item 12. The activity of narrating the event has been motivating.
- Item 13. The way of presenting and working on the topic has motivated me to discover more about it.
- Item 14. Working with photographs has improved my motivation to learn and apply myself in class.
- Item 15. My motivation has improved because I understand my social, political, and cultural context better.
- Item 16. The topic and the way of working on it through photography has improved my motivation to get better grades.
- Item 17. I felt motivated because I could contribute my point of view or own knowledge.
- Item 18. I felt motivated because we used resources other than textbooks.
- Item 19. I felt motivated because I was able to take the lead in my own learning.
- Item 20. I felt motivated to design my own activities based on photography when I become a teacher.
- Item 21. I felt motivated because I think the activity is useful for my professional future.

- Item 22. I felt motivated because I think the activity is useful for my current teacher training.

In terms of the validation of the construct, Cronbach's alpha test gave a result of 0.908, which indicates a high level of reliability and therefore a high level of internal consistency ($0.9 > 1$ represents an outstanding level of reliability according to studies by [Oviedo and Campo-Arias, 2005](#)).

Furthermore, the Guttman split-half coefficient test was carried out, giving a result of 0.839, which supports the high level of internal reliability of each of the items on the evaluation scale, as also seen in other mixed studies in the field of social sciences, for example [Gestsdóttir et al. \(2018\)](#) and [Gómez-Carrasco et al. \(2019, 2020\)](#).

Since the questionnaire is a mixed instrument, with open and closed items, Friedman's chi-square validation test was carried out to establish the validity of the quantitative items, and if these affect the qualitative responses. In this case, the result was 186,377, showing that there is no dependence between items, as also shown in other mixed studies, where a result of >0.05 is considered positive in qualitative items ([Satorra and Bentler, 2010](#); [Sharpe, 2015](#); [Moreno-Vera et al., 2020](#)).

Finally, in relation to the research process, it is important to note that participation in the study was voluntary, questionnaire responses were anonymised, and the study followed the ethical guidelines set out by the University of Alicante, where it was carried out. All participants were informed of and gave consent to the statistical processing of the data. The training programme was carried out during social science classes, under the aegis of appropriately qualified teachers. Data collection and the analysis of results was carried out using the statistical software package IBM SPSS v. 24, in the case of the descriptive statistical results of the questionnaire, while the qualitative items were analysed using the programme AQUAD 7 ([Huber, 2013](#)), with the variables developed based on the narratives of the participants. Regarding the qualitative analysis, a coding structure was carried out based on the variables that appeared in the narratives of the participants in the study. For their analysis, the Absolute Frequency (AF) and the percentage of this (% AF) have been taken into account.

3 Results

3.1 Motivation of participants in relation to the training programme (items 9, 13, 17 and 19)

Results related to SO 1, analysing the motivation of the student teachers in relation to the training programme, were generally positive. In fact, a descriptive statistical analysis of mean and standard deviation (all items have a SD <1) shows that the first variable (Item 9. The activity analysing the photographic sequence has been motivating; [Table 1](#)) has a mean of 3.26 (Likert scale of 1 to 4), meaning that participants do see the teaching experience as motivating. Results show that 42.5 percent of participants agreed, and a further 42.5 percent strongly agreed, that this activity was motivational, while only 13.9 percent and 1.1 percent disagreed and strongly disagreed, respectively.

Similarly, for the second variable (item 13. The way of presenting and working on the topic has motivated me to discover more about it;

TABLE 1 Item 9. The activity of analysing the photographic sequence has been motivating.

VAR00001					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	3	1,1	1,1	1,1
	2	37	13,9	13,9	15,0
	3	113	42,5	42,5	57,5
	4	113	42,5	42,5	100,0
	Total	266	100,0	100,0	

TABLE 2 Item 13. Working from photographs has improved my motivation to learn and work harder in class.

VAR00002					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	4	1,5	1,5	1,5
	2	28	10,5	10,5	12,0
	3	92	34,6	34,6	46,6
	4	142	53,4	53,4	100,0
	Total	266	100,0	100,0	

Table 2), in reference to the structure and planning of the teaching activity, the mean is also positive, at 3.40. In this case, the percentage of participants who strongly agree is even higher, reaching 53.4 percent of the sample, while 34.6 percent agree.

The mean of item 17 (I felt motivated because I could contribute my point of view or own knowledge; Table 3) is also positive at 3.30. Thus, 45.1 percent of participants agreed strongly and 41.7 percent agreed that it was motivational to contribute their point of view and make historical arguments throughout the exercise. These data are in line with studies in which historical thinking skills are applied together with the method of source-based investigation (Prats Cuevas, 2001; Cooper and Chapman, 2009).

Finally, the mean for item 19 (I felt motivated because I was able to take the lead in my own learning; Table 4) was 3.39, with 49.1 percent of participants strongly agreeing with this statement, 41.1 percent agreeing, and just 9.4 percent disagreeing. This result shows that, in general, student teachers feel motivated when they themselves investigate and build their own historical knowledge via sources and active learning methodologies (Gómez-Carrasco et al., 2018).

3.2 Motivation relating to teaching resources used in the activity (items 14, 18 and 20)

In terms of SO 2 of this study, concerning analysis of motivation relating to the materials—mainly photographs—used in the teaching activities, we also find positive results. Again, standard deviation was positive as none of the items exceeded the value of 1, which allows us to confirm the coherence of the participants' responses.

In relation to item 14 (Working with photographs has improved my motivation to learn and apply myself in class; Table 5) the mean was a positive result of 3.32 points, with almost half of the sample

(48.5 percent) strongly agreeing that they felt motivated when using photography as a teaching resource in history lessons, and a further 36.5 percent agreeing.

Item 18 (I felt motivated because we used resources other than textbooks; Table 6) gained the best results of the study: a mean of 3.56, with 61.7 percent of participants strongly agreeing, and 32.3 percent agreeing, meaning only 6 percent disagreed.

Last, item 20 (I felt motivated to design my own activities based on photography when I become a teacher; Table 7) is pertinent as it reflects that the learning will be applied in the future when they start working as teachers. The mean value is 3.35, with 87.9 percent (47.7 percent strongly agreeing, and 40.2 percent agreeing) of student teachers feeling motivated by being able to design their own practical activities using photography as the main teaching resource, since it helps them to generate an active learning context, as we will try to exemplify in the following sections.

3.3 Motivation relating to the teaching objective (items 15, 16, 21 and 22)

The last block of results relates to SO 3, which analyses teachers' motivation in relation to the aim of carrying out teaching activities based on photography.

Here, standard deviation again shows a positive and coherent result, with all variables at <1.

Item 15 (My motivation has improved because I understand my social, political, and cultural context better; Table 8) shows good results and offers interesting potential. The mean value is 3.38, and 89.4 percent of participants agree (40.2 percent) or strongly agree (49.2 percent) with this statement. This shows that working with sources in the classroom helps students to think historically and develop cognitive associations between materials from the past and

TABLE 3 Item 17. I was motivated because I could contribute with my own point of view or knowledge.

VAR00006					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	6	2,3	2,3	2,3
	2	29	10,9	10,9	13,2
	3	111	41 m7	41,7	54,9
	4	120	45,1	45,1	100,0
	Total	266	100,0	100,0	

TABLE 4 Item 19. I have been motivated because I have been able to be the protagonist of my own learning.

VAR00008					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	1	,4	,4	,4
	2	24	9,0	9,0	9,4
	3	110	41,4	41,4	50,8
	4	131	49,2	49,2	100,0
	Total	266	100,0	100,0	

TABLE 5 Item 14. Working from photographs has improved my motivation to learn and work harder in class.

VAR00003					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	5	1,9	1,9	1,9
	2	35	13,2	13,2	15,0
	3	97	36,5	36,5	51,5
	4	129	48,5	48,5	100,0
	Total	266	100,0	100,0	

TABLE 6 Item 18. I have been motivated because we have used resources other than the textbook.

VAR00007					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	2	16	6,0	6,0	6,0
	3	86	32,3	32,3	38,3
	4	164	61,7	61,7	100,0
	Total	266	100,0	100,0	

events occurring in the present day (Moreno-Vera and Sánchez-Ibáñez, 2022).

Item 16 (The topic and the way of working on it through photography has improved my motivation to get better grades; Table 9) confirms a high level of motivation among participants to gain higher grades with a mean of 3.07 (though this is the lowest mean of the study), and 45.1 percent agreeing with this statement. It is striking that, compared to the other items, a relatively high proportion (22.5 percent) of student teachers disagreed with this statement, since

their motivation did not depend on the final grade received for the course.

In relation to item 21 (I felt motivated because I think the activity is useful for my professional future; Table 10) the mean value of responses is 3.50 out of 4, with 59.4 percent of students strongly agreeing with this statement. This result is in line with responses to item 20, where they indicated feeling motivated by learning how to design their own activities with a view to using photography as a classroom resource in the future.

TABLE 7 Item 20. It has motivated me to design my own activities based on photography when I become a teacher.

VAR00009					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	3	1,1	1,1	1,1
	2	29	10,9	10,9	12,0
	3	107	40,2	40,2	52,3
	4	127	47,7	47,7	100,0
	Total	266	100,0	100,0	

TABLE 8 Item 15. My motivation has improved because I have a better understanding of the social, political and cultural reality with which I am in contact.

VAR00004					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	2	,8	,8	,8
	2	26	9,8	9,8	10,5
	3	107	40,2	40,2	50,8
	4	131	49,2	49,2	100,0
	Total	266	100,0	100,0	

TABLE 9 Item 16. The subject and the way of working on it through photographs has improved my motivation to get better grades.

VAR00005					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	8	3,0	3,0	3,0
	2	52	19,5	19,5	22,6
	3	120	45,1	45,1	67,7
	4	86	32,3	32,3	100,0
	Total	266	100,0	100,0	

TABLE 10 Item 21. I have been motivated because I consider the activity useful for my professional future.

VAR00010					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	2	,8	,8	,8
	2	20	7,5	7,5	8,3
	3	86	32,3	32,3	40,6
	4	158	59,4	59,4	100,0
	Total	266	100,0	100,0	

Finally, item 22 (I felt motivated because I think the activity is useful for my current teacher training; Table 11) is also in line with the two previous responses. In this case, the mean value is very high at 3.55, with 94 percent of student teachers either agreeing (32.3 percent) or strongly agreeing (61.7 percent). Just 6 percent think that the activity will not be useful as part of the teaching training they are receiving.

3.4 Positive aspects of using photography to teach history

In relation to the open questions used in the instrument, the first focused on student teachers' opinions regarding the positive aspects of introducing photography in history teaching and learning (Positive

TABLE 11 Item 22. I have been motivated because I consider the activity useful for my personal development.

VAR00011					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Válido	1	1	,4	,4	,4
	2	15	5,6	5,6	6,0
	3	86	32,3	32,3	38,3
	4	164	61,7	61,7	100,0
	Total	266	100,0	100,0	

TABLE 12 Positive aspects of using photography for teaching history.

Aspectos positivos	FA (Frecuencia absoluta)	Porcentaje
Facilita la comprensión de conceptos históricos	132	30.5
Posibilidad de trabajar con fuentes históricas	60	13.8
Trabajar la empatía y la perspectiva histórica	57	13.2
Aproxima al alumnado a la historia	47	10.8
Facilita la implementación de metodologías activas	41	9.7
Aumenta la motivación y el interés del alumnado	38	8.8
Permite el análisis y desarrollo del pensamiento crítico	22	5
Permite superar los contenidos del libro de texto	13	3
Permite trabajar conceptos de cambio y continuidad	11	2.5
Facilita llevar a cabo un aprendizaje significativo	8	1.8
Permite trabajar conceptos de causa y consecuencia	4	0.9
	433	100%

aspects of using photography to teach history; Table 12). A total of 433 responses were obtained (see [Supplementary material](#)). These were categorised according to 11 codes or variables relating to working on concepts associated with the development of historical thinking (change and continuity, causes and consequences), critical thinking, the possibility of developing active methodologies, and improving on established textbook-based content, among others.

Of the variables accounting for a higher number of responses, that relating to photography facilitating understanding of historical concepts stands out, representing a total of 30.5 percent of all coded responses. The response of student P.0156, for example, states that the use of photography “helps you to understand and remember events in a more precise and concrete way, because they are very visual images which you can remember easily, especially when you study them and look for the information you need to write about the photographs.”

Then, 13.8 percent of the responses singled out the potential of photographs as a means of working with primary historical sources in the classroom, allowing teachers to tackle issues of empathy and historical perspective. For example, participant P.038 notes that “photography puts you in direct contact with historical sources, the student works in an active way, it is a way to boost their motivation, allow them to be researchers, and improve their critical thinking.” Meanwhile, participant P.204 highlights that photography allows students to understand historical events through “empathy, being able

to feel part of that moment, understand how things were, much more than just listening to a lesson.” Of the responses obtained, 10.8 percent show, importantly, that images bring history closer to students; as participant P.049 notes, they “let you bring the boys and girls closer to the period and the event [...]”

Another of the study’s codes relates to the main topic of this paper, it is closely linked to the study and to analysis of photographs as a resource for improving students’ motivation. Nonetheless, this code represents only 8.8 percent of the responses obtained. A good example is the response of participant P.0231: “Using photographs in the classroom leads to increased motivation and interest among students, since the visual aspect of the images is more intriguing than any other resource. Also, this pedagogical tool is highly versatile thanks to its easy incorporation into all subjects on the curriculum.” Similarly, P.075 notes that “photography is a good methodology to motivate and incentivise students, because the vast majority of schools work with textbooks, and so using a different kind of material could be positive for students.”

3.5 Difficulties and limitations of using photography to teach history

The second of the qualitative items focused on responses relating to the difficulties and limitations of working with photographs in the classroom (Difficulties and limitations of using photography to teach

TABLE 13 Difficulties and limitations in using photography to teach history.

	Dificultades y limitaciones	FA (Frecuencia absoluta)	Porcentaje
1	Análisis e interpretación de la fotografía	77	28.9
2	Ninguno	43	16.2
3	Selección de imágenes en relación al contenido y al nivel del alumnado	33	12.4
4	Contextualización de la fotografía	24	9
5	La necesidad de complementar la información con otras fuentes y/o recursos	20	7.5
6	La parcialidad de la información que proporciona	13	4.8
7	Las diferentes interpretaciones	13	4.8
8	La calidad de la fotografía	11	4.1
9	La necesaria formación docente	11	4.1
10	La fotografía condiciona el pensamiento previo	9	3.8
11	Imposibilidad de trabajar etapas previas a la contemporánea	7	2.6
12	El tiempo que requiere su trabajo en el aula	5	1.8
		266	100%

history; Table 13). There were 266 responses, which were classified using 12 codes. The code with the highest proportion of responses was related to the difficulty in adequately analysing and interpreting the images, accounting for 28.9 percent of responses. For example, participant P.060 wrote: “[...] it should be noted that the photographs must be accompanied by guidance and explanations from the teacher, since students may not know how to interpret them well,” while P.094 suggested that students “may not know how to interpret and analyse the photograph and the elements it contains.” However, 16.7 percent of respondents do not see any problems with using photographs to teach history.

Following these two codes, which have the highest percentage of responses, one of the main difficulties reported (with 12.4 percent of responses) was selecting images appropriate for the topics to be worked on and for the educational level of the students. Participant P.068, for example, highlights that “you have to know how to choose age-appropriate images.” Another key aspect is the need to contextualise the photograph in order to work on it properly (9 percent of responses); as P.0145 notes, “the context of the images must be explained very well and from different perspectives.” Then, 7.5 percent of participants noted the importance of supplementing the information provided by the images with other types of sources and resources. Participant P.0179 commented that “a historical source like a photograph may not be enough to study certain concepts or historical events, and it should be accompanied by other sources or types of documents.”

The variables with lower numbers of responses relate to the diversity of interpretations that an image can generate, the quality of the images, the teacher training needed to be able to use this resource well, the possibility that an image could condition the students’ thinking, the inability to study periods prior to the invention of photography, or the time needed to adequately use the methodology in the classroom.

4 Discussion

Firstly, this research is exploratory in nature and we have chosen to develop a qualitative methodology from an interpretative approach, since this method is one of the main research strategies in educational

contexts (Atkins and Wallace, 2012). It should also be noted that data are also quantified for a better understanding of them. We can say that this study has achieved its main objective of analysing the motivation of student teachers when using photography as evidence and a teaching resource in history lessons. Although the main hypothesis of the research has been tested, given that the photographic image can be a motivating resource for teaching history, the limitations of this type of research, since it is circumscribed to a single activity and, above all, to a small sample of students, in fact, this study is the first step in a broader investigation that should be related to active learning methodologies that make possible a critical teaching of history. At the same time, the present study is an approach to a complex subject and we consider that it requires further qualitative research, not only with the use of questionnaires, but also with other qualitative methodologies.

Anyhow, the tests carried out have shown that the research instrument had a high level of reliability, both internal and between items, and the results obtained in relation to the specific objectives have been generally very positive.

In relation to SO 1, concerning the motivation of student teachers in relation to the training programme, it is notable that all the items analysed had a positive mean greater than 3 out of 4. It is interesting to see that participants were motivated by two aspects in particular: on the one hand, being able to give their point of view as part of the learning process while researching via historical sources (Prats Cuevas, 2001; Cooper and Chapman, 2009; Seixas and Morton 2013), and on the other hand, being able to actively create their own knowledge, going beyond standard history lessons where the unidirectional, passive transmission of knowledge predominates (Gómez-Carrasco et al., 2018; Gómez et al., 2023).

SO 2 concerns the motivation of student teachers in relation to the kind of resources used in the classroom experience, mainly photography as a historical source. Here, the results were also positive, with the means of all items surpassing 3 out of 4. Item 18 (I felt motivated because we used resources other than textbooks; Table 6) stood out: students see working with teaching resources other than a textbook as especially motivating. This is important given that textbooks remain the most widely used resource among social science teachers (Bel-Martínez and Colomer-Rubio, 2018).

In terms of SO 3, which aimed to analyse the motivation of participants in relation to learning goals, it should be highlighted that, again, mean values are positive and surpass 3 out of 4, with items 15 and 21 standing out (My motivation has improved because I understand my social, political, and cultural context better; Table 8; I felt motivated because I think the activity is useful for my professional future; Table 10). The first shows that the use of photography has motivated participants by allowing them to apply historical knowledge acquired in daily life, and so to establish relationships between past and present, and to understand the different political, social, and cultural situations of each period (Moreno-Vera and Sánchez-Ibáñez, 2022). Furthermore, in general, participants reported feeling motivated by the training programme, seeing it as a positive and innovative resource that they will draw on when designing activities for their history classes.

In relation to the last objective, SO 4, which focuses on the benefits and limitations of using photography in the classroom for history teaching and learning, it has been demonstrated that motivation is one of the most positive aspects when using photographic heritage in history teaching, possibly because it allows a greater understanding of the phenomenon under study thanks to its visual language—a hypothesis in line with outcomes for other resources such as comics (Moreno-Vera et al., 2021). Thus, we argue that students will feel more motivated to learn history through images, as some of the accounts collected in this study suggest. Yet we believe that there is no single reason for this motivation; multiple factors contribute to it, such as using active methodologies, going beyond the rigid content offered by some textbooks, and prioritising understanding of historical thinking concepts such as the use of historical sources, empathy, and historical perspective. It is of note that the student participants did not find using photographs well in the classroom to be straightforward, therefore, we see the need for a trained body of teachers who are able to guide the students to analyse and interpret photographs, and who are also able to select materials well. In other words, visual literacy acquires great relevance for the training of future teachers, because, in order to understand a photographic image, in a teaching context, we need to recognise its main characteristics.

Finally, the results reflect motivation and a positive predisposition on the part of the student teachers towards using photography as a historical source and as a learning tool in the classroom. Using this methodology would allow their future students to understand history through evidence (Seixas and Morton, 2013) and by investigating and working in groups (Prats Cuevas, 2001), while also identifying complex relationships through which they may understand the multiple connections that exist between past and present events.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Comité de Ética de la Universidad de Alicante. The patients/participants provided written informed consent to participate in this study.

Author contributions

SP-LA: Data curation, Investigation, Methodology, Writing – original draft. RB-M: Conceptualization, Investigation, Methodology, Writing – original draft. JM-V: Formal analysis, Methodology, Software, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2023.1270851/full#supplementary-material>

References

- Arqué i Bertran, M. (2002). “Las fuentes documentales fotográficas en la Didáctica de las Ciencias Sociales” in *Primeras Jornadas Imagen, Cultura y Tecnología*. eds. P. Amador, J. Robledano and M. Ruiz (Madrid: Editorial Archiviana), 275–283.
- Atkins, L. Y., and Wallace, S. (2012). *Qualitative research in education*. UK: SAGE Publishing
- Batchen, G. (2004). *Arder en deseos. La concepción de la fotografía* Barcelona: Gustavo Gili.
- Bel, J. C. (2017). Imagen y libros de texto de Historia en Educación Primaria: estudio comparativo a partir de un análisis cualitativo. *Rev. Educ.* 377, 82–112. doi: 10.4438/1988-592X-RE-2017-377-354
- Bel-Martínez, J. C., and Colomer-Rubio, J. C. (2018). Teoría y metodología de investigación sobre libros de texto: análisis didáctico de las actividades, las imágenes y los recursos digitales en la enseñanza de las Ciencias Sociales. *Revista Brasileira de Educação*. 23, 1–23. doi: 10.1590/S1413-24782018230082
- Benjamin, W. (2013). *La obra de arte en la época de su reproducción mecánica* Madrid: Casimiro Libros.
- Burke, P. (2001). *Eyewitnessing. The uses of images as historical evidence*. Cornell University Press Reaktion Books.
- Company, D. (2004). “Los lugares de Victor Burgin (o los placeres de Vértigo a 9.000 metros)” in *Ensayos*. ed. V. Burgin (Barcelona: Gustavo Gili), 7–17.
- Chicote, F. G. (2020). Aprender investigando: la imagen de las mujeres republicanas en la prensa gráfica durante la guerra civil española (1936-1939). In E. Higuera, A. Villaverde and S. Chaves (Coord.), *El pasado que no pasa: la Guerra Civil Española a los ochenta años de su finalización*. Ediciones de la Universidad de Castilla-La Mancha. Cuenca: (pp 353–374)
- Cooper, H., and Chapman, A. (2009). *Constructing history 11–19*. UK: SAGE Publishing.
- Cotán Fernández, A., Ruiz-Bejarano, A., and Álvarez Díaz, K. (2022). Innovando en educación: la foto-elicitación como estrategia de aprendizaje en las instituciones de Educación Superior. *Márgenes, Revista de Educación de la Universidad de Málaga* 3, 137–153. doi: 10.24310/mgnmar.v3i2.14104
- De la Nuez, I. (2010). *Blow up, blow up*. Periférica.
- De Las Heras, B. (2015). Testimoniando con imágenes. La fotografía en el estudio de la historia. *Fotocinema* 10, 27–55. doi: 10.24310/Fotocinema.2015.v0i10.5978
- Didi-Huberman, G. (2020). “Cuando las imágenes tocan lo real” in *Cuando las imágenes tocan lo real*. eds. G. Didi-Huberman, C. Chéroux and J. Arnaldo (Madrid: Círculos de Bellas Artes), 23–52.
- Fontcuberta, J. (2016). *La furia de las imágenes: Notas sobre la postfotografía* Barcelona: Galaxia Gutenberg.
- Freund, G. (1974). *La fotografía como documento social* Barcelona: Gustavo Gili.
- García, M. (2016). La fotografía como fuente histórica. *Iber: Didáctica de las ciencias sociales, geografía e historia*. 84, 47–52.
- García-Vera, A. (2019). *La fotografía en la formación del profesorado* Barcelona: Narcea.
- Gestsdóttir, S. M., Van Bostel, C., and Van Drie, J. (2018). Teaching historical thinking and reasoning: construction of an observation instrument. *Br. Educ. Res. J.* 44, 960–981. doi: 10.1002/berj.3471
- Gómez, C. J., Hinojo-Lucena, F. J., Moreno-Vera, J. R., and Alonso-García, S. (2023). Analysis of a forced blended-learning program in social sciences higher education during the COVID-19 post-pandemic. *Educ. Train.* 65, 298–311. doi: 10.1108/ET-06-2022-0246
- Gómez, C. J., and López, A. M. (2014). Las imágenes de los libros de texto y su función en la enseñanza de la Historia. Diseño de un instrumento de análisis. *Enseñanza de las Ciencias Sociales* 13, 17–29 doi: 10.1344/ECCSS2014.13.2.
- Gómez, C. J., and Miralles, P. (2015). ¿Pensar históricamente o memorizar el pasado? La evaluación de los contenidos históricos en la educación obligatoria en España. *Revista de Estudios Sociales* 52, 52–68. doi: 10.7440/res52.2015.04
- Gómez-Carrasco, C. J., Monteagudo, J., Moreno-Vera, J. R., and Sáinz, M. (2019). Effects of a gamification and flipped-classroom program for teacher in training on motivation and learning perception. *Educ. Sci.* 9:299. doi: 10.3390/educsci9040299
- Gómez-Carrasco, C. J., Monteagudo, J., Moreno-Vera, J. R., and Sáinz, M. (2020). Evaluation of a gamification and flipped-classroom program used in teacher training: perception of learning and outcome. *PLoS One* 15:e0241892. doi: 10.1371/journal.pone.0241892
- Gómez-Carrasco, C. J., Ortuño-Molina, J., and Miralles-Martínez, P. (2018). *Enseñar Ciencias Sociales con métodos activos de aprendizaje. Reflexiones y propuestas a través de la indagación* Barcelona: Octaedro.
- Gudín, E., and Chávarri, S. (2019). Fotografía en el aula para el desarrollo del pensamiento histórico. *Didáctica de las ciencias experimentales y sociales* 37, 19–36. doi: 10.7203/dces.37.13316
- Huber, G. L. (2013). *AQUAD7-analysis of qualitative data* Tübingen: University of Tübingen.
- Iglesias, M. (2009). Fotografías antiguas e historia local: una experiencia de investigación histórica con alumnado de secundaria. *Iber: Didáctica de las ciencias sociales, geografía e historia* 60, 115–123.
- Kossov, B. (2014). *Lo efímero y lo perpetuo en la imagen fotográfica* Madrid: Cátedra.
- López Facal, R., Miralles Martínez, P., Prats, J., and Gómez Carrasco, C. J. (2017). Educación histórica y desarrollo de competencias. R. López, P. Miralles and J. Prats (Dirs.) C. J. Gómez (Coord.). *Enseñanza de la historia y competencias educativas* Barcelona. Graó (pp.7–22).
- Moreno-Vera, J. R., and Martínez-Leguizamo, J. (2022). Welcome refugees! The use of cultural heritage to teach democratic values. *Sustain. For.* 14:13466. doi: 10.3390/su142013466
- Moreno-Vera, J. R., Ponsoda-López de Atalaya, S., and Blanes-Mora, R. (2021). By Toutatis! Trainee teachers' motivation when using comics to learn history. *Front. Psychol.* 12:778792. doi: 10.3389/fpsyg.2021.778792
- Moreno-Vera, J. R., Ponsoda-López de Atalaya, S., López-Fernández, J. A., and Blanes-Mora, R. (2020). Holistic or traditional conceptions of heritage among early-childhood and primary trainee teachers. *Sustain. For.* 12:8921. doi: 10.3390/su12218921
- Moreno-Vera, J. R., and Sánchez-Ibáñez, R. (2022). “Historical thinking skills and cognitive levels in Spanish high school history textbooks” in *Cases on historical thinking and gamification in social studies and humanities education*. eds. M. Martínez-Hita, C. J. Gómez and P. Miralles (US: IGI-Global)
- Muñoz, J. (2019). Fotografía, memoria e identidad. *Revista de comunicación de la SEECI* 49, 123–140. doi: 10.15198/seeci.2019.49.123-140
- Oviedo, H. C., and Campo-Arias, A. (2005). An approach to the use of cronbach's alfa. *Rev. Colomb. Psiquiatr* 34, 572–580.
- Pagés, J. (2021). La formación del profesorado de Historia y Ciencias Sociales. *Nuevas Dimensiones* 8, 57–67. doi: 10.53689/nv.vi8.42
- Pantoja, A. (2010). La fotografía Como recurso Para la didáctica de la Historia/the photography as a resource for teaching history. *Tejuelo* 9, 179–194.
- Ponsoda López de Atalaya, S., and Blanes Mora, R. (2020). La fotografía como fuente histórica en el aula. Análisis de una metodología para la enseñanza de la Historia en la Educación Superior. *Didáctica de las ciencias experimentales y sociales* 39, 17–30. doi: 10.7203/dces.39.16078
- Prats Cuevas, J. (2001). *Enseñar historia: notas para una didáctica renovadora*. Extremadura: Junta de Extremadura.
- Riego, B. (2019). Las imágenes como fenómeno cultural: una necesaria mirada en etapas para abordar los retos actuales. *Historia y Memoria de la Educación* 10, 17–49. doi: 10.5944/hme.10.2019.22348
- Rodríguez De Las Heras, A. (2010). L'ús pedagògic de la fotografia històrica/ pedagogical use of historical photography. *Educació i Història: Revista d'Història de l'Educació* 15, 41–54.
- Sáiz, J. (2013). Alfabetización histórica y competencias básicas en libros de texto de historia y en aprendizajes de estudiantes. *Didáctica de las ciencias experimentales y sociales* 27, 43–66.
- Sánchez Moreno, J. (2011). La fotografía, el espejo con memoria. *Con-ciencia social: anuario de didáctica de la geografía, la historia y las ciencias sociales* 15, 37–46.
- Santisteban, A., González-Monfort, N., and Pagés, J. (2010). Una investigación sobre la formación del pensamiento histórico. In R. Ávila, P. Rivero and P. Domínguez, (Coord.) *Metodología en investigación en didáctica de las ciencias sociales*. Zaragoza: Institución Fernando el Católico-Asociación Universitaria de Profesorado de Didáctica de las Ciencias Sociales.
- Satorra, A., and Bentler, P. M. (2010). Ensuring positiveness of the scaled difference chi-square test statistic. *Psychometrika* 75, 243–248. doi: 10.1007/s11336-009-9135-y
- Seixas, P., and Morton, T. (2013). *The Big Six Historical Thinking Concepts*. Toronto: Nelson College Indigenous.
- Sharpe, D. (2015). Chi-square test is statistically significant: now what? *Pract. Assess. Res. Eval.* 20, 1–10. doi: 10.7275/tbfa-x148
- Sontag, S. (2008). *Sobre la fotografía*. Barcelona: Penguin Random House Grupo Editorial.



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Academic emotions, college adjustment, and dropout intention in university students

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Introduction: In recent years, due to the COVID-19 pandemic, the entrance and development of university life has become a complex process, making it relevant to investigate which variables could facilitate the adaptation of young people to university. This study aimed to analyze academic emotions and their prediction of university adaptation and intention to drop out.

Methods: The study was quantitative, explanatory, and cross-sectional. A total of 295 university students participated. Academic emotions were assessed with the short version of The Achievement Emotions Questionnaire, adaptation to university life with the reduced version of the Student Adjustment to College Questionnaire, and intention to drop out with three items designed to measure this variable.

Results: Differences were identified in the emotions experienced during classes and study by students according to the year of entry. We found that males report experiencing emotions such as enjoyment and hope more during evaluations.

Discussion: Generally, students report positive emotions in their academic experience. Positive emotions predict adaptation to university life and the intention to study.

KEYWORDS

academic emotions, adjustment to university life, university dropout, university students, higher education

1 Introduction

Due to the consequences generated by the COVID-19 pandemic, students entering universities during the last years presented essential changes in how they experienced their university entrance. In this context, academic adaptation has been considered a fundamental problem for today's educational system (Shamionov et al., 2023). This set of changes in young people has been overwhelming and has had significant effects on various aspects of their training, especially on how they adapted to university life and the effects of this on university dropout.

Adapting to university life has been defined as the student's ability to adjust effectively to the challenges encountered in the new university environment (Crede and Niehorster, 2012). This variable is considered an important indicator of academic success and permanence of students (Pérez et al., 2020). For the achievement of an adequate integration into

university life, empirical evidence has shown that contributing to the adaptation of young student's elements such as emotions, wellbeing, and perception of support is essential for their development, and this is because during the transition processes students experience emotions such as anxiety, hopelessness, worry, and stress (Chan and Rose, 2023; Hako et al., 2023). Adaptation to university life is critical to permanence and depends, from the student's point of view, on the social experiences and resources that the student uses at the university (Van Rooij et al., 2018).

When students have difficulties adapting to university, they may present thoughts associated with dropping out of their studies (Galve-González et al., 2022). Dropping out of university studies is one of the current problems of higher education (López-Angulo et al., 2023). Figures in Chile, where this study was conducted, show that the student dropout rate increased by two percentage points in 2020, exceeding 25% (SIES, 2021). The COVID-19 pandemic had a significant impact on the educational system. In this case, it generated a negative impact in terms of the social and academic experiences of young people when entering their university careers, affecting the academic performance of students, their achievements, and their emotional wellbeing (Casanova et al., 2022; Galve-González et al., 2022).

The intention to abandon studies is considered an early warning sign of university dropout, and it is possible to characterize it by feelings of apathy toward studies manifested by non-attendance to classes, procrastination in the delivery of work or not taking exams (Jacobo-Galicia et al., 2021). It can also be defined as those ideas, desires, and intentions associated with the possibility of withdrawing from one's career before graduating or leaving a higher education institution (Díaz-mujica et al., 2018).

In recent years, research has sought to contribute to identifying issues related to students' educational experiences in the aftermath of the COVID-19 pandemic. In this regard, a recent bibliometric review indicated that mental health and wellbeing were among the most researched topics in the university context during the pandemic (Aristovnik et al., 2023). In that line, research has shown how academic emotions contribute significantly to the adaptation and success of university students (Zhang et al., 2021). Additionally, it has been found that students who experienced the remote teaching emergency produced by the pandemic have reported a more significant presence of negative emotions such as anxiety, stress, and boredom, which may impact their adaptation process (Wu et al., 2022).

1.1 Academic emotions in university students

Emotions are an intrinsic part of everyday life for all human beings and are ubiquitous in academic settings (Pekrun, 2016), yet over the years, educational researchers have tended to neglect the role they play in students' lives, focusing exclusively on cognitive, motivational, and behavioral constructs (Ganotice et al., 2016). The emotions correspond to a multidimensional process of short duration that generates diverse responses in the organism as a reaction to internal or external stimuli with biological, behavioral, and cognitive implications (García-Álvarez et al., 2019).

To understand the importance of emotions in academia, it is essential to recognize that they involve sets of coordinated

psychological processes that include affective, cognitive, physiological, motivational and expressive components (Pekrun, 2016), having particular relevance the cognitive component of every emotional process, which consists of the interpretation and evaluation of objects, situations or people, to which neurophysiological reactions are associated (Bzuneck, 2018).

The connection between teaching-learning processes and emotions has given rise to the concept of "academic emotions," which is understood as those emotional experiences (e.g., enjoyment, pride, anxiety) that are directly related to academic learning, classroom instruction, and performance (Pekrun and Perry, 2014). These emotions can be grouped according to their valence of activation. Valence refers to the extent to which an emotion is experienced as pleasant or unpleasant. At the same time, the activation dimension determines the state of physiological arousal, distinguishing between activating and deactivating emotions (Martínez-López et al., 2021b).

According to Lei and Cui (2016), it is possible to group emotions considering their valence arousal, managing to distinguish four groups: (a) high arousal positive emotions, including enjoyment, hope, and pride; (b) low arousal positive emotions including satisfaction, calm and relief; (c) high arousal negative emotions including anger, anxiety and embarrassment; and (d) low arousal negative emotions including hopelessness, boredom, depression, exhaustion and discomfort (Lei and Cui, 2016).

The following groups of academic emotions based on the object approach have been established, which can be identified as (a) achievement emotions, both to the activity and to the outcome, being possible to identify that the results can be past or future-oriented, in the dimensions of success (hope and pride) or failure (anxiety and shame); (b) epistemic emotions, which arise as a result of the cognitive qualities of the task information and the processing of such information; (c) subject emotions, triggered by the contents of the learning material; and (e) social emotions, derived from the interactive nature of most academic environments (Pekrun, 2016).

The impact of academic emotions on students' performance and wellbeing is undeniable. According to the results of research conducted by Pelch (2018), students reporting high levels of anxiety coincided with statements of lack of confidence, academic excuses, and fear; furthermore, poor performance would be linked to a spectrum of negative academic emotions, including negative self-image, lack of confidence, and defeat mentality. Pelch establishes that students' challenge mentality was associated more with good study habits than with and, as well as with students' security, associated with confidence. The influence of academic emotions on the teaching-learning process is so significant that it can affect students' attitudes toward learning, motivation, involvement with academic tasks, and general wellbeing (Barrios Tao and Gutiérrez De Piñeres Botero, 2020).

A study by Lei and Cui (2016) suggests that academic emotions can directly impact learning-related decision-making and the strategies students adopt to cope with academic situations. For example, those students who experience negative high-arousal emotions, such as anxiety, tend to avoid learning situations that they perceive as threatening. In contrast, those who experience positive, high-arousal emotions, such as pride, may be more willing to take on academic challenges.

Regarding adaptation to university life, another study indicated that students at their university entrance experience both positive

and negative emotions during the beginning of their university careers. Although positive emotions usually predominate, negative emotions may increase during the university experience (Cobo-Rendón et al., 2020). Today's college students possess characteristics due to their experience living during the pandemic. They are young people who often completed their high school education or began their college education through emergency remote education. Traditionally, first-year students struggle with the academic, learning, emotional, cognitive, and social demands of beginning a college career (Lobos et al., 2022).

A successful transition of students to college life is an essential element to consider when discussing educational quality, as this transition is associated with academic success, retention, social development, and personal growth that can shape students' future success and wellbeing (Chan and Rose, 2023).

The importance of this research arises in theoretical and applied terms, especially in how the investigation of psychosocial variables such as emotions could intervene in processes related to the quality of education (Dimililer, 2018). This study attempts to know the importance of academic emotions in the university students. The teachers and researchers need to promote these variables, as well as to encourage universities to consider this during the early experiences of young people in their professional training.

Taking into account the changes experienced by students due to the pandemic and considering that entering university life is a stage in the life of young people that is characterized by a process of personal, social, academic, and behavioral transformation, it is necessary to know how psychological factors such as academic emotions predict adaptation and intention to drop out of university in young people, for this reason, the present study proposes to evaluate the predictive capacity of academic emotions on university adaptation and intention to drop out. To respond to this objective, the following hypotheses have been proposed:

H1. There are differences in academic emotions reported by students according to the emergency remote education experiences generated by COVID-19.

H2. There are differences in the academic emotions present in the different academic activities according to the sex of the participating students.

H3. Both positive (enjoyment, hope, pride, and relief) and negative (anger, anxiety, embarrassment, shame, hopelessness, and boredom) emotions predominate during the performance of academic activities by university students.

H4. Academic emotions can predict adaptation to university life and intention to drop out, according to the type of activity performed.

2 Materials and methods

A predictive associative methodology was selected. This type of research design analyzes the relationship between variables and examines the possibility of differences between two or more groups of individuals, taking advantage of differential situations created by nature or society (Ato et al., 2013), to evaluate how academic emotions reported by students during classes, studying, and exams predicted adaptation and intention to drop out of the university career. Likewise, this study corresponds to cross-sectional research since the information was obtained in a single time frame (Hernández Sampieri and Pilar, 2014).

2.1 Participants

Two hundred and ninety-five undergraduate psychology students (71 = men, 219 = women, 5 preferred not to say) from a Chilean university participated in the study. The mean age was 21.35 years (SD = 2.93). Table 1 shows the distribution of the participants according to the year of entry into university life. A total of 71.89% indicated that this was their first experience in higher education. An accidental non-probabilistic sampling was used based on the availability of the students present in the classrooms at the time of the application of the questionnaires.

