

Research report

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Intervention in Metacognitive Strategies for High School Teachers

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Abstract

This study analyzed the effects of an intervention on high school teachers' self-reported use of metacognitive strategies, conducted in the form of a curricular overlay. The quasi-experimental study consisted of three phases: pre-test, intervention, and post-test. Fourteen teachers from a public school located in a municipality in northern Paraná participated in the study, responding to a questionnaire containing 15 open-ended questions before and after the intervention. The findings revealed a significant increase in the self-reported use of metacognitive strategies in the post-test, particularly in areas such as paying closer attention during lessons, analyzing task difficulty, and planning strategies to complete the tasks. The intervention proved effective in promoting metacognitive practices, demonstrating the feasibility of quasi-experimental designs for measuring and enhancing learning strategies. The study concludes that structured interventions can contribute to the development of metacognitive skills among teachers, thereby fostering self-regulated learning environments.

Keywords: High School; Metacognition; Teacher Training.

Intervenção em estratégias metacognitivas para professores do Ensino Médio

Resumo

Este estudo analisou os efeitos de uma intervenção sobre os relatos do uso de estratégias metacognitivas por professores do Ensino Médio, desenvolvida no formato de uma sobreposição curricular. O estudo quase-experimental foi composto por três momentos: pré-teste, intervenção e pós-teste. Participaram da pesquisa 14 professores de uma escola pública localizada em um município do norte do Paraná, respondendo a um questionário contendo 15 questões abertas antes e após a intervenção. Os resultados indicaram um aumento significativo no relato do uso de estratégias metacognitivas no pós-teste, com destaque para prestar mais atenção nas aulas, analisar a dificuldade da tarefa e pensar em estratégias para realizá-la. A intervenção demonstrou ser eficaz na promoção de práticas metacognitivas, evidenciando a viabilidade de estudos quase-experimentais para mensurar e aprimorar estratégias de aprendizagem. Conclui-se que intervenções estruturadas podem contribuir para o desenvolvimento de habilidades metacognitivas em professores, promovendo ambientes de aprendizagem mais autorregulados.

Palavras-chave: Ensino Médio; Metacognição; Formação de professores.

Intervención en estrategias metacognitivas para profesores de Enseñanza Media

Resumen

Este estudio analizó los efectos de una intervención orientada al uso de estrategias metacognitivas por parte de profesores de Educación Secundaria, implementada bajo el formato de una superposición curricular. El estudio cuasi experimental incluyó tres fases: pretest, intervención y postest. Participaron en la investigación 14 profesores de una escuela pública situada en un municipio del norte de Paraná, quienes respondieron a un cuestionario compuesto por 15 preguntas abiertas antes y después de la intervención. Los resultados revelaron un incremento significativo en los relatos sobre el uso de estrategias metacognitivas en el postest, destacándose aspectos como prestar mayor atención durante las clases, analizar la dificultad de las tareas y reflexionar sobre las estrategias a emplear para su realización. La intervención demostró ser eficaz en la promoción de prácticas metacognitivas, evidenciando la viabilidad de estudios cuasi experimentales para evaluar y potenciar las estrategias de aprendizaje. Se concluye que las intervenciones estructuradas pueden contribuir al desarrollo de habilidades metacognitivas en los docentes, favoreciendo la creación de entornos de aprendizaje más autorregulados.

Palabras clave: Enseñanza Media; Metacognición; Formación de Profesores.

The school and academic context has increasingly demanded that students adopt a more autonomous approach to their own learning. An autonomous learner is one who takes responsibility for their own study process, with this proactive stance representing a crucial first step toward achieving autonomous learning and developing self-regulation skills (Oates, 2019). To facilitate this within the school environment, several changes are

required, including ensuring that teachers have access to knowledge about self-regulated learning and learning strategies, both during initial teacher education and throughout continuing professional development programs (Versuti, Andrade & Zerbini, 2020; Dias & Boruchovitch, 2020).

According to O'Malley and Chamot (1990), the use of learning strategies involves specific ways of processing information that enhance comprehension, learning, and information retention. Students are expected to develop these strategies throughout their educational journey, as they represent a key component in promoting learner autonomy. In contrast, Oxford (2017) defines learning strategies as deliberate procedures or behaviors aimed at improving the acquisition, storage, retention, retrieval, and use of new information.

