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Predictive factors of cognitive and metacognitive self-regulation among preservice teachers

Fatores preditivos da autorregulação cognitiva e metacognitiva de futuros professores

Factores predictivos de la autorregulación cognitiva y metacognitiva en futuros docentes

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Resumo

O objetivo do estudo foi analisar se as variáveis sociodemográficas e de vida acadêmica influenciam a autorregulação cognitiva e metacognitiva de futuros professores. Participaram da pesquisa 604 estudantes de três universidades públicas brasileiras, sendo duas localizadas no Paraná e uma em São Paulo. Os participantes responderam ao questionário sociodemográfico e de vida acadêmica e uma escala de avaliação de estratégias de aprendizagem. Após a aprovação do projeto pelo Comitê de Ética, os dados foram coletados, por meio de um link gerado pelo Google Formulário. Análises

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descritivas, comparativas e de regressão foram realizadas utilizando o software SAS. Os resultados da análise descritiva revelaram uso frequente da autorregulação cognitiva e metacognitiva. Diferenças estatisticamente significativas foram encontradas entre a autorregulação cognitiva e metacognitiva e as variáveis: idade, gênero, universidade, autopercepção das notas e grau de intenção de continuar o curso. Observou-se também que a idade, o gênero e o grau de intenção de continuar o curso predizem a autorregulação cognitiva e metacognitiva. Conhecer a autorregulação cognitiva e metacognitiva de futuros professores e seus fatores preditivos torna-se importante para o planejamento de intervenções que promovam a autorregulação. Sugere-se que em estudos futuros, a autorregulação seja investigada em conjunto com outras variáveis sociodemográficas.

Palavras-chave: Estratégias de aprendizagem, licenciatura, autorregulação.

Abstract

The aim of this study was to analyze whether sociodemographic and academic-life variables influence cognitive and metacognitive self-regulation among preservice teachers. The study included 604 students from three Brazilian public universities, two located in the state of Paraná and one in the state of São Paulo. Participants completed a sociodemographic and academic-life questionnaire and a learning strategies assessment scale. Following approval by the Research Ethics Committee, data were collected via a link generated using Google Forms. Descriptive, comparative, and regression analyses were conducted using SAS software. Descriptive analysis indicated frequent use of cognitive and metacognitive self-regulation strategies. Statistically significant differences in cognitive and metacognitive self-regulation were observed according to age, gender, university attended, self-perceived academic performance, and intention to remain in the program. Age, gender, and intention to remain in the program were also identified as predictors of cognitive and metacognitive self-regulation. Understanding cognitive and metacognitive self-regulation among preservice teachers and the factors that predict it is valuable for designing interventions aimed at fostering self-regulated learning. Future studies should investigate self-regulation in relation to additional sociodemographic variables.

***Keywords**: Learning strategies, teacher training, self-regulation.*

Resumen

El objetivo de este estudio fue analizar si las variables sociodemográficas y de la vida académica influyen en la autorregulación cognitiva y metacognitiva de futuros docentes. Participaron en el estudio 604 estudiantes de tres universidades públicas brasileñas, dos ubicadas en el estado de Paraná y una en el estado de São Paulo. Los participantes respondieron un cuestionario sociodemográfico y de la vida académica y una escala de evaluación de estrategias de aprendizaje. Tras la aprobación del estudio por el Comité de Ética en Investigación, los datos se recopilaron mediante un enlace generado en Google Forms. Se realizaron análisis descriptivos, comparativos y de regresión utilizando el software SAS. El análisis descriptivo indicó un uso frecuente de estrategias de autorregulación cognitiva y metacognitiva. Se observaron diferencias estadísticamente significativas en la autorregulación cognitiva y metacognitiva según la edad, el género, la universidad de procedencia, la autopercepción del rendimiento académico y el grado de intención de permanecer en la carrera. Asimismo, se identificó que la edad, el género y el grado de intención de permanecer en la carrera predicen la autorregulación cognitiva y metacognitiva. Comprender la autorregulación cognitiva y metacognitiva de los futuros docentes y sus factores predictivos es importante para planificar intervenciones orientadas a promover la autorregulación. Se recomienda que futuros estudios investiguen la autorregulación en relación con otras variables sociodemográficas.

***Palabras clave**: Estrategias de aprendizaje, formación docente, autorregulación.*

1. Introduction

Understanding human functioning and the mechanisms underlying effective learning constitutes a central area of inquiry in educational psychology. This study is grounded in Social Cognitive Theory (SCT), proposed by Albert Bandura, which moves beyond unidirectional conceptions of behavior by positing a model of triadic reciprocal determinism. From this perspective, human functioning emerges from the continuous and reciprocal interaction among personal factors (cognitive, affective, and biological), behavior, and environmental influences (Bandura, 1989). SCT assigns a central role to human agency, understood as individuals' intentional capacity to act and influence the course of their own lives. This capacity is a fundamental component of the development of self-regulation (Bandura, 2001).