2.2 Instruments

2.2.1 Academic emotions

The Achievement Emotions Questionnaire Short Version (AEQ-S). It is a measurement instrument designed to assess a wide range of emotions students experience in educational contexts, such as joy, boredom, anxiety, confidence, and frustration. These emotions are relevant to understanding how students react emotionally to academic challenges, success, and failure in educational settings. This more practical and easier-to-administer abbreviated version contains vital questions that capture the most representative or significant emotions in the academic context. The AEQ-S is helpful for ease of implementation in research studies and educational contexts, as it reduces the time required for participants to respond to the questions. In addition, the AEQ-S provides comparable results with the original version of the questionnaire, making it a valuable tool for studies that require a quick and efficient assessment of academic emotions (Bieleke et al., 2021).

TABLE 1 Description of participants according to year of university entrance.

Year of university entrance	Frequency	Percentage
2019	33	11.2
2020	78	26.4
2021	102	34.6
2022	82	27.8
Total	295	100.0

The AEQ-S comprises 24 scales assessing the nine trait emotions of achievement-related enjoyment, hope, pride, relief, anger, anxiety, shame, hopelessness, and boredom. The items cover emotional experiences before, during, or after the corresponding environment and measure each emotion's affective, cognitive, motivational, and physiological components. It consists of 96 items that measure emotions in three contexts: in classes (example: "During my classes, I enjoy being in it"), during learning or studying (example: "During my study hours, I feel confident when I study"), and in evaluations (example: "During exams, I get angry"). It presents a Likert-type response scale with five options (1 = strongly disagree to 5 = agree strongly). We averaged the items to obtain composite scores for each dimension of the questionnaire. The AEQ-S includes items to cover the four components of each emotion considered in the AEQ (i.e., affective, cognitive, motivational and physiological), the fit of the 9-factor model representing correlated emotions within learning environments was corroborated $\chi^2(133) = 340.82$, CFI = 0.96, TLI = 0.92, SRMR = 0.05, RMSEA = 0.063. The reliability of the AEQ-S was identified as ranging from $\alpha = 0.75$ to $\alpha = 0.93$ (Bieleke et al., 2021).

2.2.2 Adaptation to college life

For the assessment of adaptation to college life, four items were selected from the Student Adaptation to College Questionnaire Short Version (López-Angulo et al., 2021b). These items refer to the student's academic adaptation to college life. The items are I1, "I am satisfied with the number and variety of subjects I have;" I2, "I am satisfied with the quality of the subjects I have;" I3, "I am satisfied with the subjects of this semester," and I4 "I am delighted with the professors I have this semester." The responses were obtained using a 7-alternative scale (1 = totally disagree to agree 7 = totally). We averaged the items to obtain composite scores for the variable. The reliability obtained in this study was $\alpha = 0.89$.

2.2.3 Intention to drop-out

Participants were presented with three items related to their thoughts or intentions to continue or not to continue their university studies (López-Angulo et al., 2021a). The items aim to evaluate the intention to drop out and focus on the desire to abandon the semester, the career, and the institution (I1: "I am thinking of not continuing to study this semester," I2: "I am thinking of changing to another career," and I3: "I am thinking of dropping out of college for good"). The questions were answered utilizing a 7-alternative response scale (1 = totally disagree to agree 7 = totally). We averaged the items to obtain composite scores for the variable. The reliability obtained in this study was $\alpha = 0.86$.

2.3 Procedure

This research is part of a broader project entitled "Academic Emotions, wellbeing, and Autonomy Support as Predictors of Adaptation and Intention to Drop out of University Life," which was evaluated by the Ethics Committee of the Universidad del Desarrollo, Chile. For its development, contact was made

with the psychology faculty authorities to explain the study's characteristics and to obtain their authorization for the application of the questionnaires in their courses to guarantee the highest response rate. Some of the researchers went to the classrooms to explain to the students the characteristics of the study and to propose their participation. Subsequently, students were invited to answer the questionnaires using QR codes after reading and signing the informed consent form. The response time was an average of 15 min; the students did not receive any incentive for participation. The Ethics Committee of the Universidad del Desarrollo evaluated and approved this research on October 4, 2022.

2.4 Data analysis plan

The information obtained was stored in a Google form with the data. Initially, the reliability of the responses was analyzed using the internal consistency index of the dimensions and the total of the measurement instruments using Cronbach's Alpha and McDonald's Omega. Descriptive and central tendency analyses were performed for academic emotions and their dimensions, adaptation to university, and intention to drop out. Inferential analyses (Student's *t*-tests and ANOVA) were performed to evaluate the differences in the scores of the variables of interest according to gender and academic year. Linear regressions were performed to corroborate the statistical prediction of academic emotions on adaptation to university life and on the intention to drop out. For this purpose, compliance with the statistical assumptions according to each procedure was previously evaluated. JASP 0.16 and Power BI software were used for data analysis.

3 Results

In response to the general objective of evaluating the predictive capacity of academic emotions on university adaptation and intention to drop out, the results obtained according to the responses of the 295 participants of the study are presented. Initially, descriptive, and inferential analyses are presented that seek to respond to the hypotheses posed at the beginning of this research.

Table 2 presents the descriptive and reliability statistics for each of the dimensions of emotions and the variable's adaptation to university life and intention to drop out. In this case, according to the averages of the scores, we find that during the classes, the students report a predominance of emotions such as Pride, Enjoyment, and Hope; in this case, these types of emotions are considered positive emotions oriented to success.

Regarding the predominant emotions during learning, enjoyment, optimism, and pride were identified, constituting positive emotions of high activation. Regarding the emotions during the evaluations, Relief was identified as predominant, followed by anxiety and pride. In this case, it was possible to identify positive emotions of low arousal, such as Relief, and negative emotions of high arousal, such as anxiety. Finally, high adaptation to university life and low intention to drop out were identified on the part of the participating students (see Table 2).

TABLE 2 Descriptive statistics of academic emotions, adaptation, and intention to drop out.

Variable	M	SD	Cronbach's α	McDonald's ω
Class-related emotions				
Enjoyment	3.759	0.761	0.844	0.853
Hope	3.693	0.823	0.842	0.842
Pride	3.845	0.882	0.874	0.882
Anger	1.871	0.901	0.840	0.842
Anxiety	2.126	0.994	0.867	0.867
Shame	2.290	1.202	0.925	0.928
Hopelessness	1.669	0.900	0.922	0.924
Boredom	2.586	1.001	0.888	0.875
Learning-related emotions				
Enjoyment	4.009	0.791	0.870	0.883
Hope	3.869	0.913	0.912	0.914
Pride	3.964	0.888	0.882	0.891
Anger	2.245	0.999	0.835	0.832
Anxiety	2.925	1.085	0.813	0.815
Shame	2.179	1.114	0.871	0.869
Hopelessness	1.876	1.041	0.897	0.889
Boredom	2.247	1.095	0.899	0.890
Test-related emotions				
Enjoyment	2.431	1.120	0.931	0.932
Hope	3.036	1.145	0.925	0.926
Pride	3.214	1.090	0.896	0.897
Anger	2.014	0.974	0.823	0.830
Anxiety	3.281	1.204	0.864	0.865
Shame	2.068	1.205	0.833	0.834
Hopelessness	1.985	1.175	0.938	0.939
Relief	4.108	0.855	0.865	0.857
Adjustment to university life	4.819	1.521	0.891	0.894
Intention to drop out	1.584	0.991	0.869	0.867

M, arithmetic mean; SD, standard deviation.

On the reliability analysis of the analyzed dimensions, adequate levels of reliability were identified, presenting a range of scores from $\alpha = 0.86$ to $\alpha = 0.93$ and $\omega = 0.86$ to $\omega = 0.93$.

3.1 Academic emotions reported by students according to the emergency remote education experiences generated by COVID-19

To answer, H1 referred to check if there are differences in academic emotions reported by students according to the emergency remote education experiences generated by COVID-19. ANOVA test was performed to evaluate the presence of statistically significant differences between group scores for each emotion studied according to class activities during the study. During the evaluations, the statistically significant results are presented in each case.

When evaluating academic emotions during classes, statistically significant differences were found in the emotion of embarrassment [$F_{(3,291)} = 3.335$; $p = 0.020$; $\eta^2 = 0.033$]. In this case, the students who entered in 2020 presented less presence of this emotion during classes than those who entered in previous years.

In the case of the emotions experienced during the study, statistically significant differences were found in the student's anxiety levels according to the year of entry [$F_{(3,291)} = 3.559$; $p = 0.015$; $\eta^2 = 0.035$]. Higher anxiety levels were identified in the students who entered in recent years (2022 and 2021), ending the period of pandemic, social restrictions, and emergency remote education. Concerning the emotions experienced while taking the exams, no statistically significant differences were identified in the groups. Table 3 presents the averages of the emotion scores where such differences were identified.

3.2 Differences by sex in academic emotions

To answer H2, referring to the differences in the academic emotions of the students concerning sex, we found that in the case of emotions during classes and study, it was not possible to identify statistically significant differences (see Figures 1, 2). In the case of emotions during evaluations or exams, differences were identified in the emotions of enjoyment [$t_{(288)} = 3.459$; $p < 0.001$; $r = 0.199$]. In this case, males presented higher scores ($M = 2.827$; $SD = 1.178$) than females ($M = 2.306$; $SD = 1.079$). Statistically significant differences were also identified for the emotion of hope [$t_{(288)} = 3.036$; $p = 0.003$; $r = 0.176$]; men presented higher scores ($M = 3.398$; $SD = 1.112$) than women ($M = 2.929$; $SD = 1.136$). Finally, statistically significant differences were identified in the reported levels of anxiety during the performance of the evaluations or exams [$t_{(288)} = 3.089$; $P = 0.002$; $r = 0.179$], unlike the previous cases, men presented lower scores of this emotion

TABLE 3 Descriptive statistics on academic emotions according to year of university entrance.

Year of university entrance	2022 ($n = 82$)		2021 ($n = 102$)		2020 ($n = 78$)		2019 ($n = 33$)	
	M	SD	M	SD	M	SD	M	SD
Class-related emotions								
Shame	2.558	1.202	2.350	1.224	1.984	1.106	2.159	1.229
Anxiety	3.140	1.013	3.022	1.078	2.628	1.124	2.788	1.061

n, number of participants; M, arithmetic mean; SD, standard deviation.

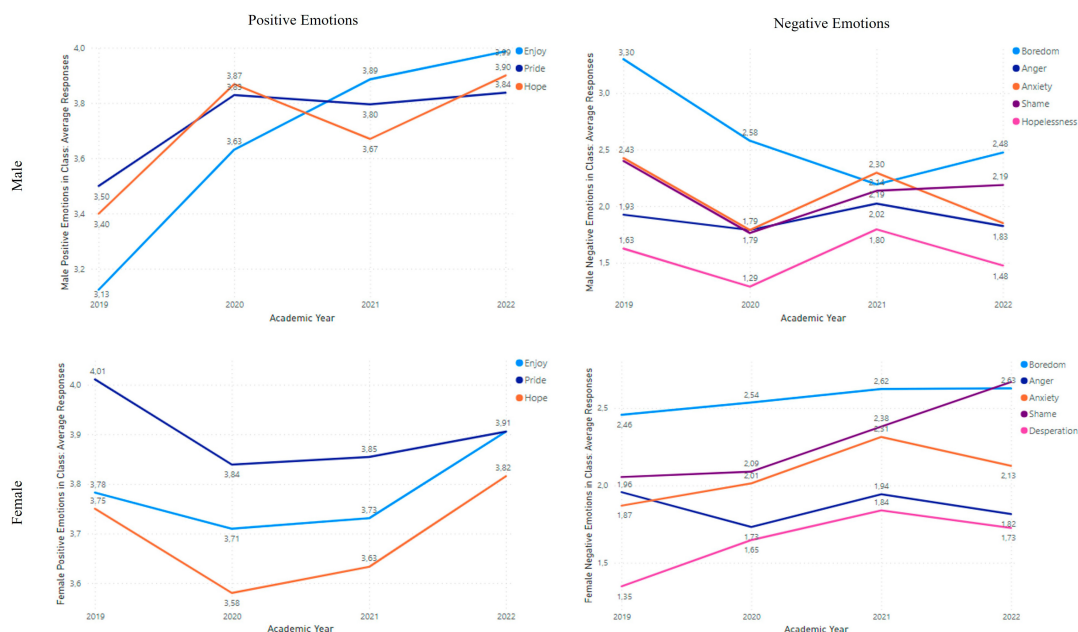


FIGURE 1

Descriptions of academic emotions in classes according to gender and year of entry of the students.

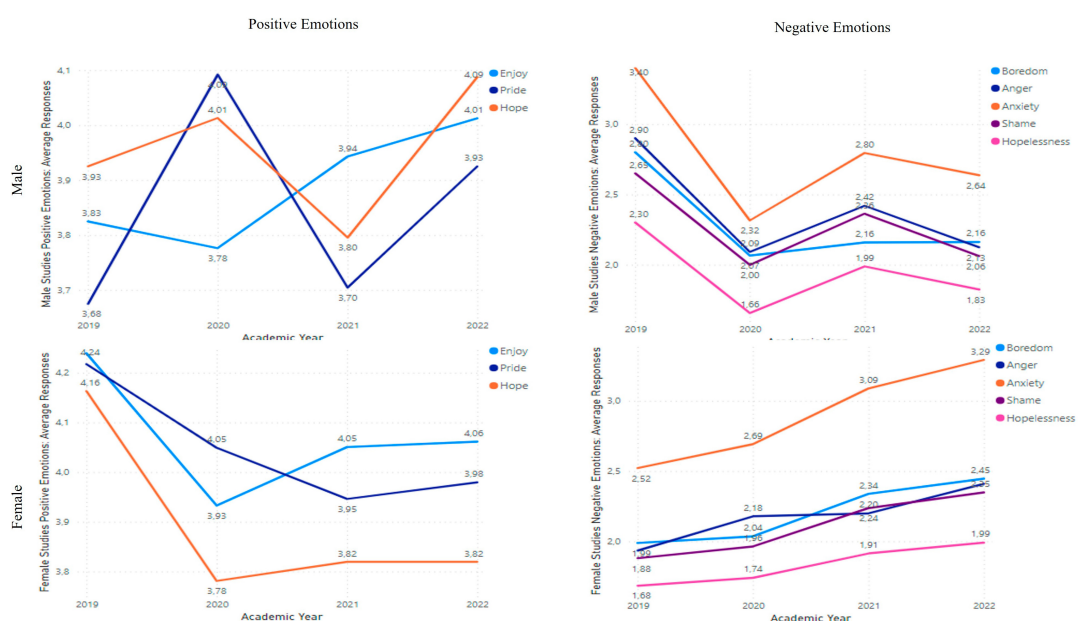


FIGURE 2

Descriptions of academic emotions in the study according to sex and year of entry of the students.

($M = 2.901$; $SD = 1.127$) than women ($M = 3.404$; $SD = 1.212$) (see Figure 3).

3.3 Predominance of emotions during academic activities

To answer H3, referring to the predominance of positive as well as negative emotions during the performance of academic activities

by university students, the emotions were organized into two large groups. For this purpose, the average of emotions was obtained as follows: for the positive emotions, the scores of enjoyments, hope, pride, and Relief were included, and for the negative emotions, the scores of angers, anxiety, shame, hopelessness, and boredom were used.

A more significant predominance of positive emotions was identified in all cases; positive emotions were highlighted during study times over lectures and evaluations. In the case of negative

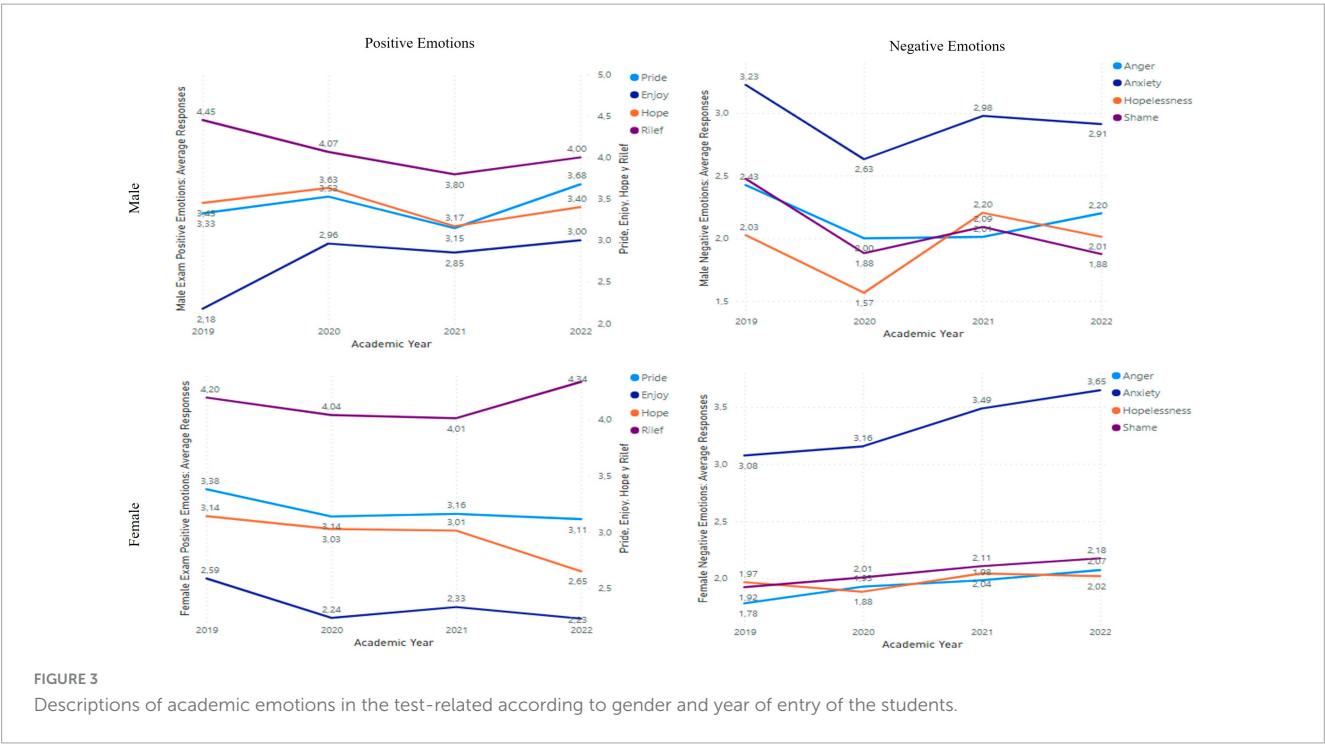


TABLE 4 Descriptive statistics of the predominance of emotions according to academic activity.

Type of emotion	Academic activity	Min	Max	M	SD
Positive	Class-related emotions	1.50	5.00	3.765	0.729
	Learning-related emotions	1.17	5.00	3.947	0.778
	Test-related emotions	1.19	5.00	3.197	0.805
Negative	Class-related emotions	1.00	5.00	2.108	0.779
	Learning-related emotions	1.00	5.00	2.294	0.869
	Test-related emotions	1.00	5.00	2.337	0.928

Min, minimum score; max, maximum score; M, arithmetic mean; SD, standard deviation.

emotions, they are presented to a lesser extent, being their highest score in the case of academic evaluations (see Table 4).

Additionally, the scores of positive and negative emotions experienced by the students were analyzed according to academic year and gender. For sex, only statistically significant differences were identified concerning the presence of positive emotions while taking the exams [$t_{(288)} = 2.606$; $p = 0.010$; $r = 0.151$], with higher scores in males ($M = 3.416$; $SD = 0.832$) than females ($M = 3.132$; $SD = 0.786$). No statistically significant differences were identified for different academic years.

3.4 Prediction of academic emotions in the adaptation to university life and the intention to drop out

Now, to respond to hypothesis H4, which referred to the prediction of academic emotions with adaptation to university life and intention to drop out, according to the type of activity performed, linear regression analyses were performed for

positive and negative emotions in each of the academic activities analyzed. The results indicate that positive emotions predict adaptation to university life during classes [$F_{(1,294)} = 97.128$; $p < 0.001$; $r^2 = 0.249$], during study hours [$F_{(1,294)} = 48.616$; $p < 0.001$; $r^2 = 0.141$], and during the performance of evaluations [$F_{(1,294)} = 31.329$; $p < 0.001$; $r^2 = 0.097$]. In the case of negative emotions, we also found that they can inversely predict adaptation to university life during classes [$F_{(1,294)} = 48.654$; $p < 0.001$; $r^2 = 0.142$], during study [$F_{(1,294)} = 31.986$; $p < 0.001$; $r^2 = 0.098$], and during exams [$F_{(1,294)} = 23.261$; $p < 0.001$; $r^2 = 0.074$], the coefficients are described in Table 5. A medium effect size is presented only in the positive emotions during classes; the identified effect size is small in the rest of the variables.

In the case of the intention to drop out, the same process was carried out linear regressions were analyzed for positive and negative academic emotions according to the academic activities reported; in the results, it was possible to identify that positive academic emotions during class [$F_{(1,294)} = 26.523$; $p < 0.001$; $r^2 = 0.083$], during the study [$F_{(1,294)} = 27.141$; $p < 0.001$; $r^2 = 0.085$], and during the exams [$F_{(1,294)} = 18.282$; $p < 0.001$; $r^2 = 0.059$] inversely predict the intention to drop out of university life. Similarly, the results indicate that negative emotions during classes [$F_{(1,294)} = 27.468$; $p < 0.001$; $r^2 = 0.086$], during study [$F_{(1,294)} = 15.639$; $p < 0.001$; $r^2 = 0.051$], and during taking exams [$F_{(1,294)} = 11.873$; $p < 0.001$; $r^2 = 0.039$] predict intention to drop out of university life. Table 6 presents the coefficients for each case; small effect sizes were identified in all the variables studied.

4 Discussion

The main objective of this research was to evaluate the predictive capacity of academic emotions on college adjustment

TABLE 5 Linear Regression on academic emotions on adaptation to university life.

Model	Scale	B	UDE	β	t	p	r ²
1	(Constant)	0.900	0.405		2.221	0.027	0.249
	Positive emotions in the classroom	1.041	0.106	0.499	9.855	< 0.001	
2	(Constant)	1.909	0.425		4.488	< 0.001	0.141
	Positive emotions in the study	0.737	0.106	0.377	6.973	< 0.001	
3	(Constant)	2.943	0.346		8.513	< 0.001	0.097
	Positive emotions in evaluations	0.587	0.105	0.311	5.597	< 0.001	
4	(Constant)	6.372	0.237		26.859	< 0.001	0.142
	Negative emotions in the classroom	-0.736	0.106	-0.377	-6.975	< 0.001	
5	(Constant)	6.079	0.238		25.535	< 0.001	0.098
	Negative emotions in the study	-0.549	0.097	-0.314	-5.656	< 0.001	
6	(Constant)	5.858	0.232		25.290	< 0.001	0.074
	Negative emotions in evaluations	-0.444	0.092	-0.271	-4.823	< 0.001	

B, unstandardized coefficient; UDE, unstandardized deviation error; β , standardized regression coefficient; Dependent variable: adaptation to university life.

TABLE 6 Linear Regression on academic emotions on intention to drop out.

Model	Scale	B	UDE	β	t	p	r ²
1	(Constant)	3.059	0.292		10.487	< 0.001	0.083
	Positive emotions in the classroom	-0.392	0.076	-0.288	-5.150	< 0.001	
2	(Constant)	3.048	0.286		10.643	< 0.001	0.085
	Positive emotions in the study	-0.371	0.071	-0.291	-5.210	< 0.001	
3	(Constant)	2.538	0.230		11.036	< 0.001	0.059
	Positive emotions in evaluations	-0.298	0.070	-0.242	-4.276	< 0.001	
4	(Constant)	0.799	0.160		5.007	< 0.001	0.086
	Negative emotions in the classroom	0.372	0.071	0.293	5.241	< 0.001	
5	(Constant)	0.995	0.159		6.252	< 0.001	0.051
	Negative emotions in the study	0.257	0.065	0.225	3.955	< 0.001	
6	(Constant)	1.092	0.154		7.101	< 0.001	0.039
	Negative emotions in evaluations	0.211	0.061	0.197	3.446	< 0.001	

B, unstandardized coefficient; UDE, unstandardized deviation error; β , standardized regression coefficient; Dependent variable: intention to drop out.

and intention to drop out. Before moving forward with the results that allowed us to respond to the intention of the study, we explored the reliability of the scores obtained in the instruments, finding that the measures of internal consistency of the scales used were adequate to interpret the results, being also congruent with previous studies that have analyzed these scales, (Bieleke et al., 2021; López-Angulo et al., 2021a,b).

The results indicate that the emotions reported by students during class are pride, enjoyment, and hope. Students feel proud of themselves in class; they feel proud of what they learn about their subject area, which motivates them to continue attending. Also, when attending classes, students typically enjoy being in the class; they are excited about learning in the class, motivated by the class, and love participating. They feel the excitement of hope in the confidence and optimism that comes from learning new material in class.

Moving forward with the emotions during learning or referring to the moment of studying, the trend described when they are in class is repeated, i.e., they report enjoying the challenge of learning

the new course material, as well as feeling happy when they are aware that they are advancing in their learning sessions, they also report hope and optimism by developing confidence due to the progress they are making, and of course they feel proud of their progress and achievements which generates motivation to continue learning, it is essential to mention that all the emotions described are considered positive emotions of high activation.

The students reported two types of emotions during the evaluations, on the one hand, emotions of relief and pride, which can be interpreted as the pride they feel when they perceive that they have performed well on the test, feel that the effort they have made during the study has been worthwhile, and feel that they have grown in their mastery of the evaluated content. In contrast, relief is associated with the post-test experience. This is consistent because anxiety was reported as one of the most experienced emotions at the time of the evaluation, feeling nervous, worrying about not being able to finish on time due to the difficulty, and even wishing not to take the exam; anxiety is considered an academic emotion of high arousal (Bieleke et al., 2021).

4.1 Academic emotions reported by students according to the emergency remote education experiences generated by COVID-19

Regarding H1, referred to check if there are differences in academic emotions reported by students according to the emergency remote education experiences generated by COVID-19, the results showed that students who entered the university in 2020 reported less embarrassment than those of other years. It can be interpreted that students who entered that year are currently more advanced in their university career; this has exposed them to multiple academic situations linked to academic achievement or failure, the latter linked to negative emotions such as anxiety, shame, or fear of failure that students have probably learned to manage during their university career and also because of their age (Respondek et al., 2017; Ekornes, 2022) in addition they entered in full COVID-19 contingency to college which according to studies was a period in which academic embarrassment was reported (Vo et al., 2021; Ghaderi et al., 2022). Similarly, statistically significant differences were found in anxiety levels, which were higher for first-year students and decreased as they progressed; note that the lowest anxiety levels were reported by upperclassmen (Respondek et al., 2017).

4.2 Differences by sex in academic emotions

Regarding H2, referring to differences in students' academic emotions concerning sex, we found that in the case of emotions during classes and study, no statistically significant differences were identified. However, we found statistically significant emotional differences during evaluations or tests. In that case, the findings can be summarized as follows: emotional valence in males during tests tends to be of more pleasant valence than for females, e.g., greater enjoyment and hope, while for females, the valence of emotions tends to be more displeasing, e.g., anxiety, being consistent with the findings of Ekornes (2022). These results are in the general line of affirming that gender could have implications in psychoeducational variables such as academic emotions (Pekrun and Stephens, 2012) and achievement (Lei and Cui, 2016), as well as in the retention of students in some regions of knowledge such as STEM in which women show greater probability of engaging in a self-deprecating cycle driven by negative academic emotions (Pelch, 2018).

4.3 Predominance of emotions during academic activities

To answer H3, referring to the predominance of positive and negative emotions during the performance of academic activities by university students, a more significant predominance of positive emotions was identified in all moments: during class, during study, and tests, positive emotions are highlighted during the moments of study on classes and evaluations, while negative emotions are presented to a lesser extent, being their highest score in the

case of academic evaluations, evidence in line with the theory of the control-value theory of achievement emotions (Pekrun et al., 2007; Pekrun and Stephens, 2012), having implications in how the emotional experience is varied, subjective, activation and not only emphasizing the anxiety that the academic and evaluation context can cause in students.

Similarly, when analyzing the average of positive and negative emotions in the sample, the finding of statistically significant reporting of positive emotions by males during the tests than females is repeated. As exposed by Lei and Cui (2016), there is some vulnerability in female students in reporting a lower frequency of positive academic emotions compared to male students, and even the literature has shown that women tend to present more negative affectivity in everyday life and academic situations (Prowse et al., 2021; Bermejo-Franco et al., 2022; Díaz-Mosquera et al., 2022; Kaleta and Mróz, 2022), this possible vulnerability should be addressed in university spaces through counseling and advice spaces that perform psychoeducational interventions that provide tools to women at the level of emotional regulation, coping and even emotional intelligence (Goetz and Bieg, 2016).

4.4 Prediction of academic emotions in the adaptation to university life and the intention to drop out

The results indicated that the sample presented adequate adaptation to university life and low intention to drop out on the part of the participating students. Positive emotions during classes, learning, and tests predict students' adaptation to college, while they inversely predict the intention to drop out. This finding is also congruent in the opposite direction, as negative emotions predict dropout intention and inversely predict college adjustment. Furthermore, it is consistent with a study at a German university that found negative emotions to predict college dropout, specifically anxiety (Respondek et al., 2017).

Our findings are also consistent with research conducted at a university in Norway, in which it was explained that academic emotions contribute significantly to the variance of explanation of the intention to drop out of university studies, with emphasis on emotions related to learning (Ekornes, 2022). Similarly, it adds to the evidence reported by Ganotice et al. (2016) about the emotional profiles that explain adequate or maladaptive outcomes in university education; specifically, those students who experience higher positive and lower negative academic emotions are those with better adaptive educational outcomes and then those students with moderate levels of shame and high positive emotions, while the worst maladaptive university profile is those students with high negative and few positive academic emotions; in our research positive emotions during classes have greater weight and even more significant effect size in explaining university adaptation, previously Yu et al. (2020) explained that academic emotions are directly implicated in college academic persistence, and Wang et al. (2022) explained that one of the internal mechanisms that mediate students' interactions with professors, content, and other peers are academic emotions.

Therefore, evidence suggests that positive academic emotions may be more suitable than those considered in promoting better

college outcomes and learning performance in students, as well as the importance of both positive and negative academic emotions in the activation spectrum of either high or low activation in the college student experience such as pride, enjoyment, hope, relief, anxiety and others in college retention (Lei and Cui, 2016; Tan et al., 2021); previous evidence suggests that academic emotions have long-term implications on psychological wellbeing, self-regulated learning, and harmonious passion displayed in studies, (Sverdlik et al., 2022).

The results have some practical theoretical implications, among them: (a) the importance of positive emotions as mechanisms that regulate cognitions and other resources as explored in the broaden-and-build theory (Fredrickson, 2002); (b) the theory of emotions that groups them according to object focus: achievement emotions, epistemic emotions, topic emotions (Pekrun, 2016; Pekrun and Linnenbrink-Garcia, 2022); (c) the balance between boredom and anxiety explained by Flow theory to motivate behaviors from a perception of challenge and overcoming (Csikszentmihalyi, 2013); (d) sources of self-efficacy precisely: the one referred to previous achievements and emotional and physiological responses (1997); (e) self-regulated learning as it is understood that some emotions such as those referred to achievement would enable conditions to commit to one's own learning (Pekrun and Perry, 2014; Asikainen et al., 2018; Martínez-López et al., 2021a); and (f) the possible relationship of academic emotions with self-determination theory specifically the need for competence (Ryan and Deci, 2022).

The practical implications of this research can be enlisted in two directions. On the one hand, academic guidance, and counseling services to carry out psychological interventions aimed at students that allow them to adapt adequately to university life, possibly with interventions to promote personal resources such as emotional regulation, coping, psychological flexibility, emotional intelligence, and other emotional competencies that can be activated for the benefit of students, it is crucial that these spaces for growth have a gender vision.

On the other hand, there are implications for teachers when planning and executing their classes, among them planning safe and positive learning environments, providing support for student autonomy, providing contextualized examples, generating a warm classroom environment to answer students' comments and doubts, reinforcing their curiosity, giving effective feedback based on content mastery, and making use of verbal persuasion as a source of self-efficacy. Teachers should also guide how to study the contents when students must perform their individual or group learning sessions. Teachers should also be transparent, predictable, and concrete about the test's learning outcomes (Pekrun and Stephens, 2012; Pekrun and Linnenbrink-Garcia, 2022). Similarly, another implication could be strengthening self-regulated learning strategies from the sources of academic self-efficacy (Bzuneck, 2018).

As a final reflection, it is essential to mention that in this study, positive academic emotions prevail over negative ones. However, it is essential to remember that although the latter are unpleasant, they also have adaptive functions within the psychological, motivational, and behavioral components in the academic context (Pekrun and Stephens, 2012). This research is intended to study how emotions affect university permanence. However, it is not intended to establish a utopian or simplistic look

at the situation of positive emotions vs. negative emotions in the university experience.

The study's main strength is to contribute to a field of knowledge about how academic emotions are related to educational outcomes, in this case, university adaptation and intention to drop out (Camacho-Morles et al., 2021). However, this study has some limitations that can be considered in future research. Among them are non-probabilistic sampling, not including students from several careers and different locations or type of institutions (public and private), inclusion of objective indicators of the university experience such as academic performance, and not only having self-report evaluations, but future research should also explore the academic emotions generated in specific areas of knowledge such as mathematics and statistics. Longitudinal studies could also investigate how the relationships between the analyzed constructs change across semesters. In promoting adaptation to higher education, psychological practices may include fostering students' development of emotional skills and resilience.

5 Conclusion

The academic emotions that characterize the college experience are varied. They can be classified into three moments: during class, pride, enjoyment, and hope are experienced; during learning or study, those above were reported; and during evaluations or tests, relief, anxiety, and pride are experienced. Therefore, positive emotions are predominant over negative ones. The report of academic emotions varies according to the year of entry to the university; For example, less embarrassment and anxiety are reported in senior students. It was also found that there are differences in the academic emotions present in the different academic activities according to the gender of the students, with male students reporting higher positive emotions. Finally, it is concluded that academic emotions have implications for college adjustment and intention to drop out; precisely, positive emotions during classes, learning, and testing predict students' college adjustment while inversely predicting intention to drop out. This finding is also congruent in the opposite direction, with negative emotions predicting dropout intention and inversely predicting college adjustment.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Comité de Ética, Universidad del Desarrollo. The studies were conducted in accordance with the local legislation and institutional

requirements. The participants provided their written informed consent to participate in this study.

Author contributions

RC-R: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review and editing. VH: Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing – original draft, Writing – review and editing. DG-Á: Investigation, Methodology, Validation, Writing – original draft, Writing – review and editing. RC: Data curation, Formal analysis, Software, Visualization, Writing – original draft, Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Aristovnik, A., Karampelas, K., Umek, L., and Ravšelj, D. (2023). Impact of the COVID-19 pandemic on online learning in higher education: a bibliometric analysis. *Front. Educ.* 8:1225834. doi: 10.3389/feduc.2023.1225834
- Asikainen, H., Hailikari, T., and Mattsson, M. (2018). The interplay between academic emotions, psychological flexibility and self-regulation as predictors of academic achievement. *J. Furth. High. Educ.* 42, 439–453. doi: 10.1080/0309877X.2017.1281889
- Ato, M., López, J., and Benavente, A. (2013). Un sistema de clasificación de los diseños de investigación en psicología. *An. Psicol.* 29, 1038–1059. doi: 10.6018/analesps.29.3.178511
- Barrios Tao, H., and Gutiérrez De Piñeres Botero, C. (2020). Neurociencias, emociones y educación superior: una revisión descriptiva. *Estud. Pedag. (Valdivia)* 46, 363–382. doi: 10.4067/s0718-07052020000100363
- Bermejo-Franco, A., Sánchez-Sánchez, J. L., Gaviña-Barroso, M. I., Atienza-Carbonell, B., Balanzá-Martínez, V., and Clemente-Suárez, V. J. (2022). Gender differences in psychological stress factors of physical therapy degree students in the COVID-19 pandemic: a cross-sectional study. *Int. J. Environm. Res. Public Health* 19:810. doi: 10.3390/ijerph19020810
- Bieleke, M., Gogol, K., Goetz, T., Daniels, L., and Pekrun, R. (2021). The AEQ-S: a short version of the achievement emotions questionnaire. *Contemp. Educ. Psychol.* 65:101940. doi: 10.1016/j.cedpsych.2020.101940
- Bzuneck, J. A. (2018). Emoções acadêmicas, autorregulação e seu impacto sobre motivação e aprendizagem. *ETD Educ. Temática Digital* 20, 1059–1075. doi: 10.20396/etd.v20i4.8650251
- Camacho-Morles, J., Slemp, G. R., Pekrun, R., Loderer, K., Hou, H., and Oades, L. G. (2021). Activity achievement emotions and academic performance: a meta-analysis. *Educ. Psychol. Rev.* 33, 1051–1095. doi: 10.1007/s10648-020-09585-3
- Casanova, J. R., Gomes, A., Moreira, M. A., and Almeida, L. S. (2022). Promoting success and persistence in pandemic times: an experience with first-year students. *Front. Psychol.* 13:815584. doi: 10.3389/fpsyg.2022.815584
- Chan, K., and Rose, J. (2023). "Conceptualizing success: a holistic view of a successful first-year undergraduate experience," in *Perspectives on enhancing student transition into higher education and beyond*, eds D. Willison and E. Henderson (Pennsylvania: IGI Global), 47–68.
- Cobo-Rendón, R., Pérez-Villalobos, M. V., Páez-Rovira, D., and Gracia-Leiva, M. (2020). A longitudinal study: affective wellbeing, psychological wellbeing, self-efficacy and academic performance among first-year undergraduate students. *Scand. J. Psychol.* 61, 518–526. doi: 10.1111/sjop.12618
- Crede, M., and Niehorster, S. (2012). Adjustment to college as measured by the student adaptation to college questionnaire: a quantitative review of its structure and relationships with correlates and consequences. *Educ. Psychol. Rev.* 24, 133–165. doi: 10.1007/s10648-011-9184-5
- Csikszentmihalyi, M. (2013). *Flow: the psychology of happiness*. London: Random House.
- Díaz-Mosquera, E., Corral Proaño, V., and Merlyn Sacoto, M. (2022). Sintomatología depresiva durante la pandemia COVID-19 en estudiantes universitarios de Quito, Ecuador. *Veritas Res.* 4, 147–159.
- Díaz-mujica, A., García, D., López, Y., Maluenda-Albornoz, J., Hernández, H., and Pérez-Villalobos, M. (2018). "Factores asociados al abandono. Tipos y perfiles de abandono," in *Octava conferencia latinoamericana sobre el abandono en la educación superior*, Panamá.
- Dimililer, K. (2018). Use of Intelligent Student Mood Classification System (ISMCS) to achieve high quality in education. *Qual. Quant.* 52, 651–662. doi: 10.1007/s11135-017-0644-y
- Ekornes, S. (2022). The impact of perceived psychosocial environment and academic emotions on higher education students' intentions to drop out. *High. Educ. Res. Dev.* 41, 1044–1059. doi: 10.1080/07294360.2021.1882404
- Fredrickson, B. (2002). "Positive emotions," in *Handbook of positive psychology*, eds C. R. Snyder and S. J. Lopez (New York, NY: Oxford University Press), 120–134.
- Galve-González, C., Blanco, E., Vázquez-Merino, D., Herrero, F. J., and Bernardo, A. B. (2022). Influencia de la satisfacción, expectativas y percepción del rendimiento en el abandono universitario durante la pandemia. *Rev. Estud. Invest. Psicol. Educ.* 9, 226–244. doi: 10.17979/reipe.2022.9.2.9153
- Ganotice, F. A. Jr., Datu, J. A. D., and King, R. B. (2016). Which emotional profiles exhibit the best learning outcomes? A person-centered analysis of students' academic emotions. *Sch. Psychol. Int.* 37, 498–518. doi: 10.1177/0143034316660147
- García-Álvarez, D., Liccioni, E., and Cobo-Rendón, R. (2019). Conociendo las emociones y sus implicaciones en los procesos de enseñanza y aprendizaje en la educación primaria. *Rev. Convocación* 40, 50–63.
- Ghaderi, E., Khoshnood, A., and Fekri, N. (2022). Achievement emotions of university students in on-campus and online education during the COVID-19 pandemic. *Tuning J. High. Educ.* 10, 319–336. doi: 10.18543/tjhe.2346
- Goetz, T., and Bieg, M. (2016). "Academic emotions and their regulation via emotional intelligence," in *Psychosocial skills and school systems in the 21st century: theory, research, and practice*, eds A. Lipnevich, F. Preckel, and R. Roberts (Cham: Springer), 279–298.
- Hako, A. N., Shikongo, P. T., and Mbongo, E. N. (2023). "Psychological adjustment challenges of first-year students: a conceptual review," in *Handbook of research on coping mechanisms for first-year students transitioning to higher education*, ed. K. R. M. Peter Jo Aloka (Pennsylvania: IGI Global), 191–210.