Just as there are multiple definitions of learning strategies, there are also various taxonomies, models, and classifications that seek to explain their types and organizational structures according to their functions (Oxford, 1990; O'Malley & Chamot, 1990; McKeachie et al., 1990; Dembo, 1994; Weinstein, Acee & Jun, 2011; Cohen, 2012; Rubin, 2013). This diversity of classifications highlights the lack of consensus among researchers regarding a single framework for categorizing learning strategies. Instead, numerous definitions, models, and classifications have been proposed to explain them, often based on criteria such as function and domain (Thomas & Rose, 2019). McCombs (2017) underscores that these classifications serve primarily didactic purposes, aiming to facilitate a clearer understanding of the dimensions involved, and should therefore be viewed as complementary (Beluce & Oliveira, 2018). Despite the variations in definitions and models, there is broad agreement that learning strategies play a crucial role in making the learning process more efficient and effective (Biwer, Bruin, & Persky, 2022).

According to McCombs (2017), the classification model most widely adopted in research within this field is that of Dembo (1994), which categorizes learning strategies into cognitive and metacognitive types. Dembo defines cognitive strategies as the attitudes, behaviors, and thoughts that enhance an individual's capacity to store information. In contrast, metacognitive strategies involve planning the activities to be performed, understanding one's own cognitive state, engaging in self-monitoring and self-evaluation, and regulating one's thought processes. For Dembo (1994), a student cannot be considered skillful if they possess only cognitive strategies but lack awareness of their

metacognitive abilities and do not understand when and how to apply them effectively.

Metacognitive strategies play a pivotal role in sustaining the self-regulation process, grounded in the notion that students possess a control mechanism that relies on introspective capacity to monitor, reflect upon, evaluate, and regulate their own comprehension (Nordin & Yunus, 2020; Rivas, Saiz, & Ossa, 2022). Metacognition encompasses both metacognitive knowledge—consisting of knowledge about strategies, tasks, and personal variables (Varghese, 2019)—and metacognitive experiences, which influence students' self-concept and causal attributions (Thienngam et al., 2020), thereby helping to explain how self-regulation occurs. These metacognitive strategies guide the learning process by directing, planning, monitoring, and evaluating learning activities (Veenman & Van Cleef, 2019). While metacognitive processes clarify how students regulate their learning, motivational and emotional constructs explain why they engage in such regulation (Zimmerman & Schunk, 2011; Zimmerman, 2013).

Teachers can employ metacognitive strategies to support students in becoming self-regulated learners and in developing a strong sense of agency over their own learning processes (Marulis & Nelson, 2021). By fostering metacognitive skills in the classroom, teachers can provide students with opportunities to apply metacognitive strategies during the initial stages of a task. This practice enables students to strengthen their metacognitive abilities and self-awareness, equipping them to select more effective thinking processes in future learning situations. Such an approach aligns with the self-regulatory cycle of self-observation, self-judgment, and self-reaction proposed by Bandura (2017).

In recent years, research has increasingly emphasized the importance of metacognitive strategies within educational contexts, particularly in teacher education. Studies by Marulis and Nelson (2021) and Dignath and Veenman (2021) demonstrate that metacognition is closely linked to the development of self-regulatory skills in both students and teachers, promoting more effective and autonomous learning. Veenman and Van Cleef (2019) and Panadero et al. (2021) further underscore that the application of metacognitive strategies—such as planning, monitoring, and evaluation—can significantly improve students' academic performance and motivation. Additionally, research by Zepeda et al. (2019) and Rivas et al. (2022) highlights that integrating metacognitive practices into teacher education fosters the creation of more reflective and self-regulated learning environments.

In the Brazilian context, Arcoverde, Boruchovitch, and Góes (2022) and Góes and Boruchovitch (2022) demonstrate that interventions centered on metacognitive strategies positively impact the pedagogical practices of high school teachers, reinforcing the need for continued investment in professional development programs. Furthermore, Sitzmann and Ely (2021) and Biwer et al. (2022) emphasize that integrating metacognitive strategies into the school curriculum can strengthen students' ability to manage their own learning, further highlighting the relevance of this topic for contemporary education.