Grounded in SCT, self-regulation stands out as a key component in explaining human agency. Bandura (1989, 2001) describes human beings as self-organizing, proactive, self-reflective, and self-regulating. Self-regulation is not an isolated act but rather an internal system that enables individuals to manage their thoughts, affections, and actions through processes such as self-monitoring, evaluating their own performance against personal goals, and generating self-reactions (Bandura, 1989). This system enables individuals to influence their own motivation and behavior, thereby moving beyond merely reactive responses to environmental influences (Bandura, 2001).

The concept of self-regulation proposed by Bandura (1989, 2001) is closely related to that of self-regulated learning, although the two constructs differ in scope. Whereas self-regulation within SCT is a domain-general construct applicable across various areas of life, self-regulated learning represents its application to the academic context. Accordingly, self-regulated learning is defined as an active, cyclical process in which students set goals, plan, monitor, and evaluate their own learning, employing strategies to optimize their performance in educational tasks (Zimmerman, 2000, 2002). Lajoie (2008) supports this perspective, emphasizing that self-regulated learning integrates cognitive, metacognitive, motivational, and contextual factors within the learning environment.

Self-regulated learning is operationalized through the use of cognitive and metacognitive strategies. Cognitive strategies are procedures used to engage directly with the material to be learned, thereby supporting the acquisition, storage, and retrieval of information (Boruchovitch, 1999; Góes; Boruchovitch, 2020). Metacognitive strategies, in turn, are more complex and involve "thinking about one's own thinking." They encompass the planning, monitoring, and regulation of cognitive activities, enabling students to develop awareness of and exercise control over their own learning processes (Flavell, 1979; Góes; Boruchovitch, 2020).

The literature classifies cognitive strategies into three main categories: rehearsal, elaboration, and organization. Rehearsal strategies consist of repeating and reviewing learning material, such as rewriting information or reading it aloud; elaboration strategies entail connecting new content to prior knowledge through techniques such as paraphrasing or summarizing; and organization strategies focus on identifying main ideas and structuring content, for example, by creating concept maps or outlines (Góes; Boruchovitch, 2020; Muijs; Bokhove, 2020). Metacognitive strategies, in turn, are classified into planning, monitoring, and regulation. Planning involves setting goals and selecting appropriate strategies; monitoring refers to tracking one's own comprehension and performance while completing a task; and regulation involves making adjustments based on the outcomes of monitoring, such as modifying a strategy or devoting additional time to specific content (Dinsmore; Alexander; Loughlin, 2008; Góes; Boruchovitch, 2020).

Cognitive and metacognitive strategies are not mutually exclusive but rather complementary and interdependent, both playing a crucial role in academic success in higher education. Dinsmore, Alexander, and Loughlin (2008) demonstrate that, although these strategies manifest in different ways, they operate in tandem: whereas cognitive strategies represent the "doing," metacognitive strategies represent "knowing how, when, and why to do it." Meta-analytic studies confirm that the combined use of these strategies is positively associated with academic achievement, motivation, and student persistence, all of which are essential for navigating the challenges inherent in higher education (Dent; Koenka, 2016; Muijs; Bokhove, 2020).

Given the importance of these skills, teacher education should prioritize the development of cognitive and metacognitive self-regulation among preservice teachers, both to support their own learning and to inform their future classroom practice. As Boruchovitch (2014) and Dembo and Seli (2020) point out, if teachers are unfamiliar with

effective learning strategies and do not apply them to their own learning, they are unlikely to recognize the importance of teaching such strategies to their students. The study by Arcoverde, Boruchovitch and Góes (2022) demonstrated that intervention programs can enhance preservice teachers' knowledge of self-regulated learning; however, it also showed that theoretical knowledge alone is insufficient to bring about changes in perceptions and intentions. These findings highlight the need for a more integrated and reflective approach to teacher education that provides preservice teachers with opportunities to actively engage with and apply these strategies.

Previous studies of preservice teachers examining cognitive and metacognitive self-regulation in relation to sociodemographic and academic-life variables have identified gender-related differences. Students who self-identified as male reported greater use of metacognitive strategies for anxiety control (Boruchovitch et al., 2020; Frison; Boruchovitch; Góes, 2024; Góes; Alliprandini, Boruchovitch, 2025) and for self-testing their learning (Frison; Boruchovitch; Góes, 2024). Age-related differences have also been identified, with older students, aged 25 years or above, reporting greater use of metacognitive strategies for anxiety control (Boruchovitch et al., 2020; Frison; Boruchovitch; Góes, 2024; Góes; Alliprandini, Boruchovitch, 2025), whereas students over 41 years of age reported greater use of metacognitive strategies for managing concentration and time.

Differences have also been observed according to racial identification. Students who self-identified as White reported greater use of cognitive strategies for identifying the main ideas in a text and for test-taking (Góes; Alliprandini; Boruchovitch, 2025). In contrast, Boruchovitch et al. (2020) found that non-White students reported greater use of the metacognitive strategy of concentration control. No studies were identified that examined differences in cognitive and metacognitive self-regulation according to the university attended. As for the type of high school attended, students who had attended private schools reported greater use of cognitive strategies, particularly those related to identifying the main ideas in a text and test-taking (Góes; Alliprandini; Boruchovitch, 2025).

