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Metacognition in the Scientific Methodology Course: a case study with preservice teachers

Metacognição na Disciplina de Metodologia Científica: um estudo de caso com licenciandos

Metacognición en la disciplina de Metodología Científica: un estudio de caso con estudiantes de licenciatura

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Abstract

This article analyzes the perceptions of 16 undergraduate teaching students (Physics, Biology, and Chemistry) regarding a pedagogical intervention in the Scientific Methodology course, mediated by reading and discussing chapters from the book Learning How to Learn (Oakley, 2015). The proposal aimed to reposition the course as a space for metacognitive development, overcoming its reduction to technical norms and fostering reflection on self-regulated learning processes. Through a qualitative case study, with frequency-based thematic content analysis, categories were constructed from the coding of responses to an open-ended questionnaire. The results reveal changes perceived by students in self-regulation mechanisms, greater awareness of illusions of competence, assimilation of study techniques, and reflective thinking about challenges such as procrastination and lack of reading habits. This demonstrates the feasibility of using the Scientific Methodology course as a privileged field for metacognitive reflection in initial teacher training.

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Keywords: Self-regulated learning. Teacher education. Scientific methodology. Pedagogical intervention.

Resumo

Este artigo analisa as percepções de 16 estudantes de licenciatura (Física, Biologia e Química) sobre uma intervenção pedagógica na disciplina de Metodologia Científica, mediada pela leitura e discussão de capítulos do livro Aprendendo a aprender (Oakley, 2015). A proposta visou ressignificar a disciplina como espaço de desenvolvimento metacognitivo, superando sua redução a normas técnicas e favorecendo a reflexão sobre processos de aprendizagem autorregulada. Por meio de estudo de caso qualitativo, com análise de conteúdo temática por frequência, foram construídas categorias a posteriori a partir da codificação de respostas a questionário aberto. Os resultados revelam mudanças percebidas pelos estudantes em mecanismos de autorregulação, maior consciência sobre ilusões de competência, assimilação de técnicas de estudo e pensamento reflexivo sobre desafios como a procrastinação e a falta de hábito de leitura. Evidencia-se assim a viabilidade de utilizar a disciplina de Metodologia Científica como campo privilegiado para reflexão metacognitiva na formação inicial de professores.

Palavras-chave: *Aprendizagem autorregulada. Formação de professores. Metodologia Científica. Intervenção pedagógica*.

Resumen

Este artículo analiza las percepciones de 16 estudiantes de licenciatura (Física, Biología y Química) sobre una intervención pedagógica en la disciplina de Metodología Científica, mediada por la lectura y discusión de capítulos del libro Aprendendo a aprender (Oakley, 2015). La propuesta buscó resignificar la disciplina como espacio de desarrollo metacognitivo, superando su reducción a normas técnicas y favoreciendo la reflexión sobre procesos de aprendizaje autorregulado. Mediante un estudio de caso cualitativo, con análisis de contenido temático por frecuencia, se construyeron categorías a posteriori a partir de la codificación de respuestas a cuestionario abierto. Los resultados revelan cambios percibidos por los estudiantes en mecanismos de autorregulación, mayor conciencia sobre ilusiones de competencia, asimilación de técnicas de estudio y pensamiento reflexivo sobre desafíos como la procrastinación y la falta de hábito de lectura. Se evidencia así la viabilidad de utilizar la disciplina de Metodología Científica como campo privilegiado para la reflexión metacognitiva en la formación inicial de profesores.

Palabras clave*: Metacognición. Aprendizaje autorregulado. Formación de profesores. Metodología científica. Intervención pedagógica.*

Introduction

Initial teacher education has been challenged in recent decades by the need to overcome models centered on content transmission and fragmentation of knowledge, in favor of pedagogical practices that promote intellectual autonomy, critical reflection, and self-regulated learning (Macedo, 2025). In this scenario, metacognition occupies a strategic position, as it refers to the subject's ability to monitor, control, and evaluate their own cognitive processes, articulating knowledge about the task, about themselves, and about the strategies mobilized to learn. In undergraduate teaching programs, this dimension acquires additional relevance, as the future teacher not only learns disciplinary content but also elaborates frameworks for thinking about ways of teaching and fostering the learning of their own students (Souza, 2023).