Before teachers can effectively teach students how to use learning strategies—particularly metacognitive ones—they must first learn to apply these strategies themselves. Teachers need to develop an awareness of their own learning processes and understand how learning strategies facilitate learning. This awareness enhances their ability to regulate their own learning and fosters the creation of self-regulated learning environments in their classrooms (Vosniadou et al., 2021; Arcoverde et al., 2022). In this regard, scholars such as Terlecki and McMahon (2018), Xu and Ku (2019), Rosa and Rosa (2020), Mengistnew et al. (2021), Góes and Boruchovitch (2022a), Góes and Boruchovitch (2022b), Lombardi, Santos and Góes (2022), Arcoverde et al. (2022), Massacani, Santos and Góes (2023), and Santos and Alliprandini (2024) emphasize that, for teachers to effectively guide students in the use of these strategies, they must first understand both how to learn and how to teach.

Santos and Alliprandini (2023) highlight the positive impacts of intervention programs focused on learning strategies and self-regulation, while also pointing to a gap in national publications and underscoring the need for further research in the Southern Hemisphere. Additionally, Santos and Alliprandini (2024) emphasize the diversity of possible interventions and stress the urgent need for investment in programs aimed at in-service teachers to promote self-regulation among their students. Grounded in these perspectives, the general objective of this study is to analyze the effects of an intervention in metacognitive strategies on high school teachers' self-reports.

Method

Research Typology

This study adopts a quasi-experimental design, consisting of three phases: pre-test, intervention, and

post-test, and employs a mixed-methods approach that integrates both qualitative and quantitative methodologies. The quasi-experimental design involves exposing the study subjects to specific variables under controlled conditions known to the researcher, with the aim of observing the effects produced by these variables (Levy & Ellis, 2011). In this design, the researcher defines the study subjects, selects the variables, and establishes the procedures for controlling and observing the effects. The quantitative component operates under the assumption that all phenomena can be quantified, meaning that opinions and information are converted into numerical data for classification and analysis. Furthermore, to ensure the reliability of the results and avoid inconsistencies during analysis and interpretation, it is essential to apply statistical tools and techniques, formulate hypotheses, and classify the relationships between variables (Prodanov & Freitas, 2013).

For the mode of intervention, the curricular overlay model was selected, as described by Rosário and Polydoro (2015). This model refers to interventions that typically take place alongside the formal curriculum, often in the form of projects or extension courses. Such interventions are conducted within a space specifically created for instruction in self-regulated learning strategies, separate from the participants' professional or academic training contexts; they are also known as curricular juxtaposition activities. This model was chosen to facilitate teacher participation, as the intervention occurs outside the work environment and can be delivered to a large group of participants in a course format specifically designed for this purpose.

Participants

All 57 teachers (100%) from the school were invited to participate in the study, and 25 (43.85%) agreed to enroll in the course. However, after the intervention schedule was set, sixteen teachers (28.07%) remained, of whom fourteen (87.5%) were female and two (12.5%) were male. Participants' ages ranged from 29 to 66 years, with a mean age of 45.5 years. It is important to note that beginning with Session 8, two participants—one female and one male—withdraw from the course. Consequently, their data were excluded from the participant characterization and from the quantitative analyses of the study results.

The fourteen participants who remained until the end of the process held academic degrees in the following fields: Sociology and Philosophy (1), Mathematics (3), Geography (2), Pedagogy (1), Biological Sciences (2), Chemistry (1), Languages and Literature (3), and Arts

and Biology (1). Their years since graduation ranged from 8 to 40 years, with a mean of 19.25 years. The participants' professional teaching experience ranged from 7 to 42 years, with an average of 19.68 years. Among them, twelve (85.71%) were tenured teachers, while two (14.29%) were employed under a temporary contract through a simplified selection process.

All teachers held a specialization degree; among them, five (35.71%) had participated in the PDE (Educational Development Program of the State of Paraná). Regarding their weekly workload, the majority reported working 40 hours per week (85.71%), followed by 30 hours (7.14%) and 20 hours per week (7.14%). In terms of continuing education in Educational Psychology—offered free of charge by government agencies or private educational institutions as short-term courses—six participants (42.85%) reported having previously attended courses in this area, while eight (57.15%) stated they had never participated in any training related to this field, whether offered by the government or private institutions. Additionally, when asked about current enrollment in educational programs at the time of the training course and the type of study, six participants (37.5%) reported not being enrolled in any program at the time of the pre-test application, five (31.25%) were engaged in continuing education courses, two (12.5%) were pursuing a Master's degree, two (12.5%) were completing a second undergraduate degree, and one (6.25%) was participating in courses and workshops.