- Hernández Sampieri, R. F., and Pilar, C. B. (2014). *Metodología de la investigación*. New York, NY: Mc Graw Hill.
- Jacobo-Galicia, G., Máñez-Guaderrama, A. I., and Cavazos-Arroyo, J. (2021). Miedo al Covid, agotamiento y cinismo: su efecto en la intención de abandono universitario. *Eur. J. Educ. Psychol.* 14, 1–18. doi: 10.32457/ejep.v14i1.1432
- Kaleta, K., and Mróz, J. (2022). Gender differences in forgiveness and its affective correlates. *J. Relig. Health* 61, 2819–2837. doi: 10.1007/s10943-021-01369-5
- Lei, H., and Cui, Y. (2016). Effects of academic emotions on achievement among mainland Chinese students: a meta-analysis. *Soc. Behav. Pers. Int. J.* 44, 1541–1553. doi: 10.2224/sbp.2016.44.9.1541
- Lobos, K., Cobo-Rendón, R., Mella-Norambuena, J., Maldonado-Trapp, A., Fernández Branada, C., and Bruna Jofré, C. (2022). Expectations and experiences with online education during the COVID-19 pandemic in university students. *Front. Psychol.* 12:815564. doi: 10.3389/fpsyg.2021.815564
- López-Angulo, Y., Cobo-Rendón, R., Saéz-Delgado, F., and Mujica, A. D. (2021b). Exploratory factor analysis of the student adaptation to college questionnaire short version in a sample of Chilean university students. *Univ. J. Educ. Res.* 9, 813–818. doi: 10.13189/ujer.2021.090414
- López-Angulo, Y., Cobo-Rendón, R. C., Pérez-Villalobos, M. V., and Díaz-Mujica, A. E. (2021a). Apoyo social, autonomía, compromiso académico e intención de abandono en estudiantes universitarios de primer año. *Formación Univ.* 14, 139–148. doi: 10.4067/S0718-50062021000300139
- López-Angulo, Y., Sáez-Delgado, F., Mella-Norambuena, J., Bernardo, A. B., and Díaz-Mujica, A. (2023). Predictive model of the dropout intention of Chilean university students. *Front. Psychol.* 13:893894. doi: 10.3389/fpsyg.2022.893894
- Martínez-López, Z., Villar, E., Castro, M., and Tinajero, C. (2021b). Self-regulation of academic emotions: recent research and prospective view. *An. Psicol.* 37, 529–540.
- Martínez-López, Z., Villar, E., Castro, M., and Tinajero, C. (2021a). Autorregulación de las emociones académicas: investigaciones recientes y prospectiva. *An. Psicol.* 37, 529–540. doi: 10.6018/analesps.415651
- Pekrun, R. (2016). *Academic emotions*. Abingdon: Routledge.
- Pekrun, R., and Linnenbrink-Garcia, L. (2022). “Academic emotions and student engagement,” in *Handbook of research on student engagement*, eds A. L. Reschly and S. L. Christenson (Berlin: Springer International Publishing), 109–132. doi: 10.1007/978-3-031-07853-8_6
- Pekrun, R., and Perry, R. P. (2014). “Control-value theory of achievement emotions,” in *International handbook of emotions in education*, eds R. Pekrun and L. Linnenbrink-Garcia (New York, NY: Routledge), 120–141.
- Pekrun, R., and Stephens, E. J. (2012). “Academic emotions,” in *Individual differences and cultural and contextual factors. APA educational psychology handbook*, Vol. 2, eds K. Harris, S. Graham, T. Urdan, S. Graham, J. Royer, and M. Zeidner (Washington, DC: American Psychological Association).
- Pekrun, R., Frenzel, A. C., Goetz, T., and Perry, R. P. (2007). “The control-value theory of achievement emotions: an integrative approach to emotions in education,” in *Emotion in education*, eds P. A. Schutz and R. Pekrun (San Diego, CA: Academic), 13–36.
- Pelch, M. (2018). Gendered differences in academic emotions and their implications for student success in STEM. *Int. J. Stem Educ.* 5, 1–15. doi: 10.1186/s40594-018-0130-7
- Pérez, A. B. D., Quispe, F. M. P., Aguilar, O. A. G., and Cortez, L. C. C. (2020). Transición secundaria-universidad y la adaptación a la vida universitaria. *Rev. Cienc. Soc.* 26, 244–258.
- Prowse, R., Sherratt, F., Abizaid, A., Gabrys, R. L., Hellems, K. G., Patterson, Z. R., et al. (2021). Coping with the COVID-19 pandemic: examining gender differences in stress and mental health among university students. *Front. Psychiatry* 12:650759. doi: 10.3389/fpsyg.2021.650759
- Respondenk, L., Seufert, T., Stupnisky, R., and Nett, U. E. (2017). Perceived academic control and academic emotions predict undergraduate university student success: examining effects on dropout intention and achievement. *Front. Psychol.* 8:243. doi: 10.3389/fpsyg.2017.00243
- Ryan, R. M., and Deci, E. L. (2022). “Self-determination theory,” in *Encyclopedia of quality of life and well-being research*, ed. F. M. Maggino (Cham: Springer), 1–7.
- Shamionov, R. M., Grigoryeva, M. V., Grinina, E. S., Sozonnik, A. V., and Bolshakova, A. S. (2023). Subjective assessments of the pandemic situation and academic adaptation of university students. *OBM Neurobiol.* 7:18. doi: 10.21926/obm.neurobiol.2301150
- SIES (2021). *Informe de retención de 1er año pregrado cohortes 2016–2020. Ministerio de educación*. Available online at: https://www.mifuturo.cl/wp-content/uploads/2021/08/Informe_Retencion_SIES_2021.pdf (accessed August 10, 2023).
- Sverdlik, A., Rahimi, S., and Vallerand, R. J. (2022). Examining the role of passion in university students’ academic emotions, self-regulated learning and well-being. *J. Adult Contin. Educ.* 28, 426–448. doi: 10.1177/14779714211037359
- Tan, J., Mao, J., Jiang, Y., and Gao, M. (2021). The influence of academic emotions on learning effects: a systematic review. *Int. J. Environ. Res. Public Health* 18:9678. doi: 10.3390/ijerph18189678
- Van Rooij, E. C., Jansen, E. P., and van de Grift, W. J. (2018). First-year university students’ academic success: the importance of academic adjustment. *Eur. J. Psychol. Educ.* 33, 749–767. doi: 10.1007/s10212-017-0347-8
- Vo, P., Lam, T., and Nguyen, A. (2021). Achievement emotions and barriers to online learning of university students during the COVID-19 time. *Proc. AsiaCALL Int. Conf.* 621, 109–120. doi: 10.2991/assehr.k.211224.012
- Wang, Y., Cao, Y., Gong, S., Wang, Z., Li, N., and Ai, L. (2022). Interaction and learning engagement in online learning: the mediating roles of online learning self-efficacy and academic emotions. *Learn. Individ. Differ.* 94:102128. doi: 10.1016/j.lindif.2022.102128
- Wu, P., Li, M., Zhu, F., and Zhong, W. (2022). Empirical investigation of the academic emotions of gaokao applicants during the COVID-19 pandemic. *SAGE Open* 12:215824402210798. doi: 10.1177/21582440221079886
- Yu, J., Huang, C., Han, Z., He, T., and Li, M. (2020). Investigating the influence of interaction on learning persistence in online settings: moderation or mediation of academic emotions? *Int. J. Environ. Res. Public Health* 17:2320. doi: 10.3390/ijerph17072320
- Zhang, K., Wu, S., Xu, Y., Cao, W., Goetz, T., and Parks-Stamm, E. J. (2021). Adaptability promotes student engagement under COVID-19: the multiple mediating effects of academic emotion. *Front. Psychol.* 11:633265. doi: 10.3389/fpsyg.2020.633265



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Research on the impact of the socio-educational environment on the academic performance of college students: the mediating role of study motivation

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Background: Enhancing the academic performance (AP) of college students can contribute to the overall scientific literacy among this population, thereby fostering societal progress.

Objective: The study investigates the correlation between college students' AP and the socio-educational environment (SEE, including family, roommates, and teachers), study motivation (SM, including self-efficacy and study behaviors). Based on the research findings, recommendations are offered to students, educators, and school administrators.

Settings: Utilizing a stratified sampling approach, data was collected by selecting a sample of 330 first-year computer science students from a specific local university in Hebei Province, China.

Methods: Data will be collected through a hierarchical sampling method. Using correlation analysis, difference analysis, and structural equation modeling (SEM) as data analysis methods. The data passed reliability and validity analysis (*Cronbach's Alpha* = 0.88, *KMO* = 0.88, χ^2/df = 1.49, *RMSEA* = 0.04).

Results: The independent sample T-test results showed that female students had higher academic performance than male students ($p < 0.001$), and there was no significant difference in academic performance between students from single parent or orphan families and students from normal families ($p = 0.14$), from non urban areas and from urban areas ($p = 0.67$). The results of the mediating effect analysis indicate that SM exerts complete mediation in the association between SEE and AP, with a mediating effect value of 0.18.

Conclusion: The educational disparity between urban and rural areas in China is gradually narrowing. Support policies for students from impoverished families in higher education institutions are showing initial effectiveness. The conducive learning environment and educational atmosphere for students can indirectly influence their psychological state, thus impacting their academic performance during their university years.

KEYWORDS

academic performance, data analysis, socio-educational environment, study motivation, questionnaire

Introduction

The field of educational studies has gained significant prominence in recent years, serving as a catalyst for scientific and technological advancements worldwide. This exemplifies the indispensable role that education plays in shaping a nation's future (Feng et al., 2023). During the 20th National Congress of the Communist Party of China in 2022, Chinese President Xi (2022) underscored the imperative of cultivating talents for both the Party and the nation. He stressed the need to comprehensively enhance the caliber of autonomous talent development, with a specific emphasis on nurturing exceptional and pioneering individuals while attracting talents from across the globe. Moreover, in order to achieve the goals of sustainable development, higher education, as a unique entity that encompasses all disciplines, should contemplate how to continuously provide society with high-quality talent (Feng et al., 2023; Gwilliam et al., 2023).

The AP of college students can serve as a predictor of their future achievements in the workplace (Kim, 2020; Peng et al., 2021). It often serves as a comprehensive indicator of students' learning ability, level of engagement in learning, and proactiveness in their studies. Students with a strong AP can receive scholarships, job offers, and even be recommended to pursue a master's degree at higher-level universities. This provides a prerequisite for us to study the influencing factors of college students' AP (Wang et al., 2022). Conversely, students who perform poorly academically may struggle to find ideal employment opportunities and may even be unable to graduate successfully (Zayed et al., 2022). As a result, researchers from different countries are actively conducting theoretical and practical studies to identify factors that impact students' academic performance and intervene accordingly to improve their academic achievements.

Regarding these influencing factors, we can categorize them into two main aspects: internal factors within the students themselves and external factors that surround the students. For instance, Smith et al. (2023) conducted a study with 302 adolescent participants and found that teenagers with attention deficit or hyperactivity disorders generally exhibit lower levels of learning motivation, which in turn affects their academic performance. The internal factors such as sleep (Boraita et al., 2023; Chan et al., 2023; Hamvai et al., 2023), depression (Song et al., 2023; Urbanska-Grosz et al., 2023), and disordered social media use (Almarzouki et al., 2022; Sserunkuuma et al., 2023) also exert varying degrees of influence on academic performance. In this study, we primarily investigate the internal factors pertaining to learning state, encompassing self-efficacy and learning behavior. Xu et al. (2023) posits that self-efficacy in learning is a significant factor that can influence, and even determine, learning motivation and cognitive emotions. By enhancing self-efficacy in learning, academic performance can be improved. Latino et al. (2023) implemented a physical activity program during breaks to artificially intervene, and found that after 12 weeks, the attention and self-efficacy of most students had significantly improved. Du et al. (2022) believes that students who achieve success in learning follow a learning pattern consisting of "before-class, in-class, and after-class" behaviors, which has been verified. This illustrates that good study habits are key to achieving academic success. From a teacher's perspective, one of the purposes of changing the teaching mode is to enhance autonomous learning ability. Lu et al. (2023) designed multiple learning activities during actual teaching process and verified this viewpoint.

From an external perspective, there are numerous factors that influence academic performance. In this study, we focus on three aspects: peers, teaching methods employed by teachers, and the family environment, which are the groups with whom students have the most interaction. The phenomenon of peer effect is an inherent law, whereby negative occurrences can spread among companions, such as depressive emotions (Huang et al., 2023). On the contrary, peers can also provide mutual support and assistance in learning, exerting a positive influence that is comparable to that of a teacher in practical activities (Sahin et al., 2023). One of the indicators for evaluating students' classroom achievements is the assessment of teachers' teaching. The appropriateness of a teacher's instructional skills directly impacts students' classroom gains (Wang et al., 2023). By utilizing advanced teaching equipment, the effectiveness of classroom interaction can be enhanced, allowing students to actively engage in classroom activities (Hu, 2023). By harnessing internet resources, the implementation of flipped classroom pedagogy can break down the constraints of time and space in learning, allowing for a more flexible and accessible approach to education (Ruzafa-Martínez et al., 2023). The influence of the family on academic performance manifests in various aspects. Zhang et al. (2023) showed that family cultural capital, family economic capital, and parental support all contribute to an increased likelihood of becoming a scientist. Conversely, parents' negative habits can lead to a decline in academic performance. For example, parental anxiety can result in child anxiety (Albulescu et al., 2023), while parents' smoking habits can influence children to mimic smoking behavior (Zhou et al., 2023), thereby impacting academic performance.

However, how does the social educational environment, including peers, teacher teaching methods, and family, affect AP? Is it related to the SM in individual factors? I suppose that SEE can shape or modify people's study state and indirectly affect AP. Against this backdrop, this study focuses on computer science students from a local university in Hebei Province, China to explore the relationships SEE, SM, and AP with the aim of analyzing the reasons behind differences in AP. The objective is to analyze the underlying reasons for the differences in academic performance among students from local universities in Hebei Province. This study can explore the impact of social education environment on academic performance, providing suggestions for students, teachers, and educational decision-makers to improve students' academic performance. For students, it helps to comprehensively develop knowledge and skills, and improve social competitiveness. For teachers, the fundamental task of cultivating morality and nurturing talents can be implemented, the teaching concepts and methods can be continuously improved, therefore, achieving a virtuous cycle of student progress and teacher self-improvement. For educational decision-makers, the plan for further deepening the reform of the education system, promoting the construction of China's "first-class university," and cultivating social talents can be achieved.

Literature review

Socio-educational environment

The educational environment of students plays a crucial role in influencing their academic performance. As previously mentioned,

parents, teachers, and the family are the primary groups that college students interact with on a daily basis. These groups, to a certain extent, represent the majority of individuals students come into contact with during their education, which we refer to as the socio-educational environment (Sahin et al., 2023; Wang et al., 2023; Zhang et al., 2023). The influence of the family on academic performance mainly includes the impact of parental educational methods on children, the effects of family economic capital and social capital on academic success, and the impact of urban–rural educational disparities on academic performance. Urban parents generally have higher levels of education compared to rural parents. This leads to they can invest more abundant time, energy and financial resources in their children's education. In other words, the higher the parents' educational attainment is, the more scientifically they educate their children, the greater their academic involvement, and the higher the academic performance their children can achieve. The urban–rural educational disparities primarily manifest in terms of educational resources and teacher qualifications (Zhang et al., 2018, 2020). Compared to urban areas, rural areas lag behind in terms of educational facilities and teachers' pedagogical approaches. Therefore, these factors have long-term effects on rural children, preventing them from attaining a favorable learning environment (Yuan et al., 2021).

The teaching methods of teachers can also impact students' AP. The traditional methodology of instruction primarily entails the dissemination of knowledge through theoretical lectures and direct demonstrations during practical laboratory sessions (Deng, 2023). While these methods indeed serve a necessary purpose by directly aiding in students' comprehension of course content and operational procedures, the integration of novel pedagogical approaches such as online and offline blended teaching methods, can effectively enhance the quality of instruction (Guo et al., 2022).

The improved pedagogical techniques encompass heuristic teaching, discussion-based teaching, problem-based learning, and case-based teaching. Compared to traditional methods, these improved pedagogical techniques are more favorably received by students. They have the ability to captivate students' learning interests and attentiveness in the classroom, thus enhancing their AP (Zhou et al., 2016). The proactive pedagogical reform by teachers can subtly influence students' academic resilience, learning motivation, and academic fatigue, thereby indirectly impacting their AP. Teachers who actively explore pedagogical reform and seek progress set a non-academic example for students, fostering intrinsic motivation and providing them with a drive to learn (Trigueros et al., 2020). By proactively enhancing the classroom atmosphere and strengthening interaction with students, teachers significantly improve students' engagement. It has a positive impact on enhancing students' AP (Aguilera and Perales-Palacios, 2020; Tong et al., 2022). On the contrary, if teachers fail to assume their rightful responsibilities and resort to violent behavior towards students, it can negatively affect both student behavior and their emotional well-being, ultimately hampering their AP (Kiziltepe et al., 2020).

The Chinese idiom “The environment one is in will have a great influence on one” describes the phenomenon of peer influence or the company one keeps. The phenomenon of peer influence has long been a focal point of research in the fields of education and psychology. A plethora of literature has already demonstrated that peers can exert both positive and negative influences on one another. In the study

conducted by Bi et al. (2023) on the impact of depression on academic performance in adolescents, it was found that male students can enhance their academic achievement through the improvement of peer relationships, whereas this improvement was not observed among female students. Ni and Wang (2023) discovered that an increase in the number of friends, regardless of whether they are of the same sex or opposite sex, can lead to a decline in academic performance among Chinese middle school students. Meanwhile, Wu et al. (2023), through a controlled experiment, found that peer feedback can effectively enhance the English academic writing proficiency of Chinese doctors. Similarly, Durak (2022) employed a controlled experimental approach and implemented four different blended teaching methods in classrooms. The research findings indicate that students using peer-assisted methods are more likely to achieve success compared to those using other methods. Additionally, peer assistance has been shown to significantly improve both the learning motivation and self-efficacy within the group, providing favorable evidence for enhancing academic performance. Chinese college students typically spend about 8 months in school each year, and they spend a significant amount of time living with their roommates. Based on previous research findings, we can boldly speculate that the AP of Chinese college students is influenced by their roommates.

Study motivation

Currently, the scientific community has reached a consensus that learning behavior and learning self-efficacy have a direct impact on academic performance. Learning self-efficacy refers to an emotional state experienced during the learning process. Behavior is influenced by the prevailing emotional state (Kim et al., 2023), and a positive psychological state is more likely to generate positive behaviors. Therefore, in this study, the term “learning state” refers to both learning self-efficacy and learning behavior.

The study behaviors have long been considered a direct factor influencing AP. In their study on “The Relationship Between Improvement in Higher Education Quality and Cognitive, Behavioral, and Personality Factors of Students,” Martinez et al. (2019) found a positive linear relationship between study behaviors and AP. In their research on the impact of academic achievement among secondary school students, del Rosal et al. (2012) employed SEM to identify the optimal factors influencing AP. They found that study behaviors, compared to personal adjustment, exhibited stronger predictive power for AP. Liu (2017) conducted a study focused on vocational education, using multivariable linear regression model analysis. The findings revealed that classroom study behaviors had the greatest impact on academic achievement, followed by extracurricular study behaviors and internship training behaviors. In another similar study conducted by Liu (2016), it was indicated that active note-taking and actively engaging in discussions or seeking advice from teachers are study behaviors that contribute to improved AP.

Indeed, study self-efficacy is also considered a direct factor that influences AP. Since Bandura's concept of self-efficacy was put forward in 1986, numerous scholars have conducted extensive research in this area. During the investigation of the relationship between self-efficacy, teacher-student relationships, and mathematical performance, Fu (2023) discovered that self-efficacy can serve as a mediating variable.

Establishing a positive teacher-student relationship facilitates the enhancement of self-efficacy, reduction of academic anxiety, and improvement in mathematics achievement. Similar research has also been conducted by Ji and Zhao (2021), who employed SEM to reveal that teacher support can indirectly influence academic achievement through its impact on academic self-efficacy. Meng and Zhang (2023) findings in higher education research indicate a significant and positive correlation between academic self-efficacy, academic engagement, and academic achievement. Academic self-efficacy has the capability to directly predict AP.

The existing research findings have some limitations. Firstly, some literature examines the factors influencing AP from a narrow perspective. If intrinsic and extrinsic factors are combined together, it is unclear how they affect AP. Secondly, some literature focuses on preschool or primary/secondary school students as research subjects. Compared to college students, their cognitive development is not yet fully completed. Therefore, the research conclusions may not be entirely applicable to college students. Thirdly, each country has its own national conditions, educational philosophies, and teaching methods, which are not entirely consistent. Therefore, research conclusions may not be universally applicable. Fourthly, students from different levels of universities have varying levels of abilities. For example, in terms of learning ability and study behaviors, there may be no difference between students from Tsinghua University and Peking University, while students from ordinary universities may lag behind those from the aforementioned two universities.

Method

Participants and contexts

The participants are students from a provincial university in Hebei Province, China. This university serves as a representative of local general higher education institutions in Hebei Province. In 2022, the test group of participants had a minimum entrance exam score of 515, a maximum score of 537, an average score of 521, and the college entrance examination rank should be at least sixty thousand or so. The research findings of this paper can be applicable to other general higher education institutions in Hebei Province, as well as can be extended to colleges and universities of similar caliber in other provinces nationwide.

Measures

In order to explore the causal relationship among SEE, psychological factors related to learning, and AP, this study will employ a questionnaire survey method for data collection. The SEE will be assessed based on factors such as family relationships, teaching skills of educators, and roommate relationships. Psychological aspects of learning will be measured through self-efficacy and study behaviors, among other aspects. AP will be evaluated by the research subjects' grade point averages. To develop the necessary measurement instruments for this study, we will design appropriate questionnaires and conduct comprehensive analyzes by incorporating students' overall AP from the school's grading system and survey data on their family backgrounds. These data will contribute to our understanding

of the relationship between SEE, psychological factors related to learning, and AP, as well as the extent to which they influence students' academic achievements.

The dimensions of peers, educators, and family can collectively be referred to as the SEE. Wu and Qian (2007) developed the "Questionnaire on Interpersonal Relationship Quality in University Dormitories." This questionnaire consists of a total of 19 indicators, divided into four dimensions: emotional harmony among dormitory residents, interpersonal communication in the dormitory, interregional differences in interpersonal dynamics, and disturbances affecting interpersonal relationships in the dormitory. It comprehensively reflects the dormitory relationships among college students. Olson constructed the "Family Adaptability and Cohesion Evaluation Scale II" (FACES II), which is an adapted version of the original scale based on the Chinese family environment. It primarily assesses the aspects of family cohesion and adaptability, examining the family environment. Regarding SM, it can be observed through learning attitudes and self-efficacy. Tan (2007) developed the "Self-report Scale of Learning Attitude for Primary and Secondary School Students," which posits that learning attitudes consist of three components: emotional experiences, behavioral tendencies, and cognitive levels. The behavioral tendencies component showcases students' study behaviors. Xu (2015) developed the "Questionnaire on Learning Attitudes of College Students." Its dimension of intellectual curiosity includes learning motivation, encompassing cognitive, emotional, and behavioral aspects of learning attitudes. Pintrich and Groot (1990) developed the Academic Self-Efficacy Questionnaire, which divides academic self-efficacy into two dimensions: self-efficacy perception of learning abilities and self-efficacy perception of study behaviors. However, it is worth noting that there is a scarcity of scales and questionnaires targeting teacher-related factors. Upon our observations, it has come to our attention that there is a lack of scales and questionnaires specifically designed for assessing teacher-related factors. As a result, we have taken the initiative to independently design a section pertaining to the evaluation of teaching skills based on practical considerations. Building upon the aforementioned analysis, we aim to develop and refine measurement tools in this regard.

The preliminary development of the questionnaire is divided into two steps. The first step involves reviewing and selecting relevant domestic and international literature and scales, and collecting pertinent information. The second step entails adapting existing mature scales to align with the specific context and requirements. The questionnaire consists of two sections. The first section includes non-scale items, which gather basic information about the students, such as their names, genders, and family backgrounds. The second section comprises test questions that assess five dimensions: peer relationships, teacher influence, family environment, study behaviors, and self-efficacy. Following the completion of this task, we conducted separate discussions with 5 students, 2 frontline teachers, and 1 educational expert. Through these interactions, we made necessary modifications and improvements to the questionnaire, resulting in the final version. The peer scale consists of 5 measurement indicators, the teacher scale comprises 5 indicators, the family relationships scale includes 5 indicators, the study behaviors scale has 3 indicators, and the self-efficacy scale comprises 5 indicators. The whole questionnaire consists of 23 indicators. The scale employs a 5-point Likert scale for scoring. "Extremely Inconsistent" is assigned a score of 1, "Inconsistent" is assigned a score of 2, "Neutral" is assigned a score of

3, “Consistent” is assigned a score of 4, and “Extremely Consistent” is assigned a score of 5.

Data analysis

The data analysis for this study primarily utilizes SPSS 26.0 software and AMOS 26.0 software. SPSS 26.0 is primarily employed for exploratory factor analysis (EFA) of reliability analysis, correlation analysis, and analysis of variance (ANOVA) in the assessment of validity. On the other hand, AMOS software is primarily utilized for confirmatory factor analysis (CFA) of reliability analysis and constructing a structural equation model (SEM).

Results

Data screening

We provided a total of 23 estimated parameters, and calculated the minimum sample size of 230 based on the ratio of 10:1 (sample size: estimated parameter) recommended by relevant researchers (Bentler and Chou, 1987; Jackson, 2003). We have initially gathered 330 questionnaires, resulting in a sample size of 330 for the study, which exceeds the minimum requirement of 230. In order to ensure the questionnaires possess sufficient reliability, we have excluded the 15 questionnaires that were completed in the shortest amount of time. Among the remaining 315 questionnaires, no instances of missing values or outliers have been identified. Therefore, there are a total of 315 valid samples in the final dataset.

Reliability and validity analysis

Reliability analysis

The reliability test results are presented in Table 1. The overall reliability is 0.88, with a reliability of 0.83 for peer influence, 0.90 for teacher influence, 0.90 for family influence, 0.83 for self-efficacy influence, and 0.77 for study behaviors. The results of the credibility test are shown in Table 1. The overall reliability coefficient is 0.88, with a reliability coefficient of 0.83 for the peer section, 0.90 for the teacher section, 0.90 for the family section, 0.83 for the self-efficacy section, and 0.77 for the study behavior section. With the exception of the slightly lower reliability in the dimension of study behaviors, all other dimensions have achieved a reliability of 0.80 or above. This indicates

that the questionnaire has good reliability and can be processed to the next step of analysis.

Validity analysis

The validity analysis is mainly conducted through factor analysis. Factor analysis can be divided into exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Perform KMO and Bartlett's sphericity test on a sample of 315 survey responses. Upon examination, the overall questionnaire $KMO=0.88$, $\chi^2=3635.70$, $df=253$, $p<0.05$. The test results demonstrate the fulfillment of the prerequisites for EFA. In the results of principal component analysis, there are five factors with eigenvalues greater than 1 (as shown in Table 2, only the factors with eigenvalues greater than 0.60 were selected). In the scree plot, the first five factors exhibit steep slopes, while the slope becomes gentler starting from the sixth factor (as illustrated in Figure 1). Based on the eigenvalues and the scree plot, it is advisable to select five dimensions, which aligns with the initial assumptions. By computing the component matrix of the 23 indicators after rotation (as shown in Table 3) and observing the factor loading coefficients of each item on the five dimensions, it can be concluded that the indicators are consistent with the predetermined dimensions. Furthermore, it can be observed from Table 2 that the cumulative variance contribution rate of the five factors reaches 66.99%, with the largest factor variance contribution rate being 15.67%. Therefore, it can be concluded that there is no significant issue of common method bias in the questionnaire data.

The dataset consisting of 315 questionnaires was subjected to a validity assessment using the AMOS 26.0 software, specifically employed for CFA. The validity analysis can be conducted from three perspectives: construct validity, convergent validity, and discriminant validity. These aspects will be examined to ensure the robustness of the measures. The validity analysis of the results showed that the chi square ratio of degrees of freedom and RMSEA were, respectively, 1.65 and 0.05 and the NFI, RFI, IFI, TLI, and CFI are, respectively, 0.91, 0.90, 0.96, 0.95, and 0.96, which met the requirements (as shown in Table 4). All indicators have reached excellent levels, indicating that the questionnaire has good construct validity. The convergent validity analysis result is depicted in Table 5, where the Average Variance Extracted (AVE) of each dimension ranges from 0.51 to 0.65, and the Composite Reliability (CR) ranges from 0.77 to 0.90. This indicates that the questionnaire has good convergent validity. The discriminant validity analysis result is depicted in Table 6, where the square root of the AVE for each factor is greater than the maximum correlation coefficient between that factor and other factors. This indicates that the questionnaire has good discriminant validity.

Correlation analysis

Utilizing the SPSS 26.0 software, we shall conduct a correlation analysis among the 315 questionnaire responses across five dimensions, namely peers, teachers, family, study behavior, and study self-efficacy. The results are presented in Table 7. Except the relationship between roommate relations and AP is not significant; all other relationships demonstrate significant correlations.

Differential analysis

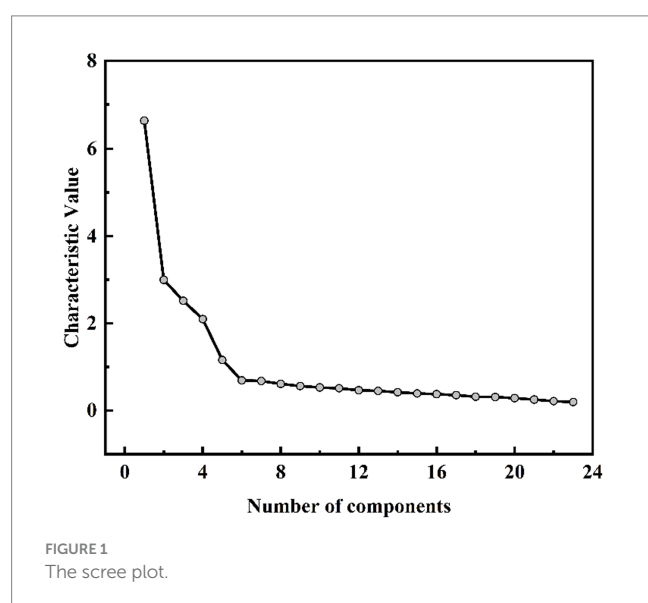
In order to investigate the differences in AP among students based on gender, family background, and educational area, an independent samples t-test was conducted. The results are presented in Table 8. The

TABLE 1 The reliability test.

	Cronbach's Alpha	Number of indicators
Roommate	0.83	5
Teacher	0.90	5
Family	0.90	5
Study self-efficacy	0.83	5
Study behavior	0.77	3
Total	0.88	23

TABLE 2 Total variance exposition.

	Initial eigenvalue			Sum of extracted load squares			Sum of rotational load squares		
	Total	Variance	Cumulative variance %	Total	Variance	Cumulative variance %	Total	Variance	Cumulative variance %
1	6.65	28.89	28.89	6.65	28.89	28.89	3.60	15.67	15.67
2	3.00	13.02	41.91	3.00	13.02	41.91	3.60	15.66	31.32
3	2.52	10.95	52.86	2.52	10.95	52.86	3.16	13.73	45.05
4	2.10	9.11	61.97	2.10	9.11	61.97	3.10	13.48	58.53
5	1.16	5.02	66.99	1.16	5.02	66.99	1.95	8.46	66.99
6	0.69	3.01	70.00						
7	0.68	2.94	72.94						
8	0.61	2.65	75.59						



normality test revealed that AP follows a normal distribution ($p < 0.001$), which satisfies the assumptions for conducting an independent samples t -test.

Based on the results of the independent samples t -test, it was found that male students have lower AP compared to female students. This difference is statistically significant at a significance level of 1%, indicating a significant gender difference in AP. According to the analysis results, there is no significant difference in AP based on whether or not there are special circumstances within the family. Special circumstances refer to situations such as economic difficulties, single-parent households, or being an orphan. Based on previous research findings, urban students tend to have higher AP compared to non-urban students due to factors such as abundant educational resources. In this study, students' areas of residence were categorized into urban and non-urban area. However, the analysis results indicate that there is no significant difference in AP based on whether students receive education in urban or non-urban areas.

Mediation analysis

Preliminary SEM

Applying a second-order SEM to assess the relationships among SEE, SM and AP, as illustrated in Figure 2. Table 9 presents the results

of the bootstrap analysis on the measurement instrument, providing standardized and non-standardized path coefficients, total effects, direct and indirect effects, significance of non-standardized path coefficients, and 95% confidence intervals. The observed variables for the SEE include peers, teachers, and family, with loadings ranging from 0.53 to 0.63. Regarding the observed variables for SM, they consist of study behavior and self-efficacy, with loadings ranging from 0.63 to 0.99. The path coefficient between the SEE and SM is 0.64 ($p < 0.01$), with the 95% confidence interval not containing zero, indicating a significant positive influence. The path coefficient between SM and AP is 0.28 ($p < 0.01$), with the 95% confidence interval not containing zero, indicating a significant positive influence. However, the path coefficient between the SEE and AP is 0.10 ($p > 0.05$), with the 95% confidence interval containing zero, suggesting that there is no significant positive influence.

Improved SEM

Based on the preliminary analysis of the SEM, we speculate that there is a complete mediating effect between the SEE, psychological factors related to learning, and AP. Specifically, the SEE indirectly influences AP by affecting SM. Therefore, we revised the model by removing the direct influence of the SEE on AP. The results of the structural equation model testing are presented in Figure 3, while the Bootstrap test results are shown in Table 10. After removing the path connecting the SEE and AP, the impact of SM on AP remains significant. The indirect effect of the SEE on AP through its influence on SM is estimated to be 0.18. After the revision, the model fit indices demonstrate a satisfactory level of fit. The χ^2/df value is 1.42 (< 3), RMSEA is 0.04 (< 0.08), and NFI, IFI, TLI, and CFI are all greater than 0.90. These results indicate that the revised model has reached a desirable level of fit.

Discussion

Discussion of differential analysis results

In terms of gender differences, male students exhibit lower academic performance than their female counterparts. This finding contradicts our traditional beliefs. Based on previous research analysis, males have been found to exhibit stronger superiority in logical thinking and have a higher working memory capacity (Pezzuti et al., 2020). Therefore, during the primary and secondary school stage,

TABLE 3 The component matrix after rotation.

Indicators	Component				
	1	2	3	4	5
Family Relations1		0.87			
Family Relations2		0.85			
Family Relations3		0.82			
Family Relations4		0.80			
Family Relations5		0.75			
Teacher's Teaching Skills1	0.85				
Teacher's Teaching Skills2	0.84				
Teacher's Teaching Skills3	0.81				
Teacher's Teaching Skills4	0.78				
Teacher's Teaching Skills5	0.78				
Roommate Relations1				0.81	
Roommate Relations2				0.75	
Roommate Relations3				0.77	
Roommate Relations4				0.74	
Roommate Relations5				0.72	
Study Behavior1			0.83		
Study Behavior2			0.72		
Study Behavior3			0.68		
Study Self-Efficacy1					0.72
Study Self-Efficacy2					0.69
Study Self-Efficacy3					0.78
Study Self-Efficacy4					0.80
Study Self-Efficacy5					0.79

TABLE 4 The construct validity analysis.

	Result	Standard
χ^2/df	1.65	<3.00
RMSEA	0.05	<0.08
Normed fit index(NFI)	0.91	>0.90
Relative fit index(RFI)	0.90	>0.90
Incremental fit index (IFI)	0.96	>0.90
Tucker-Lewis index(TLI)	0.95	>0.90
Comparative fit index (CFI)	0.96	>0.90

there does exist a phenomenon where male students demonstrate superior scientific reasoning ability and academic performance compared to female students (Luo et al., 2021). When it comes to studying computer science or other technical fields, it is often assumed that males are naturally more skilled than females. However, research has found that the gender-based differences in these areas are unstable and vary across different research contexts (Vo and Csapó, 2020). In the field of computer programming, Yang and Bers (2023) conducted an observational study on the manifestation of programming skills in early childhood and found that there were no significant differences in programming abilities between boys and girls. Therefore, we can

infer that gender does not necessarily lead to differences in logical thinking among individuals. By analyzing the research findings on engineering education in the past 2 years, we have discovered that female students do not perform worse than male students academically. Tong (2005) conducted a statistical analysis and did not find any evidence suggesting that males have an advantage in STEM (Science, Technology, Engineering, and Mathematics) subjects. On the contrary, females have shown superior performance in multiple mathematics-related courses compared to males. Wrigley-Asante et al. (2023) conducted a comparative study between college students' performance in STEM subjects in Advanced Placement (AP) exams and their high school subject grades. They found that male students had better AP scores during their high school years. However, during their college years, female students showed an improvement in their AP scores compared to male students. They argue that it is necessary to break the stereotypes associated with STEM subjects, as female students demonstrate greater levels of dedication, self-discipline, and commitment to learning compared to male students. Although male students may have advantages over female students in engineering job opportunities, female students strive to improve their competitiveness to ensure good job prospects after graduation, leading to differences in their learning styles (Chu, 2017). As a result, it is observed that female engineering students perform significantly better than male students in major coursework. Our research findings are consistent with those of the aforementioned scholars. Although male students may initially have an advantage in computer learning, they tend to be overconfident in their abilities, which can reduce their motivation and enthusiasm for learning. On the other hand, although female students may face disadvantages in computer-related fields, they often strive to compensate for these disadvantages through diligent study. Furthermore, an additional possibility exists whereby the presence of stereotypes poses a threat, as it implies that gender-based irrational beliefs can have a detrimental impact on the intellectual performance of women (Takatsuka et al., 2022). As a result, male students exhibit a more favorable attitude towards learning programming in comparison to their female counterparts (Sun et al., 2022). However, it is important to note that this study primarily focuses on first-year students enrolled in foundational courses, where computer programming classes are rarely included in the curriculum. Additionally, the increased dedication of female students to their academic pursuits exacerbates the widening gap between genders.

The detrimental familial environment appears to exert no discernible impact on students' academic performance. The findings of this study are inconsistent with those of other scholars' researches. Regarding students from financially disadvantaged backgrounds, other scholars' researches tend to suggest that their academic performance will significantly lag behind those who come from relatively high-income families. Poverty exerts a direct negative impact on students' academic achievement, and increasing family income is fundamental to ensuring children's academic success (Li et al., 2023). Scholar Wang (2017) revealed the significant impact of family economic capital on college students' academic performance. Similarly, Li and Ou (2018) found that the disposable income of impoverished families can also have a certain influence on academic achievement. For students with more unique family structures such as single-parent or left-behind children, other scholars also suggest that academic performance of students from single-parent or reconstituted families is worse than that of students from two-parent families

TABLE 5 The convergent validity analysis.