Intention to remain in the program has also been associated with differences in strategy use. Students who reported a strong intention to continue their studies had higher scores on the cognitive strategies of attitudes, identifying main ideas, and test-taking, as well as on the metacognitive strategy of concentration control (Frison; Boruchovitch; Góes, 2024). Similar findings were reported by Boruchovitch et al. (2020) and Góes, Alliprandini and Boruchovitch (2025) for the cognitive strategies of attitudes and information processing and the metacognitive strategies of self-testing and time management.

Finally, regarding students' self-perceptions of their academic performance, those with more positive perceptions tended to report greater use of the metacognitive strategy of anxiety control and the cognitive strategies of identifying main ideas and test-taking (Frison; Boruchovitch; Góes, 2024; Góes; Alliprandini; Boruchovitch, 2025). Boruchovitch et al. (2020) also identified differences in the same direction for the metacognitive strategies of concentration control, self-testing, and time management.

Understanding and promoting cognitive and metacognitive self-regulation in higher education is essential for several reasons. First, the transition to university poses significant challenges, requiring students to exercise greater autonomy, manage their time effectively, and cope with complex academic demands for which many are not adequately prepared (Dembo; Seli, 2020; Zimmerman, 2002). Second, the development of these skills is directly associated with lower rates of course failure and dropout, as well as with reduced social inequality, all of which are persistent challenges in undergraduate education, particularly in teacher education programs (Ferreira, 2016; Muijs; Bokhove, 2020).

Investing in the development of cognitive and metacognitive self-regulation means preparing professionals who are more autonomous, critical, and capable of managing their own lifelong learning, an essential capacity in a constantly changing world. This study is warranted by the need to identify factors that explain cognitive and metacognitive self-regulation among preservice teachers and aims to provide empirical evidence to inform pedagogical practices, teacher education curricula, and institutional policies designed to promote self-regulated learning. Accordingly, the overall objective of this study was to examine whether sociodemographic and academic-life variables influence cognitive and metacognitive self-regulation among preservice teachers. The specific objectives were to: (a) assess the level of cognitive and metacognitive self-regulation among preservice teachers; (b) compare cognitive and

metacognitive self-regulation across sociodemographic and academic-life variables; and (c) identify the sociodemographic and academic-life variables that predict cognitive and metacognitive self-regulation.

2. Methodological Approach

This study can be characterized as exploratory, as it seeks to understand the factors that may influence cognitive and metacognitive self-regulation. According to Gil (2002), exploratory research aims to provide greater familiarity with the research problem, thereby making it more explicit. The author further states that the primary purpose of this type of research is to enhance understanding of the phenomenon under investigation.

2.1 Research Setting

This study was conducted at three state public universities in Brazil, two located in the state of Paraná and one in the state of São Paulo. The university located in northern Paraná was established in 1970 through the incorporation of five previously existing independent colleges. It currently has an academic community of approximately 22,000 individuals, including 12,599 undergraduate students, 5,781 graduate students, 1,685 faculty members, and 2,203 university staff members. The institution is organized into nine academic centers and 58 departments and offers 53 on-campus undergraduate programs, 15 of which are teacher education programs.

The university located in the central-western region of Paraná is a multicampus institution. Founded in 2001, it serves a region encompassing 150 municipalities and a population of approximately 4.5 million people. The university has approximately 9,544 students across seven campuses located in different regions of the state and offers approximately 40 undergraduate programs, 15 of which are teacher education programs. The campus where the study was conducted has 1,373 students, 565 of whom are enrolled in one of the five teacher education programs offered at the campus.

Finally, the university located in the central-western region of the state of São Paulo was founded in 1976 through the integration of several existing independent higher education institutions across the state, resulting in a distinctive multicampus structure. The university currently serves 38,782 undergraduate students across approximately 168 undergraduate programs, 30 of which are teacher education programs. The campus where the study was conducted serves approximately 2,013 undergraduate students enrolled in nine programs, three of which are teacher education programs.

2.2 Participants

A total of 604 preservice teachers participated in the study. Of these, 238 attended a university located in northern Paraná, 191 attended a university in the central-western region of Paraná, and 175 attended a university in the central-western region of the state of São Paulo. Most participants self-identified as female (77.2%) and White (65.7%), had attended public high schools (78.1%), were enrolled in a Pedagogy program (57.1%), and attended evening classes (66.2%). Additionally, 30.0% were employed, and 55.3% reported being fully committed to continuing their undergraduate program. The participants' mean age was 24.1 years.

2.3 Data Collection Instruments

2.3.1 Sociodemographic and Academic-Life Questionnaire

The sociodemographic and academic-life questionnaire was developed to characterize the study participants. The instrument consists of 11 questions: six multiple-choice questions, three open-ended questions, and two Likert-type questions. Examples of multiple-choice items include class schedule, racial identification, and type of high school attended. Age and university attended are examples of information collected through open-ended questions. One of the Likert-type items assesses the "degree of intention to remain enrolled at the university in the following academic year."