Instruments

Two instruments were used in the development of this study. The first was a sociodemographic questionnaire administered to the teachers to collect general information about their profiles. This questionnaire included items on personal data, such as age and gender; academic background, including field of study and specialization or continuing education courses; and professional experience, such as years of teaching, educational level taught, subject taught, and weekly workload. This information was essential for characterizing the participants' profiles and for contextualizing the collected data.

The second instrument was an open-ended questionnaire on self-regulated learning, consisting of 15 open-ended questions developed based on the guidelines provided by Gomes and Boruchovitch (2019, Chapter 5, pp. 125–144). This questionnaire was designed to encourage teachers to reflect on learning and self-regulatory strategies, with a particular emphasis

on metacognitive strategies. Examples of questions included in the instrument are: “Reflect on how you perceive yourself as a student. Choose a behavior you would like to change, improve, or eliminate,” and “Do you think reflecting on your own learning process can be useful to you as a student and as a teacher? And as a student?”

Ethical Procedures and Data Collection

The research project was initially submitted to the Research Ethics Committee for Studies Involving Human Subjects and was approved, as documented in substantiated opinion number 3.762.483. Following approval, teachers were invited to participate in the study and were provided with detailed information regarding the study's relevance, objectives, justification, potential risks, and anticipated benefits. Participation included enrollment in a 50-hour short-term course, which would be officially certified by the Pro-Rectorate of Extension of the proposing institution.

Upon agreeing to participate by signing the Informed Consent Form (ICF), the teachers enrolled in the training course and indicated their availability for the in-person sessions. An agreement was also made with the other teachers at the school that, should the results demonstrate a positive effect on the use of metacognitive learning strategies as a result of the intervention, a short-term course would subsequently be offered. This course would aim to promote the effective use of learning strategies, with a particular emphasis on when and how to apply them, to help teachers become more self-regulated learners.

Several adjustments to the scheduling of the in-person sessions were necessary and, based on the availability of the majority of participants, the sessions were held on Tuesdays. During the first in-person meeting, the pre-test data were collected from the teachers.

Pre-test

Data collection during the pre-test phase, conducted in person, followed the following sequence: completion of the Sociodemographic Questionnaire and the Structured Questionnaire, with all necessary instructions and clarifications provided. During the administration of the instruments, participants did not report any difficulties with the Structured Questionnaire but did request assistance in completing the Sociodemographic Questionnaire. On average, teachers required 50 minutes to complete both instruments. Following this stage, the next phase of the study—the intervention—was initiated.

Intervention

The course was initially designed to span one academic semester, totaling 50 hours, with 25 hours allocated to in-person sessions and 25 hours to distance learning activities. The sessions were intended to take place weekly, alternating between face-to-face meetings and remote activities. However, due to the COVID-19 pandemic, only the first two intervention sessions were conducted in person. As a result, adjustments were necessary: of the planned 50 hours, six hours (two sessions) were conducted in person, with dates and times scheduled according to teacher availability, while the remaining 44 hours (fifteen sessions) were delivered in a remote learning format, both synchronous and asynchronous, using Google Classroom and Google Meet due to their user-friendly and accessible interfaces. Consequently, the 50-hour intervention was distributed across seventeen sessions: the first two were in-person, and the remaining sessions were conducted entirely online (both synchronous and asynchronous), with occasional exceptions when the researcher provided in-person support to assist some teachers with navigating Google Classroom and completing and submitting activities.

Each intervention session lasted three hours, except for the 17th session, which was conducted in two hours to align with the total planned workload. As a subproject of a broader research initiative, this study focuses specifically on the metacognitive strategies addressed during eight sessions (Sessions 1 to 8, totaling 24 hours). These intervention sessions on metacognitive strategies were organized into eight meetings, delivered in both in-person and asynchronous formats. Session 1, conducted in person, involved administering the pre-test and providing participants with guidance on using the Google Classroom platform. Session 2, also held in person, introduced the foundations of learning strategies and time management techniques, incorporating activities such as theoretical presentations, discussions, and debates on the assigned reading materials.