It is precisely in this horizon of overcoming transmissive models that the Scientific Methodology course can be understood as a privileged space for intellectual formation, since in it the student can be called not only to know research procedures, but also to reflect on the ways in which they construct, organize, and validate their own knowledge.

Despite this potential centrality, the Scientific Methodology course, present in different undergraduate programs, is rarely problematized as a fertile field for metacognitive development. In many situations, its teaching is limited to the exposition of basic research concepts, types of studies, writing norms, and formal procedures, without making explicit that investigating, reading, summarizing, arguing, revising, and writing are also actions that require planning, self-regulation, monitoring of comprehension, and evaluation of one's own cognitive performance. From this perspective, it is argued that the Scientific Methodology course has an intrinsically metacognitive dimension, as it invites the student to think about how knowledge is produced, validated, and communicated, while also fostering reflection on how they themselves learn and construct knowledge.

It is precisely in this gap between intrinsic potentiality and teaching practice that a proposal was structured to use the book "Learning How to Learn", by Barbara Oakley (2015), not as a manual of "study techniques" in a narrow sense, but as a didactic mediator to make visible cognitive and metacognitive processes often developed unconsciously. Through this approach, conditions were sought to be created so that preservice teachers could interpret their own study routines, recognize limitations and potentialities of their strategies, and establish relationships between self-regulated learning and future teaching practice.

Starting from this horizon, the present article analyzes preservice teachers' perceptions of a didactic intervention developed in the Scientific Methodology course, based on the reading and discussion of selected chapters from Barbara Oakley's book (2015). It seeks to identify signs of metacognitive development, appropriation of study techniques, and recognition of the relevance of these concepts for teacher education. In doing so, the study aims to contribute to the debate on the teaching of Scientific Methodology in initial teacher training, showing that this discipline can be repositioned as a privileged space for reflection on learning and on teaching.

Theoretical Framework

Metacognition constitutes one of the most fruitful concepts in learning psychology and educational research, especially when seeking to understand how subjects regulate their cognitive processes in situations of study, problem-solving, and knowledge production. In classical terms, the concept involves both the knowledge that the individual possesses about their own cognition and the regulation processes that allow planning, monitoring, and evaluating intellectual performance. In the educational literature, this dimension has been associated with self-regulated learning, reading comprehension, academic performance, and the development of intellectual autonomy, especially in higher education contexts (Inchausti, 2006; Portilho, 2021).

In the field of teacher education, metacognition assumes an even more relevant status. Teaching requires more than mastery of disciplinary content; it requires the ability to reflect on ways of organizing explanations, evaluating

students' comprehension, adjusting didactic strategies, and making pedagogical decisions based on class responses. In other words, the future teacher needs to learn to observe their own thinking and, at the same time, develop sensitivity to interpret students' thought processes (Pellisson, 2022). Studies on teacher education have shown that formative practices focused on reflection on one's own learning can foster processes of autonomy, criticality, and the elaboration of more consistent pedagogical repertoires (Maraglia, 2022).

For teachers, self-regulation mechanisms (one of the aspects that make up the concept of metacognition) are crucial in continuous professional development, acting as a tool for evaluating and refining pedagogical practices. Research indicates that teacher self-regulation, through self-evaluation of teaching strategies, enables significant adjustments and visible improvements in disciplines, fostering innovation and educational guidance. This competence allows educators to promote not only their own training but also the self-regulation of students, creating collaborative learning cycles that elevate the quality of teaching (Moura, 2023; Ganda, 2018).

It is within this horizon that the Scientific Methodology course, common to many undergraduate teaching programs, can be understood as an entry point for reflection on research, teaching, and study practices with a metacognitive focus. Its object should not be only "the scientific method" in a strict sense, but should also include the very cognitive processes of the subjects who interpret, give meaning to, and produce knowledge.