2.3.2 Learning Strategies Assessment Scale (Santos; Boruchovitch, 2015, revised by Santos; Boruchovitch, 2020)

The Learning Strategies Assessment Scale was developed to assess the learning strategies used by university students. It consists of 43 items distributed across four factors. Factor 1, Cognitive and Metacognitive Self-Regulation (α = 0.86), comprises 23 items. One example is "Developing questions and answers about the material being studied." Factor 2, Self-Regulation of Internal and Contextual Resources (α = 0.71), comprises eight items, including "Organizing one's study environment." Factor 3, Social Self-Regulation (α = 0.65), comprises four items. One example is "Discussing the subject matter with classmates to check one's understanding." Finally, Factor 4, Self-Regulation of Digital Technology Use, comprises eight items. An example is "Watching online video lessons to better understand the course content." Factor 4 was added when the authors adapted the scale in 2020 and is therefore still undergoing statistical validation.

The instrument uses a four-point Likert-type response scale with the following options: always, sometimes, rarely, and never. It also includes one reverse-scored item, Item 26: "Becoming distracted or thinking about something else while reading, studying, or completing assignments." For the present study, only Factor 1, Cognitive and Metacognitive Self-Regulation, was analyzed to allow for a more in-depth and focused examination of this construct. In interpreting the scale results, higher mean and median scores indicate higher levels of cognitive and metacognitive self-regulation among students.

2.4 Data Collection Procedures

The present study was submitted to and approved by the Research Ethics Committee for Research Involving Human Subjects, in accordance with applicable ethical standards, under Approval No. 6.932.674.

Initially, the researchers contacted the coordinators of the teacher education programs to obtain information about the faculty members teaching during the semester in which the study was conducted and to schedule dates and times for data collection. Data were collected primarily in the classroom, with a member of the research team present. Faculty members who preferred to administer the survey themselves were provided with a link to the questionnaire hosted on Google Forms. After receiving instructions on the data collection procedures, they administered the survey to their students.

For classroom-based data collection, the same procedures were followed at all three universities: the researcher administering the survey introduced themselves to the class, explained the research project and its objectives, risks, and benefits, and informed students that participation was voluntary. Students were then provided with a link to the survey questionnaire hosted on Google Forms.

Upon accessing the link, students were first presented with the Informed Consent Form, which provided key information about the study as well as the email address of the researcher responsible for addressing any questions. After providing consent to participate, students were directed to a new screen containing the sociodemographic and academic-life questionnaire. Upon completing the questionnaire, they proceeded to the second instrument, the Learning Strategies Assessment Scale. The entire data collection procedure took approximately 20 minutes to complete.

2.5 Data Analysis Procedures

Scores were calculated as the arithmetic mean of the components comprising each measure. Sample characteristics were summarized using absolute (n) and relative (%) frequencies or the mean, standard deviation, and median, as appropriate. Internal consistency was assessed using Cronbach's alpha coefficient for the components within each domain and for the overall scale.

Differences in domain scores across sociodemographic characteristics were assessed using the Kruskal–Wallis test. When significant differences were identified, pairwise comparisons between groups were performed using the Mann–Whitney U test. Multivariable linear regression analyses were conducted using a stepwise procedure to select

sociodemographic variables. Variables identified as significant were subsequently examined using multivariable general linear models (GLMs), with effect estimates expressed as least-squares means (LS-means) and their respective confidence intervals.

The significance level was set at 5%, and all statistical analyses were performed using SAS version 9.4.

3. Results

To assess participants' level of cognitive and metacognitive self-regulation, a descriptive analysis of the corresponding factor was conducted. The results are presented in Table 1, which summarizes measures of internal consistency, central tendency, variability, and score range for the overall sample.

Table 1- Descriptive analysis of the "Cognitive and Metacognitive Self-Regulation" factor

Cognitive and Metacognitive Self-Regulation n = 604					
Alpha	**Mean**	**Median**	**Standard Deviation**	**Minimum**	**Maximum**
0.856	2.90	2.91	0.446	1.22	4.00

Source: The Authors (2026).

Based on the results presented in Table 1, the scale demonstrated high internal consistency. The mean and median scores were above the midpoint of the scale, suggesting frequent use of cognitive and metacognitive self-regulation strategies. The standard deviation indicated considerable variability in participants' scores, which was also reflected in the observed range, from a minimum of 1.22 to a maximum of 4.00.

Table 2 presents the results of the bivariate analysis examining the associations between students' sociodemographic and academic-life variables and cognitive and metacognitive self-regulation.