Sessions 3 to 7 were conducted asynchronously and covered topics such as teaching and learning strategies, metacognitive monitoring, motivation self-regulation, and emotional regulation. During these sessions, participants completed reading assignments, watched instructional videos, and responded to reflective questions. Session 8, also delivered asynchronously, focused on reviewing the metacognitive strategies addressed throughout the intervention, with activities centered on self-assessment and reflection on learning.

All sessions were intentionally designed to promote reflection and the practical application of metacognitive strategies within the educational context. It is important to note that, as opportunities and needs emerged, these strategies were also revisited and integrated into other sessions, in alignment with the actions and behaviors targeted for development.

Post-test

For this phase, teachers were invited to attend a meeting via Google Meet. During the meeting, the same instructions provided during the pre-test were reiterated, along with any necessary clarifications. Teachers were also advised to ensure they were in a distraction-free environment while completing the questionnaire, with an emphasis on reading carefully and re-reading any questions they did not fully understand. The questionnaire was made available through Google Forms, and teachers completed the instrument independently, without the researcher's assistance in reading the items. The average time required to complete the questionnaire during this phase was 50 minutes.

Data analysis procedures

For the analyses, the results from the pre-test and post-test phases were compared. Following material selection and preliminary reading, data exploration was conducted through coding procedures. Based on the teachers' responses to the structured questionnaire, content analysis was performed for both time points, with categorization performed according to Bardin's (2015) guidelines and the categorization procedures described by Silva and Fossá (2015). Additionally, to determine whether the self-reports showed statistically significant differences, the McNemar test for related samples was applied. This test was used to compare responses within each subcategory between the pre-test and post-test phases, using the data collected during the pre-test. Statistical analysis was performed using The SAS System for Windows (Statistical Analysis System), version 9.2, developed by SAS Institute Inc. (2002–2008), Cary, NC, USA.

Results

The category “Metacognitive Self-Regulation Strategies” reflects teachers' self-reports on the use of metacognitive strategies for reading, studying, and learning content in both the pre-test and post-test phases. Table 1, presented below, displays the responses

that emerged from the analyses, along with the absolute and relative frequencies (%) observed in the pre-test and post-test.

When comparing the use of metacognitive strategies between the pre-test and post-test phases, a significant increase was observed in teachers' self-reports following the intervention. In the pre-test, 13 references to metacognitive strategies were identified, whereas in the post-test, this number rose to 49 references, indicating a positive impact of the intervention.

The most frequently reported strategies in the post-test were paying more attention during classes and to the content (92.85% of teachers), showing a significant increase compared to the pre-test ($p=0.03$); analyzing task difficulty (50% of teachers), a strategy not mentioned in the pre-test ($p=0.01$); and thinking about which strategy to use to complete the task (50% of teachers), also absent in the pre-test ($p=0.00$). Other strategies that demonstrated significant increases in the post-test included evaluating one's learning (35.71%; $p=0.02$), controlling one's thoughts (28.57%; $p=0.04$), and evaluating one's motivation (28.57%; $p=0.04$), all of which were not reported during the pre-test phase.

Among the strategies reported in both phases, statistically significant differences were observed in the following: paying more attention during classes and to the content (pre-test $fr = 50\%$; post-test $fr = 92.85\%$;

$p = 0.03$), analyzing task difficulty (pre-test $fr = 0\%$; post-test $fr = 50\%$; $p = 0.01$), thinking about which strategy to use to complete the task (pre-test $fr = 0\%$; post-test $fr = 50\%$; $p = 0.00$), evaluating one's learning (pre-test $fr = 0\%$; post-test $fr = 35.71\%$; $p = 0.02$), controlling one's thoughts (pre-test $fr = 0\%$; post-test $fr = 28.57\%$; $p = 0.04$), and evaluating one's motivation (pre-test $fr = 0\%$; post-test $fr = 28.57\%$; $p = 0.04$).