	Path	Standardized estimate	AVE	CR
Family F1	F1 → Family Relations1	0.89	0.64	0.90
	F1 → Family Relations2	0.84		
	F1 → Family Relations3	0.77		
	F1 → Family Relations4	0.77		
	F1 → Family Relations5	0.74		
Teacher F2	F2 → Teacher's Teaching Skills1	0.73	0.65	0.90
	F2 → Teacher's Teaching Skills1	0.77		
	F2 → Teacher's Teaching Skills1	0.78		
	F2 → Teacher's Teaching Skills1	0.87		
	F2 → Teacher's Teaching Skills1	0.85		
Roommate F3	F3 → Roommate Relations1	0.78	0.51	0.84
	F3 → Roommate Relations1	0.71		
	F3 → Roommate Relations1	0.70		
	F3 → Roommate Relations1	0.73		
	F3 → Roommate Relations1	0.64		
Study Behavior F4	F4 → Study Behavior1	0.74	0.52	0.77
	F4 → Study Behavior2	0.74		
	F4 → Study Behavior3	0.69		
Study Self-Efficacy F5	F5 → Study Self-Efficacy1	0.75	0.54	0.85
	F5 → Study Self-Efficacy2	0.80		
	F5 → Study Self-Efficacy3	0.68		
	F5 → Study Self-Efficacy4	0.68		
	F5 → Study Self-Efficacy5	0.75		

AVE represents the average variance extracted, CR represents composite reliability.

TABLE 6 The discriminant validity analysis.

	Study self-efficacy	Study behavior	Roommate	Teacher	Family
Study self-efficacy	0.73				
Study behavior	0.63	0.72			
Roommate	0.14	0.30	0.71		
Teacher	0.30	0.41	0.37	0.80	
Family	0.27	0.40	0.33	0.33	0.80
AVE	0.54	0.52	0.51	0.65	0.64

(Dufur et al., 2023). Scholar Suk (2021) conducted research and found that the level of single-parent children in CSAT (College Scholastic Ability Test) scores, family education support, school education experience, and student education experience is lower than that of two-parent children. As per these research findings, the varying social economic conditions within households can lead to differences in students' educational investment, educational impact, psychological influence, and ultimately affect their academic performance. However, the findings of this study are more congruous with the actual circumstances of the research subjects. Currently, in accordance with relevant policies established by the Chinese government and educational institutions, students from disadvantaged family backgrounds are receiving academic support. For instance, subsidies

are being provided to impoverished students as well as their families. Furthermore, national scholarships, institutional grants, national student loans, and part-time job opportunities are offered to alleviate financial burdens. As a result, students from financially stable backgrounds and those from disadvantaged family backgrounds do not exhibit significant disparities in terms of economic conditions. Moreover, students from underprivileged families demonstrate greater determination to achieve outstanding academic results by persisting through adversity. Considering that university students are of legal age and exhibit higher levels of psychological maturity, these factors may contribute to minimizing the influence of their family backgrounds on their academic performance (Götz et al., 2020; Slobodskaya and Kornienko, 2021).

TABLE 7 Pearson correlation analysis.

	Roommate relations	Teacher's teaching skills	Family relations	Study behavior	Study self-efficacy	AP
Roommate Relations	1					
Teacher's teaching skills	0.33**	1				
Family relations	0.30**	0.31**	1			
Study behavior	0.24**	0.34**	0.33**	1		
Study self-efficacy	0.17*	0.25**	0.23**	0.51**	1	
AP	0.08	0.14*	0.22**	0.29**	0.21**	1
M	3.70	4.03	3.85	2.93	3.34	0.03
SD	0.76	0.70	0.85	0.79	0.67	0.92

* $p < 0.05$, ** $p < 0.01$, M represents the mean, SD represents standard deviation.

In terms of educational resources, there is no significant disparity in academic performance between students from urban and rural areas. It is widely acknowledged that there does exist a developmental gap between urban and rural regions. It cannot be denied that students receiving education in urban areas have access to more comprehensive educational resources compared to their rural counterparts. This disparity is attributable to the differential pace of development between urban and rural areas, which is understandable. In recent years, China's education policy has gradually shifted towards prioritizing rural areas. Various levels of government have increased investment in rural basic education, indicating a growing focus on rural areas in educational policies. For example, the government has increased financial investment to improve rural infrastructure conditions. Additionally, there is a recognition of the cognitive and teacher quality disparities between urban and rural areas, emphasizing the priority of improving the quality of rural teachers to promote educational equity (Zheng et al., 2023). Therefore, China employs various methods such as recruitment, training, and providing financial support to attract excellent teachers to teach in rural schools. Furthermore, with the development of the digital economy (Jiang et al., 2022), digital learning resources and distance education services are being provided (Zhang et al., 2017) to compensate for the relative lack of educational resources in rural schools. This series of measures has contributed to the gradual reduction of the urban–rural education resource gap. Lastly, the efforts made by the students themselves are also crucial (Asadullah et al., 2021).

Discussion of correlation analysis results

The correlation between learning behaviors and self-efficacy is significantly positive. This signifies that the more proactive one's learning behaviors are, the more knowledge and skills they acquire, thereby enhancing their self-efficacy. In other words, possessing higher self-efficacy can stimulate more proactive learning behaviors. This finding aligns with the research findings of other scholars. The research conducted by Hammad et al. (2022) confirms a significant positive correlation between students' self-efficacy and academic achievement, as well as between learning motivation and academic achievement. Furthermore, in other studies, it has been found that self-efficacy can influence learning behaviors both directly and

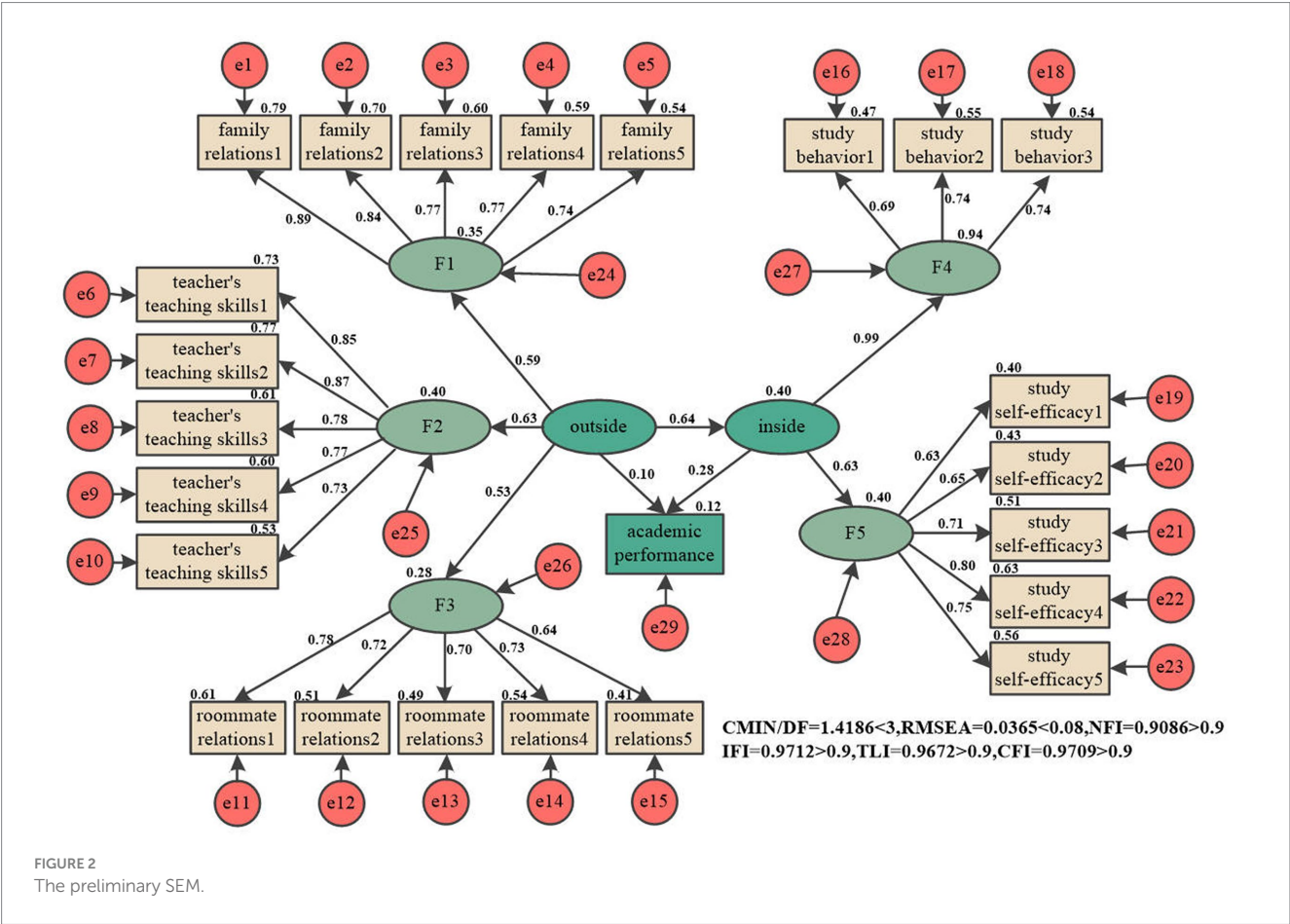
indirectly through its impact on intermediate variables. For instance, the academic self-efficacy of college students indirectly affects their learning behaviors by influencing their learning motivation (Bai et al., 2020). Similarly, self-efficacy itself can act as an intermediate variable affecting learning behaviors. Zhang and Xv (2023) not only confirmed a significant positive correlation between self-efficacy and learning behaviors among college students but also discovered that place identity indirectly influences learning behaviors through self-efficacy. In other words, self-efficacy plays a partial mediating role in the relationship between place identity and learning behaviors.

The relationship between roommate dynamics and learning behaviors exhibits a significant positive correlation. This finding aligns with the aforementioned phenomenon of peer effects. Within the university context, students spend a considerable amount of time with their roommates, and their behaviors, including their study habits, can mutually influence one another. Certain students are more strongly influenced by peer effects, specifically those with a higher degree of peer attachment. These individuals tend to demonstrate better adaptation and conformity (Xu and Tu, 2023), resulting in a higher consistency between their learning behaviors and those of their peers. Kaehwan (2020) have found through their research that peer attachment significantly influences intrinsic learning motivation. Additionally, peer attachment exhibits a partial mediating effect between self-esteem and intrinsic learning motivation. Since learning motivation has a significant positive impact on autonomous learning behaviors (Bai et al., 2020), it can also confirm the significant positive correlation between peer effects and learning behaviors. However, the correlation between roommate dynamics and learning behaviors tends to weaken gradually over time due to cumulative factors. Cheng and Liang (2022) conducted research revealing that dormitory peers have a significant positive impact on individuals' engagement in negative classroom behaviors, positive classroom behaviors, and negative extracurricular learning behaviors. However, as students make progress in their academic pursuits, their social circles expand, which makes them spend less time with their roommates. Consequently, this influence tends to gradually diminish over time.

There is a significant positive correlation between a teacher's teaching skills and students' learning behaviors. This result suggests that students' learning behaviors are easily influenced by the teacher's teaching methods. The stronger a teacher's teaching ability is, the more

TABLE 8 The independent samples T-test.

Grouping variables		$M \pm SD$	t	p
Gender	Male ($n = 214$)	-0.12 ± 1.00	-4.11	0.00
	Female ($n = 101$)	0.33 ± 0.62		
Family	Normal family ($n = 282$)	-0.00 ± 0.92	-1.50	0.14
	Special family ($n = 33$)	0.25 ± 0.89		
Educational area	Non-urban area ($n = 251$)	0.37 ± 0.91	0.42	0.67
	Urban area ($n = 64$)	-0.02 ± 0.95		



proactive the students' learning behaviors become. This is consistent with our understanding. Xie et al. (2017) research demonstrated that six types of teaching behaviors, such as "clearly explaining course objectives and requirements," have a significant impact on students' learning behaviors. Li and Xue (2023) study also confirmed that positive teacher behaviors are moderately correlated with students' participation in classroom learning.

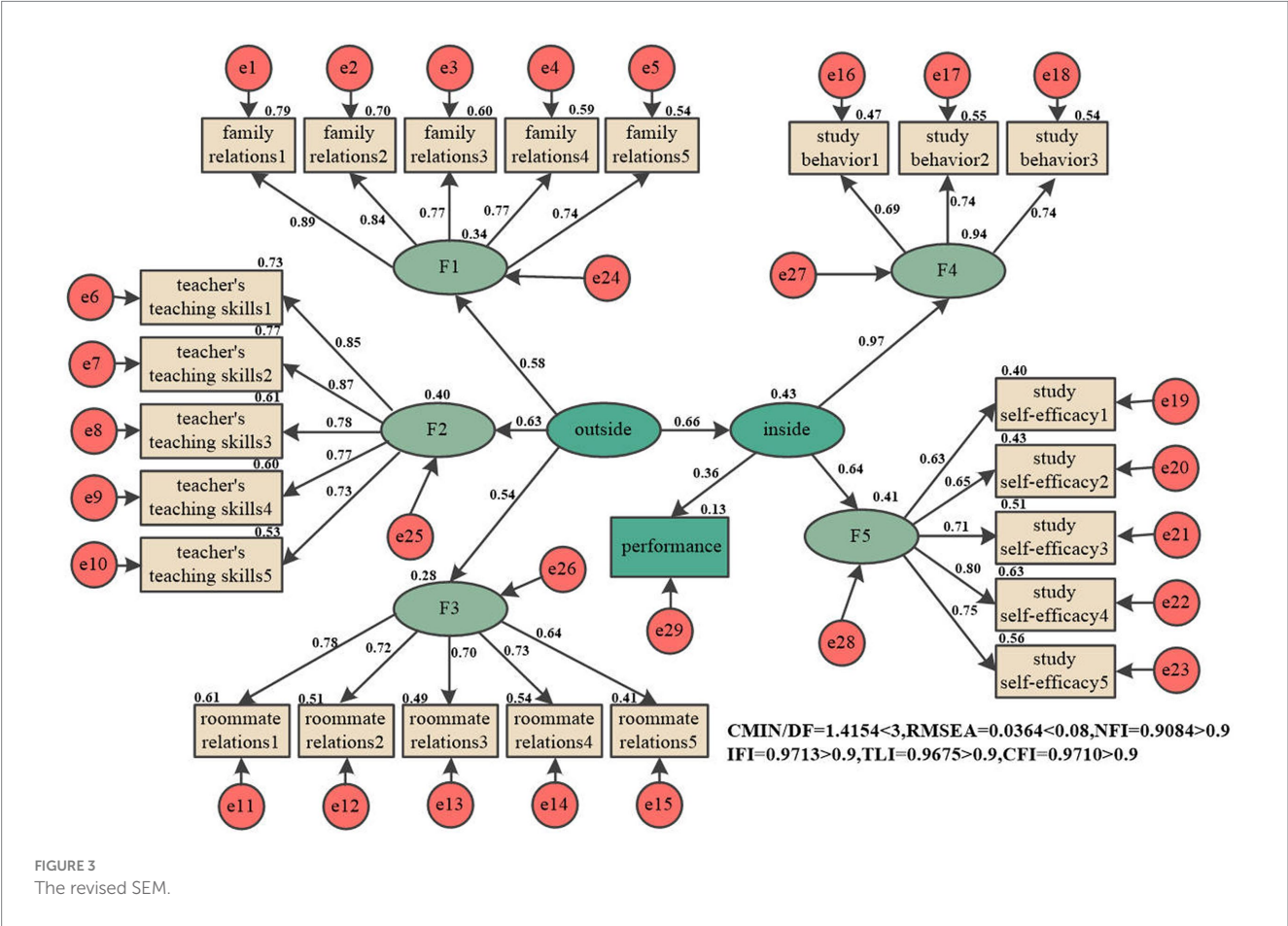
The correlation between family relationships and academic performance is significantly positive. The household serves as the developmental environment for every student, as well as the breeding ground for cultivating habits. Harmonious family relationships contribute to the cultivation of students' good learning behaviors, while parenting styles have a positive impact on students' self-efficacy (Chen et al., 2023). The environmental factors within the family also exert a considerable influence on academic achievements

(Ortiz-de-Villate et al., 2021). This viewpoint has also been substantiated by scholars such as Otero et al. (2021), who affirm that family control and support influence students' academic performance. Similarly, Cheng et al. (2012) has reached the conclusion that family support indeed correlates with students' success in university studies. Beyond subtly shaping students' study habits, the family environment also impacts academic performance by influencing students' learning states. Research conducted by Wang (2020) reveals a significant relationship between family environmental factors and students' test anxiety. In other words, certain family factors contribute to the occurrence of test anxiety and other related issues, which ultimately affect students' final academic performance.

The correlation between teaching skills and academic performance is significantly positive. Factors such as teachers' knowledge base, teaching methods, and teaching skills directly impact students'

TABLE 9 The preliminary SEM Bootstrap test.

	Path	Standard error	Effect size	Lower	Upper	p
Direct effect	SEE→SM	0.08	0.64	0.48	0.80	0.00
	SM → AP	0.13	0.28	0.05	0.54	0.02
	SEE→AP	0.13	0.10	−0.18	0.34	0.46
Indirect effect	SEE→SM → AP	0.09	0.18	0.04	0.41	0.02



academic achievement. This conclusion has been validated by numerous scholars and has become the mainstream view (Aguilera and Perales-Palacios, 2020; Tong et al., 2022). Tao et al. (2022) also proved that the impact of teacher support and its three dimensions on students' academic performance is significant. Similarly, these teaching skills of teachers can also affect students' learning motivation, problem-solving ability, and ultimately academic performance, thus having a positive impact on academic achievements (Retnawati, 2022).

There is no significant correlation between roommate relationships and AP. This indicates that there is no direct relationship between the two, but it does not mean there is no indirect relationship. Roommates can indirectly influence AP through the mutual impact on study behaviors. This viewpoint has also been demonstrated in SEM. Scholar Ha (2016) conducted research on the allocation system of university dormitories in China and the influence of roommates. It was found that roommate selection and behavior significantly affect students. Students' mimicking behavior can lead to changes in their study behaviors, thereby affecting AP.

Discussion of SEM results

At present, numerous scholars have provided evidence that the environment in which an individual is situated can influence their behavior and attitudes. For instance, the work milieu can exert an influence on psychological capital and innovative conduct (Lee et al., 2022). The perceived neighborhood environment holds the potential to impact behaviors such as sedentary lifestyles, smoking, and alcohol consumption (Liu et al., 2022). Furthermore, street conditions can influence pedestrian route selection (Jin et al., 2022), while the clinical practice environment can influence innovative behaviors. Similarly, this study confirms the impact of the educational environment on one's SM. Analysis of the results obtained through structural equation modeling reveals that the educational environment influences the state of learning, subsequently influencing academic performance. The influence of roommate relationships on learning disposition is primarily attributed to the presence of peer effects. Peers play a crucial role, either positively or

TABLE 10 The revised SEM Bootstrap test.

	Path	Standard error	Effect size	Lower	Upper	<i>p</i>
Direct effect	SEE→SM	0.08	0.66	0.49	0.81	0.00
	SM → AP	0.07	0.36	0.21	0.50	0.00
Indirect effect	SEE→SM → AP	0.06	0.23	0.12	0.36	0.00

negatively, in various aspects of college students' lives (Madtha et al., 2023). Peer effects have been proven to impact students' attitudes (Poquet and Assoc Comp, 2021). However, the outcomes resulting from peer effects vary from person to person. If an individual has a strong attachment to their peers, they tend to exhibit better adaptability and compliance in a new environment. In other words, their learning disposition is more influenced by their peers, and their learning disposition becomes more similar to that of their peers (Xu and Tu, 2023). Teachers play a significant role in influencing students' learning disposition, which is mainly manifested through their teaching skills, teaching habits, and teacher-student relationships. Over an extended period of interaction with teachers, their behavior and habits can subtly impact students (Yang and Kaiser, 2022). Teachers with excellent teaching skills can make learning easier for students and improve their learning disposition. Additionally, teachers with good teaching habits can help regulate students' learning disposition (Beausaert et al., 2013). High-quality teacher-student relationships also have significant benefits for students (Poling et al., 2022; Sun and Shi, 2022). The family environment is where individuals develop their behavioral habits, making family education crucial (Volodina, 2022). Therefore, family relationships directly influence students' learning disposition (Manukaram and Abdullah, 2021). From this, it can be deduced that the educational environment has a significant impact on students' study states. Drawing upon Burrhus Frederic Skinner's behaviorism theory and Albert Bandura's social learning theory, we postulate that learning behavior changes in response to changes in learning outcomes. Positive outcomes reinforce learning behavior, while negative outcomes weaken it, thereby establishing a feedback loop (Yin, 2010). Vu et al. (2022) referred to this cycle as a positive feedback loop and provided an apt description: motivation feeds achievement, and achievement in turn motivates, creating a mutually beneficial causal relationship. This also explains the close connection between learning status and academic performance.

Limitations

The teacher dimension in the questionnaire is assessed and filled in by students, which can introduce a certain degree of subjectivity. The teaching methods of the same teacher are easy for some students to accept, while others are not.

The AP data utilized in this study was generated during the period of the COVID-19 pandemic. During the pandemic, there was a slight relaxation in course management, with assessment methods primarily focusing on open-book examinations, course projects, and research papers. Although these assessment methods hold some reference value, they cannot fully capture students' AP compared to closed-book examinations.

Regarding external factors, beyond peers, teachers, and family, there may exist additional potential factors within the learning and

living environment of students that can impact their study behaviors and self-efficacy. For different universities, the management style and academic atmosphere of the institution may also influence students' study behaviors. Similarly, there may be other mediating variables that can impact students' AP, such as study strategy. These aspects will be the focus of our future research.

Conclusion

This study investigated the factors influencing AP among 315 students by using analysis of variance, correlation analysis, and SEM. The findings revealed that the urban-rural disparity in China is gradually decreasing. Furthermore, female students are demonstrated better AP compared to male students. The SEE was found to have a fully mediating role in both SM and AP. Based on these research results, several recommendations are proposed for students, teachers, and school administrators.

Students should engage in more communication with peers who excel beyond their own capabilities and learn from their lifestyle and study methods. When it comes to studying, one should remain humble in victory and resilient in defeat. Teachers should proactively enhance their research capabilities and set an example for their students. Utilizing holiday periods to engage in learning exchanges, they should absorb advanced teaching methods and pedagogical concepts, actively seek educational reforms, integrate information technology into the classroom to cultivate students' interest in learning. Teachers need to strengthen interventions concerning students' study behavior and AP. Timely recognition should be given to outstanding students, while encouragement and assistance should be provided to those who are struggling, thereby creating a virtuous cycle. School administrators should proactively seek to understand the family situations of each student and provide assistance to those facing economic hardships. They should establish frequent communication with students' parents to stay informed about their academic progress and daily lives. When assigning student dormitories, it is advisable to avoid concentrating students with poor AP in one dormitory, aiming to prevent the formation of a negative cycle.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving humans were approved by Agricultural University of Hebei. The studies were conducted in accordance with

the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

WW: Writing – original draft, Writing – review & editing. LH: Writing – original draft, Writing – review & editing. QL: Writing – original draft, Writing – review & editing. XL: Writing – original draft, Writing – review & editing. YL: Writing – original draft, Writing – review & editing. DW: Writing – original draft, Writing – review & editing.

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References

- Aguilera, D., and Perales-Palacios, F. J. (2020). Learning biology and geology through a participative teaching approach: the effect on student attitudes towards science and academic performance. *J. Biol. Educ.* 54, 245–261. doi: 10.1080/00219266.2019.1569084
- Albulescu, I., Labar, A. V., Manea, A. D., and Stan, C. (2023). The mediating role of anxiety between parenting styles and academic performance among primary school students in the context of sustainable education. *Sustainability* 15:13. doi: 10.3390/su15021539
- Almarzouki, A. F., Mandili, R. L., Salloom, J., Kamal, L. K., Alharthi, O., Alharthi, S., et al. (2022). The impact of sleep and mental health on working memory and academic performance: a longitudinal study. *Brain Sci.* 12:13. doi: 10.3390/brainsci12111525
- Asadullah, M. N., Trannoy, A., Tubeuf, S., and Yalonetzky, G. (2021). Measuring educational inequality of opportunity: pupil's effort matters. *World Dev.* 138:105262. doi: 10.1016/j.worlddev.2020.105262
- Bai, X., Wang, X., Wang, J. X., Tian, J., and Ding, Q. (2020). "College Students' autonomous learning behavior in blended learning: learning motivation, self-efficacy, and learning anxiety." presented at international symposium on educational technology (ISET), Kasetsart Univ, Bangkok, Thailand.
- Beausaert, S. A. J., Segers, M. S. R., and Wiltink, D. P. A. (2013). The influence of teachers' teaching approaches on students' learning approaches: the student perspective. *Educ. Res.* 55, 1–15. doi: 10.1080/00131881.2013.767022
- Bentler, P. M., and Chou, C. P. (1987). Practical issues in structural modeling. *Sociol. Methods Res.* 16, 78–117. doi: 10.1177/0049124187016001004
- Bi, Y. C., Moon, M., and Shin, M. (2023). The longitudinal effects of depression on academic performance in Chinese adolescents via peer relationships: the moderating effect of gender and physical activity. *Int. J. Environ. Res. Public Health* 20:11. doi: 10.3390/ijerph20010181
- Boraita, R. J., Ibort, E. G., Torres, J. M. D., and Alsina, D. A. (2023). Lifestyle habits, health indicators and sociodemographic factors associated with health-related quality of life and self-esteem in adolescents. *Clin. Child Psychol. Psychiatry* 20:13591045231200661. doi: 10.1177/13591045231200661
- Chan, N. Y., Wu, W. J., Chan, J. W. Y., Chan, K. C. C., Li, A. M., Chan, S. S. M., et al. (2023). Sleep and academic performance among students in Hong Kong: curvilinear relationship suggesting an optimal amount of sleep. *Sleep Med.* 106, 97–105. doi: 10.1016/j.sleep.2023.04.001
- Chen, R., Guo, Q., and Xiong, X. (2023). The impact of parental rearing patterns on the healthy lifestyle of college students: the mediating role of general self-efficacy. *J. Jiangxi Norm. Univ. Nat. Sci. Ed.* 1, 95–101.
- Cheng, W., Ickes, W., and Verhofstadt, L. (2012). How is family support related to students' GPA scores? A longitudinal study. *High. Edu.* 64, 399–420. doi: 10.1007/s10734-011-9501-4
- Cheng, L., and Liang, F. (2022). A tracking study on the impact of peer effectiveness on college Students' learning engagement: based on learning behavior engagement. *Univ. Edu.* 8, 5–10.
- Chu, B. (2017). A study on the relationship between gender and academic performance of engineering majors. *Sci. Technol. Stud.* 15, 199–200. doi: 10.16661/j.cnki.1672-3791.2017.33.199
- del Rosal, A. B., Hernandez-Jorge, C. M., and Sierra, M. A. G. (2012). Achievement predictors in a secondary students' sample. *Qual. Quant.* 46, 1687–1697. doi: 10.1007/s11135-011-9547-5
- Deng, Z. X. (2023). A quantitative overview of the approaches influencing traditional and new teaching methods on technical college students. *Soft. Comput.* 19. doi: 10.1007/s00500-023-08276-9
- Du, X., Chen, M., and Wei, S. G. (2022). How academically successful students learn: analysis based on the sequence of course learning behaviors. *J. High. Educ.* 43, 81–89.
- Dufur, M. J., Pribesh, S. L., and Jarvis, J. A. (2023). Family structure and first-term college GPA: do resources, selectivity, and resilience factors explain potential differences across family structures? *J. Child Fam. Stud.* 32, 211–229. doi: 10.1007/s10826-022-02368-0
- Durak, H. Y. (2022). Flipped classroom model applications in computing courses: peer-assisted groups, collaborative group and individual learning. *Comput. Appl. Eng. Educ.* 30, 803–820. doi: 10.1002/cae.22487
- Feng, Y. J., Zhao, D., Gao, Y. J., Wang, P. W., Zhao, X., Li, Y. D., et al. (2023). Accelerating the construction of an educational powerhouse to provide strong support for the great rejuvenation of the Chinese nation (written discussion). *Modern Educ. Manag.* 10, 24–45. doi: 10.16697/j.1674-5485.2023.10.003
- Fu, Y. (2023). A study on the relationship between teacher student relationship and mathematics academic performance: the mediating effect of self efficacy and mathematics anxiety. *J. Math. Educ.* 32, 25–30.
- Götz, F. M., Bleidorn, W., and Rentfrow, P. J. (2020). Age differences in Machiavellianism across the life span: evidence from a large-scale cross-sectional study. *J. Pers.* 88, 978–992. doi: 10.1111/jopy.12545
- Guo, Y. J., Liu, H. H., Hao, A. J., Liu, S. M., Zhang, X. L., and Liu, H. Q. (2022). Blended learning model via small private online course improves active learning and academic performance of embryology. *Clin. Anat.* 35, 211–221. doi: 10.1002/ca.23818
- Gwilliam, J., Reeves, A., and Timus, N. (2023). Seeing the wood for the trees: a heuristic framework to enable the integration of sustainability education in higher education settings. *J. Integr. Environ. Sci.* 20:19. doi: 10.1080/1943815x.2023.2250420
- Ha, W. (2016). Quasi-experimental evidence of academic peer effects at an elite university in People's republic of China. *Asia Pac. Educ. Rev.* 17, 703–718. doi: 10.1007/s12564-016-9461-6
- Hammad, S., Graham, T., Dimitriadis, C., and Taylor, A. (2022). Effects of a successful mathematics classroom framework on students' mathematics self-efficacy, motivation, and achievement: a case study with freshmen students at a university foundation programme in Kuwait. *Int. J. Math. Educ. Sci. Technol.* 53, 1502–1527. doi: 10.1080/0020739x.2020.1831091

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1289064/full#supplementary-material>

- Hamvai, C., Kiss, H., Vörös, H., Fitzpatrick, K. M., Vargha, A., and Pikó, B. F. (2023). Association between impulsivity and cognitive capacity decrease is mediated by smartphone addiction, academic procrastination, bedtime procrastination, sleep insufficiency and daytime fatigue among medical students: a path analysis. *BMC Med. Educ.* 23:537. doi: 10.1186/s12909-023-04522-8
- Hu, X. Y. (2023). The role of deep learning in the innovation of smart classroom teaching mode under the background of internet of things and fuzzy control. *Heliyon* 9:e18594. doi: 10.1016/j.heliyon.2023.e18594
- Huang, L., Cao, Y. C., Liu, Y. H., Zhu, W. M., and Zhou, M. (2023). Peer effects on rural children's depression: do online games matter? *Eur. Child Adolesc. Psychiatry*. doi: 10.1007/s00787-023-02271-z
- Jackson, D. L. (2003). Revisiting sample size and number of parameter estimates: some support for the N: q hypothesis. *Struct. Equ. Model. Multidiscip. J.* 10, 128–141. doi: 10.1207/s15328007sem1001_6
- Ji, C., and Zhao, H. (2021). The relationship between teacher support, academic self-efficacy, and academic performance of primary and secondary school students: a meta-analysis structural equation model. *Teach. Educ. Res.* 33, 106–113. doi: 10.13445/j.cnki.te.r.2021.06.008
- Jiang, Q., Li, Y. H., and Si, H. Y. (2022). Digital economy development and the urban-rural income gap: intensifying or reducing. *Land* 11:23. doi: 10.3390/land11111980
- Jin, L., Lu, W., and Sun, P. J. (2022). Effect of the street environment on walking behavior: a case study using the route choice model in the Chunliu Community of Dalian. *Front. Public Health* 10:11. doi: 10.3389/fpubh.2022.874788
- Kaehwan, Y. O. O. (2020). Mediating effect of middle School's peer attachment on relation between self-esteem and intrinsic learning motivation. *J. Korea Cont. Ass.* 20, 263–273. doi: 10.5392/jkca.2020.20.07.263
- Kim, J. Y. (2020). A longitudinal study of the relation between creative potential and academic achievement at an engineering university in Korea. *J. Eng. Educ.* 109, 704–722. doi: 10.1002/jee.20365
- Kim, E. M., Lee, S. A., Ahn, H. Y., and Choi, H. S. (2023). Structural equation model on the problem behavior of adolescents. *Int. J. Environ. Res. Public Health* 20:15. doi: 10.3390/ijerph20010756
- Kiziltepe, R., Irmak, T. Y., Eslek, D., and Hecker, T. (2020). Prevalence of violence by teachers and its association to students' emotional and behavioral problems and school performance: findings from secondary school students and teachers in Turkey. *Child Abuse Negl.* 107:104559. doi: 10.1016/j.chiabu.2020.104559
- Latino, F., Tafuri, F., Saraiello, E., and Tafuri, D. (2023). Classroom-based physical activity as a means to improve self-efficacy and academic achievement among Normal-weight and overweight youth. *Nutrients* 15:15. doi: 10.3390/nu15092061
- Lee, K. S., Kim, Y. S., and Shin, H. C. (2022). The effect of personal environment suitability and work environment of luxury hotels on psychological capital and innovation behavior. *Sustainability* 14:16. doi: 10.3390/su14127074
- Li, J., and Ou, M. (2018). The intergenerational transmission of poverty: poverty level and academic performance. *Financ. Econ.* 9, 107–119.
- Li, J., and Xue, E. (2023). Dynamic interaction between student learning behaviour and learning environment: Meta-analysis of student engagement and its influencing factors. *Behav. Sci. (Basel)* 13:59. doi: 10.3390/bs13010059
- Li, L. Z., Zhang, F., and Zhou, L. (2023). Family income, non-cognitive skills and academic performance. *Asia Pac. Educ. Rev.* doi: 10.1007/s12564-023-09872-y
- Liu, L. (2016). A model analysis of the impact of professional interest and classroom habits on performance of vocational college Students: an empirical study based on a sample of 2027 students from Five Colleges in Chongqing. *J. Southeast Univ. Nat. Sci. Ed.* 41, 108–112. doi: 10.13718/j.cnki.xsxb.2016.07.019
- Liu, L. (2017). A model analysis of the impact of learning habits on academic performance of vocational college students: an empirical analysis based on a sample of 2027 students from 5 vocational colleges in Chongqing. *J. Southeast Univ. Nat. Sci. Ed.* 42, 175–179. doi: 10.13718/j.cnki.xsxb.2017.07.028
- Liu, J. X., Yang, L. C., Xiao, L. Z., and Tao, Z. L. (2022). Perceived neighborhood environment impacts on health behavior, multi-dimensional health, and life satisfaction. *Front. Public Health* 10:14. doi: 10.3389/fpubh.2022.850923
- Lu, S. Y., Ren, X. P., Xu, H., and Han, D. (2023). Improving self-directed learning ability of medical students using the blended teaching method: a quasi-experimental study. *BMC Med. Educ.* 23:616. doi: 10.1186/s12909-023-04565-x
- Luo, M., Sun, D., Zhu, L. Y., and Yang, Y. Q. (2021). Evaluating scientific reasoning ability: student performance and the interaction effects between grade level, gender, and academic achievement level. *Think. Skills Creat.* 41:100899. doi: 10.1016/j.tsc.2021.100899
- Madtha, L. J., Joseph, J., Joy, M. M., Reji, M. P., Mariya, C. S., and Sabu, L. (2023). Peer influence on lifestyle behaviors among undergraduate students of professional colleges. *J. Health Allied Sci. NU* 13, 389–394. doi: 10.1055/s-0042-1757444
- Manukaram, K., and Abdullah, M. (2021). The influence of family and psychological factors on self-regulated learning behavior of elementary school students. *J. Behav. Sci.* 16, 1–15.
- Martínez, R., Alvarez-Xochihua, O., Mejia, O., Jordan, A., and Gonzalez-Fraga, J. (2019). Use of machine learning to measure the influence of behavioral and personality factors on academic performance of higher education students. *IEEE Lat. Am. Trans.* 17, 633–641. doi: 10.1109/tla.2019.8891928
- Meng, Q., and Zhang, Q. (2023). The influence of academic self-efficacy on university Students' academic performance: the mediating effect of academic engagement. *Sustainability* 15:14. doi: 10.3390/su15075767
- Ni, C. X., and Wang, Z. (2023). The spillover effect of junior high school students making friends: academic performance, cognitive and non cognitive abilities. *China J. Econ.*, 1–27. doi: 10.16513/j.cnki.cje.20230308.002
- Ortiz-de-Villate, C., Rodríguez-Santero, J., and Torres-Gordillo, J. J. (2021). Contextual, personal and family factors in explaining academic achievement: a multilevel study. *Sustainability* 13:11297. doi: 10.3390/su132011297
- Otero, M. J. F., Moledo, M. L., Otero, A. G., and Rego, M. A. S. (2021). Students' mediator variables in the relationship between family involvement and academic performance: effects of the styles of involvement. *Psicol. Educ.* 27, 85–92. doi: 10.5093/psed2020a19
- Peng, M. Y. P., Wang, L., Yue, X. Y., Xu, Y., and Feng, Y. J. (2021). A study on the influence of multi-teaching strategy intervention program on college Students' absorptive capacity and employability. *Front. Psychol.* 12:12. doi: 10.3389/fpsyg.2021.631958
- Pezzuti, L., Tommasi, M., Saggino, A., Dawe, J., and Lauriola, M. (2020). Gender differences and measurement bias in the assessment of adult intelligence: evidence from the Italian WAIS-IV and WAIS-R standardizations. *Intelligence* 79:101436. doi: 10.1016/j.intell.2020.101436
- Pintrich, P. R., and Groot, E. V. D. (1990). Motivational and self-regulated learning components of classroom academic performance. *Educ. Psychol.* 82, 33–40. doi: 10.1037/0022-0663.82.1.33
- Poling, D. V., Van Loan, C. L., Garwood, J. D., Zhang, S., and Riddle, D. (2022). Enhancing teacher-student relationship quality: a narrative review of school-based interventions. *Educ. Res. Rev.* 37:100459. doi: 10.1016/j.edurev.2022.100459
- Poquet, O., and Assoc Comp, M. (2021) "Why birds of a feather flock together: factors triaging students in online forums." presented at 11th international conference on learning analytics and knowledge (LAK), electr network.
- Retnawati, H. (2022). Empirical study of factors affecting the Students' mathematics learning achievement. *Int. J. Instr.* 15, 417–434. doi: 10.29333/iji.2022.15223a
- Ruzafa-Martínez, M., Molina-Rodríguez, A., Pérez-Muñoz, V., Costa, C. L., and Ramos-Morcillo, A. J. (2023). Effectiveness of the flipped classroom methodology on the learning of evidence-based practice of nursing students: quasi-experimental design. *Nurse Educ. Today* 128:105878. doi: 10.1016/j.nedt.2023.105878
- Sahin, O. O., Aközül, Z., and Tasdelen, Y. (2023). Pediatric nursing students' self-efficacy regarding medication administration and clinical comfort and worry: a pre-posttest comparative study of nurse mentoring versus peer mentoring. *Nurse Educ. Pract.* 71:103712. doi: 10.1016/j.nepr.2023.103712
- Slobodskaya, H. R., and Kornienko, O. S. (2021). Age and gender differences in personality traits from early childhood through adolescence. *J. Pers.* 89, 933–950. doi: 10.1111/jopy.12624
- Smith, Z. R., Flax, M., Becker, S. P., and Langberg, J. (2023). Academic motivation decreases across adolescence for youth with and without attention-deficit/hyperactivity disorder: effects of motivation on academic success. *J. Child Psychol. Psychiatry* 64, 1303–1313. doi: 10.1111/jcpp.13815
- Song, H. J., Mu, Y. F., Wang, C., Cai, J., Deng, Z. Y., Deng, A. P., et al. (2023). Academic performance and mental health among Chinese middle and high school students after the lifting of COVID-19 restrictions. *Front. Psych.* 14:8. doi: 10.3389/fpsyg.2023.1248541
- Sserunkuma, J., Kaggwa, M. M., Muwanguzi, M., Najjuka, S. M., Murungi, N., Kajjimu, J., et al. (2023). Problematic use of the internet, smartphones, and social media among medical students and relationship with depression: an exploratory study. *PLoS One* 18:e0286424. doi: 10.1371/journal.pone.0286424
- Suk, K. H. (2021). The effect of educational support within the family and educational experience within a school on the academic achievement of single parent-children: mediating effects of student's educational experience, multi-group analysis on two-parent children. *J. Sch. Soc. Work* 53, 211–239. doi: 10.20993/jssw.53.9
- Sun, L. H., Hu, L. L., and Zhou, D. H. (2022). Programming attitudes predict computational thinking: analysis of differences in gender and programming experience. *Comput. Educ.* 181:104457. doi: 10.1016/j.compedu.2022.104457
- Sun, Y. C., and Shi, W. S. (2022). On the role of teacher-student rapport and teacher support as predictors of Chinese EFL Students' affective learning. *Front. Psychol.* 13:9. doi: 10.3389/fpsyg.2022.856430
- Takatsuka, Y., and Tsunoda, M. (2022). Preliminary analysis of the influence of the stereotype threat on computer programming. Presented at 29th Asia-Pacific Software Engineering Conference (APSEC), Electr Network.
- Tan, M. (2007) *A study on the relationship between students' learning attitude and teachers' educational attitude in primary and secondary schools* Guangxi Normal University. Guangxi
- Tao, Y., Meng, Y., Gao, Z. Y., and Yang, X. D. (2022). Perceived teacher support, student engagement, and academic achievement: a meta-analysis. *Educ. Psychol.* 42, 401–420. doi: 10.1080/01443410.2022.2033168