Table 2- Bivariate analysis of cognitive and metacognitive self-regulation according to students' sociodemographic and academic-life variables

Sociodemographic and academic-life variables	n	Mean	SD	Mdn	p-value	Pairwise comparison	p-value
Age							
Up to 20 years	246	2.9	0.4	2.9	<0.0001*	Up to 20 × 21–24 years	0.2174
21–24 years	221	2.8	0.5	2.9		Up to 20 × ≥25 years	<0.0001*
≥ 25 years	136	3.1	0.5	3.1		21–24 × ≥25 years	<0.0001*
Gender							
Female	466	2.9	0.4	3.0	0.0229*	Female × Male	0.0070*
Male	133	2.8	0.5	2.9		Female × Other	0.5500
Other	5	2.9	0.2	2.9		Male × Other	>0.9999
University							
Northern Paraná	238	2.9	0.4	2.9	0.0371*	Northern PR × Central-Western PR	0.3539
Central-Western Paraná	191	2.9	0.5	2.9		Northern PR × Central-Western SP	0.0077*

Sociodemographic and academic-life variables	n	Mean	SD	Mdn	p-value	Pairwise comparison	p-value
Central-Western São Paulo	175	3.0	0.4	3.0		Central-Western PR × Central-Western SP	0.1808
Self-Perceived Academic Performance							
Well above the average grade required to pass the program	116	3.0	0.4	3.1		Well above average × Above average	0.0020*
Above the average grade required to pass the program	279	2.9	0.4	2.9		Well above average × Around average	0.0011*
Around the average grade required to pass the program	166	2.9	0.5	2.9	0.0018*	Well above average × Below/well below average	0.0507*
Below/well below the average grade required to pass the program	10	2.7	0.5	2.7		Above average × Around average	0.4178
						Above average × Below/well below average	0.2265
						Around average × Below/well below average	0.3230
Degree of Intention to Remain in the Program							
(I) No intention	12	3.2	0.4	3.4		I x II	0.0097*
(II) Very little/Little intention	31	2.7	0.5	2.7		I x III	0.0022*
(III) Moderate intention	78	2.7	0.5	2.8	<0.0001*	I x IV	0.0089*
(IV) High/Very high intention	149	2.9	0.4	2.9		I x V	0.0398*
(V) Definite intention	334	3.0	0.4	3.0		II x III	0.9279
						II x IV	0.1143
						II x V	0.0118*
						III x IV	0.0114*
						III x V	<0.0001*
						IV x V	0.0545*
Paid Employment							
Yes	423	2.9	0.4	2.9			
No	181	2.9	0.5	3.0	0.1780	Not significant	
Program							
Physics	9	2.8	0.5	2.9			
History	52	2.9	0.5	2.9			
Pedagogy	345	2.9	0.4	3.0			
Chemistry	29	2.9	0.4	2.9	0.4092	Not significant	
Languages and Literature	70	2.9	0.5	2.9			
Philosophy	10	3.0	0.5	3.1			
Social Sciences	22	3.0	0.5	2.9			

Sociodemographic and academic-life variables	n	Mean	SD	Mdn	p-value	Pairwise comparison	p-value
Geography	27	2.7	0.5	2.8			
Arts	7	2.6	0.6	2.5			
Biology	33	3.0	0.4	3.0			
Field of Study							
Exact Sciences	38	2.9	0.4	2.9	0.4362	Not significant	
Humanities	526	2.9	0.5	2.9			
Arts	7	2.6	0.6	2.5			
Biological Sciences	33	3.0	0.4	3.0			
Class Schedule							
Morning	168	3.0	0.5	3.0	0.1303	Not significant	
Afternoon	18	2.7	0.4	2.8			
Evening	400	2.9	0.4	2.9			
Full-time	18	2.9	0.4	2.9			
Racial Identification							
White	395	2.9	0.4	2.9	0.7663	Not significant	
Non-White	206	2.9	0.5	2.9			
Type of High School Attended							
Private school	103	2.9	0.4	2.9	0.7728	Not significant	
Public school	472	2.9	0.5	2.9			
Both public and private schools	29	2.9	0.5	3.0			

Source: The Authors (2026).

The results of the bivariate analysis revealed statistically significant differences in cognitive and metacognitive self-regulation according to age and gender. Among the academic-life variables, significant differences were observed according to university attended, self-perceived academic performance, and intention to remain in the program. No statistically significant differences were found according to employment status, racial identification, program, field of study, class schedule, or type of high school attended.

Age-related differences were observed, with students aged 25 years or older reporting greater use of cognitive and metacognitive self-regulation strategies than students in the other age groups. Gender-related differences were also identified, with female students reporting greater use of these strategies than male students.

Differences were also observed across universities, with students from the university in São Paulo reporting higher levels of cognitive and metacognitive self-regulation than those from the university located in northern Paraná. Self-perceived academic performance was also associated with significant differences: students who perceived their academic performance as well above average showed higher levels of cognitive and metacognitive self-regulation than those who perceived their performance as above average, average, or below/well below the minimum passing grade.

Intention to remain in the program was also associated with significant differences in cognitive and metacognitive self-regulation. Students who reported having no intention of continuing their studies showed higher levels of cognitive and metacognitive self-regulation than all other groups. Those who reported a definite intention to remain in the program also showed greater use of these strategies than students reporting very little/little, moderate, or high/very high intention to continue. Furthermore, students with a high/very high intention to remain in the program reported greater use of these strategies than those with a moderate intention to continue.