On the other hand, some strategies did not show significant changes between the pre-test and post-test phases, such as reviewing class notes (14.29% in the pre-test and 35.71% in the post-test; $p = 0.08$), recognizing the need to study more (14.29% in both phases), and feeling lost (14.29% in both phases). It is worth noting that, following the intervention, new metacognitive strategies not mentioned in the pre-test were reported in the post-test, including analyzing task difficulty, thinking about which strategy to use to complete the task, evaluating one's learning, controlling one's thoughts, and evaluating one's motivation.

Discussion

In the study conducted by Cunha and Boruchovitch (2016), the authors found that the metacognitive strategy of "paying more attention during class" was rarely mentioned by participants, in contrast to the

Table 1.

Metacognitive Self-Regulation Strategies for Reading, Studying, and Learning Content More Effectively

		n = 14						
Category	Answers	Pre-test		Post-test		McNEMAR		
			%	Freq	%	S	GL	p
Metacognitive Self-Regulation Strategies for Reading, Studying, and Learning Content More Effectively	Paying more attention during classes and to the content	7	50	13	92.85	4.20	1	0.03*
	Analyzing task difficulty	0	0	7	50	6.00	1	0.01*
	Thinking about which strategy to use to complete the task	0	0	7	50	7.00	1	0.00*
	Evaluating learning	0	0	5	35.71	5.00	1	0.02*
	Reviewing class notes	2	14.29	5	35.71	3.00	1	0.08
	Controlling thoughts	0	0	4	28.57	4.00	1	0.04*
	Evaluating motivation	0	0	4	28.57	4.00	1	0.04*
	Recognizing the need to study more	2	14.29	2	14.29	0.00	1	1.00
	Feeling lost	2	14.29	2	14.29	0.00	1	1.00

*Values with statistically significant differences ($p < 0.05$).

Source: The authors.

findings of the present study, in which this strategy emerged as the most frequently reported by teachers, with 92.85% of mentions in the post-test. However, the strategies of “studying more” and “feeling lost” were among the least reported, corroborating the findings of this research, which showed stable frequencies of 14.29% in both phases. This observation is further supported when comparing teachers’ self-reports about their own learning with practical classroom observations. Mengistnew et al. (2021) emphasize that even when teachers report mastery of and instruction in these self-regulatory strategies, such practices may not be consistently reflected in their actual pedagogical activities. These findings underscore the importance of structured interventions, such as those proposed by Góes and Boruchovitch (2022), which have demonstrated the effectiveness of continuing education programs in developing teachers’ metacognitive skills. The results of the present study further support this effectiveness, showing a significant increase in the use of metacognitive strategies following the intervention, with references rising from 13 in the pre-test to 49 in the post-test.

The results presented in this study contrast with the findings reported by Jeronymo and Alliprandini (2020) in their analysis of learning strategies used by university professors. In that earlier study, a high frequency of metacognitive strategies was identified, particularly strategies such as “reviewing notes taken during class,” “checking for mistakes after receiving a test grade,” and “identifying difficulties in learning specific topics or subjects.” These strategies were not observed in the pre-test analyses of participants in the present study. One possible explanation for this discrepancy is that the instrument used in this research may not have provided teachers with sufficient opportunity to mention such strategies in their responses. This divergence may also be attributed to contextual differences between the studies, as highlighted by Veenman and Van Cleef (2019), who emphasize that the use of metacognitive strategies varies according to teaching level and teacher training background. In the present study, the intervention appears to have played an important role in broadening teachers’ repertoire of metacognitive strategies, as evidenced by the emergence of new strategies in the post-test phase, including analyzing task difficulty, thinking about which strategy to use, and evaluating motivation.

These results may be explained by the inherent difficulty in accurately measuring metacognitive strategies

due to their complexity, as highlighted in the studies by Veiga-Simão and Frison (2013) and Beluce and Oliveira (2018). Mesrabadi and Erfani (2014) argue that cognitive and metacognitive strategies are interdependent and that both must be employed to maximize academic performance. Moreover, the authors conclude that without prior mastery of cognitive strategies, the impact of metacognitive strategies on the self-regulation process remains limited. This interdependence is further supported by recent studies, such as that of Biwer et al. (2022), which demonstrate that combining cognitive and metacognitive strategies in intervention programs leads to significant improvements in students’ academic performance and self-regulation. The present intervention appears to have facilitated this integration, as reflected in the significant increase in the use of strategies such as controlling thoughts (28.57% in the post-test) and evaluating learning (35.71% in the post-test).