- Tong, F. (2005). Statistical analysis of academic achievements of college students. *Stat. Edu.* 7, 9–12.
- Tong, D. H., Uyen, B. P., and Ngan, L. K. (2022). The effectiveness of blended learning on students' academic achievement, self-study skills and learning attitudes: a quasi-experiment study in teaching the conventions for coordinates in the plane. *Heliyon* 8:e12657. doi: 10.1016/j.heliyon.2022.e12657
- Trigueros, R., Padilla, A., Aguilar-Parra, J. M., Mercader, I., Lopez-Liria, R., and Rocamora, P. (2020). The influence of transformational teacher leadership on academic motivation and resilience, burnout and academic performance. *Int. J. Environ. Res. Public Health* 17:12. doi: 10.3390/ijerph17207687
- Urbanska-Grosz, J., Walkiewicz, M., and Sitek, E. J. (2023). Is there sufficient evidence for the association between executive dysfunction and academic performance in adolescents with major depressive disorder?: a systematic review. *Eur. Child Adolesc. Psychiatry* 12:10. doi: 10.1007/s00787-023-02275-9
- Vo, D., and Csapó, B. (2020). Development of inductive reasoning in students across school grade levels. *Think. Skills Creat.* 37:100699. doi: 10.1016/j.tsc.2020.100699
- Volodina, A. (2022). Home learning environment and out-of-home activities: their relations to prosocial behaviour and peer relationships in primary school children. *Curr. Psychol.* 42, 23619–23633. doi: 10.1007/s12144-022-03410-6
- Vu, T., Magis-Weinberg, L., Jansen, B. R. J., van Atteveldt, N., Janssen, T. W. P., Lee, N. C., et al. (2022). Motivation-achievement cycles in learning: a literature review and research agenda. *Educ. Psychol. Rev.* 34, 39–71. doi: 10.1007/s10648-021-09616-7
- Wang, D. (2017). *A study on the influence of family economic capital on academic achievement of college students* Nanjing: Nanjing Agricultural University.
- Wang, X. (2020). *The relationship between family environment and exam anxiety of college students* Tianjin Normal University. Tianjin
- Wang, D. X., Han, L., Cong, L., Zhu, H. W., and Liu, Y. (2023). Practical evaluation of human-computer interaction and artificial intelligence deep learning algorithm in innovation and entrepreneurship teaching evaluation. *Int. J. Hum. Comput. Int.* 9, 1–9. doi: 10.1080/10447318.2023.2199632
- Wang, D. X., Lian, D. P., Xing, Y. Z., Dong, S. Y., Sun, X. Y., and Yu, J. (2022). Analysis and prediction of influencing factors of college student achievement based on machine learning. *Front. Psychol.* 13:11. doi: 10.3389/fpsyg.2022.881859
- Wrigley-Asante, C., Ackah, C. G., and Frimpong, L. K. (2023). Gender differences in academic performance of students studying science technology engineering and mathematics (STEM) subjects at the University of Ghana. *SN Soc. Sci.* 3:12. doi: 10.1007/s43545-023-00608-8
- Wu, L., and Qian, L. (2007). Preliminary development and psychometric testing of a questionnaire on the quality of interpersonal relationships in college dormitories. *J. Psychiatry* 1, 27–29. doi: 10.3969/j.issn.1009-7201.2007.01.010
- Wu, C. Z., Zhang, Y. W., and Li, A. W. (2023). Peer feedback and Chinese medical students' English academic writing development: a longitudinal intervention study. *BMC Med. Educ.* 23:11. doi: 10.1186/s12909-023-04574-w
- Xi, J. (2022). Hold high the great banner of socialism with Chinese characteristics and work in Unity for the comprehensive construction of a socialist modernized country -- report on the 20th National Congress of the CPC. *Create* 30, 6–29.
- Xie, N., Zhang, X., and Wan, H. (2017). A study on the influence of teaching behavior of university teachers on student learning behavior. *Chin. High. Edu. Rev.* 7, 211–223.
- Xu, C., and Tu, C. C. (2023). Impact of college Students' learning adaptation on learning conformity behavior in Hengyang: moderating role of peer attachment. *Asia-Pac. Educ. Res.* 32, 585–594. doi: 10.1007/s40299-022-00678-x
- Xu, T., Zhu, P. T., Ji, Q. Y., Wang, W., Qian, M. Y., and Shi, G. H. (2023). Psychological distress and academic self-efficacy of nursing undergraduates under the normalization of COVID-19: multiple mediating roles of social support and mindfulness. *BMC Med. Educ.* 23:348. doi: 10.1186/s12909-023-04288-z
- Xv, B. L. (2015). *Preliminary preparation and application of learning attitude questionnaire of Mongolian and Han university students* Inner Mongolia Normal University. Hohhot
- Yang, Z. X., and Bers, M. (2023). Examining gender difference in the use of scratch Jr in a programming curriculum for first graders. *Comput. Sci. Educ.* 22, 1–22. doi: 10.1080/08993408.2023.2224135
- Yang, X. R., and Kaiser, G. (2022). The impact of mathematics teachers' professional competence on instructional quality and students' mathematics outcomes. *Curr. Opin. Behav. Sci.* 48:101225. doi: 10.1016/j.cobeha.2022.101225
- Yin, J. (2010). The application value of behavioral learning theory. *J. Xinzhou Teach. Univ.* 26, 75–77.
- Yuan, W., Guo, H., Fung, C. V., Chen, F. M., Liu, L. S., Xu, L. Y., et al. (2021). Family socioeconomic status and Chinese Adolescents' academic achievement in the arts: the mediating role of family arts resources and the moderating role of family arts atmosphere. *Front. Psychol.* 12:9. doi: 10.3389/fpsyg.2021.751135
- Zayed, Y., Salman, Y., and Hasasneh, A. (2022). A recommendation system for selecting the appropriate undergraduate program at higher education institutions using graduate student data. *Appl. Sci. (Basel)* 12:14. doi: 10.3390/app122412525
- Zhang, M. H., Hu, Y., and Hu, Y. N. (2023). The influences of socioeconomic status on parental educational expectations: mediating and moderating effects. *Sustainability* 15:15. doi: 10.3390/su151612308
- Zhang, F., Jiang, Y., Ming, H., Ren, Y., Wang, L., and Huang, S. L. (2020). Family socioeconomic status and children's academic achievement: the different roles of parental academic involvement and subjective social mobility. *Br. J. Educ. Psychol.* 90, 561–579. doi: 10.1111/bjep.12374
- Zhang, J., Jin, S. Q., Torero, M., and Li, T. (2018). Teachers and URBAN-rural gaps in educational outcomes. *Am. J. Agric. Econ.* 100, 1207–1223. doi: 10.1093/ajae/aay009
- Zhang, S. H., Wang, H., Miao, C. X., and Yang, J. (2017). "Digital divide" of China's online education under the background of "internet plus." Presented at 7th international conference on education, management, computer and society (EMCS), Shenyang, Peoples R China.
- Zhang, L., and Xv, X. (2023). The influence of locality on the learning behavior of college students: the chain mediating effect of learning adaptation and learning self efficacy. *Chin. J. Health Psychol.* 31, 1595–1600. doi: 10.13342/j.cnki.cjhp.2023.10.029
- Zheng, L., Qi, X., and Zhang, C. J. (2023). Can improvements in teacher quality reduce the cognitive gap between urban and rural students in China? *Int. J. Educ. Dev.* 100:102781. doi: 10.1016/j.ijedudev.2023.102781
- Zhou, A. D., Li, X. R., Song, Y. W., Hu, B. Q., Chen, Y. T., Cui, P. Y., et al. (2023). Academic performance and peer or parental tobacco use among non-smoking adolescents: influence of smoking interactions on intention to smoke. *Int. J. Environ. Res. Public Health* 20:14. doi: 10.3390/ijerph20021048
- Zhou, H. X., Liu, M. J., Zeng, J., and Zhu, J. C. (2016). Selection of nursing teaching strategies in mainland China: a questionnaire survey. *Nurse Educ. Today* 39, 147–151. doi: 10.1016/j.nedt.2015.12.022



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Integrating EQUIP competency-based training into a university curriculum: a qualitative inquiry with students and faculty at Makerere University in Uganda

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Introduction: Competency-based training has gained prominence in clinical psychology education, emphasizing practical skills acquisition. The EQUIP competency-based approach, recognized for its effectiveness in in-service training, raises questions about its feasibility and utility in pre-service education.

Methods: Faculty and supervisors were trained in and applied EQUIP competency-based assessment and techniques with current graduate students. A cohort comprising 15 graduate students, 12 faculty members, and supervisors from Butabika National Referral Mental Health and Teaching Hospital participated in focus group discussion and key informant interviews. Qualitative data was collected from 1st August 2022 to 4th August 2022. Thematic analysis identified three central themes.

Findings: The first theme reveals participants' recognition of EQUIP's feasibility in standardizing competence levels and addressing curriculum gaps. An extended training period, approximately 15h, was identified as crucial to enhance educators' and supervisors' confidence in implementing the approach. The second theme emphasizes the pivotal role of role-play in competency-based training, transforming initial apprehension into constructive learning. Lastly, feedback emerged as a crucial component, with participants highlighting its role in fostering self-assuredness and refining skills.

Conclusion: The study emphasizes the importance of robust training in competency-based methodologies. The EQUIP approach's potential in clinical psychology education is evidenced by its alignment with research outcomes. Beyond this, the study advocates for longitudinal research to assess sustained engagement with EQUIP resources and their long-term impact. This research not only advances the discourse on competency-based training but also sets the stage for continuous improvements in clinical psychology education.

KEYWORDS

competency-based training, role-play, feedback, competence, clinical psychology, EQUIP

Introduction

In the ever-evolving area of clinical psychology education, where mental health concerns in Uganda require immediate attention, Competency-Based Education through the EQUIP approach has emerged as a new paradigm. The need for creative training methods that not only meet but also exceed industry standards is growing as the mental health landscape shifts. In Uganda, 13 % of the country's disease burden is caused by mental health issues (Kigozi et al., 2010; Wakida et al., 2019). A recent report indicates that over 11 million people in Uganda have mental health problems (The New Vision, 2022). Uganda faces the same problems as the majority of black African nations of the Sub-Saharan, including poverty and underdevelopment, child abuse and neglect, trauma brought on by various types of crime and abuse of human dignity, kidnapping, and hijacking, rising stress-inducing lifestyles, westernization and globalization, the HIV/AIDS pandemic, and various cancers (Kiima et al., 2004; Mayeya et al., 2004; Ndyabangi et al., 2009; Opio et al., 2022). The adverse emotional consequences of such stressors need a well-trained mental health workforce who can utilize suitable psychotherapy techniques that are safe and effective in treating clients, and that will be appealing to them (Madu, 2016). However, in Uganda, there is still a significant gap between those who require mental health services and those who can get it, with an estimated treatment gap as large as 85% (Lund et al., 2012; Shidhaye et al., 2015).

To better fulfill the ongoing and changing mental health requirements of communities, there have been an increasing number of requests in recent years for the education of mental health professionals to be changed using a competency-based approach (Kiguli-Malwadde et al., 2014; Mills et al., 2020). Particularly in the field of clinical psychology, competency-based education is receiving more attention as a potential solution to some of the problems associated with mental health training (Hall et al., 2014; Stevens et al., 2017; Mills et al., 2020). It has also been traditionally used in the medical field. It takes an outcomes-based approach, wherein the required competencies form the basis for establishing training objectives, planning training activities, and carrying out assessments to ensure competent professionals (Kaslow, 2004; Kaslow et al., 2004). Competent mental health providers are more likely to provide clients with psychological therapies that are efficient and secure (McHugh and Barlow, 2010). Although many programs have followed a competency-based model, each program is unique according to the tools and strategies used, and therefore there is a lack of consistency in terms of how competency is measured and assessed, including among clinical psychology students training in Uganda. For this reason, clinical psychology programs in Uganda require consistent use of standardized tools and guidance to competency-based training to ensure a minimum standard of competency for safe and effective mental health intervention.

In March 2022, the World Health Organization (WHO) and The United Nations Children's Fund (UNICEF) developed the Ensuring

Quality in Psychological Support (EQUIP) standard method (Kohrt et al., 2020). The EQUIP platform is meant to support trainers and supervisors in using a competency-based approach to ultimately ensure safe and effective mental health intervention (Kohrt et al., 2020). As a digital tool, which contains both online and offline formats, it offers resources that support the training and supervision of mental healthcare of adults, children and adolescents, as well as groups (Kohrt et al., 2015; Jordans et al., 2021b; Pedersen et al., 2021b). The EQUIP platform generously provides an array of competency assessment tools. First and foremost, it addresses the foundational competencies crucial for delivering effective mental health care to adults. (e.g., communication, empathy, promoting hope) [Enhancing Assessment of Common Therapeutic factors (ENACT)] (Kohrt et al., 2015; Singla et al., 2017; Pedersen et al., 2020), with children, – Assessment of Competencies Tool (WEACT) (Jordans et al., 2021a) and adolescents, and core skills for facilitating groups Group facilitation Assessment of Competencies Tool (GroupACT) (Pedersen et al., 2021a). The platform also includes treatment package competencies for WHO interventions guides such as Problem Management Plus (PM+) and the Thinking Healthy Programme (THP), as well as condition-specific techniques for diverse therapy classes including cognitive, problem-solving, interpersonal, trauma-related, motivational enhancement, and stress management techniques (Pedersen et al., 2020, 2021a). The EQUIP platform provides direction on how to perform role plays for competency-based training, which includes competency-based feedback into the training, and a feature that tracks data and enables data to be visualized which enables changes in competency over time to be followed.

The digital platform makes it simple to assess competencies during and after training and supervision programs, allowing trainers and supervisors to immediately evaluate learners (e.g., clinical psychology students) and to track their competency progress over time. On the platform, feedback is automatically displayed to highlight learners' achievements and any potentially harmful behaviors that require extra teaching prior to working with patients in the real world. The use of EQUIP platform has been reported to be effective in boosting mastery of foundational helping skills as well as reduce harmful behaviors (Jordans et al., 2022), when compared to other non-competence-based programs.

The EQUIP competency-based approach's viability and acceptability have been investigated in a number of in-service training scenarios. Studies by Mathai et al. (2023) and Jordans et al. (2022), among others, have shown the viability and acceptance of the technique for teaching non-specialists, mental health professionals, and group-based therapies. These research showed that the technique improved skills and competence among various target groups and showed efficacy in various situations, and as such, was received favorably. Furthermore, Jordans et al. (2021b) examined the viability and acceptability of the EQUIP method in the context of training and oversight for Psychological First Aid (PM+) practitioners. Their findings provided important new information on the viability and

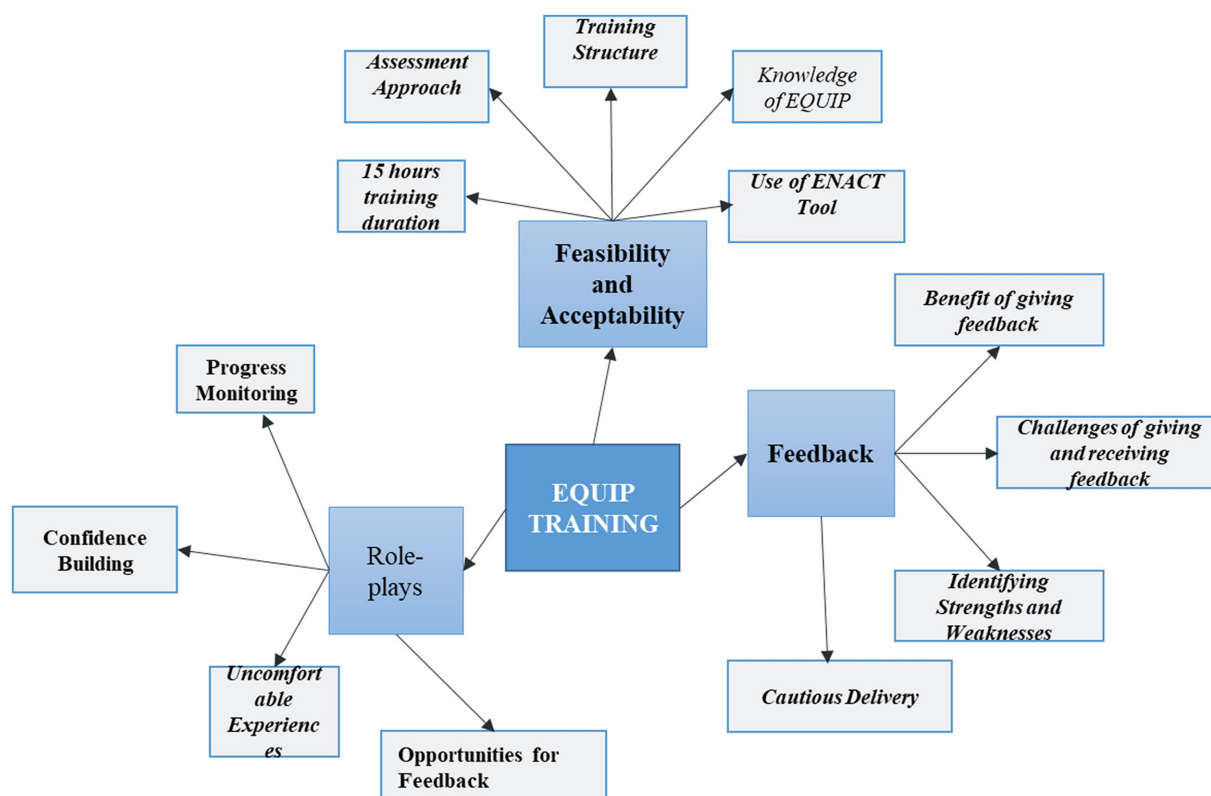


FIGURE 1
Thematic map.

acceptability of the strategy in this particular domain. A research by [Jordans et al. \(2021a,b\)](#) on the viability of evaluating competences using the EQUIP technique was carried out in Zambia, and the results were helpful for understanding how to assess and rate competencies in a specific environment. However, it is important to note that there is a gap in research regarding the feasibility and acceptability of the EQUIP competency-based approach in pre-service training programs, such as those conducted in university settings. The department of Mental Health and Community Psychology at Makerere University offers a Master of Science degree in Clinical Psychology. The courses are taught through interactive learning approaches including tutorials, fieldwork, case studies, small group and class discussions, and self-study. Students on practical and internships are trained through actual work with patients under the supervision of a placement site supervisor and a university supervisor. Students attend weekly class consultations and supervision with the course coordinator to discuss their practicum or internship experiences. Formative and summative evaluations are based on the learning strategies used, such as case studies based on patients, class presentations on predetermined subjects, independent study, and prescribed readings. For certification, a student must successfully complete all courses, including the final exam, with a minimum cumulative grade of 60% obtained through the various evaluation methods mentioned above. However, there is inconsistency in the methods of training, assessment and supervision of the targeted psychology competencies. The choice of training, assessment and supervision is not regulated and is left up to the discretion of the individual course lecturer. As a result, a trainee might do well on all knowledge-based exams but badly on skill-based

evaluations and still successfully finish the master's degree course since the 60% minimum criterion does not distinguish between knowledge and skill-based evaluations. As such, the clinical psychology program at the Makerere University seems to be an ideal place to incorporate a competency-based approach using the EQUIP tools and resources to standardize assessments and feedback.

According to [Alipanga and Kohrt \(2022\)](#), formal training institutions are best placed to ensure the sustainability of training and competency maintenance for effective mental health care. Moreover, if specialist pre-service programs integrate resources such as EQUIP, this prepares their graduates to conduct competency-based approaches in their future training of both specialists and non-specialists, and thus creating multiple effect. Although EQUIP competency-based approaches have been integrated in some parts of Africa ([Pedersen et al., 2021a; Mathai et al., 2023](#)), it has not yet been systematically evaluated and integrated into the pre-service training of mental health professionals. In response to the need for mental health service providers with skills to manage the unique problems of LMIC like Uganda, [Alipanga and Kohrt \(2022\)](#) proposed even steps to develop, implement, and evaluate a competency-based curriculum in pre-service training. Competency-based training focuses on specific and pre-determined skills which are taught, assessed and supervised during training. Accordingly, a 3-day training on how to use EQUIP was held among faculty and clinical supervisors from Makerere University and Butabika Hospital. Here, they learned how to rate competency assessment tools, how to perform in competency-based role plays, how to provide competency-based feedback, and held discussions on best ways to assess and provide feedback with

students in classroom settings. A sample training agenda can be found in the supplement. This training was directly followed by a half-day of brief, 10-min role play based competency assessments and tailored feedback sessions with current clinical psychology students at Makerere University.

Therefore, this study aimed to investigate the experiences of faculty and clinical supervisors implementing an EQUIP competency-based approach, and experiences of clinical psychology students participating in competency-based role plays assessments and feedback sessions. We explored areas of feasibility and utility of incorporating an EQUIP competency-based approach within the clinical psychology curriculum for standardizing the training, assessment and supervision of pre-service students at Makerere University.

Materials and methods

Focus groups and in-depth interviews were used to collect data from 27 participants on the feasibility and utility of using the EQUIP protocol. The participants were purposively selected and comprised faculty and pre-service students from the Department of Mental Health and Community Psychology at Makerere University, and mental health practitioners from Butabika National Referral Mental Health and Teaching Hospital who are involved in supervising the mental health service competencies of the students.

Procedures

Faculty at the Makerere University and Butabika Hospital in Uganda had a 3 days training about the implementation of a competency-based approaches using tools and resources provided on the WHO/UNICEF EQUIP digital platform. The faculty at Makerere University applied to learn by performing standardized role-play assessments using the ENACT and feedback piloted the use of the EQUIP protocol in training, assessing and supervising pre-service students of clinical psychology at the university in order to establish the feasibility and utility of the protocol in a formal training institution. In-depth interviews were held with the faculty and student supervisors from Butabika National Mental Health Referral and Teaching Hospital on the days of the training and participated in a FGD at the end after the assessment. The students held two FGDs after participating in role-plays and were given feedback about the role-plays.

All participants participated voluntarily and gave their verbal and written consent after thorough information about the study in both oral and written form. Participants had time for reflection and were able to ask any questions to the researchers before the written consent was given. Confidentiality was emphasized to all participants, along with the rules of the interview, in the beginning of each interview. They were familiar with the possibility of ending the interview with no following consequences, and only to tell and share what they found acceptable. Participants were pseudo-anonymized and the initials presented in the text are fictive. IRB approval was obtained from the Institutional Review Board (IRB) of Makerere University School of Health Sciences Research Ethics Committee (MAKSHSREC-2022-285).

Participants

The qualitative study enlisted the participation of fifteen graduate students pursuing clinical psychology, along with twelve faculty members from Makerere University and supervisors from Butabika National Referral Mental Health and Teaching Hospital. A heterogeneous purposive sampling strategy was meticulously employed to ensure the inclusion of the intended participants. The eligible participants encompassed faculty members from the Department of Mental Health and Community Psychology, students pursuing Masters of Clinical Psychology within the same department, and mental health practitioners responsible for supervising clinical psychology students during their practicum at Butabika National Referral Mental Health and Teaching Hospital. To equip the faculty and supervisors with the necessary insights, a comprehensive three-day training was conducted. Immediately following the training, they effectively translated their acquired knowledge into practice by evaluating the foundational helping competencies of the clinical psychology students through standardized role-playing scenarios. Every student engaged in role-plays subsequently partook in focused group discussions (FGDs). The involvement of faculty and internship supervisors extended to both in-depth interviews and FGDs. Notably, the faculty and supervisors who underwent the training boasted extensive experience in both training and clinical supervision concerning the students. The focus group discussions comprised five to twelve participants each, categorically assembled. Within this structure, one FGD was convened for the participants of the training, specifically the faculty and supervisors. In addition, two separate FGDs were orchestrated for the students.

Data collection method

The interviews encompassed both students and supervisors and spanned a duration of 20–45 min. This interview process was divided into two distinct sets. The initial set was conducted after 5 h of training on the first day of the program. The second set occurred during focused group discussions (FGDs) after a comprehensive 15-h training period, which concluded with role-play assessments and feedback on the final day. These interviews were meticulously recorded, strictly following the participants' granted permissions. Participants were reassured of the utmost confidentiality concerning their workplaces and roles. They were explicitly informed that the information shared would solely serve the study's purpose and that their identities, as well as their workplaces, would remain entirely anonymous in any subsequent reports. Post-interviews, the recordings underwent transcription and were stored securely as computer files. The researchers took conscientious measures to ensure the research report's final version and the interview recordings were safeguarded under lock and key. This approach guarantees the information's privacy and preserves the integrity of the study's findings.

Data analysis

We applied thematic analysis, a method recognized for its effectiveness in uncovering patterns and themes within qualitative

data. Thematic analysis was chosen due to its suitability in exploring participants' perceptions and experiences (Fugard and Potts, 2015). This approach involves several key steps, each contributing to a comprehensive understanding of the collected data. The initial step involved familiarization with the data, wherein all interview recordings and transcriptions were repeatedly reviewed to establish a sense of immersion. Subsequently, initial codes were generated, systematically identifying meaningful phrases, sentences, or paragraphs that encapsulated the data's essential aspects. Following this, codes were collated into potential themes, considering their relevance and cohesiveness with the research objectives. The themes underwent a meticulous review process, refining their definitions and boundaries to ensure clarity and accuracy. These refined themes were then organized into a coherent structure, capturing the essence of participants' insights while maintaining a logical flow. This stage aimed to construct a narrative that aligns with the research's objectives. Throughout this process, a rigorous approach was taken to maintain the research's integrity. The analysis was both iterative and reflexive, involving multiple researchers in reviewing and validating the identified themes. This ensured that the findings genuinely represented the participants' perspectives. Thematic analysis facilitated the identification of recurring patterns, enabling a nuanced exploration of the EQUIP approach's feasibility and effectiveness. This methodological approach enhances the study's robustness, enabling a rich understanding of participants' viewpoints and experiences.

Results

Three themes emerged during the analysis: (a) The feasibility and usefulness of the EQUIP resources in training, assessing and supervision of competency, (b) Experience of using role plays and integrating them in the training and supervision of the students (c) The benefits and the challenges of giving and receiving feedback.

Theme A: the feasibility and usefulness of the EQUIP resources in training, assessing and supervising of competency

Participants' provided insights into their perception of the feasibility and usefulness of the EQUIP resources for training, assessing, and supervising competency. This theme explored their views on the assessment approach, use of role plays, training structure, knowledge of EQUIP, and the use of the ENACT tool. The results under this theme is presented progressively from the interviews on Day one and the FDGs on the last day.

After a comprehensive five-hour training session on the first day, participants were questioned about their comprehension of the EQUIP approach. Faculty members and supervisors demonstrated a clear understanding of EQUIP's essence, with one practicum supervisor succinctly summarizing it as,

"EQUIP is an approach to assessing, training, and supervising individuals in the mental health field. It focuses on assessing skills and competence, particularly in delivering interventions in a helping profession." (Onsite Supervisor)

The participants were also prompted to share their expectations and what they hoped to learn in the upcoming training days. Notably, the need for a more profound understanding of the assessment procedure under EQUIP emerged. A participant articulated this need, stating:

I want to look at the detail of this assessment. Now it looks like an introduction to me. So possibly now we are getting into detail in the coming days of the training. (Onsite Supervisor)

Additionally, participants expressed the desire for further clarification on using the assessment tools, particularly regarding the various levels (Level 1 through Level 4) and the corresponding remediation strategies based on the attained level. One practicum supervisor voiced their query:

"I would like to learn more about the different levels of ENACT and how they work. Are there specific interventions for each level? If someone moves from level one to level three, should they go back to the basic competencies?" (Onsite Supervisor)

As the training progressed, after a cumulative 15 h, participants were prompted to share their perceptions about the feasibility and utility of the competency-based approach, as well as their overall training experience. A faculty member expressed optimism about the EQUIP approach, viewing it as an avenue to enhance the current training of clinical psychologists. He explained that:

"...yeah, if we go on with such a system of [competency-based] training it would have been really good. ...it will work very much for improvement of training, if it gets to be done like that continuously, it will be very helpful." (Faculty)

Another faculty member stated that the EQUIP tools specifically ENACT can help in assessing the impact of the trainings conducted:

"We have done training before in our organization and we have been wondering, 'Did it actually create an impact? How can we assess impact?' So far, I think the tool that we have gone through, the ENACT tool, can give us that opportunity to strive and actually assess using an evidence-based structured way." (Faculty)

Regarding the feasibility of using the EQUIP/ENACT tool for training, assessment, and supervision, participants noted that the EQUIP enables the establishment of clear learning objectives and the assessment of learning outcomes as important. A supervisor mentioned:

"The ENACT helps structure training and assess the learning outcomes of various elements. For example, we can train on confidentiality and assess confidentiality skills. We can also train on assessment and determine whether participants have learned." (Onsite Supervisor)

Additionally, another participant reported that because the ENACT tool is structured, detailed, and user-friendly in nature, it is practical for learners. One participant had this to say:

“The ENACT tool is structured, detailed, and simple to use. It can be applied to students and learners in practice, as it covers relevant basic skills. It serves as an excellent guide.” (Onsite Supervisor)

Overall, after 15h of training, the participants became more confident in using the tool and appreciated the EQUIP approach to competency-based training, regarding to it as a novel and structured approach to measuring competence that ensures standardized quality across different educational institutions. One participant noted:

“... Actually having a structured format will mean that the students that are being produced from different universities have the same standard. Everyone will know that we have students (trained) at a certain level of competence. So in other words, even if you are from different universities we can know that this person has gone through this competence training and they have passed, which means they have a certain level of skills.” (Faculty)

Another faculty member added that;

“In the past, there was a lack of a structured way to measure students’ competence. With EQUIP, different universities can have the same standard for assessing competence. “We can confidently identify students who have gone through this competence training and have reached a certain level of skills, regardless of their university.” (Faculty)

In summation, participants recognized EQUIP as a feasible and invaluable resource for training, assessing, and supervising competency within the realm of mental health. Their initial need for enhanced training was effectively addressed throughout the program, culminating in a profound grasp of EQUIP’s purpose and advantages. The structured approach of EQUIP, coupled with the efficacy of the ENACT tool, garnered praise for their ability to set precise learning objectives, evaluate learning outcomes, and ensure uniform competence measurement.

Theme B: experience of using role plays and integrating them in the training and supervision of the students

This theme explores the participants’ experiences with using role-plays and integrating them into the training and supervision of students. Three sub-themes were identified under this theme which comprised of their experiences of using role-plays, the learning derived from them, the structure of role-plays, and their implementation.

Subtheme B.1: experiences of using role-plays

When asked about their experiences with using role-plays in training, assessment, and supervision of competencies, the participants reported that role-play training facilitated the observation of students’ progress and instilled confidence in their ability to perform tasks in real-life practice. One participant expressed this sentiment:

“When you are training people through role-plays, you can easily assess their improvement. If they struggle to perform a task in a

role-play, it implies that they will face difficulties in executing it with actual clients.” (Faculty)

Some of the participants emphasized the importance of role-plays in identifying and replacing unhelpful behaviors with more effective ones, and the use of feedback to help learners improve the identified behaviors. Regarding this, one participant had this to say:

“I found the role-play process highly beneficial. Using the tool, it was easy for us to identify harmful or less helpful behaviors and work on removing them while focusing on strengthening essential skills during feedback.” (Onsite supervisor)

Another participant acknowledged that role-plays enabled students to identify their strengths and weaknesses, serving as a motivating factor for self-improvement. The participant stated:

“Most students were able to recognize their strengths and weaknesses through role-plays. This awareness drives them to improve their performance in subsequent role-plays and assessments. Reflecting on weaknesses helps us monitor progress in various competencies.” (Faculty)

All students endorsed the implementation of role-plays in the assessment and training of competence and believed that it enables actions to be observed and competencies to be evaluated, and therefore determine readiness for work in real life. One student captured this by saying:

“In therapy practice, it is not about documenting what we do but about the supervision process. [Through role plays] supervisors can observe us in action, evaluate our competence, and determine if we are ready. Implementing role-plays would provide a comprehensive assessment of our abilities.” (Student)

However, there were some reservations about the use of role-plays. Some students expressed anxiety during role-plays, feeling self-conscious and under pressure due to the presence and assessment by supervisors. Additionally, the allotted time for role-plays (10 min) was perceived as insufficient. One student shared this experience:

“When told that you only have ten minutes for a session, even if you are well-prepared, anxiety can creep in. You become anxious about managing time and demonstrating everything required within such a limited period.” (Student)

Similarly, another student admitted feeling nervous during role-plays but found the overall experience enlightening, particularly the feedback sessions. They stated:

“I was nervous during the role-play, but the feedback was valuable. It helped me recognize areas for improvement. I appreciate this experience.” (Student)

Additionally, some participants who took part in student assessment reported that anxiety indeed affected the students’ performance, and they suggested that additional support should

be provided to help students relax before the sessions. One participant commented about this thus:

“The instructions are clear, but we need to understand that students may feel anxious during assessment sessions. It is important for us to help them calm down and alleviate their anxiety, as this might lead to skipping important elements.” (Faculty)

While most participants agreed on the benefits of role-plays for training purposes, some had reservations about using role-plays as the sole method for evaluating students' skills. One participant stated:

“Role-plays are excellent for training, but they may not be the most effective approach for evaluating practitioners' skills. However, if integrated continuously into training, they can be highly beneficial.” (On-site Supervisor)

Another participant echoed similar thoughts and expressed concerns about the applicability of skills learnt through role-plays in real life situations. The participant said:

“Assessing competence through role-plays is crucial during training as it provides insights into individuals' readiness for real work. However, success in role-plays does not guarantee the same performance in actual practice. Anxiety can negatively affect their performance.” (Onsite Supervisor)

In summary, participants believed role-plays were useful because they enable identification of strengths and weaknesses of learning, and thus enable relevant improvements and confidence building in the learners. They recommended the use of role-plays in training, assessment, and supervision for prospective trainees to promote skill development for effective mental health service.

Subtheme B.2: learning from the role-plays

The majority of students reported that participating in role-plays provided them with valuable insights into their strengths and weaknesses. One student reported that:

“The role-play exercise was incredibly educational and made us aware of our current baseline skills. It was a great experience because we learned about our strengths and weaknesses from others. Overall, it was a highly valuable experience.” (Student)

Another student expressed a strong support for using role-plays because they enable identification of existing competencies and therefore lead to the consolidation of the competencies. The student said:

“I highly recommend the continuation of role-plays because they help us acknowledge our skills and provide opportunities for improvement. Follow-up sessions would be valuable to ensure mastery and practical application. From my perspective, this exercise is highly recommended.” (Student)

Furthermore, some students expressed the desire to have more role-play session, possibly involving real patients and longer

observation and feedback periods in order to master the competencies being learnt better. The following are some remarks by the students:

“We need more role-plays and more practice. It should not be a one-time event. Immersing ourselves in practice and having more role-plays will lead to better results.” (Student)

Another student mentioned;

“I have thoroughly enjoyed the role-play experience, and I hope it can be repeated with more time. It would be ideal to have an entire session where we work with a real patient under the supervision of our mentor until we fully learn. I'm not sure if it's feasible, but it would be a valuable approach.” (Student)

Subtheme B.3: structure of the role-plays

Participants appreciated the clarity and adequacy of the instructions provided before the role-plays. They found the instructions informative enough to carry out the role-plays effectively. One participant expressed their opinion:

“The role-play instructions were clear, especially regarding the fact that the interviewer had not met the client before. This prompted the students to ask for the client's name and reason for their visit. The instructions provided just enough information, particularly for skills like building rapport. I found them to be useful.” (Faculty)

However, some participants felt that the instructions for executing the role-plays were insufficient. For example, one participant noted an issue with the role-play script, where only one name was provided, leading to a weakness in the performance:

“One student asked me for my second name, but the role-play script only provided one name. This created confusion and impacted the overall performance.” (Onsite Supervisor)

Another participant observed that several students did not ask the reason why the client visited their office, attributing this to the instruction in the role-play script. They stated:

“At the beginning, it seemed like students were instructed not to ask the ‘presenting problem’, resulting in two out of three students missing the client's reason for seeking help. It appeared that they took the instruction about the client being distressed as the reason for the visit.” (Onsite Supervisor)

Many students expressed dissatisfaction with the limited time allotted for the role-plays. They felt that 10 min was insufficient to assess a person's competence and that it only allowed for the opening phase of a session. The time constraint induced anxiety even before the sessions began. One student shared their experience:

“The most challenging aspect was the time limitation. I agree with my peers that being given only ten minutes for a session with a client presenting their problems is difficult. Even if you are well-prepared, your performance is affected by the limited time.” (Student)

Another student expressed a desire for more time, acknowledging the value of being trained as time managers but also recognizing the need for an extended role-play and feedback process:

“Personally, I found the experience enjoyable, although the time provided was very short. Nonetheless, I took it as an opportunity to practice time management. However, I would appreciate more time for the role-play and feedback process, perhaps an entire session under observation and feedback.” (Student)

Theme C: the benefits and the challenges of giving feedback

Benefits and challenges associated with the process of giving and receiving feedback are the two sub-themes that emerged from this section. The section describes the participant's perception of giving feedback to the clinical psychology students after a role play. It also covers the benefits and the challenges of feedback.

Subtheme C.1: benefit of giving feedback

From the students' perspective, feedback played a critical role in helping them identify their strengths and weaknesses. Positive feedback was particularly encouraging as it highlighted specific competencies possessed by the students. Additionally, some students embraced negative feedback as an opportunity to address weaknesses and motivate themselves to practice more in order to overcome perceived limitations. One student reflected on this, stating,

“Receiving feedback made me aware of skills I did not know I possessed as an individual. I also appreciated the negative feedback because it revealed areas where I needed further improvement. Overall, the experience was enlightening.” (Student)

Another student echoed similar sentiments, expressing,

“I found the experience (of feedback) to be positive. If we engage in more exercises like these and receive feedback, we can enhance our learning and gain a better understanding of what needs to be done. Sometimes, we may be moving forward without knowing the right direction. Engaging in role-plays and receiving feedback can be immensely beneficial.” (Student)

One student emphasized the transformative impact of receiving feedback on a personal level compared to group feedback in a classroom setting. The student explained that individualized feedback is very impactful and fosters a strong sense of responsibility and the motivation for improvement. One of them stated,

“Having the opportunity to receive feedback personally has been truly impactful. It delves deep within, compelling me to put in the necessary effort. When feedback is delivered personally, it becomes my responsibility to work on it. Thus, I consider it a more valuable experience.” (Student)

The majority of students who received feedback exhibited positive emotional reactions. Students particularly appreciated feedback that

focused on their strengths, as it boosted their confidence and enabled them to relate to the facilitator's comments.