Table 3 presents the results of the multivariable linear regression analysis using a stepwise variable selection procedure to examine the associations between sample characteristics and cognitive and metacognitive self-regulation.

Table 3 - Multivariable linear regression analysis using a stepwise variable selection procedure

Sample characteristics	Cognitive and Metacognitive Self-Regulation	
Total model R^2	**0.108**	
	(LS Means Effect) p-value	**Confidence Interval (CI)**
Age (partial R^{2*})	**0.039**	
Up to 20 years	(2.8)	(2.7 to 2.9)
21–24 years	(2.8)	(2.6 to 2.9)
≥ 25 years	(3.0)	(2.8 to 3.1)
Up to 20 × 21–24 years	<0.0001	(0.0)
Up to 20 × ≥25 years	0.9455	-(0.2)
21–24 × ≥25 years	<0.0001	-(0.2)
Gender (partial R^{2*})	**0.018**	
Female	(2.9)	(2.9 to 3.0)
Male	(2.8)	(2.7 to 2.9)
Other	(2.8)	(2.4 to 3.2)
Female × Male	**0.0030**	(0.1)
Female × Other	0.7976	(0.1)
Male × Other	0.9957	(0.0)
Intention to Remain in the Program (partial R^{2*})	**0.054**	
(I) No intention	(3.2)	(2.9 to 3.4)
(II) Very little/Little intention	(2.7)	(2.5 to 2.9)
(III) Moderate intention	(2.7)	(2.5 to 2.8)
(IV) High/Very high intention	(2.9)	(2.7 to 3.0)
(V) Definite intention	(2.9)	(2.8 to 3.1)
I X II	**0.0125**	(0.5)
I X III	**0.0031**	(0.5)
II X IV	NS	
II X V	**0.0210**	-(0.2)
III x IV	**0.0236**	-(0.2)
III X V	**<0.0001**	-(0.3)
Racial Identification (partial R^{2*})	NS	
Self-Perceived Academic Performance (partial R^{2*})	NS	
Type of High School Attended (partial R^{2*})	NS	

Note: *Partial R-squared. **Model with low explanatory power

Source: The Authors (2026).

Overall, the results presented in Table 3 indicate that the proposed model, in which sociodemographic and academic-life variables predict cognitive and metacognitive self-regulation, explains 10% of the variance in this construct. Age (0.3%), gender (0.1%), and intention to remain in the program (0.5%) contributed to the explanatory power of the model. The remaining variables (racial identification, self-perceived academic performance, and type of high school attended) did not appear to contribute significantly to the proposed model. Thus, the findings suggest that age, gender, and intention to remain in the program are predictors of cognitive and metacognitive self-regulation.

4. Discussion

Analyzing the predictors of cognitive and metacognitive self-regulation is essential for understanding the mechanisms underlying effective learning. Studies such as those by Zimmerman (2000) and Pintrich (2004) have shown that skills such as planning, monitoring, and adjusting learning strategies are directly associated with academic achievement and problem-solving. Examining these predictors can not only help identify profiles of students with higher or lower levels of autonomy in learning but also inform the development of more effective and intentional pedagogical interventions aligned with students' actual learning needs (Arcoverde; Boruchovitch; Góes, 2022). Such initiatives are particularly important in higher education, especially in teacher education programs, where professional preparation requires both mastery of subject matter and the development of self-regulation, an essential component of effective teaching practice (Boruchovitch, 2014; Dembo; Seli, 2020).

The present study aimed to examine whether sociodemographic and academic-life variables influence cognitive and metacognitive self-regulation among preservice teachers. Specifically, the study sought to: (a) assess the level of cognitive and metacognitive self-regulation among preservice teachers; (b) compare cognitive and metacognitive self-regulation across sociodemographic and academic-life variables; and (c) identify the sociodemographic and academic-life variables that predict cognitive and metacognitive self-regulation.

The results indicated frequent use of cognitive and metacognitive self-regulation strategies among preservice teachers and showed that the sociodemographic variables of age and gender were associated with cognitive and metacognitive self-regulation. Previous studies have demonstrated the importance of personal characteristics in preservice teachers' strategic and self-regulated behavior (Boruchovitch et al., 2020; Frison; Boruchovitch; Góes, 2024; Góes; Alliprandini; Boruchovitch, 2025; Herrera Torres et al., 2021). More specifically, Boruchovitch et al. (2020) and Frison, Boruchovitch and Góes (2024) identified significant differences in study and learning strategies according to age, gender, and other demographic variables, supporting the view that such factors should be considered when planning educational interventions. According to the Social Cognitive Theory framework underpinning the present study (Bandura, 1986), human functioning is explained by the reciprocal interaction among personal factors (such as age and gender), behavior, and environmental influences. In this regard, the findings of the present study are consistent with the theoretical framework adopted.