It is recommended that cognitive and metacognitive strategies be prioritized simultaneously within educational curricula. Particular emphasis is placed on the importance of metacognitive strategies for achieving learning success and academic performance, as they are recognized as essential cognitive processes that enhance learners’ skills. The self-regulated learner identifies personal goals and, when deviations occur, actively manages the learning process to realign with these goals (Terlecki & McMahon, 2018; Xu & Ku, 2019; Rosa & Rosa, 2020; Mengistnew et al., 2021). This perspective is further reinforced by Dignath and Veenman (2021), who emphasize the need to integrate metacognitive strategies into school curricula from the early years of education to foster self-regulation from the outset. The findings of this study support this recommendation, providing evidence that the intervention encouraged the use of more complex metacognitive strategies, such as planning and self-reflection.

Based on these considerations, it can be inferred that the participants possess an understanding of the importance of both cognitive and metacognitive strategies, as clearly illustrated in the following statement: “It is important to think about what I already know. Assess the difficulty of the task to choose the appropriate strategy and estimate how much time I will need to complete it (Teacher 05).” In this response, the participant highlights the significance of considering task difficulty when selecting a cognitive strategy for task completion and adjusting the estimated time required. Additionally, the teacher refers to the planning strategy, a topic widely discussed by various authors (Saks &

Leijen, 2018; Nordin & Yunus, 2020; Rivas et al., 2022). The practice of planning is further supported by recent studies, such as that by Panadero et al. (2021), which demonstrate that the use of metacognitive planning strategies is associated with greater engagement and improved academic performance. Planning was one of the strategies that emerged in the post-test phase, with 50% of teachers mentioning it, in contrast to its absence in the pre-test.

Self-reflection on one's personal learning style and the strategies used in study situations enables teachers to better understand how they learn. This process promotes the enhancement of cognitive processes, behaviors, and emotions, leading to a higher level of metacognition by enabling individuals to assess what they know, reflect on their learning, control, and monitor their thoughts—thus requiring greater conscious cognitive effort (Machado & Boruchovitch, 2018; Vosniadou et al., 2021; Arcoverde et al., 2022). Self-reflection is essential for the development of metacognitive skills, as emphasized by Zepeda et al. (2019), who demonstrate that teachers' engagement in self-reflection is directly associated with improved implementation of metacognitive strategies in the classroom. In the present study, self-reflection was evidenced by the increased use of strategies such as evaluating motivation (28.57% in the post-test) and controlling thoughts (28.57% in the post-test).

The results indicate positive impacts from the continuing education intervention offered to teachers, as evidenced by significant differences in the use of metacognitive strategies between the pre-test and post-test phases. These findings align with the existing literature, which supports self-reflective practices as effective approaches for strengthening metacognitive and self-regulatory skills (Terlecki & McMahon, 2018; Xu & Ku, 2019; Rosa & Rosa, 2020; Mengistnew et al., 2021; Góes & Boruchovitch, 2022a, 2022b; Arcoverde et al., 2022). These results are further reinforced by recent studies, such as that of Sitzmann and Ely (2021), which demonstrate that interventions targeting self-regulation and metacognition produce lasting effects on both academic performance and teaching practice.

Teachers can employ metacognitive strategies to help students become self-regulated learners and develop a strong sense of agency over their learning processes. At the core of metacognition lies the formulation of self-reflective questions, which serve as powerful tools by enabling learners to assess their current situation (reflecting on what they already know),

evaluate their learning methods (identifying what is effective and what is not), and set achievable goals (through an accurate assessment of their mastery of the material). Metacognition empowers learners to become self-aware problem solvers, taking active control of their learning journey. By incorporating metacognitive practices into their study routines, students can evaluate their existing knowledge, identify areas for improvement, and adopt the most effective strategies for assimilating new information (Sunggungwati & Nguyen, 2013; Klug, Schultes & Spiel, 2018). This perspective is further supported by Dignath and Veenman (2021), who emphasize the importance of explicitly teaching metacognitive strategies, particularly in teacher education contexts.