“I observed a student over there receiving positive feedback and I could see her glow, her face glowed with confidence. The feedback is confidence building for her and she was able to relate to what the facilitator was saying.” (Student)

A student stated that feedback help him cope with anxiety of the things he did not do well in the role-play. He stated:

“I was helped to know how to cope with my inadequacies. I should use the word “anxiety” for some of those things that I did not do well.” (Student)

Subtheme C.2: challenges of giving and receiving feedback

Although most students accepted the feedback provided, the raters noted that some few students exhibited resistance, claiming that it contradicted what they had been taught in class. The raters clarified that this resistance did not indicate any flaw in the students' prior training. Instead, they reinforce the importance of flexibility and the application of clinical judgment in real-world practice. One onsite supervisor shared their experience, saying,

“During the feedback session, two students repeatedly expressed that their training instructed them otherwise. We did not perceive it as negative, but it seemed like they were resistant to feedback. When students assert that their training conflicts with the feedback I provide while supervising, it can pose challenges.” (Onsite Supervisor)

Some students commented on the same issue as the supervisors, some found some contradictions between what they were originally taught and what was expected of them in the assessment. They believe that having a clear standard for what is appropriate and what is not would be good for them as one of them stated:

“I think having a clear benchmark of what is appropriate and what is not would have been a better option because even right now we have left the assessment we have been assessed by different people we all got different opinions and therefore we do not know what is right, what is wrong because he has now told me he was told he was laughing at the client and yet he was laughing with the client, Sanyu (not real name) is saying she took three minutes so each of us now has these issues but I think if you guys had come up with a bench marker of uniformity to ensure that everyone must meet this criterion it would have been a better way of assessing than just that way of assessing based on the individual.” (Student)

However, it was observed that some students reacted defensively when receiving negative feedback. One participant acknowledged this phenomenon, stating:

“Conversely, I also observed a defensive reaction from a student when confronted with what he perceived as negative feedback.” (Faculty)

The participants emphasized the importance of considering various factors when providing feedback to students, with a particular emphasis on the need for sensitivity in choosing an appropriate starting point. According to the participants, starting on the negative feedback can lead to defensiveness in students. To address this, one participant suggested beginning with a positive feedback or asking students to share their impressions of the session, which establishes expectations and lays the groundwork for constructive feedback. They explained,

“Starting with negative feedback can activate the defensive gear in students, so it is beneficial to begin on a positive note. If starting positively feels challenging, asking students about their feelings and identifying three positive aspects of the session can provide valuable insights.” (Faculty)

In conclusion, the participants’ insights shed light on the benefits and challenges associated with giving and receiving feedback. Feedback was found to enhance self-awareness, facilitate the identification of strengths and weaknesses, and serve as a source of motivation for improvement. The challenges identified included the importance of sensitivity in delivering feedback, the importance of positive feedback, and uncertainty about the apparent conflict between classroom teachings and real-world application. These findings underline the importance of the dynamics of feedback and its role within the context of competency training, assessment and supervision/feedback.

Discussion

This study significantly enhances the ongoing discourse pertaining to competency-based education within the clinical psychology domain. The findings robustly affirm the viability and reception of the EQUIP competency-based approach, not only in in-service training but also in pre-service contexts. This addresses a crucial void stemming from the absence of standardized curricula for teaching clinical psychologist in Uganda. Moreover, the alignment of this study with prior research bolsters the credibility of the EQUIP approach and magnifies its transformative potential for reshaping clinical psychology education.

Numerous studies focusing on the feasibility and acceptance of the EQUIP competency-based approach in in-service training consistently highlight its viability and positive reception (Jordans et al., 2021b, 2022; Mathai et al., 2023). These antecedent findings are consonant with this research, demonstrating that the EQUIP approach holds equal relevance and importance for pre-service training and the mentorship of clinical psychology students. Participants in this study acknowledged its potency in establishing uniform competence levels and rectifying the absence of standardized curricula, aligning with the overarching goal of fostering adept professionals. This resonates with extant literature on competency evaluation, which accentuates the pivotal role of real-world application and readiness during assessments (Sheen et al., 2015).

The qualitative findings of this study had a striking resemblance to fundamental topics covered in the brief (~15h) training. Notably, several concerns raised by participants earlier in the training, such as how to rate the ENACT tool, were addressed through proceeding training sessions that included role play practice, as well as real-world application with students immediately after the training. However,

based on the findings of this study, it’s important to recognize that there may be a learning curve in terms of incorporating EQUIP competency-based assessment and techniques beyond initial training sessions. The EQUIP platform offers resources within their Learning Management System (LMS)¹ to support new users. For instance, participants in this study described anxiety surrounding role-playing, a noteworthy concern for many participants. Although this was briefly covered in the training, folks learning how to use EQUIP can also refer to a dedicated, self-paced learning module on the website, designed to teach faculty, trainers, and supervisors on how to prepare students for this aspect.

Similarly, during the training session on competency-based feedback, the faculty and supervisors were encouraged to refer back to the EQUIP LMS module as needed when applying these techniques in the real-world. Furthermore, the study’s findings seamlessly correspond with the focus on ensuring a competency benchmark when rating. The issue of establishing clear ‘benchmarks’ was covered within the training, emphasizing rater agreement and resolving potential confusion in how to rate competencies, which was particularly pertinent given the varied backgrounds of the participants. Still, it is recognized that more practice using the competency assessment tools and role plays in their work may strengthen the application. As such, it will be integral to do longer term follow-up, both quantitatively and qualitatively, to see long term impacts of the EQUIP training and application of competency-based approaches at Makerere University and Butabika Hospital.

The study’s results resonate with the comprehensive training provided through the EQUIP approach, and as such we recommend those interested in incorporating an EQUIP competency-based approach to follow a similar 15-h training program for preparing faculty, supervisors, and others in the university setting. The carefully designed training modules, addressing concerns such as role-playing anxiety, feedback delivery, and benchmarking, contributed to the participants’ favorable perceptions and experiences. This harmony between training components and research outcomes strengthens the credibility and practicality of the study’s findings, endorsing the potential of the EQUIP approach in clinical psychology education.

The recognition of the significance and utility of role-playing exercises in competency-based training, assessment, and supervision emerges as a notable takeaway. These exercises serve as a dynamic tool for tracking students’ progress and nurturing their confidence in clinical practice. Evidence corroborating the effectiveness of role-playing spans various domains, including medical education and counseling programs [Grant, 2006; Smith, 2009; Sude and Baima, 2020; Jordans et al. (2021a,b)]. It’s noteworthy that occasional student discomfort during role-plays is a shared experience, which can be leveraged for constructive feedback and support. Role-playing offers a simulated platform for students to navigate diverse clinical scenarios, guided by supervisory feedback, thereby identifying areas for growth and honing their skills.

In the realm of competency training and assessment, feedback plays a crucial role that consistently comes to the forefront. Participants consistently emphasize its significance in pinpointing strengths and areas for improvement, serving as a catalyst for

¹ <https://equipcompetency.org/en-gb/resources>

self-improvement. The positive effects of encouraging feedback on enhancing self-confidence have been well established by various sources (Nicholls, 2002; Boud, 2007; Watling and Ginsburg, 2019). However, delivering feedback requires a careful approach to prevent defensive student reactions. Supervisors, who embody the roles of mentors, guides, educators, and role models, bear the responsibility of providing feedback on progress and areas needing refinement (Johnson et al., 2007; Johnson, 2015; Tull et al., 2023). Offering constructive feedback empowers students to address their weaknesses while gaining the essential skills, knowledge, and attitudes required to excel as clinical psychologists (Kilminster et al., 2007). The pivotal roles of supervisors as mentors and educators become evident in this context, showcasing their influence on students' growth and development. By bridging the gap between theory and practice, supervisors empower students to overcome limitations and cultivate the skills necessary for excellence in clinical psychology (Dunne and Rawlins, 2000). This study highlights the vital importance of supervisor involvement in shaping students' experiences within a competency-based learning framework, thus deepen the pivotal role of mentorship in nurturing adept clinicians.

The innovative methodology employed in this study, involving the immediate application of training knowledge, introduces experiential learning as a potent strategy. This study prompts the necessity for longitudinal research to gauge the enduring impact and sustainability of the acquired competencies. Continuously tracking participants' progress and utilization of EQUIP resources over time assumes significance to assess the approach's sustained efficacy, thereby yielding insights into the potential for ongoing support or refresher training. The concept of sustained utilization of EQUIP resources post-training carries noteworthy implications. It signifies a commitment to integrating these resources into regular teaching and assessment practices, potentially heightening student competencies and clinical outcomes over the long haul. This integration demands a sustainable and user-friendly platform, stress-out the importance of fostering an encouraging environment that nurtures ongoing engagement. In conclusion, this study propels our comprehension of competency-based education within the realm of clinical psychology in university settings. Its alignment with prior research, emphasis on role-play and feedback, acknowledgment of supervisor roles, and insights into training duration collectively contribute to the ongoing refinement of clinical psychology education. The study's implications are profound for educational institutions seeking to embrace competency-based approaches, advocating for comprehensive training and nurturing environments. Furthermore, the study's pioneering approach and its enduring impact emphasize the demand for continuous research and enhancement in competency-based education strategies.

Limitation

Possible limitations of this study include a small sample size, reliance on self-report data, and the short follow-up period. These limitations call for caution in generalizing the findings and highlight the need for further research to address these gaps and provide a more comprehensive understanding of the EQUIP approach's feasibility and effectiveness.

Key recommendations

Training in EQUIP and Continued Utilization of Learning Resources: Practical, competency-based training in how to use EQUIP resources will support faculty, supervisors, and other university staff in feasibly implementing these techniques. Additionally, continued learning or “refreshers” should be emphasized through access to the EQUIP LMS. These freely accessible modules are self-paced learning and can act as useful and detailed reminders for certain techniques while supporting different learning styles.

Longitudinal Studies: To gauge the long-term impact of the competency-based approach, institutions are encouraged to conduct longitudinal studies collecting both qualitative and quantitative data. These studies can follow participants who have undergone the training and track their application of EQUIP principles over an extended period (e.g., 3, 6, 9, or 12 months). Longitudinal research will provide insights into the sustained effectiveness of the approach in real-world clinical settings.

Collaborative Implementation: Establish platforms for collaborative implementation and continuous improvement within the university and with other universities and institutions applying the same concepts. Regular forums, workshops, and discussion groups can facilitate the exchange of experiences, strategies, and best practices among educators, supervisors, and faculty members. This collaborative approach will foster a supportive community focused on refining the application of the competency-based approach.

Institutional Commitment: Institutional leadership and administration should recognize the significance of competency-based education and allocate resources to support its successful implementation. This includes not only dedicating time and funds for training but also creating an environment that encourages ongoing professional development and the incorporation of innovative teaching methodologies.

Conclusion

This study offers strong proof of the viability and importance of introducing the EQUIP competency-based approach into clinical psychology students' pre-service training. Participants—faculty members and supervisors—acknowledged that the strategy might guarantee uniformity in proficiency levels, addressing Uganda's lack of a defined curriculum. The organized design of the EQUIP tools—especially the ENACT tool—made them useful tools for educating and evaluating students. The participants conveyed their confidence that, with continuous application, a competency-based approach like this may improve the general caliber of clinical psychology training. The use of role-plays in training, assessment, and supervision of competencies was deemed important and beneficial by participants. Although role-playing may cause some students to feel uncomfortable at first, research indicates that it works well in a variety of educational settings, and the EQUIP approach successfully incorporates this style. It has been shown that role-playing activities are quite helpful in tracking students' development and boosting their self-assurance during clinical practice. The EQUIP approach's integration of role-plays is in line with accepted teaching methodologies and gives students hands-on experience that mimics real-world scenarios. Feedback emerged as a crucial component in competency training

and assessment. Participants acknowledged that feedback, when delivered thoughtfully, empowered them to identify strengths and weaknesses, fostering a commitment to improvement. It was emphasized that supervisors' dual roles as educators and mentors in giving feedback are crucial for assisting students in their development into qualified clinical psychologists. To sum up, this pilot project makes a substantial contribution to the conversation on competency-based training and assessment in clinical psychology, especially in environments with limited resources like Uganda. The results recommend more assistance and training to guarantee the EQUIP approach's effectiveness. Including role-plays and providing feedback is essential to optimizing the advantages of this novel training approach, as is resolving related issues. To ensure the development of competent practitioners, the research suggests that future clinical psychology and psychotherapy courses adopt comparable competency-based approaches with an emphasis on hands-on training techniques, standardized role-plays, and strong feedback systems.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Makerere University School of Health Sciences REC. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MN: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing. GP: Conceptualization, Project administration, Validation, Writing – review & editing. BA: Conceptualization, Methodology, Project administration, Writing – review & editing, Formal analysis. IL: Formal analysis, Resources, Methodology, Writing – review & editing. BK: Funding acquisition,

Resources, Writing – review & editing, Methodology, Validation. RK: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Alipanga, B., and Kohrt, B. A. (2022). Competency-based pre-service education for clinical psychology training in low-and middle-income countries: case study of Makerere University in Uganda. *Front. Psychol.* 13:924683. doi: 10.3389/fpsyg.2022.924683
- Boud, D. (2007). "Reframing assessment as if learning were important" in *Rethinking assessment in higher education*. eds. D. Boud and N. Falchikov (London: Routledge), 24–36.
- Dunne, E., and Rawlins, M. (2000). Bridging the gap between industry and higher education: training academics to promote student teamwork. *Innov. Educ. Train. Int.* 37, 361–371. doi: 10.1080/135580000750052973
- Fugard, A. J. B., and Potts, H. W. W. (2015). Supporting thinking on sample sizes for thematic analyses: a quantitative tool. *Int. J. Soc. Res. Methodol.* 18, 669–684. doi: 10.1080/13645579.2015.1005453
- Grant, J. (2006). Training Counselors to Work With Complex Clients: Enhancing Emotional Responsiveness Through Experiential Methods. *Counselor Education and Supervision*, 45, 218–230. doi: 10.1002/j.1556-6978.2006.tb00144.x
- Hall, J., d'Ardenne, P., Nsereko, J., Kasujja, R., Baillie, D., Mpango, R., et al. (2014). Mental health practitioners' reflections on psychological work in Uganda: exploring perspectives from different professions. *Br. J. Guid. Couns.* 42, 423–435. doi: 10.1080/03069885.2014.886672
- Johnson, W. B. (2015). *On being a mentor: a guide for higher education faculty*. Routledge London
- Johnson, W. B., Rose, G., and Schlosser, L. Z. (2007). "Student-faculty mentoring: Theoretical and methodological issues" in *The Blackwell handbook of mentoring: A multiple perspectives approach*. eds. T. D. Allen and L. T. Eby (Malden, MA: Blackwell Publishing), 49–69.
- Jordans, M. J. D., Coetzee, A., Steen, H. F., Koppenol-Gonzalez, G. V., Galayini, H., Diab, S. Y., et al. (2021a). Assessment of service provider competency for child and adolescent psychological treatments and psychosocial services in global mental health: evaluation of feasibility and reliability of the WeACT tool in Gaza, Palestine. *Global Mental Health* 8, e7–e12. doi: 10.1017/gmh.2021.6

- Jordans, M. J. D., Kohrt, B. A., Sangraula, M., Turner, E. L., Wang, X., Shrestha, P., et al. (2021b). Effectiveness of group problem management plus, a brief psychological intervention for adults affected by humanitarian disasters in Nepal: a cluster randomized controlled trial. *PLoS Med.* 18:e1003621. doi: 10.1371/JOURNAL.PMED.1003621
- Jordans, M. J. D., Steen, F., Koppenol-Gonzalez, G. V., El Masri, R., Coetzee, A. R., Chamate, S., et al. (2022). Evaluation of competency-driven training for facilitators delivering a psychological intervention for children in Lebanon: a proof-of-concept study. *Epidemiol. Psychiatr. Sci.* 31:e48. doi: 10.1017/S2045796022000348
- Kaslow, N. J. (2004). Competencies in professional psychology. *Am. Psychol.* 59, 774–781. doi: 10.1037/0003-066X.59.8.774
- Kaslow, N. J., Borden, K. A., Collins, F. L. Jr., Forrest, L., Illfelder-Kaye, J., Nelson, P. D., et al. (2004). Competencies conference: future directions in education and credentialing in professional psychology. *J. Clin. Psychol.* 60, 699–712. doi: 10.1002/jclp.20016
- Kigozi, F., Ssebunnya, J., Kizza, D., Cooper, S., and Ndyabangi, S. (2010). An overview of Uganda's mental health care system: results from an assessment using the world health organization's assessment instrument for mental health systems (WHO-AIMS). *Int. J. Ment. Heal. Syst.* 4, 1–9. doi: 10.1186/1752-4458-4-1
- Kiguli-Malwadde, E., Omaswa, F., Olapade-Olaopa, Kiguli, S., Chen, C., Sewankambo, N., et al. (2014). Competency-based medical education in two sub-Saharan African medical schools. *Adv. Med. Educ. Pract.* 5, 483–489. doi: 10.2147/AMEP.S68480
- Kiima, D. M., Njenga, F. G., Okonji, M. M. O., and Kigamwa, P. A. (2004). Kenya mental health country profile. *Int. Rev. Psychiatry* 16, 48–53. doi: 10.1080/09540260310001635096
- Kilminster, S., Cottrell, D., Grant, J., and Jolly, B. (2007). AMEE guide no. 27: effective educational and clinical supervision. *Med. Teach.* 29, 2–19. doi: 10.1080/01421590701210907
- Kohrt, B. A., Jordans, M. J. D., Rai, S., Shrestha, P., Luitel, N. P., Ramaiya, M. K., et al. (2015). Therapist competence in global mental health: development of the ENhancing Assessment of Common Therapeutic factors (ENACT) rating scale. *Behav. Res. Ther.* 69, 11–21. doi: 10.1016/j.brat.2015.03.009
- Kohrt, B. A., Schafer, A., Willhoite, A., van't Hof, E., Pedersen, G. A., Watts, S., et al. (2020). Ensuring Quality in Psychological Support (WHO EQUIP): developing a competent global workforce. *World Psychiatry* 19, 115–116. doi: 10.1002/wps.20704
- Lund, C., Tomlinson, M., de Silva, M., Fekadu, A., Shidhaye, R., Jordans, M., et al. (2012). PRIME: a programme to reduce the treatment gap for mental disorders in five low-and middle-income countries. *PLoS Med.* 9:e1001359. doi: 10.1371/journal.pmed.1001359
- Madu, S. N. (2016). Psychotherapy training in Nigeria. *Int. J. Psychother. Africa* 1, 7–13.
- Mathai, M., Mwayo, A., Concepcion, T., Mutavi, T., Njeru, M., Waruinge, S., et al. (2023). Sustainable partnerships to ensure quality in psychological support (EQUIP) for adolescents. *Psychiatr. Serv.* 74, 781–784. doi: 10.1176/APPI.PS.20220200
- Mayeya, J., Chazulwa, R., Mayeya, P. N., Mbewe, E., Magolo, L. M., Kasisi, F., et al. (2004). Zambia mental health country profile. *Int. Rev. Psychiatry* 16, 63–72. doi: 10.1080/09540260310001635113
- McHugh, R. K., and Barlow, D. H. (2010). The dissemination and implementation of evidence-based psychological treatments: a review of current efforts. *Am. Psychol.* 65, 73–84. doi: 10.1037/a0018121
- Mills, J. A., Middleton, J. W., Schafer, A., Fitzpatrick, S., Short, S., and Cieza, A. (2020). Proposing a re-conceptualisation of competency framework terminology for health: a scoping review. *Hum. Resour. Health* 18, 1–16. doi: 10.1186/s12960-019-0443-8
- Ndyabangi, S., Basangwa, D., Lutakome, J., and Mubiru, C. (2009). Uganda mental health country profile. *Int. Rev. Psychiatry* 16, 54–62. doi: 10.1080/09540260310001635104
- New Vision Official. (2022). 14 million Ugandans have mental disorders - report. Available at: https://www.newvision.co.ug/category/news/14-million-ugandans-have-mental-disorders-rep-NV_133833
- Nicholls, G. (2002). *Developing teaching and learning in higher education*. London, New Fetter Lane: Routledge Falmer.
- Opio, J. N., Munn, Z., and Aromataris, E. (2022). Prevalence of mental disorders in Uganda: a systematic review and meta-analysis. *Psychiatry Q.* 93, 199–226. doi: 10.1007/s11126-021-09941-8
- Pedersen, G. A., Gebrekristos, F., Eloul, L., Golden, S., Hemmo, M., Akhtar, A., et al. (2021b). Development of a tool to assess competencies of problem management plus facilitators using observed standardised role plays: the EQUIP competency rating scale for problem management plus. *Intervention* 19, 107–117. doi: 10.4103/INTV.INTV_40_20
- Pedersen, G. A., Lakshmin, P., Schafer, A., Watts, S., Carswell, K., Willhoite, A., et al. (2020). Common factors in psychological treatments delivered by non-specialists in low- and middle-income countries: manual review of competencies. *J. Behav. Cogn. Therapy* 30, 165–186. doi: 10.1016/J.JBCT.2020.06.001
- Pedersen, G. A., Sangraula, M., Shrestha, P., Lakshmin, P., Schafer, A., Ghimire, R., et al. (2021a). Developing the group facilitation assessment of competencies tool for group-based mental health and psychosocial support interventions in humanitarian and low-resource settings. *J. Educat. Emerg.* 7:334. doi: 10.33682/u4t0-acde
- Sheen, J., McGillivray, J., Gurtman, C., and Boyd, L. (2015). Assessing the clinical competence of psychology students through objective structured clinical examinations (OSCEs): student and staff views. *Australian Psychologist*, 50, 51–59. doi: 10.1111/ap.12086
- Shidhaye, R., Lund, C., and Chisholm, D. (2015). Closing the treatment gap for mental, neurological and substance use disorders by strengthening existing health care platforms: strategies for delivery and integration of evidence-based interventions. *Int. J. Ment. Heal. Syst.* 9, 1–11. doi: 10.1186/s13033-015-0031-9
- Singla, D. R., Kohrt, B. A., Murray, L. K., Anand, A., Chorpita, B. F., and Patel, V. (2017). Psychological treatments for the world: lessons from low- and middle-income countries. *Annu. Rev. Clin. Psychol.* 13, 149–181. doi: 10.1146/ANNUREV-CLINPSY-032816-045217
- Smith, A. L. (2009). Role play in counselor education and supervision: Innovative ideas, gaps, and future directions. *Journal of Creativity in Mental Health*, 4, 124–138. doi: 10.1080/15401380902945194
- Stevens, B., Hyde, J., Knight, R., Shires, A., and Alexander, R. (2017). Competency-based training and assessment in Australian postgraduate clinical psychology education. *Clin. Psychol.* 21, 174–185. doi: 10.1111/cp.12061
- Sude, M. E., and Baima, T. (2020). Training the Self of the Therapist through Marriage and Family Therapy Role-Plays. *Journal of Family Psychotherapy*, 10, 1–18. doi: 10.1080/2692398X.2020.1825909
- Tull, A., Hirt, J. B., and Saunders, S. (2023). *Becoming socialized in student affairs administration: a guide for new professionals and their supervisors*. New York, NY: Taylor & Francis.
- Wakida, E. K., Okello, E. S., Rukundo, G. Z., Akena, D., Alele, P. E., Talib, Z. M., et al. (2019). Health system constraints in integrating mental health services into primary healthcare in rural Uganda: perspectives of primary care providers. *Int. J. Ment. Heal. Syst.* 13:16. doi: 10.1186/s13033-019-0272-0
- Watling, C. J., and Ginsburg, S. (2019). Assessment, feedback and the alchemy of learning. *Med. Educ.* 53, 76–85. doi: 10.1111/medu.13645



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Resilience and self-regulated learning as predictors of student competence gain in times of the COVID 19 pandemic – evidence from a binational sample

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Emergency Remote Teaching (ERT) was introduced around the globe during the COVID-19 pandemic to ensure that students could continue with their studies during social distancing. Subsequent studies found considerable individual differences in the adjustment to ERT and identified resilience as a critical factor for coping with the challenges of independent studying. The growing evidence led to calls for resilience training in preparation for emergency situations. Against the backdrop of a three-phase model of self-regulated learning, this study examines self-regulated learning activities as an additional protective resource and a predictor for academic performance in ERT. Results from a survey of resilience, self-regulated learning strategies, and competence gain completed by students from universities in the US and Germany ($N = 333$) found self-regulated learning strategies to be more predictive of student competence gain than resilience. As a consequence, in addition to fostering resilience, institutions should also include self-regulation strategies in student training and support programs to better prepare students for academic success.

KEYWORDS

resilience, self-regulated learning, competence gain, higher education, emergency remote teaching

1 Introduction

The COVID-19 pandemic forced universities worldwide to transition to emergency remote teaching (ERT) on extremely short notice. ERT was perceived to be dramatically different from online learning (Hodges et al., 2020) as there was little time to prepare, teachers and students faced both academic challenges as well as public and personal health uncertainties. The impact of the crisis on the mental health and the psychological well-being of students quickly became a topic of interest to scholars (e.g., Sood and Sharma, 2020; Forycka et al., 2022). Early studies found that student concerns often focused less on contracting a COVID infection and more on the uncertainties resulting from changes in the traditional academic environment (see Hoofman and Secord, 2021, for an early review). These studies consistently reported mental health challenges for higher education students following the switch to ERT, including higher levels of academic stress and anxiety, the loss of cooperative learning networks, as well as depression symptoms, loneliness, and socio-economic concerns

(Elmer et al., 2020; Sarasjärvi et al., 2022; Versteeg et al., 2022; Laranjeira et al., 2023; Lin et al., 2023; Salimi et al., 2023).

As the pandemic persisted, questions of how remote teaching and learning affected student study behaviors and learning outcomes arose (Gonzalez et al., 2020; Paetsch and Drechsel, 2021; Weidlich and Kalz, 2021; Imhof, 2022; Pertegal-Felices et al., 2022). At the same time, researchers sought to identify and better understand factors that may play a protective role in addressing the stressors students were experiencing (Sood and Sharma, 2020; Ye et al., 2020; Versteeg et al., 2022). These studies found considerable individual differences in the adjustment to ERT and identified resilience as a critical factor for coping with the challenges of independent studying (de la Fuente et al., 2021). The present study extends this research, examining the role and potential benefit of self-regulated learning activities on academic competence gain in an ERT context.

2 Literature review

2.1 Resilience

The level of resilience has been found to determine the ability to adapt to changing demands and to maintain well-being and psychological functioning. As a comprehensive construct used to explain differential perceptions and behavior in difficult situations, it encompasses a set of “personal qualities that enable one to thrive in the face of adversity” (Connor and Davidson, 2003, p. 76). In short, resilience is the ability to bounce back from stressful experiences and includes confidence in one’s ability to solve novel problems, optimism in the face of challenges, commitment to goals, a realistic sense of control, and tolerance of difficulties and negative affect (Connor and Davidson, 2003; Robbins et al., 2018). While individuals may face similar negative experiences, their ability to adapt to adversity differs. Previous studies suggest that resilience factors are predictive of the experienced levels of stress (see Reyes et al., 2015; San Román-Mata et al., 2020).

In ordinary times, the move to university and college life and studies is challenging for students. How they respond to the resulting stress has been linked to academic performance as well as a range of social and psychological factors (McPherson, 2012). Reviews of the resilience literature have highlighted its importance in helping students cope with academic pressures and study (Caruana et al., 2011), adapt to and recover from adverse and stressful situations in higher education (Fuller et al., 2016), as well as rise above challenges, manage personal wellbeing, and meet academic goals (Hartley, 2011; Reyes et al., 2015). In higher education, resilience has been identified as a factor affecting student engagement, persistence, and learning (Ahmed et al., 2018; Ayala and Manzano, 2018; Sood and Sharma, 2020).

The advent of the pandemic and the subsequent pivot to ERT was a major stressor for both faculty and students. In most instances, the transition to ERT was abrupt, with immediate educational goals and solutions prioritized over course design. At the same time, the transition frequently outstripped the ability of campus personnel to provide needed support to faculty and students. Among the many questions asked at the time – by parents, faculty, higher education institutions, mental health practitioners and others: how well were students coping with these stressors, what effect did the challenges and

uncertainties have on student learning, and, what factors may mediate learning outcomes (Elmer et al., 2020; Kunzler et al., 2021).

Given the understandable concern of the effects of the crisis on student progress and mental health, numerous researchers began investigating the role of resilience on student behavior and success. The findings of pandemic era studies found resilience to be related to student mental well-being, academic success, and study behavior (Polizzi et al., 2020; Sood and Sharma, 2020; Ye et al., 2020; Ang et al., 2021; Nandy et al., 2021; Versteeg et al., 2022) – findings that were repeated across cultures and countries (e.g., Australia, Poland, Ecuador; Eri et al., 2021; Forycka et al., 2022; Pertegal-Felices et al., 2022). Investigations across several cultures identified low level of resilience as a risk factor for dysfunctional study behavior and dropping out of higher education (Eri et al., 2021; Forycka et al., 2022; Jehi et al., 2022; Pertegal-Felices et al., 2022).

Drawing on findings that identified intrinsic (e.g., desire to succeed, motivation) and extrinsic factors (e.g., friendships, family, teachers) factors enhancing resilience, Ang et al. (2021) recommended developing resilience training programs that take a socio-ecological approach to support gaining and maintaining a positive mindset and coping skills. More specifically, they explored the role that schools can play in developing resilience education courses for students. Based on the results of their school-based intervention programs, they concluded that such programs can provide students with the necessary skills to successfully meet academic challenges.

The organizational perspective on resilience building emphasizes the role of the institution and organizational leadership for navigating crisis and uncertainty (Nandy et al., 2021). Similar to personal resilience, organizational resilience emphasizes an organization’s “ability to anticipate potential threats, to cope effectively with adverse events, and to adapt to changing conditions” (Duchek, 2020, p. 220). Early studies of organizational resilience centered on identifying a range of “resources, behaviors, strategies, and processes that may enhance an organization’s resilience” (Duchek, 2020, p. 221), among them are improvisation and respectful interaction (Weick and Sutcliffe, 2015), sufficient and available resources (Mallak, 1998; Välikangas and Romme, 2013), redundancy (Kendra and Wachtendorf, 2003), and positive relationships (Gittell et al., 2006).

From this perspective, as large organizations, institutions of higher education are responsible for creating learning and work environments that provide a safe framework for individual members to tackle the difficulties that arise during times of crisis. At the onset of the COVID-19 pandemic, many researchers conducted literature reviews seeking to identify positive coping strategies. For example, Polizzi et al. (2020), reviewing studies conducted following natural disasters and other traumatic crises (e.g., earthquakes, floods, hurricanes, terrorist attacks), recommended a set of measures to strengthen resilience and enhance physical and mental well-being, among them: carrying on with positive activities, observing mindfulness and appreciation, keeping connected and taking good care of social contacts through digital media, and working toward acceptance-based coping, including planning ahead for the post-crisis period.

As the review above suggests, student resilience is important to educational performance and faculty and academic institutions can help foster that success (Gillham et al., 2013). One means of building student resilience in traditional academic settings is through the use classroom learning activities – activities students found to

be significantly curtailed or missing as higher education institutions turned to ERT.

Notably, few empirical studies have examined both resilience and the role of the learning environment on student competence gain. It is plausible that with reduced access to the learning environment, student self-regulation competence would become even more critical for learning and academic success. Thus, this study investigates resilience and the potential impact of self-regulated learning in the wake of ERT. Study results may help identify program elements and design features academic institution decision makers should utilize when developing programs aimed at strengthening learner resilience.

2.2 Self-regulated learning

An important factor that affects student outcomes and success is student self-regulated learning (SRL). Even prior to the pandemic, SRL has long been acknowledged a key component of successful learning in both higher education (Travis and Bunde, 2020) and digital learning and distance learning (see Theobald, 2021). Self-regulation is a self-directed process, rather than a personality trait or a mental ability (Zimmerman, 2002). Pintrich (2000) defined SRL as “an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment” (p. 453). SRL occurs when learners assess their learning environment and processes, then use those assessments to adequately plan, subsequently modify, and actively manage their learning practices. SRL is typically described as a process involving cognitive (e.g., rehearsal, organization of material), metacognitive (e.g., goalsetting and monitoring), and motivational processes (e.g., raising value of a task, increasing perceptions of self-efficacy, introducing strategies supporting persistence in learning). Activities are cyclical in nature. They begin with a preparatory or pre-actional phase, move to the actional phase of actual handling with the materials and tasks, and conclude in the post-actional phase which contains self-evaluation, reflection, and revised goal setting (Winne, 2018).

Studies of SRL with students in higher education have found that SRL competences positively predict engagement and performance in online courses (Kizilcec et al., 2017; Theobald, 2021; Jansen et al., 2022). Moreover, students who were successful in these courses persistently demonstrated a high level of SRL behaviors in the areas of metacognition and resource management (Broadbent and Poon, 2015).

While there is accumulated evidence for the beneficial effects of SRL competences on academic achievement (Broadbent and Poon, 2015; Anthonysamy et al., 2020), research also suggests that a large proportion of students struggle with them (Alemayehu and Chen, 2021) and lack the ability to employ them efficiently. As a consequence, many institutions have established programs for beginning students to build study skills and SRL competences during the initial phases of their career in higher education (van der Zanden et al., 2018).

The abrupt transition to ERT raised important questions about the role of SRL in student coping. The crisis challenged the SRL competences of all students to a degree that might have been, in many cases, more comprehensive than before. Students had to review the practices and habits which they typically employed, and they were

pushed to come up with adaptive strategies. In this context, it is plausible to assume that the more demanding aspects of SRL strategies (e.g., metacognition and resource management) might be more affected by the preoccupation with the uncertainty of the general situation than other, less complex SRL strategies (e.g., cognitive strategies, such as organizing information).

2.3 Student competences and competence gain

Outcomes of higher education involve the development of declarative knowledge and thinking skills (e.g., general content knowledge and domain specific knowledge, complex thinking, problem-solving skills) and non-cognitive outcomes (e.g., attitudes and values, motivational competences, academic self-concept, social skills). In higher education, these outcomes are typically demonstrated and measured in terms of knowledge, skills, and competences.¹ In most cases, assessment of these learning outcomes is framed by subject-specific practices which rarely allow for cross-subject comparisons. In addition, both the format and content of teacher-made and course-specific tests, the most common form of assessment, have been criticized for not reflecting actual competences and student learning, particularly in cases where long-term and non-cognitive outcomes were of interest (Rychen and Salganik, 2003).

As an alternative way of assessing student competences, researchers have explored students' ability to self-report and self-assess their own learning and the effect of these self-evaluations on student learning motivation and areas of non-cognitive learning (e.g., academic self-efficacy, academic self-concept, and professional development; Panadero et al., 2017). Panadero et al. (2017) defined self-assessment as a “... wide variety of mechanisms and techniques through which students describe (i.e., assess) and possibly assign merit or worth to (i.e., evaluate) the qualities of their own learning processes and products” (p. 75). Self-assessment is viewed as a central element of formative assessment because it is the student who “... ‘close[s] that gap’ between a current performance (as revealed by assessment) and the desired standard” (Panadero et al., 2017, p. 76).

Regarding self-assessment of student achievement, the literature suggests that in spite of occasional errors, the validity of self-reported learning estimate can be assumed, provided that the design features of the questionnaires are based in theory and carefully validated (Braun et al., 2012). Braun et al. (2008) identified six areas of competency that represent student learning in a generic manner. The claim is that learning occurs in the areas of knowledge processing (e.g., subject specific facts and problems), systematic competences (e.g., information search), presentational competence (e.g., giving talks), communication competence (e.g., expressing one's opinion),

¹ The European Qualifications Framework for Higher Education classifies desired competences along four dimensions as (1) knowledge and understanding, (2) application, utilization, and generation of knowledge, (3) communication and cooperation, and (4) scientific self-understanding/professionalism (HRK, 2005, p. 12). The Essential Learning Outcomes (ELOs) of the American Association of Colleges and Universities (2007) reflect the same basic cognitive and noncognitive competences.

cooperation competence (e.g., contributing to group work), and personal competence (e.g., identification with the subject). It is reasonable to expect that ERT would not support student learning equally well in all of the areas listed above and that some areas are more susceptible to being negatively affected by ERT than others. Early studies on the effects of ERT on student learning suggest that there is a positive effect on students' performance in terms of knowledge processing and subject-specific competences due to the confinement (Gonzalez et al., 2020).

2.4 Transnationally shared challenges

As the pandemic unfolded, countries around the globe imposed lockdowns and contact restrictions (Gupta, 2020; Nurunnabi et al., 2020). The resulting isolation resulted in profound changes to the psychosocial environment of these countries. In education, schools were closed and ERT was imposed. Around the world, both teachers and students were challenged by the necessity to rapidly transition to digital learning and teaching (Kizilcec et al., 2017). The global character of the pandemic and the similarity of the measures that were taken worldwide was unprecedented. However, countries and institutions were not equally prepared in terms of digital infrastructure, availability of electronic devices and software, and expertise in handling a large-scale crisis (Eri et al., 2021).

Researchers examined a variety of individual and cultural differences and their effect on how individuals differentially experienced the pandemic. For example, the way in which academic and learning culture might be affected might vary depending on a country's position on Hofstede's (2001) individualism – collectivism dimension. This dimension of Hofstede's cultural values framework addresses differences in group membership and integration. Cultures emphasizing individualism emphasize personal needs, rights, and achievement, while collectivistic cultures value relationships and loyalty. Kowal et al. (2020), examining perceived stress during the COVID-19 pandemic, surveyed participants from 26 countries. They reported that stress levels did not differ on Hofstede's individualism – collectivism dimension. Using the 10 item Perceived Stress Scale (Cohen and Williamson, 1988) (0 = never to 4 = very often which would allow for a theoretical maximum sum score of 40), they reported that countries with the lowest stress levels were Switzerland ($M = 13.93$, $SD = 6.66$), Denmark ($M = 14.22$, $SD = 7.21$), and Finland ($M = 14.85$, $SD = 7.50$), countries with the highest reported stress levels were Turkey ($M = 21.71$, $SD = 6.67$), Poland ($M = 20.19$, $SD = 7.28$), and Japan ($M = 20.08$, $SD = 5.74$), with Germany ($M = 16.52$, $SD = 6.87$) and the United States ($M = 17.59$, $SD = 7.36$) in a range between the lower and upper limits (Kowal et al., 2020, p. 955). However, perceived stress did vary with biological sex and age, with women reporting higher levels of stress than men, and younger respondents reporting higher stress than those who were older.

2.5 The role of resilience and self-regulated learning for competence gain

Resilience and SRL are typically conceptualized as processes within a given context, where the availability of relevant

competences is critical for coping with challenges and addressing tasks. As resilience is defined as the ability to recover following stress exposure (Versteeg et al., 2022), planned behavior should be an essential element, particularly in challenging times. Studies demonstrating a positive relationship between resilience and academic achievement support this assumption and suggest that a high level of resilience should protect students from disengagement, aid them in maintaining motivation, and foster learning (e.g., Ayala and Manzano, 2018; Polizzi et al., 2020; Sood and Sharma, 2020; Ang et al., 2021; Nandy et al., 2021; Versteeg et al., 2022).

In addition to planned behavior, the set of SRL competences that make self-regulated learning successful (i.e., the ability to monitor effort investment, to adjust one's goals, and to show persistence when faced with unexpected challenges), may also contribute to the general adjustment processes in times of crisis. Strong study competences and other related SRL behavior would allow students to successfully facilitate their learning while navigating the challenges of a crisis. If true, self-regulatory strength, as indicated by SRL competences, may be predictive of student competence gain (Chung et al., 2022; Edisherashvili et al., 2022).

2.6 The present study

The purpose of the present study is to identify and disentangle the effects of resilience and SRL on student competence gain in ERT. We contend that resilience alone does not safeguard academic competence gain in ERT, but that SRL makes an independent contribution to academic achievement. Acknowledging the importance of resilience for academic persistence, we expect to find a higher level of competence gain for students with higher levels of resilience. In addition, we expect to see additional variance in competence gain explained by SRL competences.

For the purpose of this study, we focus on the areas of knowledge processing and personal competence on the most likely common denominator across the subjects and course types. Based on the previous review, this study is driven by the following research question:

RQ1: Are self-regulated learning and resilience predictive of self-rated competence gain in ERT?

The research question is broken down into the following hypotheses:

H1: Self-regulated learning will be positively related to competence gain. This hypothesis is based on the broad literature that demonstrated the beneficial role of SRL competences on academic success (Broadbent and Poon, 2015; Anthonysamy et al., 2020; Travis and Bunde, 2020; Theobald, 2021). For more detailed analyses, we look into the contributions of self-regulated learning activities in the three theoretically defined phases of the learning cycle (Zimmerman, 2002).