Students aged 25 years or older reported higher levels of cognitive and metacognitive self-regulation than those in the other age groups. This finding is consistent with the results reported by Arcoverde et al. (2022) and Frison, Boruchovitch and Góes (2024), who found that older students, aged 25 years or above, outperformed their younger counterparts in cognitive self-regulation. Similarly, although focusing on emotional exhaustion, Araújo et al. (2024) found that younger students (under 20 years of age) were more vulnerable to symptoms of anxiety and stress, which may negatively affect cognitive and metacognitive self-regulation. Complementing these findings, Arcoverde et al. (2022), in investigating the strategies students used to cope with anxiety, found that older students employed more effective anxiety-regulation strategies. One possible explanation is provided by Zimmerman's (2000) cyclical model, which conceptualizes self-regulation as a dynamic and recursive process in which prior experiences and cognitive maturity shape subsequent learning cycles. From this perspective, older students may have developed a more refined repertoire of strategies for planning, monitoring, and regulating their learning as a result of greater academic experience and, potentially, greater exposure to academic demands throughout their studies, as suggested by Frison, Boruchovitch and Góes (2024).

Divergent findings regarding age have been reported in previous studies. Although Boruchovitch et al. (2020) found significant age-related differences in cognitive and metacognitive self-regulation, they did not identify specific differences in anxiety-control strategies, suggesting that the relationship between age and anxiety regulation may vary depending on sample characteristics or the instrument used. Similarly, Vieira and Góes (2025) found no statistically significant age-related differences in time management or academic procrastination. Taken together, these findings suggest that not all dimensions of self-regulation are equally sensitive to age, reinforcing the need to consider

environmental factors alongside personal factors when investigating cognitive and metacognitive self-regulation (Bandura, 1986).

The analysis by gender showed that female students reported higher levels of cognitive and metacognitive self-regulation than male students. This finding is consistent with several national and international studies in the field, which indicate that women tend to report greater use of learning strategies, particularly those related to metacognition and effort regulation (Boruchovitch et al., 2020; Frison; Boruchovitch; Góes, 2024; Filho; Nova, 2020; Góes; Alliprandini; Boruchovitch, 2025; Kurt; Demir; Atay, 2021; Pinto; Faria; Pinto, 2016; Suhlmann et al., 2018). Overall, previous research has shown that female students exhibit higher levels of metacognitive self-regulation, including greater use of strategies to monitor their own learning (Góes; Alliprandini; Boruchovitch, 2025), more adaptive self-regulatory behaviors (Dignath; Büttner, 2008), and significantly higher levels of self-regulated learning (Filho; Nova, 2020).

Students from the university in São Paulo reported greater use of self-regulation strategies than those from the university located in northern Paraná. This finding may be understood in light of differences in institutional and regional contexts (Herrera Torres et al., 2021). Herrera Torres et al. (2021) found significant differences according to type of institution (public/private) and region, indicating that factors such as infrastructure, faculty quality, and institutional student support policies may affect the development of self-regulation. Similarly, a study conducted by Botha and Potgieter (2024) in South Africa showed that contextual variables, such as access to resources (e.g., libraries and computers) and English proficiency, were significant predictors of self-directed learning. Taken together, these findings suggest that regional and institutional differences, such as those that may exist between São Paulo and northern Paraná, may create distinct learning environments that influence students' strategic learning behaviors. One possible explanation, therefore, is that the university in São Paulo may provide more opportunities or a more conducive environment for the development and practice of cognitive and metacognitive self-regulation.

Students who perceived their academic performance as well above average reported higher levels of cognitive and metacognitive self-regulation than those with less favorable perceptions of their academic performance. This finding is consistent with evidence frequently reported in the literature on self-regulated learning and aligns with Zimmerman's (2013) cyclical model, according to which self-reflection on past performance influences subsequent phases of learning. Students who perceive their grades as well above average may be more likely to experience positive affective reactions, such as satisfaction and confidence, which may carry over into the forethought phase of the subsequent cycle, strengthening self-efficacy and goal setting and, consequently, promoting more frequent and varied use of cognitive and metacognitive self-regulation strategies. Conversely, negative self-perceptions may lead to dissatisfaction, reduced self-efficacy, and lower levels of strategic engagement.

Frison, Boruchovitch and Góes (2024) demonstrated that students with positive self-perceptions of their academic performance exhibited higher levels of cognitive and metacognitive self-regulation. Similarly, Vieira and Góes (2025) found that students who perceived their grades as above average managed their time more effectively and procrastinated less. Taken together, these findings reinforce the cyclical and reciprocal nature of self-regulation: cognitive and metacognitive self-regulatory processes, such as planning, organization, and monitoring, may contribute to better academic performance; in turn, academic success may strengthen self-efficacy beliefs and positive self-perceptions, motivating students to continue using and refining these strategies in future learning tasks (Bandura, 1997; Zimmerman, 2000).