The teaching of metacognitive strategies has demonstrated significant effects on individuals (Nordin & Yunus, 2020; Rivas et al., 2022). However, for these benefits to be fully realized, it is essential that teachers have access to this knowledge (Lombardi et al., 2022; Massacani et al., 2023). Therefore, the importance of integrating the teaching of these strategies into both initial teacher education and continuing professional development programs is emphasized (Góes & Boruchovitch, 2022; Ganda & Boruchovitch, 2018), particularly at the high school level, with the aim of fostering more self-regulated learning environments (+, 2020). Within this context, the present study seeks to address the gap in national publications, especially in the Southern Hemisphere, as highlighted by Santos and Alliprandini (2023), and suggests the feasibility of implementing programs aimed at in-service teachers, with the goal of also promoting self-regulation among their students (Santos & Alliprandini, 2024). This need is further corroborated by recent studies, such as that of Arcoverde et al. (2022), which demonstrate the effectiveness of self-regulation intervention programs for teachers participating in continuing education.

Finally, the significant importance of metacognitive learning strategies, as highlighted by Santos and Alliprandini (2023), is reinforced. This association underscores the essential role of these strategies in fostering effective emotional regulatory processes, suggesting that metacognitive development may play a crucial role in promoting emotional balance and well-being. This implies that the more students engage in metacognitive strategies, the greater their ability to regulate their emotions—and vice versa—thus becoming more self-regulated learners (Góes & Boruchovitch, 2022; Santos & Alliprandini, 2024). The relationship

between metacognition and emotional regulation is further supported by recent studies, such as Biwer et al. (2022), which emphasize the importance of integrating metacognitive and emotional strategies into intervention programs to promote academic well-being.

Final considerations

The objective guiding this study was to analyze the effects of an intervention focused on metacognitive strategies on the self-reports of high school teachers. In summary, the results demonstrated that following the intervention, participants reported increased use of metacognitive strategies. This was evidenced by the emergence of strategies in the post-test that had not been previously mentioned, such as analyzing task difficulty, thinking about which strategy to use to complete the task, evaluating learning, controlling thoughts, and evaluating motivation. Furthermore, statistically significant increases were observed in the frequency of strategies whose use increased after the intervention period, including paying more attention during classes and to the content, analyzing task difficulty, thinking about which strategy to use, evaluating learning, controlling thoughts, and evaluating motivation.

The intervention highlights the potential for positive outcomes in the teaching of learning strategies, particularly metacognitive strategies. These strategies are crucial as they enable individuals to guide their own learning by planning, monitoring, and evaluating their cognitive processes. This becomes especially important in the context of continuing teacher education, as it offers a pathway for promoting metacognition among in-service teachers who may not have previously had access to this knowledge. Additionally, it is essential to emphasize that initial teacher education programs should incorporate content related to learning strategies—especially metacognitive strategies—into their curricula, with the aim of preparing future teachers to reflect on their own learning processes, become more active learners themselves, and, consequently, foster more self-regulated learning environments in their classrooms.

The present study makes important contributions to the understanding of metacognitive strategies reported by teachers and the impact of an intervention focused on teaching these strategies. However, it also presents certain limitations, including the pandemic period, which restricted more extensive in-person contact with some participants, and the reliance on

self-reported data. Although self-reports offer several advantages, they may also lead to exaggerated or overly favorable responses, as participants might feel pressured or uncomfortable disclosing personal details. Additionally, various biases, such as social desirability bias, may have influenced the results.

As recommendations for future research, it is suggested that further studies build upon the work presented here by replicating the proposed intervention in different contexts while addressing the identified limitations. Future studies should also explore cognitive strategies, as well as strategies related to social, motivational, and emotional self-regulation. Given these considerations, it is important to highlight that this study demonstrated the feasibility of quasi-experimental designs organized around pre-test, intervention, and post-test phases, as it showed the potential for measuring the positive contributions of an intervention on participants' use of metacognitive strategies. This reinforces the notion that the validity of studies with this design can be achieved when combined with randomization, control of internal and external biases, and the application of basic statistical analyses, enabling researchers to establish associations based on the measured outcomes within this study design.

DATA AVAILABILITY STATEMENT

The research data is not available.

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