H1a: Goal setting and Planning and Time Management – as a set of SRL learning strategies in the pre-actional phase – will have a positive effect on competence gain.

H1b: Attention Allocation – as a SRL learning strategy in the actional phase – will have a positive effect on competence gain.

H1c: Adjustment – as a SRL learning strategy in the post-actional phase – will have a positive effect on competence gain.

H2: Resilience will be positively related to competence gain. This hypothesis is based in previous research supporting the role of resilience on academic success in general and in times of pandemic in particular (e.g., Ayala and Manzano, 2018; Polizzi et al., 2020; Sood and Sharma, 2020; Ye et al., 2020; Ang et al., 2021; Nandy et al., 2021; Versteeg et al., 2022).

3 Method

3.1 Sample

Participants were drawn from higher education students enrolled in a large university in the south-west of Germany and in the southeastern United States. The total sample consisted of 333 individuals with an average age of 21.67 years ($SD = 2.84$), of whom about 73% were female ($n = 248$). Of the total sample, 192 participants were from Germany ($n = 141$ female; $n = 1$ no gender identification), while 141 participants were from the United States ($n = 107$ female, $n = 5$ no gender identification). The mean age of participants from the German sample ($M_{age} = 23.00$, $SD = 2.80$) was significantly higher than for the US sample ($M_{age} = 19.74$, $SD = 1.39$). The study utilized a convenience sample. Students were invited to participate in the survey through a variety of channels (e.g., university mailing lists, personal contacts, and social media postings). They were informed that participation was voluntary, and that no course credit or other benefits were being offered for taking the survey.

The global nature of the pandemic encouraged cross-national cooperation between the US and Germany. Ultimately, the data across the groups was collapsed. This was done for several reasons. First, the countries have been found to be similar in terms of cultural values on the individualism – collectivism dimension (Hofstede, 2001). Second, research suggests that the perceived stress levels at the time are comparable in both countries (Kowal et al., 2020). Finally, empirical data suggests that the two countries may be similar in terms of their self-regulation competences (Eggers et al., 2021). However, due to differences in the organization of the educational system, students in US higher education were somewhat younger ($M = 19.7$, $SD = 1.4$) than those in Germany ($M = 23.1$; $SD = 2.8$).

3.2 Procedure

Students were initially invited to participate in an online survey. The German version of the questionnaire was available from September 16 through November 15, 2021. This period covered the beginning of the fall term (mid-October) and went into the first 4 weeks of the fall term. This was the third semester in a row with mandatory online teaching due to the pandemic. All participants were informed about the purpose of the study and the handling of data protection. Participation was voluntary and

anonymous and not connected to a specific course or class. In the case of Germany, students were asked to share the invitation to participate with peers. The US version of the survey was available online from April 2 through June 23, 2021, with data being collected at the end of students' third semester of mandatory online teaching. As with the German version, participation was voluntary and anonymous, and participants were drawn from a variety of courses. However, unlike the German version, students could not invite others to participate.

3.3 Instruments

Data for all constructs were collected as self-report using subscales from validated instruments. Predictor variables were resilience and SRL competences as indicators of study behavior. The dependent variable was participants' self-rated competence gain.

3.3.1 Resilience

The 10-item short version the Connor-Davidson Resilience Scale (CD-RISC; Connor and Davidson, 2003; Campbell-Sills and Stein, 2007; Sarubin et al., 2015) was utilized to measure resilience. This measurement was chosen because the theoretical underpinnings of the instrument allow for the interpretation of resilience as a protective factor and because it has validated across international samples (Gras et al., 2019; Kuiper et al., 2019; Velickovic et al., 2020; Kavčič et al., 2023; Wollny and Jacobs, 2023). The scale captures resilience as a general, trait ability to tolerate challenges and to bounce back from personal crisis. The items are worded as active self-report (e.g., "I am able to adapt to change," "I can achieve goals despite obstacles.") and rated on a five-point scale ($1 = \text{not at all true}$ to $5 = \text{true nearly all the time}$). The questionnaire was available both in a validated English and German version with satisfactory psychometric characteristics, with internal consistency measured as Cronbach's $\alpha = 0.84$ for the German version (Sarubin et al., 2015) and Cronbach's $\alpha = 0.85$ for the version in English (Campbell-Sills and Stein, 2007). In the current study, reliabilities were returned at Cronbach's $\alpha = 0.90$ for both the German and the English version.

3.3.2 Self-regulated learning strategies

To measure pre-actional, actional, and post-actional learning strategies, we administered selected subscales of a short version of the Learning Strategies of University Students questionnaire (LIST-K, Klingsieck, 2018). Originally published in German (Klingsieck, 2018), the instrument was translated into English with the support of a bilingual speaker, then back-translated into German to establish equivalence of both versions. To address our hypotheses, we selected the subscales Goalsetting and Planning (e.g., "I set specific goals to guide studying.") as well as Time Management ("I determine daily time-windows when I study."), which in combination were taken to represent pre-actional strategies, Attention Allocation ("I am easily distracted when I study.") as an actional strategy, and Adjusting ("I adjust my study activities when I encounter difficulties.") as a post-actional strategy. With three items per subscale, this section of the survey contained a total of 12 items. Item responses utilized a five-point scale ($1 = \text{very rarely}$ to $5 = \text{very often}$) to indicate the degree to which these activities reflected the study behavior. Validity studies have demonstrated that the psychometric characteristics of the version

(LIST-K) are sound (Loock et al., 2022; Roick et al., 2023). In the current study, the internal consistencies of the selected subscales (Cronbach's $\alpha_{\text{Pre-actional}} = 0.77$, $\alpha_{\text{Actional}} = 0.92$, $\alpha_{\text{Post-actional}} = 0.70$) were in keeping with that of previous studies (Klingsieck, 2018; Loock et al., 2022; Roick et al., 2023).

3.3.3 Self-rated competence gain

The measurement of learning outcome across subject area, course type, institutions, and countries was a particular challenge as standard indicators (e.g., grades and grade point average) could not be expected to be equivalent. Additionally, due to emergency regulations, some courses had been re-scaled to a pass/fail mode. As grades were either not comparable across participants or not available, the most feasible alternative was to use an instrument that would allow guided self-evaluation of competence development.

Braun et al. (2008) developed a self-report questionnaire to measure the increase in student competences in a way that would allow comparisons across courses, subjects, years, and schools. Utilizing a survey of students in different institutions of higher education enrolled in a broad range of subjects (liberal arts, education, economics and business administration, social sciences, physics, psychology) ($N=988$), Braun et al. (2008) generated a questionnaire to capture competence gain after the course of one semester. Factor analyses yielded evidence for a six factor-solution, distinguishing subject specific skills and knowledge processing, systematic competences (e.g., generic academic skills), presentational competence, communication competence, cooperation competences, and personal competence (which is interpreted as identification with the academic field). Their analysis demonstrated excellent reliabilities in terms of internal consistency and discriminant validity (values for Cronbach's α ranged between $\alpha=0.83$ and 0.92). In particular, the authors did not find evidence for the assumption that data would contain a large self-serving bias.

For the purposes of the current study, we selected the dimensions of Knowledge Processing ("I can define core concepts and principles from this course.") and of Personal Competences ("The course has supported my determination to continue my study program.") as it was most plausible that progress in these aspects could be expected to occur for all students. As the scales had displayed very strong bivariate correlations in the original study ($r=0.76$; Braun et al., 2008) as well as in our analyses ($r=0.63$) and an exploratory factor analysis suggested a single factor-solution, we integrated the two scales. The new scale was labeled 'competence gain' and comprised 10 items to

be rated on a five-point scale ranging from $1 = \text{not at all true}$ to $5 = \text{totally true}$. As the questionnaire was available in German only, it was translated into English by a bilingual research assistant, then back-translated. The new scale's internal consistency for the combined sample was satisfactory (Cronbach's $\alpha=0.90$).

3.4 Data analysis

The data was analyzed using JASP (JASP Team, 2023). We tested our hypotheses with a critical alpha of $\alpha=0.05$. To test hypotheses H1 and H2, we used a hierarchical linear regression model with competence gain as dependent variable (see Table 1). In our stepwise procedure, we began with an intercept-only model. Next, we regressed competence gain on resilience (H2), followed by adding the SRL strategies from the pre-actional (H1a), actional (H1b), and post-actional (H1c) phase as predictors. In the last step, we inserted age and gender in our model as control variables. The online survey did not allow for item non-response, thus there were no issues related to missing data. We did not exclude outliers from our data set.

4 Results

4.1 Descriptive results

After obtaining adequate reliability estimates for all scales included in our analyses, descriptive statistics for the overall sample and calculated bivariate correlations for all model variables were generated (see Table 2).

Descriptively, the means for all constructs were well above the scale mean. Except for resilience, the full range of the scales running from 1 through 5 has been found. As seen in Table 2, students who had participated in this survey rated themselves rather strongly on resilience ($M=3.7$; $SD=0.7$). Self-reported competence gain is in keeping with results reported in Braun et al.'s (2008) original study, which reported an average gain of $M=3.55$ ($SD=0.94$) for knowledge processing and $M=3.48$ ($SD=1.16$) for personal competences. As seen in Table 2, competence gain was significantly related to resilience as well as to all three of the SRL learning strategies variables (Table 1 in the Appendix presents the descriptives separately for the two subsamples).

TABLE 1 Descriptive statistics of the binational sample.

Variable	US sample ($n = 141$)				German sample ($n = 192$)			
	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Age	19.7	1.4	17	27	23.1	2.8	19	38
SRL pre-actional ⁺	3.3	0.8	1.5	5	2.9	0.9	1	5
SRL actional ⁺	3.7	1.0	1	5	3.4	1.2	1	5
SRL post-actional ⁺	3.8	0.7	2	5	3.4	0.8	1	5
Resilience ⁺⁺	3.7	0.6	1.8	5	3.7	0.7	1.5	5
Competence gain ⁺⁺	3.7	0.9	1	5	3.0	0.7	1.3	4.8

⁺All SRL scales range from 1 = rarely through 5 = very often.

⁺⁺Likert scale from 1 = totally disagree through 5 = totally agree.

TABLE 2 Descriptives and bivariate correlations of all model variables.

Variable		M	SD	Min	Max	Skewness	Kurtosis	1	2	3	4
1	SRL pre-actional ⁺	3.1	0.9	1.0	5.0	0.05	−0.62				
2	SRL actional ⁺	3.5	1.1	1.0	5.0	−0.39	−0.77	0.19***			
3	SRL post-actional ⁺	3.6	0.8	1.0	5.0	−0.55	0.53	0.32***	0.10		
4	Resilience ⁺⁺	3.7	0.7	1.5	5.0	−0.32	−0.15	0.09	0.33***	0.18***	
5	Competence gain ⁺⁺	3.3	0.9	1.0	5.0	−0.06	−0.58	0.26***	0.26***	0.33***	0.23***

N = 333. SRL, self-regulated learning. **p* < 0.05 (two-tailed). ***p* < 0.01 (two-tailed). ****p* < 0.001 (two-tailed).
⁺⁺Likert scale from 1 = totally disagree through 5 = totally agree.

TABLE 3 Stepwise linear regression of competence gains on resilience, self-regulated learning, and demographics.

Parameter	Model 1	Model 2	Model 3	Model 4
Intercept	3.33* (0.05)	2.23* (0.26)	1.85* (0.39)	2.98* (0.55)
Resilience		0.30* (0.07)	0.15* (0.69)	0.15* (0.07)
Self-regulated learning				
Pre-actional			0.14* (0.05)	0.12* (0.05)
Actional			0.13* (0.04)	0.15* (0.04)
Post-actional			0.27* (0.06)	0.26* (0.06)
Demographics				
Age				−0.05* (0.02)
Gender				0.06 (0.10)

**p* < 0.05. Parameters are unstandardized.

4.2 Self-reported resilience, SRL-strategies, and competence gain

To test the first set of hypotheses (H1a–H1c), we examined the predictive power of SRL (pre-actional, actional, and post-actional) as well as resilience for students’ subjective competence gain utilizing stepwise hierarchical multiple regression (see Table 3).

Results of the regression analysis suggest that all four variables – SRL activities in the pre-actional, actional, and post-actional phase and resilience – contribute to student competence gain. The standardized regression weights of all predictor variables and 95% confidence intervals are depicted in Figure 1.

As can be seen, SRL strategies significantly contribute to competence gain. While resilience was also predictive of competence gain, its contributions are less than that of the SRL strategies. Based on these data, hypotheses H1 and H2 are supported – both SRL and resilience contribute to explaining competence gain in ERT. In addition, SRL explains a greater amount of the variance in competence gain when compared to resilience. The confidence interval of the regression coefficient for the predictive power of resilience is rather broad and ranges from close to zero through 0.29. The likelihood of finding similarly high coefficients for the predictive power of resilience for learning is rather limited.

While SRL activities from all three phases of the studying contribute significantly to competence gain, SRL activities in the post-actional phase appear to make a somewhat larger contribution to competence gain as demonstrated by both the value and the confidence interval for SRL activities in the post-actional phase (see Figure 1).

5 Interpretation and discussion

5.1 The learning from the current study

Resilience, the ability to cope with adverse conditions, has been identified as a critical factor for maintaining psychological well-being and functioning in academic contexts in studies conducted prior to and following the global transition to ERT (Sood and Sharma, 2020; Forycka et al., 2022; Gabrovec et al., 2022; Pertegal-Felices et al., 2022; Quintiliani et al., 2022; Versteeg et al., 2022). Subsequently, recommendations for preparing students for, and supporting them during, times of crisis have emphasized strengthening personal resilience.

This study sought to extend this research, exploring the role of self-regulated learning (SRL) as an additional protective factor supporting competence gain of higher education students. Drawing on a sample of students from two different institutions of higher education in Germany and the US, we measured resilience, self-regulated learning strategies, and competence gain.

Results of the regression analysis support the claim that both SRL strategies, and resilience are critical resources for students to make progress in challenging circumstances. Resilience and SRL strategies across all three learning phases had a separate impact on competence gain. However, the SRL post-actional phase (e.g., reflecting on one’s progress, readjusting goals for studying) was most predictive of competence gain when compared to the other variables under study (i.e., the SRL pre-actional and actional phases, and resilience).

As previous surveys had reported higher stress levels for younger people and women (Kowal et al., 2020), we also included age and gender into the regression analysis. While our data did not reveal a gender effect, younger students reported somewhat higher competence gain than older students. This finding may be related to several factors, which potentially confound the results: The US sample was composed of younger students, who were surveyed toward the end of a term and who had, therefore, a clearer and more immediate grasp of their competence gain. In contrast, German students were surveyed at the beginning of a term and asked to look back at their competence gain from the past semester.

The results of this investigation add to our understanding of factors that help protect against academic challenges and failure, particularly in during a crisis. Study results suggest that resilience alone is probably not sufficient to meet the challenges students experience in higher education. For competence gain and progress in their studies, students in higher education need to also possess a full set of self-regulated learning strategies and to use them in a meaningful way (Imhof, 2022; Klimova et al., 2022).

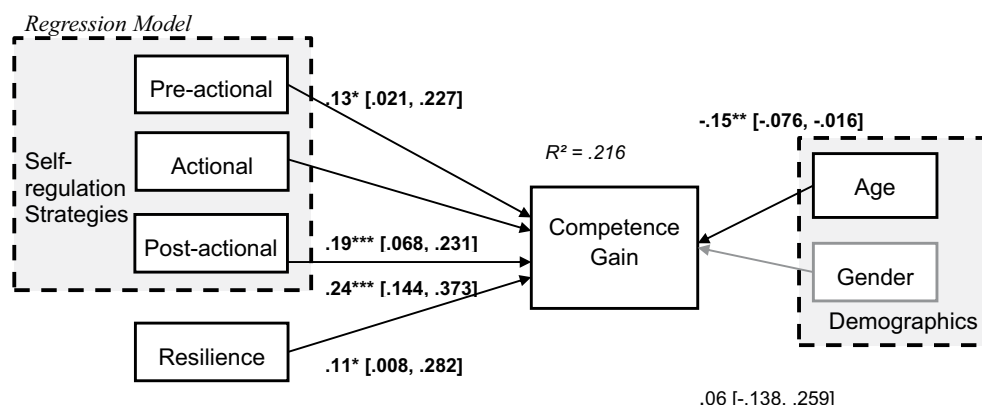


FIGURE 1

Regression model note. Regression weights are completely standardized and, if displayed in bold, significant at $*p < 0.05$, $**p < 0.01$, or $***p < 0.001$. 95%-confidence intervals are presented in square brackets. For reasons of parsimony, the model intercept is omitted.

Based on the pattern of results of this study, we recommend preparing students for emergency situations. This preparation should include a component that equips them with strong study competences that take them through the three phases of the SLR learning cycle (Broadbent and Poon, 2015; Bellhäuser et al., 2016; Theobald, 2021). However, special emphasis should be placed the post-actional phase, where students learn how to reflect upon and adjust their learning activities. In times of crisis, these SRL competences are of substantial importance for academic competence gain in addition to strengthening resilience against adversity in general. Given that no suppressor effects were detected in our analysis, results suggest that SRL strategies and resilience are independent resources that students draw on when addressing difficulties as. While both require regulatory skills (e.g., resource allocation, finding and maintaining a focus), they also result in differing outcomes. While self-regulation in learning may lead to task completion, resilience would lead to coping with open ends that cannot yet be tackled conclusively.

5.2 Limitations

All studies have their limitations. For example, the current study addressed a narrow range of the many potential factors (e.g., the quality of the digital devices, the quality of ERT teaching) that might be related to competence gain in an ERT environment.

In addition, the study design precludes estimating the response rates and the amount of non-responses of the survey, which restrains the generalizability of the results (Dzakadzie and Quansah, 2023). Participation was totally voluntary, using multiple recruitment methods. As a result, the size of the population cannot be determined. This is a challenge inherent in survey research. However, one means of addressing the challenge is through a meta-analysis. For now, we argue that the current study produces insights that could and should prompt further research.

The study is limited by the temporal limitations of cross-sectional research. For example, the causal directions specified in our path model rely on the theory formation established and the previous findings outlined. Conducting longitudinal studies would provide a means to address this limitation, while also allowing for an exploration of the trajectories of the obtained effects.

The current study investigated the role of SRL learning activities and resilience on competence gain in a unique situation of worldwide pandemic and, consequently, ERT. As a result, there is no control group for comparison. However, it is plausible to assume that SRL competences contribute to competence gain in other learning environments. What remains, however, is the finding that a solid basis of SRL competency is critical for mastering unexpected challenges when routines are interrupted and when external anchors, such as social support provided by teachers and peers, have been removed.

While the results here reflect those of other studies reporting competence gain in ERT (Elmer et al., 2020; Gonzalez et al., 2020; Iglesias-Pradas et al., 2021), through a methodological lens, data and results may be tinged by the Common Method Bias² (Jordan and Troth, 2020) as all constructs were measured through self-report. As a result, it remains unclear to what extent the “variance of a measure is attributable to the measurement method rather than to the construct(s) measured” (Steenkamp and Maydeu-Olivares, 2021, p. 5). This is a critical issue, as the beliefs, attitudes, and motivation of the participants to respond to the survey questions in a certain manner is unclear. The degree to which participants tweak their responses toward social desirability is hard to estimate, in particular in a binational sample as the perception of what is socially desirable can be quite different in the two countries. Future research would need to plan for a design that allows a more detailed analysis of the variance that is generated through a common method.

As noted previously, a closer examination of the German and US samples revealed that the participants from the United States were significantly younger than the group from Germany. How the age difference might have affected the results and what kind of bias might have been brought along by the age difference is unclear. In spite of the age difference, the groups were similar in terms of academic age as they were all enrolled in undergraduate programs. So, it is safe to

² We would like to thank our reviewer for raising the issue of the common method bias.

assume that the experience with higher education was not substantially different in the subsamples.

6 Conclusion

Based on the findings of this study, institutions of (higher) education are well-advised to develop programs supporting student training in both resilience and in self-regulated learning strategies. Though resilience is a personal resource that has an impact on competence gain – as was demonstrated in a number of studies that had been conducted during the COVID-19 pandemic, our study suggests that resilience alone may not be sufficient for academic success in times of crisis. In an education context, resilience should be complemented by a set of SRL strategies to ensure competence gain. The development and practice of SRL strategies should address all three phases of learning, with a special emphasis on reflective and meta-cognitive strategies in the post-actional phase. Further research that takes personal resources, such as resilience, study competences, and study outcomes into account simultaneously, is needed to more fully understand the interaction among these and other factors that contribute to academic success.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The authors confirm that the study was conducted in compliance with the practice as specified by the Declaration of Helsinki. All participants had confirmed a written informed consent. The protocol

was approved by the IRB Admin Office of Research Compliance at Auburn University as “Exempt” under federal regulation 45 CFR 46.101(b)(1,2).

Author contributions

MI: Conceptualization, Data curation, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing. DW: Data curation, Writing – review & editing. JB: Data curation, Formal analysis, Visualization, Writing – review & editing. HB: Formal analysis, Methodology, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Ahmed, U., Umrani, W. A., Qureshi, M. A., and Samad, A. (2018). Examining the links between teachers support, academic efficacy, academic resilience, and student engagement in Bahrain. *Int. J. Adv. Appl. Sci.* 5, 39–46. doi: 10.21833/ijaas.2018.09.008
- Almayehu, L., and Chen, H.-L. (2021). Learner and instructor-related challenges for learners' engagement in MOOCs: a review of 2014–2020 publications in selected SSCI indexed journals. *Interact. Learn. Environ.* 31, 3172–3194. doi: 10.1080/10494820.2021.1920430
- American Association of Colleges and Universities. (2007). *Essential Learning Outcomes*. Available at <https://www.aacu.org/trending-topics/essential-learning-outcomes#:~:text=The%20Essential%20Learning%20Outcomes%20%28ELOs%29%20define%20the%20knowledge,changed%20in%20the%20world%20and%20in%20higher%20education>
- Ang, W. H. D., Shorey, S., Lopez, V., Chew, H. S. J., and Lau, Y. (2021). Generation Z undergraduate students' resilience during the COVID-19 pandemic: a qualitative study. *Curr. Psychol.* 41, 8132–8146. doi: 10.1007/s12144-021-01830-4
- Anthonyamy, L., Koo, A.-C., and Hew, S.-H. (2020). Self-regulated learning strategies and non-academic outcomes in higher education blended learning environments: a one decade review. *Educ. Inf. Technol.* 25, 3677–3704. doi: 10.1007/s10639-020-10134-2
- Ayala, J. C., and Manzano, G. (2018). Academic performance of first-year university students: the influence of resilience and engagement. *High. Educ. Res. Dev.* 37, 1321–1335. doi: 10.1080/07294360.2018.1502258
- Bellhäuser, H., Lösch, T., Winter, C., and Schmitz, B. (2016). Applying a web-based training to foster self-regulated learning — effects of an intervention for large numbers of participants. *Internet High. Educ.* 31, 87–100. doi: 10.1016/j.iheduc.2016.07.002
- Braun, E., Gusy, B., Leidner, B., and Hannover, B. (2008). Das Berliner Evaluationsinstrument für selbsteingeschätzte, studentische Kompetenzen (BEvaKomp) [the Berlin evaluation instrument for self-evaluated student competences]. *Diagnostica* 54, 30–42. doi: 10.1026/0012-1924.54.1.30
- Braun, E., Woodley, A., Richardson, J. T. E., and Leidner, B. (2012). Self-rated competences questionnaires from a design perspective. *Educ. Res. Rev.* 7, 1–18. doi: 10.1016/j.edurev.2011.11.005
- Broadbent, J., and Poon, W. L. (2015). Self-regulated learning strategies academic achievement in online higher education learning environments: a systematic review. *Internet High. Educ.* 27, 1–13. doi: 10.1016/j.iheduc.2015.04.007
- Campbell-Sills, L., and Stein, M. B. (2007). Psychometric analysis and refinement of the Connor-Davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. *J. Trauma. Stress.* 20, 1019–1028. doi: 10.1002/jts.20271
- Caruana, V., Clegg, S., Ploner, J., Stevenson, J., and Wood, J. (2011). *Promoting students' 'resilient thinking' in diverse higher education learning environments* HE Academy Subject Centre for Sociology, Anthropology and Politics. Leeds.
- Chung, J., McKenzie, S., Schweinsberg, A., and Mundy, M. E. (2022). Correlates of academic performance in online higher education: a systematic review. *Front. Educ.* 7:820567. doi: 10.3389/feduc.2022.820567
- Cohen, S., and Williamson, G. (1988). “Perceived stress in a probability sample of the United States” in *Social psychology of health*. eds. S. Spacapan and S. Oskamp (Thousand Oaks, CA: Sage), 31–67.
- Connor, K. M., and Davidson, J. R. (2003). Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC). *Depress. Anxiety* 18, 76–82. doi: 10.1002/da.10113

- de la Fuente, J., Santos, F. H., Garzón-Umerenkova, A., Fadda, S., Solinas, G., and Pignata, S. (2021). Cross-sectional study of resilience, positivity and coping strategies as predictors of engagement-burnout in undergraduate students: implications for prevention and treatment in mental well-being. *Front. Psychol.* 12:596453. doi: 10.3389/fpsyg.2021.596453
- Duchek, S. (2020). Organizational resilience: a capability-based conceptualization. *Bus. Res.* 13, 215–246. doi: 10.1007/s40685-019-0085-7
- Dzakadzhe, Y., and Quansah, F. (2023). Modeling unit non-response and validity of online teaching evaluation in higher education using generalizability theory approach. *Front. Psychol.* 14:1202896. doi: 10.3389/fpsyg.2023.1202896
- Edisherashvili, N., Saks, K., Pedaste, M., and Leijen, A. (2022). Supporting self-regulated learning in distance learning contexts at higher education level: systematic literature review. *Front. Psychol.* 12:792422. doi: 10.3389/fpsyg.2021.792422
- Eggers, J. H., Oostdam, R., and Voogt, J. (2021). Self-regulation strategies in blended learning environments in higher education: a systematic review. *Australas. J. Educ. Technol.* 175–192, 175–192. doi: 10.14742/ajet.6453
- Elmer, T., Mephram, K., and Stadtfeld, C. (2020). Students under lockdown: comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. *PLoS One* 15:e0236337. doi: 10.1371/journal.pone.0236337
- Eri, R., Gudimetla, P., Star, S., Rowlands, J., Girgla, A., To, L. et al. (2021). Digital resilience in higher education in response to COVID-19 pandemic: student perceptions from Asia and Australia. *J. Univ. Teach. Learn. Pract.* 18, 108–134. doi: 10.53761/1.18.5.7
- Forycka, J., Pawłowicz-Szlarska, E., Burczyńska, A., Cegielska, N., Harendarz, K., and Nowicki, M. (2022). Polish medical students facing the pandemic — assessment of resilience, well-being and burnout in the COVID-19 era. *PLoS One* 17:e0261652. doi: 10.1371/journal.pone.0261652
- Fuller, A., Belihouse, R., and Johnston, G. (2016). *Get it – Creating resilient learners*. Queenscliff: Inyahead Press.
- Gabrovec, B., Selak, Š., Crnković, N., Cesar, K., and Šorgo, A. (2022). Perceived satisfaction with online study during COVID-19 lockdown correlates positively with resilience and negatively with anxiety, depression, and stress among Slovenian postsecondary students. *Int. J. Environ. Res. Public Health* 19:7024. doi: 10.3390/ijerph19127024
- Gillham, J., Abenavoli, R. M., Brunwasser, S. M., Linkins, M., Reivich, K. J., and Seligman, M. E. P. (2013). Resilience education. *Oxford Handbook Happ.* doi: 10.1093/oxfordhb/9780199557257.013.0046 <https://works.swarthmore.edu/fac-psychology/537>
- Gittell, J. H., Cameron, K., Lim, S., and Rivas, V. (2006). Relationships, layoffs and organizational resilience: airline responses to the crisis of September 11th. *J. Appl. Behav. Sci.* 42, 300–329. doi: 10.1177/0021886306286466
- Gonzalez, T., La Rubia, M. A. de, Hincz, K. P., Comas-Lopez, M., Subirats, L., Fort, S., and Sacha, G. M. (2020). Influence of COVID-19 confinement on students' performance in higher education. *PLoS One*, 15:e0239490. doi: 10.1371/journal.pone.0239490
- Gras, M.-E., Font-Mayolas, S., Baltasar, A., Patiño, J., Sullman, M. J. M., and Planes, M. (2019). The Connor-Davidson resilience scale (CD-RISC) amongst young Spanish adults. *Clinica Y Salud* 30, 73–79. doi: 10.5093/clysa2019a11
- Gupta, S. D. (2020). Ravaging pandemic of COVID-19. *J. Health Manag.* 22, 115–116. doi: 10.1177/2F0972063420951876
- Hartley, M. T. (2011). Examining the relationships between resilience, mental health, and academic persistence in undergraduate college students. *J. Am. Coll. Heal.* 59, 596–604. doi: 10.1080/07448481.2010.515632
- HRK. (2005). *Qualifikationsrahmen für Deutsche Hochschulabschlüsse* [Qualification Framework for Higher Education in Germany]. Available at www.kmk.org/doc/beschl/BS_050421_Qualifikationsrahmen_AS_Ka.pdf
- Hodges, C., Moore, S., Lockee, B., Trust, T., and Bond, A. (2020). *The difference between emergency remote teaching and online learning*. Educause Review. Available at: <https://er.educause.org/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Hofstede, G. (2001). *Culture's consequences: comparing values, behaviors, institutions, and organizations across nations*. Thousand Oaks, CA: Sage Publications.
- Hoofman, J., and Secord, E. (2021). The effect of COVID-19 on education. *Pediatr. Clin. N. Am.* 68, 1071–1079. doi: 10.1016/j.pcl.2021.05.009
- Iglesias-Pradas, S., Hernández-García, Á., Chaparro-Peláez, J., and Prieto, J. L. (2021). Emergency remote teaching and students' academic performance in higher education during the COVID-19 pandemic: a case study. *Comput. Hum. Behav.* 119:106713. doi: 10.1016/j.chb.2021.106713
- Imhof, M. (2022). "Studieren in den Zeiten der Pandemie. Untersuchungen zum Einfluss von Resilienz, Motivationalen Grundbedürfnissen und Lernverhalten auf die Kompetenzentwicklung von Studierenden im digitalen Studium" in *Schule zwischen Wandel und Stagnation [Schools Between Change and Stagnation]*. eds. L. Fuhrmann and Y. Akkaba (Wiesbaden: Springer), 457–484.
- Jansen, R. S., van Leeuwen, A., Janssen, J., and Kester, L. (2022). Exploring the link between self-regulated learning and learner behaviour in a massive open online course. *J. Comput. Assist. Learn.* 38, 993–1004. doi: 10.1111/jcal.12675
- JASP Team (2023). JASP (Version 0.17.1)[Computer software].
- Jehi, T., Khan, R., Dos Santos, H., and Majzoub, N. (2022). Effect of COVID-19 outbreak on anxiety among students of higher education: a review of literature. *Curr. Psychol.* 42, 17475–17489. doi: 10.1007/s12144-021-02587-6
- Jordan, P. J., and Troth, A. C. (2020). Common method bias in applied settings: the dilemma of researching in organizations. *Aust. J. Manag.* 45, 3–14. doi: 10.1177/0312896219871976
- Kavčič, T., Zager Kocjan, G., and Dolenc, P. (2023). Measurement invariance of the CD-RISC-10 across gender, age, and education: a study with Slovenian adults. *Curr. Psychol.* 42, 1727–1737. doi: 10.1007/s12144-021-01564-3
- Kendra, J. M., and Wachtendorf, T. (2003). Elements of resilience after the world trade center disaster: reconstituting new York City's emergency operations center. *Disasters* 27, 37–53. doi: 10.1111/1467-7717.00218
- Kizilcec, R. F., Pérez-Sanagustín, M., and Maldonado, J. J. (2017). Self-regulated learning strategies predict learner behavior and goal attainment in massive open online courses. *Comp. Educ.* 104, 18–33. doi: 10.1016/j.compedu.2016.10.001
- Klimova, B., Zamborova, K., Cierniak-Emerych, A., and Dziuba, S. (2022). University students and their ability to perform self-regulated online learning under the COVID-19 pandemic. *Front. Psychol.* 13:781715. doi: 10.3389/fpsyg.2022.781715
- Klingsieck, K. B. (2018). Kurz und knapp – die Kurzskaala des Fragebogens "Lernstrategien im Studium" (LIST) [short and sweet – the short version of the questionnaire learning strategies of university students (LIST)]. *Zeitschrift für Pädagogische Psychologie* 32, 249–259. doi: 10.1024/1010-0652/a000230
- Kowal, M., Coll-Martin, T., Ikizer, G., Rasmussen, J., Eichel, K., Studzińska, A., et al. (2020). Who is the most stressed during the COVID-19 pandemic? Data from 26 countries and areas. *Appl. Psychol. Health Well Being* 12, 946–966. doi: 10.1111/aphw.12234
- Kuiper, H., van Leeuwen, C. C. M., Stolwijk-Swüste, J. M., and Post, M. W. M. (2019). Measuring resilience with the Connor-Davidson resilience scale (CD-RISC): which version to choose? *Spinal Cord* 57, 360–366. doi: 10.1038/s41393-019-0240-1
- Kunzler, A. M., Röthke, N., Günthner, L., Stoffers-Winterling, J., Tüscher, O., Coenen, M., et al. (2021). Mental burden and its risk and protective factors during the early phase of the SARS-CoV-2 pandemic: systematic review and meta-analyses. *Glob. Health* 17:34. doi: 10.1186/s12992-021-00670-y
- Laranjeira, C., Dixe, M. A., and Querido, A. (2023). Mental health status and coping among Portuguese higher education students in the early phase of the COVID-19 pandemic. *Eur. J. Invest. Health. Psychol. Educ.* 13, 429–439. doi: 10.3390/ejihpe13020032
- Lin, C.-H., Lin, S.-Y., Hu, B.-H., and Lo, C. O. (2023). Investigating mental health outcomes of undergraduates and graduate students in Taiwan during the COVID-19 pandemic. *J. Am. Coll. Heal.* 1–8, 1–8. doi: 10.1080/07448481.2022.2162824
- Loock, V. S., Fleischer, J., Scheunemann, A., Froese, L., Teich, K., and Wirth, J. (2022). Narrowing down dimensions of e-learning readiness in continuing vocational education - perspectives from the adult learner. *Front. Psychol.* 13:1033524. doi: 10.3389/fpsyg.2022.1033524
- Mallak, L. A. (1998). Measuring resilience in health care provider organizations. *Health Manpow. Manag.* 24, 148–152. doi: 10.1108/09552069810215755
- McPherson, A. V. (2012). *College student life and financial stress: an examination of the relation among perception of control and coping styles on mental health functioning*. Raleigh, NC: North Carolina State University.
- Nandy, M., Lodh, S., and Tang, A. (2021). Lessons from COVID-19 and a resilience model for higher education. *Ind. High. Educ.* 35, 3–9. doi: 10.1177/095042220962696
- Nurunnabi, M., Almusharraf, N., and Aldeghaither, D. (2020). Mental health and well-being during the COVID-19 pandemic in higher education: evidence from G20 countries. *J. Public Health Res.* 9:2010. doi: 10.4081/jphr.2020.2010
- Paetsch, J., and Drechsel, B. (2021). Factors influencing pre-service teachers' intention to use digital learning materials: a study conducted during the COVID-19 pandemic in Germany. *Front. Psychol.* 12:733830. doi: 10.3389/fpsyg.2021.733830
- Panadero, E., Jonsson, A., and Botella, J. (2017). Effects of self-assessment on self-regulated learning and self-efficacy: four meta-analyses. *Educ. Res. Rev.* 22, 74–98. doi: 10.1016/j.edurev.2017.08.004
- Portegal-Felices, M. L., Valdivieso-Salazar, D. A., Espín-León, A., and Jimeno-Morenilla, A. (2022). Resilience and academic dropout in Ecuadorian university students during COVID-19. *Sustainability* 14:8066. doi: 10.3390/su14138066
- Pintrich, P. R. (2000). "The role of goal orientation in self-regulated learning" in *Handbook of self-regulation*. eds. M. Boekaerts, P. R. Pintrich and M. Zeidner (San Diego, CA: Academic Press), 451–502.
- Polizzi, C., Lynn, S. J., and Perry, A. (2020). Stress and coping in the time of COVID-19: pathways to resilience and recovery. *Clin. Neuropsychiatry* 17, 59–62. doi: 10.36131/CN20200204
- Quintiliani, L., Sisto, A., Vicinanza, F., Curcio, G., and Tambone, V. (2022). Resilience and psychological impact on Italian university students during COVID-19 pandemic: distance learning and health. *Psychol. Health Med.* 27, 69–80. doi: 10.1080/13548506.2021.1891266

- Reyes, A. T., Andrusyszyn, M.-A., Iwasiw, C., Forchuk, C., and Babenko-Mould, Y. (2015). Resilience in nursing education: an integrative review. *J. Nurs. Educ.* 54, 438–444. doi: 10.3928/01484834-20150717-03
- Robbins, A., Kaye, E., and Catling, J. C. (2018). Predictors of student resilience in higher education. *Psychol. Teach. Rev.* 24, 44–52. doi: 10.53841/bsptr.2018.24.1.44
- Roick, J., Poethke, P., and Richter, M. (2023). Learners' characteristics and the mastery of digital education during the COVID-19 pandemic in students of a medical faculty in Germany. *BMC Med. Educ.* 23:86. doi: 10.1186/s12909-023-04012-x
- Rychen, D. S., and Salganik, L. H. (2003). *Key competencies for a successful life and a well-functioning society*. Bern: Hogrefe and Huber Publishers.
- Salimi, N., Gere, B., Talley, W., and Iriogbe, B. (2023). College students mental health challenges: concerns and considerations in the COVID-19 pandemic. *J. Coll. Stud. Psychother.* 37, 39–51. doi: 10.1080/87568225.2021.1890298
- San Román-Mata, S., Zurita-Ortega, F., Puertas-Molero, P., Badicu, G., and González-Valero, G. (2020). A predictive study of resilience and its relationship with academic and work dimensions during the COVID-19 pandemic. *J. Clin. Med.* 9. doi: 10.3390/jcm9103258
- Sarasjärvi, K. K., Vuolanto, P. H., Solin, P. C. M., Appelqvist-Schmidlechner, K. L., Tamminen, N. M., Elovainio, M., et al. (2022). Subjective mental well-being among higher education students in Finland during the first wave of COVID-19. *Scand. J. Public Health* 50, 765–771. doi: 10.1177/14034948221075433
- Sarubin, N., Gutt, D., Giegling, I., Bühner, M., Hilbert, S., Krähenmann, O., et al. (2015). Erste analyse der psychometrischen Eigenschaften und Struktur der deutschsprachigen 10- und 25-item version der Connor-Davidson resilience scale (CD-RISC) [first analysis of the 10- and 25-item German version of the Connor-Davidson resilience scale (CD-RISC) regarding psychometric properties and components]. *Zeitschrift für Gesundheitspsychologie* 23, 112–122. doi: 10.1026/0943-8149/a000142
- Sood, S., and Sharma, A. (2020). Resilience and psychological well-being of higher education students during COVID-19: the mediating role of perceived distress. *J. Health Manag.* 22, 606–617. doi: 10.1177/0972063420983
- Steenkamp, J.-B. E., and Maydeu-Olivares, A. (2021). An updated paradigm for evaluating measurement invariance incorporating common method variance and its assessment. *J. Acad. Mark. Sci.* 49, 5–29. doi: 10.1007/s11747-020-00745-z
- Theobald, M. (2021). Self-regulated learning training programs enhance university students' academic performance, self-regulated learning strategies, and motivation: a meta-analysis. *Contemp. Educ. Psychol.* 66:101976. doi: 10.1016/j.cedpsych.2021.101976
- Travis, J., and Bunde, J. (2020). Self-regulation in college: the influence of self-efficacy, need satisfaction, and stress on GPA, persistence, and satisfaction. *Curr. Psychol.* 41, 6185–6195. doi: 10.1007/s12144-020-01091-7
- Välikangas, L., and Romme, A. G. L. (2013). How to design for strategic resilience: a case study in retailing. *J. Organ. Des.* 2, 44–53. doi: 10.7146/jod.2.2.7360
- Van der Zanden, P. J. A. C., Denessen, E., Cillessen, A. H. N., and Meijer, P. C. (2018). Domains and predictors of first-year student success: a systematic review. *Educ. Res. Rev.* 23, 57–77. doi: 10.1016/j.edurev.2018.01.001
- Velickovic, K., Rahm Hallberg, I., Axelsson, U., Borrebaeck, C. A. K., Rydén, L., Johnsson, P., et al. (2020). Psychometric properties of the Connor-Davidson resilience scale (CD-RISC) in a non-clinical population in Sweden. *Health Qual. Life Outcomes* 18:132. doi: 10.1186/s12955-020-01383-3
- Versteeg, M., Kappe, R. F., and Knuiman, C. (2022). Predicting student engagement: the role of academic belonging, social integration, and resilience during COVID-19 emergency remote teaching. *Front. Pub. Health* 10:849594. doi: 10.3389/fpubh.2022.849594
- Weick, K. E., and Sutcliffe, K. M. (2015). *Managing the unexpected: sustained performance in a complex world*. 3rd Edn. Hoboken, NJ: John Wiley & Sons.
- Weidlich, J., and Kalz, M. (2021). Exploring predictors of instructional resilience during emergency remote teaching in higher education. *Int. J. Educ. Technol. High. Educ.* 18:43. doi: 10.1186/s41239-021-00278-7
- Winne, P. H. (2018). "Cognition and metacognition within self-regulated learning" in *Handbook of self-regulation of learning and performance*. eds. D. H. Schunk and J. A. Greene (New York NY: Routledge/Taylor & Francis Group), 36–48.
- Wollny, A. I., and Jacobs, I. (2023). Validity and reliability of the German versions of the CD-RISC-10 and CD-RISC-2. *Curr. Psychol.* 42, 3437–3448. doi: 10.1007/s12144-021-01670-2
- Ye, Z., Yang, X., Zeng, C., Wang, Y., Shen, Z., Li, X., et al. (2020). Resilience, social support, and coping as mediators between COVID-19-related stressful experiences and acute stress disorder among college students in China. *Appl. Psychol. Health Well Being* 12, 1074–1094. doi: 10.1111/aphw.12211
- Zimmerman, B. J. (2002). Becoming a self-regulated learner: an overview. *Theory Pract.* 41, 64–70. doi: 10.1207/s15430421tip4102_2



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The influence of grit on life satisfaction of Brazilian undergraduate students: academic adaptation as a mediator

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Introduction: In recent years, research in educational contexts has pointed to the role of grit as a variable related to various positive outcomes, including life satisfaction. Academic adaptation seems vital for the success of academic life in college students. Considering university as an important life context for people pursuing higher education, what is the mediating effect of academic adaptation? This study proposed a mediation model to examine the mediating effect of academic adaptation in the relationship grit and life satisfaction.