Students who reported a definite intention to remain in the program indicated greater use of these strategies than those reporting little, moderate, or high/very high intention to continue, while students with high/very high intention reported greater strategy use than those with moderate intention. This finding suggests a progressive relationship between commitment to the program and engagement in self-regulated academic behaviors, consistent with the findings of Boruchovitch et al. (2020) and Frison, Boruchovitch and Góes (2024). Intention to remain in the program can be viewed as an indicator of motivation and long-term goal setting, both of which are fundamental components of self-regulation (Pintrich, 2000; Zimmerman, 2002). Students who intend to persist in their program may have clearer academic goals and place greater value on learning activities, which may lead them to employ a broader

range of strategies, such as maintaining concentration, adopting positive attitudes, and preparing for tests, thereby supporting their academic success and, consequently, their persistence in the program. The observed gradient (definite > high > moderate intention) suggests that the strength of students' motivation and commitment may be an important factor differentiating their levels of cognitive and metacognitive strategy use.

An unexpected finding emerged from this study, diverging from previous research examining intention to remain in the program in relation to cognitive and metacognitive self-regulation (Boruchovitch et al., 2020; Frison; Boruchovitch; Góes, 2024; Góes; Alliprandini; Boruchovitch, 2025). In the present study, students who reported having no intention of remaining in the program exhibited higher levels of cognitive and metacognitive self-regulation than those in all other intention categories (very little, little, moderate, high, very high, and definite intention). One possible explanation for this finding is the small number of participants who selected the "no intention" response category (n = 12), which may have introduced bias into the results for this subgroup. Alternatively, the finding may reflect the influence of other factors not measured in the present study. Further research with larger samples of students who report no intention of remaining in their programs is therefore warranted to better examine the relationship between this characteristic and cognitive and metacognitive self-regulation.

The lack of statistically significant differences in cognitive and metacognitive self-regulation scores according to the academic-life variables of program and field of study is noteworthy, given that the specific demands of different programs and fields of knowledge might be expected to influence students' choice and repertoire of learning strategies. In other words, differences in program and field-specific characteristics might be expected to give rise to distinct learning behaviors. Conversely, these findings may be interpreted in light of the premise that cognitive and metacognitive self-regulation is essential for university students regardless of their field of study or the program in which they are enrolled (Boruchovitch, 2014; Dembo; Seli, 2020; Zimmerman, 2000, 2002).

The findings for the variables that did not show statistically significant differences—engagement in paid employment, class schedule, racial identification, and type of high school attended—are noteworthy, as they suggest that potential educational inequalities associated with combining work and study, attending evening classes, the absence of privileges historically afforded to White populations, and having attended public schools were not associated with differences in cognitive and metacognitive self-regulation in the present sample. These findings underscore the importance of maintaining and strengthening policies aimed at promoting access to and persistence in higher education among historically underrepresented groups, given the role of such policies in addressing and reducing social inequalities.

Finally, the multivariable analysis showed that age, gender, and intention to remain in the program may predict cognitive and metacognitive self-regulation. These findings provide useful directions for future interventions, highlighting the importance of considering factors related to age, gender, and students' intention to continue their undergraduate studies. Given the importance of cognitive and metacognitive self-regulation both for enhancing preservice teachers' own learning and for enabling them to foster these skills in their future students, further research in this area is warranted.

5. Final Considerations

This study aimed to examine whether sociodemographic and academic-life variables influence cognitive and metacognitive self-regulation among preservice teachers. The findings indicated frequent use of cognitive and metacognitive self-regulation strategies among participants. Comparisons across sociodemographic and academic-life variables revealed statistically significant differences according to age, gender, university attended, self-perceived academic performance, and intention to remain in the program. Furthermore, age, gender, and intention to remain in the program were identified as predictors of cognitive and metacognitive self-regulation.

Understanding the predictive factors of cognitive and metacognitive self-regulation among preservice teachers is relevant and can inform the development of intervention programs that integrate personal, academic, and contextual

dimensions, all of which are integral to initial teacher education. This understanding can help tailor interventions to the needs of potentially more vulnerable groups, such as younger students, those with less favorable perceptions of their academic performance, and those with little intention of remaining in their programs.

The limitations of this study include its reliance on self-report measures and its exploratory nature. Self-reporting may have introduced social desirability bias, potentially leading participants to overestimate or underestimate the phenomena under investigation. The exploratory nature of the study also limits the generalizability of the findings, as the sample is not representative of the broader population and the analyses do not allow definitive causal relationships to be established. The findings should therefore be interpreted with caution and replicated in other contexts. Future research should combine different data collection methods, including structured and semi-structured questionnaires, interviews, and observations, and employ quasi-experimental and longitudinal designs. Furthermore, future studies should investigate the relationship between having no intention to remain in the program and cognitive and metacognitive self-regulation more specifically and with larger samples.

Sociodemographic and academic-life variables, particularly age, gender, self-perceived academic performance, intention to remain in the program, and institutional context, are associated with preservice teachers' use of cognitive and metacognitive self-regulation strategies. Recognizing these potential markers of vulnerability is an important step toward enabling teacher education institutions to address the diverse needs and circumstances of their students and to inform pedagogical practices, teacher education curricula, and institutional policies aimed at promoting self-regulation. In doing so, institutions can not only contribute to students' success in higher education but also prepare teachers who are better equipped to help their future students become autonomous and strategic learners.

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