Methods: A sample of 413 undergraduate Brazilian students, age ranging from 18 to 71 years ($M = 27.30$; $SD = 10.20$). A correlation analysis was performed between the variables and the following mediation model was tested: Grit (independent variable), academic adaptation (mediating variables) and life satisfaction (dependent variables).

Results: Mediation analysis indicated that academic adaptation mediated around 46.80% for the factor of consistency of interests and 40.90% of the relationship with perseverance of effort. Thus, the greater the grit of the university student, the greater the grit, which leads to better satisfaction with life.

Discussion: In recent years, research in educational contexts has pointed to the role of grit as a variable related to various positive outcomes. The findings elucidated that grit in academic context could benefit students' adaptation process, and the university's responsibility to improve its students' softskills, not only for the future stage after university, but also during the student's schooling.

KEYWORDS

college students, grit, higher education, soft skills, life satisfaction

Introduction

The study of psychological resources for achieving good academic results has attracted the attention of researchers around the world, beyond the cognitive capacity of individuals (Duckworth et al., 2007; Credé et al., 2017). Grit is a personality trait (defined as consistency of interest and perseverance of effort) (Duckworth et al., 2007) that is necessary for achievement in various areas of life (Khan and Khan, 2017; Cormier et al., 2019; Mosewich et al., 2021), including academic (Casali et al., 2023). There is evidence that grit is positively associated with life satisfaction (Khan

and Khan, 2017), that is the cognitive dimension of subjective well-being and refers to the people's global evaluation of the quality of their life (Diener et al., 1997). This relationship can be direct (Singh and Jha, 2008), mediated, or moderated by other variables (Li et al., 2018). In this paper, in addition to grit, academic adaptation, which is the capacity of the college students to effectively adjust the changes imposed by new educational environment, is investigated, especially in relation to its mediating effect on the relationship between grit and life satisfaction (Collie et al., 2016; Mendes, 2021). Despite the growing interest in the relationship between grit and life satisfaction, few studies have investigated this dynamic in Brazilian students, especially when the academic adaptation variable is included. This research seeks to fill this gap, as positive constructs can be protective of challenging situations such as those found in higher education, such as greater demands, separation from family members, adaptation to different rules, and establishment of new interpersonal relationships.

Grit is a multifactorial construct that includes the dimensions of constant interest and perseverance to achieve a long-term goal. Perseverance of effort pertains to the degree to which individuals exert long-lasting determination in confronting obstacles. And consistency of interest relates to the propensity to embrace a consistent range of interests over a prolonged duration. Grit is one of the psychological variables that can help to answer the question: "why do some individuals accomplish more than others with equal intelligence?" As grit is observed in behaviors manifested by the ability to sustain effort and interest in long-term goals, even in the face of adversity (Noronha and Almeida, 2022). Grittier people seem to face their fails as commas and not final points, meaning that they will continue to make an effort on that specific goal they have even if it is tough, they will persevere and be passionate about their long term goals (Duckworth et al., 2007; Duckworth and Quinn, 2009).

Duckworth et al. (2007) made the initial theoretical proposition of the construct, which subsidized the development of the Grit Scale (Duckworth et al., 2007; Duckworth and Quinn, 2009), and other similar scales to measure the construct in different populations and cultures (Disabato et al., 2018; Clark and Malecki, 2019; Datu and Zhang, 2020; Postigo et al., 2020; Singh and Chukkali, 2021). These instruments prompted researchers around the world to investigate the relationship that grit establishes with other variables (Li et al., 2018; Tang et al., 2019; Alhadabi and Karpinski, 2020; Ain et al., 2021; Casali et al., 2023).

Studies indicate that grit has a positive relationship with life satisfaction (Singh & Jha, 2008; Datu et al., 2016; Credé et al., 2017; Li et al., 2018; Ain et al., 2021). Life satisfaction refers to the cognitive component of subjective well-being, i.e., a person's perception of how satisfied they are with their life. Subjective well-being is a tripartite construct, made up of cognitive and affective dimensions (positive and negative affections) (Diener et al., 1997). Life satisfaction appears to be more stable than the affective components, however, it can be affected by some factors, namely external events (Anusic and Schimmack, 2016), age (Fergusson et al., 2015), gender (Chen et al., 2019) and personality traits (Casali et al., 2023), such as grit. According to Khan and Khan (2017) individuals who are determined and committed to achieving ambitious and long-term goals, regardless of the difficulties encountered, are generally more satisfied with themselves and their lives. Moreover Casali et al. (2023) argues that grit functions as an internal resource enabling growth in the face of adversity which in turn can lead to greater satisfaction in the lives of individuals.

Results from a study of 776 North American adolescents found a correlation of $r=0.41$ between the constructs (Clark and Malecki, 2019). The relationship between grit and life satisfaction is not always direct, and can be mediated by other variables (Li et al., 2018; Oriol et al., 2020; Casali et al., 2023). A study of 243 Chinese workers found correlations ranging from 0.28 to 0.47, magnitudes classified as low to high. In addition, the results indicated the direct effect of grit on life satisfaction, as well as optimism as a mediating variable between the constructs (Li et al., 2018). Thus, just as important as external variables, personality traits, which are more stable, are fundamental in influencing how people perceive and evaluate their lives. In a meta-analysis a significant and positive relationship was identified between grit and life satisfaction. Specifically, the perseverance of effort dimension yielded higher results ($p=0.54$) compared to the consistency of interest dimension ($p=0.20$).

In addition to its individual benefits, grit is considered an important non-cognitive variable in educational contexts due to its direct effects on academic outcomes, such as school performance (Duckworth et al., 2007; Credé et al., 2017; Clark and Malecki, 2019; Alhadabi and Karpinski, 2020), school permanence (Eskreis-Winkler et al., 2016), school engagement. It should be highlighted that the study of grit is relatively recent (Duckworth et al., 2007) and that other important variables for the field of school psychology should be investigated in order to better understand their relationship with grit. The relationship between these studies is justified because of the contribution of their findings so that effective interventions can be planned for the educational context (Vainio and Daukantaite, 2016).

In this sense, in the academic context, another variable to be considered and its relationship with grit studied is academic adaptation, which refers to the ability of students to adjust effectively to the demands of the educational environment. The construct encompasses the extent to which students are able to develop learning strategies, deal with stressful situations and respond to academic challenges in a constructive way, in addition to creating a network of relationships (Almeida, 2007; Nadelson et al., 2013). Academic adaptation is crucial for academic success, as students who are able to adapt to new learning environments and overcome obstacles are more likely to achieve their academic goals (Collie et al., 2016). Academic adaptation is the way students deal with adversity in the academic environment (Chen et al., 2023). It is a multidimensional process, encompassing various aspects to be considered (e.g., particularity of the course, culture and climate of the educational institution, learning process, and academic success), requiring the individual to achieve adaptive skills in the face of the demands of the new context (Mendes, 2021; Chen et al., 2023). In this way, grit seems to be an important characteristic for students in their training process, whether at school or university, since the construct refers to persistence in effort (even in the face of adversity, the individual will persist to achieve their goals) and consistency of interest (staying interested and focused) (Duckworth et al., 2007; Noronha and Almeida, 2022).

There are few empirical studies dedicated to study the relation between these specific constructs (academic adaptation and grit). Mendes (2021) found a positive relationship between grit and the perception of learning, academic performance, confidence in completing the course started and the well-being of students. The regression analysis indicated that well-being and the degree of confidence had a significant impact on grit. Furthermore, in Chinese university students, academic adaptability had a negative impact on burnout, that is, the greater

adaptability, the lower the level of burnout (Chen et al., 2023). Students with a lower capacity for academic adaptability are more susceptible to psychological stress, academic dropout and less success in their academic journey (Xie et al., 2019; Barroso et al., 2022). Therefore, it is relevant that this variable is studied together with grit, which is a strong predictor of positive academic results (Duckworth et al., 2007; Credé et al., 2017; Allen et al., 2021).

Brazilian university students are known to face a variety of challenges, including academic demands, social pressures and significant life transitions. Consequently, studying constructs such as grit, which helps explain why some individuals are able to reach their full potential (Duckworth et al., 2007); life satisfaction, which reflects how satisfied a person is with their own life (Diener et al., 1997); and academic adaptation, which allows students to adaptively go through the changes imposed on them, can help in understanding student success in academic environments. Studies presented above show that there is a relationship between the variables. This study proposed a mediation model to examine the mediating effect of academic adaptability in the relationship between grit and life satisfaction following two hypotheses:

H1: Grit factors - Consistency of Interests and Perseverance of Effort would directly relate to life satisfaction.

H2: Academic Adaptation would serve as a mediator between Grit and Life Satisfaction.

Methods

Participants

This study used a non-probabilistic convenience sample with a sample of 413 undergraduated students, 329 (79.70%) were female and 84 (20.30%) male. Ages ranged from 18 to 71 years ($M = 27.30$; $SD = 10.20$). Of the participants, 90.10% ($n = 372$) were students from private higher education institutions and 9.90% ($n = 41$) from public institutions.

Instruments

Sociodemographic questionnaire

An instrument made up of 11 questions, developed by the authors specifically for this research, with the aim of obtaining data such as gender, age, university and course attended.

Grit assessment scale (EAGrit-LP)

Self-report instrument for assessing grit that was built and validated according to the AERA Standards specifically for the Portuguese language speakers (Noronha and Almeida, 2022). The scale consists of 12 items, distributed into two factors (Consistency of Interests = 6 items and Perseverance of Effort = 6 items): GrIt-LP has a Likert scale response key, ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Examples of items are: "I have defined my life goals for the next few years"; "I persevere in my efforts to achieve my goals"; "I try to commit myself to achieving my goals." In this research sample, the estimated accuracy of the scores was $\alpha = 0.81$ and $\omega = 0.82$

for the Consistency of Interests factor, and $\alpha = 0.84$ and $\omega = 0.85$ for Perseverance of Effort.

Questionnaire on adaptation to higher education (QAES)

This self-report instrument aims to assess the university student's adaptation process, experiences and academic integration into the higher education institution (Araújo et al., 2014). The instrument was built and validated for the Portuguese language speakers. The QAES consists of 56 items, divided into five factors: Career Planning (6 items), Social Adaptation (12 items), Personal Emotional Adaptation (11 items), Academic Adaptation (8 items) Study Adaptation (12 items) and Institutional Adaptation (7 items). The instrument has a Likert scale response key, ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Examples of items are: "Lately at university I've felt more irritable than usual"; "Lately I've felt disoriented and confused"; "Lately I've felt sad or down." In this study's sample, the estimated reliability of the scores for the Personal Emotional Adaptation factor was $\alpha = 0.88$ and $\alpha = 0.89$.

Life satisfaction scale (SWLS)

A self-report instrument that assesses the cognitive component of subjective well-being - the level of satisfaction of the individuals (Diener et al., 1985). The SWLS has 5 items, which are answered on a seven-point Likert scale, ranging from "strongly disagree" to "strongly agree." Examples of items are: "My life is close to my ideal," "My living conditions are excellent"; "I am satisfied with my life." Zanon et al. (2013) carried out a validation study of the measure for the Brazilian context, gathering evidence of internal structure and reliability estimates. In this study, the reliability estimates were $\alpha = 0.83$ and $\omega = 0.85$.

Procedures

Initially, the project was submitted to a Research Ethics Committee for appraisal, and was approved under number 5.392.664. Data was collected *online*. The instruments were inserted into the *Google Forms* platform, and the *link* to access the survey was made available on social networks (i.e., *facebook*, *instagram* and *whatsapp*). Participants signed a Free and Informed Consent Form (FICF), which stated the objectives of the research, the instruments used as well as guaranteeing the anonymity and confidentiality of the data. It took an average of 10 min to answer the instruments, in the following order: Sociodemographic and academic characterization questionnaire, EAGrit-LP, QAES and SWLS.

Data analysis

Pearson's correlation analysis was used between the scores on the EAGrit-LP, QAES and SWLS scales. The values proposed by Cohen (1988) were used to interpret the magnitudes: $r \leq 0.29$ (weak); $0.30 \leq r \leq 0.49$ (moderate); $r \geq 0.50$ (strong). We tested a model for investigating the effects of Grit and Academic Adaptation on Satisfaction with Life. Next, the Academic Adaptation as mediating variable between Grit (independent variables) and Satisfaction with Life (dependent variables). The tested models were made through Structural Equation Modeling, with a Maximum Likelihood estimator and bootstrapping of 500 cases. The following fit indices were considered:

Root-Mean-Square Error of Approximation (RMSEA; reference value <0.08), Comparative Fit Index (CFI; reference value >0.90) and Tucker-Lewis Index (TLI; reference value >0.90 ; Hair et al., 2009).

The mediation model was tested following these steps: (a) Grit (independent variable) should have direct effects on life satisfaction (dependent variables); and on academic adaptation (mediating variables); (b) academic adaptation should have direct effects on life satisfaction; (c) the initial effect of Grit on the dependent variable should not be significant or be reduced, since the mediating variables were inserted in the model. We used 95% confidence interval for direct and indirect effects. The analyses were performed using JASP.

Results

As can be seen in Table 1, the correlation analysis indicated positive associations between the variables, with magnitudes ranging from moderate to high. Consistency of Interests was the factor that showed the greatest association with Academic Adaptation and with Satisfaction with Life.

To investigate the direct effect of the independent variables on life satisfaction, we performed regression analysis using Structural Equation Modeling. We conducted diagnosis of multicollinearity between the variables. The VIF values obtained ranged from 1.27 to 1.65, indicating that there are no exact or approximately exact linear relations. As shown in Figure 1, Consistency of Interests (B , non-standardized = 0.21; $Beta$ = 0.16) and Perseverance of Efforts (B , non-standardized = 0.11; $Beta$ = 0.08) and Academic Adaptation (B , non-standardized = 0.63; $Beta$ = 0.49) were predictors of Life satisfaction (adjusted R^2 = 0.41), with good model fit indexes (RMSEA = 0.06; CFI = 0.93; TLI = 0.92).

It was possible to observe that academic adaptation mediated the relationship between Consistency of Interests and Satisfaction with Life. The initial direct effect was $b = 0.47$, 95% CI [0.35–0.59], $p < 0.001$ and adjusted R^2 of 0.12. After inserting the mediating variable, the total effect was reduced to $b = 0.25$, 95% CI [0.13–0.37], $p < 0.001$, with an improvement in adjusted R^2 to 0.28. Academic adaptation mediated around 46.80% of the relationship between Consistency of Interests and Satisfaction with Life. Similarly, when Perseverance of Efforts was included as a predictor in the model, the initial effect was $b = 0.44$, 95% CI [0.32–0.56], $p < 0.001$ and adjusted R^2 of 0.11, which was reduced to $b = 0.26$, 95% CI [0.14–0.17], $p < 0.001$ and adjusted R^2 of 0.28. Academic adjustment mediated approximately 40.90% of the relationship between the variables. See Table 2 and Figure 2.

Discussion

The present study aimed to analyze the extent to which the relationship between grit and life satisfaction is impacted by

academic adaptation. Grit is a trait that informs about the maintenance of interest and perseverance of effort (Duckworth et al., 2007; Duckworth and Quinn, 2009). There is a relationship between grit and life satisfaction that is theoretically justified because people who are committed to their goals tend to be more satisfied (e.g., Khan and Khan, 2017). The question in this study was to assess whether the consistency of interests and perseverance of effort (Noronha and Almeida, 2022) in relation to student satisfaction would be impacted by academic adaptation. The construct is defined as the extent to which the individual is able to develop strategies and deal with stressful situations in order to respond to the challenges imposed by higher education (Almeida et al., 1999).

Adapting to higher education requires a set of provocations portrayed in processes of acquiring academic content inherent to the specifics of the courses chosen, while at the same time requiring the development of skills. Each student brings with them a reality that distinguishes them from their peers, and in addition to academic performance, they are expected to develop marked social skills, adapt to new contexts and rules, incorporate the values of the host institution, and develop new roles that imply autonomy, among others (Tinto, 1993; Soares et al., 2019). It is reiterated in the literature that adaptation to higher education brings benefits to the individual and to society (e.g., Faria and Almeida, 2020; Santos et al., 2022). It is important to mention that, although the academic adaptation instrument currently used generates information on five factors (Career Planning, Social Adaptation, Personal Emotional Adaptation, Study Adaptation, Institutional Adaptation), we only used the one aimed at understanding personal emotional adaptation because it is theoretically justified in relation to the other concepts (Almeida et al., 1999; Almeida, 2007). Findings in the current research corroborate that Grit is directly related to life satisfaction and indirectly related through the partial mediator variable of academic adaptation. The results suggest that the more grit university students have, the more effectively they adjust personally and emotionally to the demands of academic life, which leads to better life satisfaction.

Fernández-Martín et al. (2020) conducted a literature review on grit as a predictor associated with personal, educational and professional outcomes. By analyzing 90 studies, totaling 70,963 participants, the results of the review indicated that people with greater grit have a series of successes in various domains of life, such as better physical and mental health, better interpersonal relationships, better performance at work, better school grades and lower academic dropout. Thus, this series of positive outcomes in a person's life leads to a state of well-being, which results in better satisfaction with life (Kushlev et al., 2019). Thus, even if stressful events occur, grit, observed in behaviors of passion for interests and

TABLE 1 Data correlation matrix.

	CI	PE	AA	LS
Consistency of interests (CI)	–			
Perseverance of effort (PE)	0.71	–		
Academic adaptation (AA)	0.40	0.33	–	
Life satisfaction (LS)	0.36	0.33	0.50	–

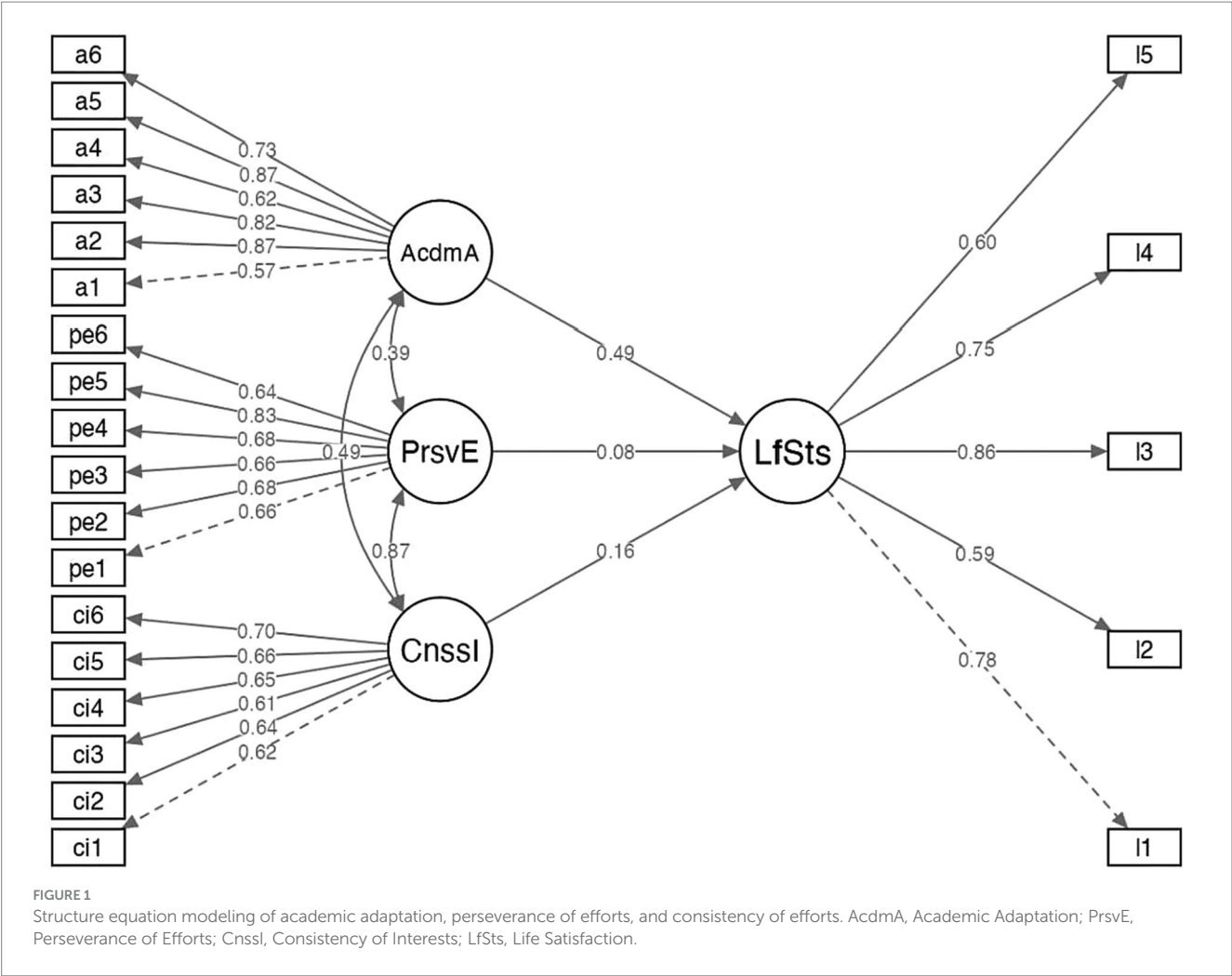


TABLE 2 Standardized effect coefficients of the mediation models investigated.

Model 1		Direct effect without Vmed	Direct effect with Vmed	Indirect effect
Consistency of interests →	Academic adaptation	0.47**	0.25**	0.22**
Academic adaptation →	Life satisfaction			
Consistency of interests →	Life satisfaction			
Model 2				
Perseverance of efforts →	Academic adaptation	0.44**	0.26**	0.19**
Academic adaptation →	Life satisfaction			
Perseverance of efforts →	Life satisfaction			

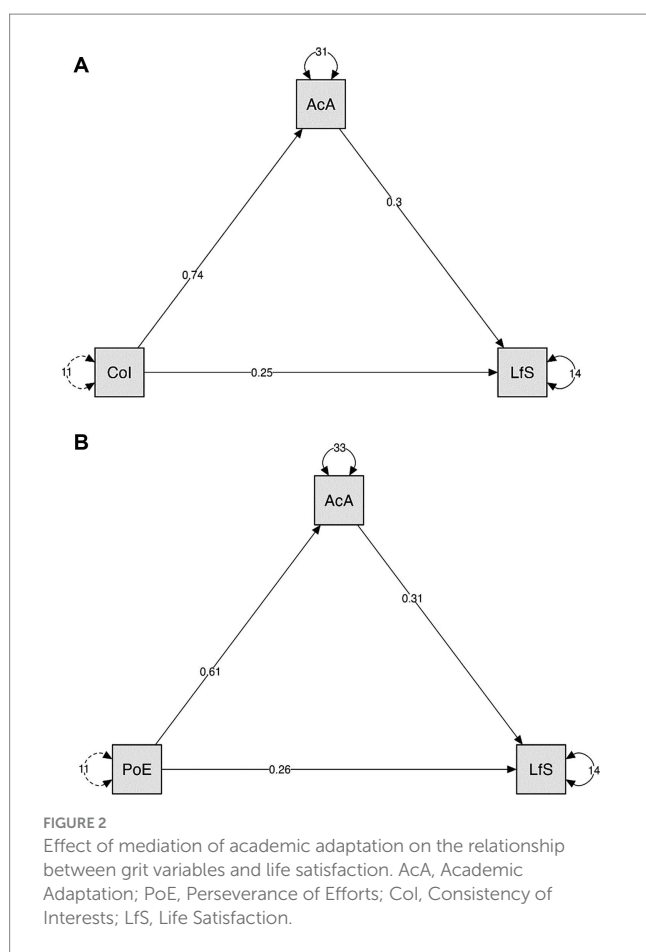
** $p < 0.01$.

perseverance helps the person to achieve their goals, obtaining successful outcomes.

Conclusions, limitations and future directions

This research shows that, among this sample of Brazilian university students, a large part of the relationship between grit and

life satisfaction is explained by academic adaptation. In Brazil, as in other countries where there is evident socio-economic inequality, access to and permanence in higher education includes not only the student's individual personal and emotional resources, but also financial and social resources. The transition from school to university or entering higher education after years of completing high school, as in the case of older students who are or are not in the job market, demands physical, psychological and financial resources from the student, as well as a commitment to learning



academic content and a new set of norms and new models of behavior required by the university (Santos et al., 2022). Faced with this reality, grit and adaptation to the new stage of life are fundamental. Thus, personal and contextual difficulties demand internal mechanisms from the student, such as grit, that through clarity about their life and career goals, persevere in higher education.

The current study examined the mediating mechanism of academic adaptation on grit and life satisfaction. This has two main implications for educators and educational managers. First, the importance of individual characteristics, like Grit, strengthening emotional regulation promoting a growth mindset, and through vicarious experiences. Second, universities, as institutions of human development education, must be committed to transmitting pragmatic content to their students, but they must also be committed to developing soft skills in their students, for the future stage after university and for life (Scheirlinckx et al., 2023). Although the current study contributed to the literature, it still has several limitations to be considered. First, it is important to highlight that the cross-sectional methodological design does not allow to test the causal relationship among variables, requiring that in future studies a longitudinal design be used. Furthermore, it would be interesting to conduct a comparative study according to specific characteristics of the students, such as gender, age, ethnicity, sexual orientation, with the objective of investigating possible differences between the groups.

In particular, concerning future studies, it seems appropriate to test research with an experimental design. An intervention based on the literature could potentially promote higher levels of life satisfaction and adaptation to higher education, both variables investigated in this study, as well as other non-cognitive variables explored by Li et al. (2018), Tang et al. (2019), and Casali et al. (2023). Similarly, analyzing how grit interacts with characteristics inherent to higher education can provide relevant information for the field of knowledge, for managers, and for university students.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Universidade São Francisco Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AN: Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Investigation, Methodology, Supervision. JD-V: Writing – original draft, Writing – review & editing, Data curation, Formal analysis, Software. AC: Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Ain, N. U., Munir, M., and Suneel, I. (2021). Role of emotional intelligence and grit in life satisfaction. *Heliyon* 7:e06829. doi: 10.1016/j.heliyon.2021.e06829
- Alhadabi, A., and Karpinski, A. C. (2020). Grit, self-efficacy, achievement orientation goals, and academic performance in university students. *Int. J. Adolesc. Youth* 25, 519–535. doi: 10.1080/02673843.2019.1679202
- Allen, R. E., Kannagara, C., and Carson, J. (2021). True grit: how important is the concept of grit for education? A narrative literature review. *Int. J. Educ. Psychol.* 10, 73–87. doi: 10.17583/ijep.2021.4578
- Almeida, L. S. (2007). Transição, adaptação académica e êxito escolar no ensino superior. *Rev. Galego Port. Psico. Educa.* 15, 1138–1663.
- Almeida, L. S., Soares, A. P. C., and Ferreira, J. A. G. (1999). *Adaptação, Rendimento e desenvolvimento dos estudantes no Ensino Superior: construção, Validação do Questionário Académico de Vivências Académicas -Relatórios de investigação*. Centro de estudos em Educação e Psicologia, Universidade de Minho. Braga
- Anusic, I., and Schimmack, U. (2016). Stability and change of personality traits, self-esteem, and well-being: introducing the meta-analytic stability and change model of retest correlations. *J. Pers. Soc. Psychol.* 110, 766–781. doi: 10.1037/pspp0000066
- Araújo, A. M., Almeida, L. S., Ferreira, J. A., Santos, A. D., Noronha, A. P., and Zanon, C. (2014). Adjustment to higher education questionnaire: development and validation. *Psicol. Educ. Cult.* 18, 131–145.
- Barroso, P. C. F., Oliveira, M. I., Noronha-Sousa, D., Noronha, A., Mateus, C. C., Vázquez-Justo, E., et al. (2022). Dropout factors in higher education: a literature review. *Psicol. Escol. Educ.* 26:e228736. doi: 10.1590/2175-3539202228736T
- Casali, N., Feraco, T., and Meneghetti, C. (2023). Keep going, keep growing: a longitudinal analysis of grit, posttraumatic growth, and life satisfaction in school students under COVID-19. *Learn. Individ. Differ.* 105:102320. doi: 10.1016/j.lindif.2023.102320
- Chen, X., Yu, G., Cheng, G., and Hao, T. (2019). Research topics, author profiles, and collaboration networks in the top-ranked journal on educational technology over the past 40 years: a bibliometric analysis. *J. Comput. Edu.* 6, 563–585. doi: 10.1007/s40692-019-00149-1
- Chen, X., Cai, Z., He, J., and Fan, X. (2020). Gender Differences in Life Satisfaction Among Children and Adolescents: A Meta-analysis. *J. Happiness Stud.* 21, 2279–2307. doi: 10.1007/s10902-019-00169-9
- Chen, C., Shen, Y., Zhu, Y., Xiao, F., Zhang, J., and Ni, J. (2023). The effect of academic adaptability on learning burnout among college students: the mediating effect of self-esteem and the moderating effect of self-efficacy. *Psychol. Res. Behav. Manag.* 16, 1615–1629. doi: 10.2147/PRBM.S408591
- Clark, K. N., and Malecki, C. K. (2019). Academic grit scale: psychometric properties and associations with achievement and life satisfaction. *J. Sch. Psychol.* 72, 49–66. doi: 10.1016/j.jsp.2018.12.001
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- Collie, R., Martin, A., Papworth, B., and Ginns, P. (2016). Students' interpersonal relationships, personal best (PB) goals, and academic engagement. *Learn. Individ. Differ.* 45, 65–76. doi: 10.1016/j.lindif.2015.12.002
- Cormier, D. L., Dunn, J. G., and Dunn, J. C. (2019). Examining the domain specificity of grit. *Person. Individ. Differ.* 139, 349–354. doi: 10.1016/j.paid.2018.11.026
- Credé, M., Tynan, M. C., and Harms, P. D. (2017). Much ado about grit: A meta-analytic synthesis of the grit literature. *J. Person. Social Psychol.* 113, 492–511. doi: 10.1037/pspp0000102
- Datu, J. A. D., Valdez, J. P. M., and King, R. B. (2016). Perseverance counts but consistency does not! Validating the short grit scale in a collectivist setting. *Curr. Psychol.* 35, 121–130. doi: 10.1007/s12144-015-9374-2
- Datu, J. A. D., and Zhang, J. (2020). Validating the Chinese version of Triarchic model of grit scale in technical-vocational college students. *J. Psychoeduc. Assess.* 39:381–387. doi: 10.1177/0734282920974813
- Diener, E., Emmons, R. A., Larsen, R. J., and Griffin, S. (1985). The satisfaction with life scale. *J. Pers. Assess.* 49, 71–75. doi: 10.1207/s15327752jpa4901_13
- Diener, E., Suh, E., and Oishi, S. (1997). Recent findings on subjective well-being. *Indian J. Clin. Psychol.* 24, 25–41.
- Disabato, D. J., Goodman, F. R., and Kashdan, T. B. (2018). Is grit relevant to well-being and strengths? Evidence across the globe for separating perseverance of effort and consistency of interests. *J. Pers.* 87, 194–211. doi: 10.1111/jopy.12382
- Duckworth, A. L., Peterson, C., Matthews, M. D., and Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *J. Pers. Soc. Psychol.* 92, 1087–1101. doi: 10.1037/0022-3514.92.6.1087
- Duckworth, A. L., and Quinn, P. D. (2009). Development and validation of the short grit scale (grit-S). *J. Pers. Assess.* 91, 166–174. doi: 10.1080/00223890802634290
- Eskreis-Winkler, L., Gross, J., Duckworth, A., Vohs, K., and Baumeister, R. (2016). "Grit: sustained self-regulation in the service of superordinate goals" in *Handbook of self-regulation: Research, theory and applications*. eds. K. D. Vohs and R. F. Baumeister (New York, NY: Guilford), 380–395.
- Faria, A. A. G. B. T., and Almeida, L. S. (2020). Adaptation of 1st year students: promoting success and permanence at the university. *Rev. Int. Educ. Sup.* 7, 1–16. doi: 10.20396/riesup.v7i0.8659797
- Fergusson, D. M., Mcleod, G. F. H., Horwood, L. J., Swain, N. R., Chapple, S., and Poulton, R. (2015). Life satisfaction and mental health problems (18 to 35 years). *Psychol. Med.* 45, 2427–2436. doi: 10.1017/S0033291715000422
- Fernández-Martín, F. D., Arco-Tirado, J. L., and Hervás-Torres, M. (2020). Grit as a Predictor and Outcome of Educational, Professional, and Personal Success: A Systematic Review. *Psicol. Educa.* 26, 163–173. doi: 10.5093/psed2020a11
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. (2009). *Multivariate data analysis*. Pearson Prentice Hall, Upper Saddle River.
- Khan, B. M., and Khan, A. M. (2017). Grit, happiness and life satisfaction among professionals: a correlational study. *J. Psychol. Cogn.* 2, 123–132. doi: 10.35841/psychology-cognition.2.2.123-132
- Kushlev, K., Drummond, D. M., and Diener, E. (2019). Subjective well-being and health behaviors in 2.5 million americans. *Appl. Psychol. Health Well Being* 12, 166–187. doi: 10.1111/aphw.12178
- Li, J., Fang, M., Wang, W., Sun, G., and Cheng, Z. (2018). The influence of grit on life satisfaction: self-esteem as a mediator. *Psychol. Belg.* 58, 51–66. doi: 10.5334/pb.400
- Mendes, A. P. A. (2021). Transition and adaptation to higher education: validation of a grit scale. Available at: <http://hdl.handle.net/1822/77160>
- Mosewich, A. D., Dunn, J. G. H., Causgrove Dunn, J., and Wright, K. S. (2021). Domain-specific grit, identity, and self-compassion in intercollegiate athletes. *Sport Exerc. Perform. Psychol.* 10, 257–272. doi: 10.1037/spy0000267
- Nadelson, L. S., Semmelroth, C., Matinez, G., Feather-stone, M., Fuhrman, C. A., and Sell, A. (2013). Why did they come here? The influences and expectations of first-year students college experience. *High. Educ. Stud.* 3, 50–62. doi: 10.5539/hes.v3n1p50
- Noronha, A. P., and Almeida, L. S. (2022). Construction and psychometric studies of the Garra assessment scale: international version in portuguese language (EAGRIT-LP). *Rev. Psicol. Educ. Cult.* 26, 8–23.
- Oriol, X., Miranda, R., Bazán, C., and Benavente, E. (2020). Distinct routes to understand the relationship between dispositional optimism and life satisfaction: self-control and grit, positive affect, gratitude, and meaning in life. *Front. Psychol.* 11:907. doi: 10.3389/fpsyg.2020.00907
- Postigo, A., Cuesta, M., García-Cueto, E., Menéndez-Aller, A., González-Nuevo, C., and Muñiz, J. (2020). Grit assessment: is one dimension enough? *J. Pers. Assess.* 103, 786–796. doi: 10.1080/00223891.2020.1848853
- Santos, C. O., Pilatti, L. A., and Bondarik, R. (2022). Dropout in brazilian universities: concept, measurement, causes and consequences. *Debat. Educa.* 14, 294–314. doi: 10.28998/2175-6600.2022
- Scheirlinckx, J., Van Raemdonck, L., Abrahams, L., Teixeira, K. C., Alves, G., Primi, R., et al. (2023). Social-emotional skills of teachers: mapping the content space and defining taxonomy requirements. *Front. Educ.* 8:1094888. doi: 10.3389/educ.2023.1094888
- Singh, K., and Jha, S. D. (2008). Positive and negative affect, and grit as predictors of happiness and life satisfaction. *J. Indian Acad. Appl. Psychol.* 34, 40–45.
- Singh, S., and Chukkali, S. (2021). Development and validation of Multi-Dimensional Scale of Grit. *Cogent Psychol.* 8:1923166. doi: 10.1080/23311908.2021.1923166
- Soares, A. B., Monteiro, M. C., Souza, M. S. D., Maia, F. A., Medeiros, H. C. P., and Barros, R. D. S. N. (2019). Difficult interpersonal situations: relations between social skills and coping in academic adaptation. *Psicologia* 39:183912. doi: 10.1590/1982-3703003183912
- Tang, X., Li, Y., Duan, W., Mu, W., and Cheng, X. (2019). Character strengths lead to satisfactory educational outcomes through strength use: a longitudinal analysis. *Front. Psychol.* 10:1829. doi: 10.3389/fpsyg.2019.01829
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition*. University of Chicago Press. Chicago
- Tinto, V. (2010). "From theory to action: exploring the institutional conditions for student retention" in *Higher education: handbook of theory and research*. ed. J. Smart (Dordrecht: Springer), 25–32.
- Vainio, M. M., and Daukantaite, D. (2016). Grit and different aspects of well-being: direct and indirect relationships via sense of coherence and authenticity. *J. Happiness Stud.* 17, 2119–2147. doi: 10.1007/s10902-015-9688-7
- Xie, Y. J., Cao, D. P., Sun, T., and Yang, L. B. (2019). The effects of academic adaptability on academic burnout, immersion in learning, and academic performance among Chinese medical students: a cross-sectional study. *BMC Med. Educ.* 19, 1–8. doi: 10.1186/s12909-019-1640-9
- Zanon, C., Bastianello, M. R., Pacico, J. C., and Hutz, C. S. (2013). Desenvolvimento e validação de uma escala de afetos positivos e negativos. *Psico-usf*, 18, 193–201. doi: 10.1590/S1413-82712013000200003

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