When students analyze types of research, elaborates summaries, reads articles, distinguishes problem, hypothesis, objective, and method, they should not merely be memorizing procedures; they should be invited to reflect on how knowledge itself is constructed, intrinsically and extrinsically (Gil-Pérez, 2001). It is, therefore, a discipline that requires the subject to monitor their own understanding, identify gaps, revise interpretations, and regulate the way they learn to research, thus being a fertile field for the development of metacognitive skills.

However, this potential is not always made explicit in the teaching of the discipline. In many courses, Scientific Methodology is reduced to a normative repertoire of formatting rules, formal project stages, and technical requirements of academic writing, which impoverishes its formative scope (Artêro, 2025). By subtracting the reflective dimension from teaching, the opportunity to use the discipline as a space for learning about learning is lost. Therefore, the proposal analyzed in this article shifts the focus from mere instrumentalization to an approach that articulates epistemology, self-regulation, and study practices, understanding Scientific Methodology as a privileged scenario for metacognitive development.

In this context, the adoption of the book "Learning How to Learn", by Barbara Oakley (2015), is justified by its ability to translate into accessible language cognitive mechanisms with direct implications for self-regulated learning and metacognitive development. Concepts such as focused mode and diffuse mode, working memory and long-term memory, spaced repetition, active recall, conceptual chunks, and combating procrastination function, within the discipline, as operators of reflection on one's own learning. Instead of offering only “tips”, the developed dynamic allowed students to name practices, perceive unproductive habits, and attribute meaning to changes in their study routines.

This mediation is particularly important in initial teacher education because it brings academic learning and teaching practice closer together. By recognizing that study strategies require planning, attention alternation, review, and self-evaluation, the preservice teacher can also understand that their future students will face similar challenges in school contexts. Thus, metacognition also comes to be understood as a didactic and formative tool.

Methodological Path

This research is characterized as a qualitative case study, developed in the context of a pedagogical intervention in the Scientific Methodology course. The choice of this design is justified by the interest in understanding, in a situated and in-depth manner, the perceptions of a specific group of preservice teachers regarding a didactic proposal centered

on the reading and discussion of the book Learning How to Learn (Oakley, 2015), as well as the meanings attributed by them to the possible repercussions of this experience on their study and self-regulation practices.

The study was conducted at a higher education institution in the federal network, in the 2026.1 academic semester, in a compulsory course offered to undergraduate teaching programs, during the day, distributed in weekly meetings of 2 class hours. Although the class was linked to the Physics Teaching program, the course also included students from Biology Teaching (2) and Chemistry Teaching (1), due to its common nature to the institution's teaching programs. Sixteen students participated in the research, aged between 18 and 55 years, with a mean of 24.2 years, 43.8% female and 56.3% male. All participants voluntarily responded to the instrument, signed a Free and Informed Consent Form, had their anonymity preserved, and the research was approved by a research ethics committee.

The pedagogical intervention was developed over seven weeks (including the initial class presenting the course and the work proposal). During this period, chapters 1 to 4 of the book "Learning How to Learn" were addressed. Chapter 1 dealt with an emotional retrospective of the author's difficulties with learning mathematics and science; chapter 2 introduced focused and diffuse modes of thinking; chapter 3 discussed the alternation between these modes, the relationship between working memory and long-term memory, spaced repetition, and the importance of sleep in learning consolidation; finally, chapter 4 problematized illusions of competence, active recall, and conceptual chunks, articulating fundamental concepts for self-regulated learning.

The temporal organization of the proposal was designed to articulate prior reading, production of handwritten summaries, responses to questions, and classroom discussions, implicitly incorporating principles of spaced repetition and conceptual review.

As part of the students' assessment for grade composition, weekly delivery of summaries of the sections indicated by the professor was requested, accompanied by responses to review questions from the book or questions specifically elaborated for the class. At the end of the seven weeks, a test with discursive questions on the concepts worked on in chapters 2, 3, and 4 was applied, with chapter 1 considered only motivational and introductory in nature. A margin of flexibility was also provided: out of a total of six expected summaries, the student could choose not to deliver one of them without prejudice to their average, in order to accommodate any personal unforeseen events. The summaries were requested in handwritten format, as a strategy to reduce improper use of artificial intelligences and favor an authorial process of reading and elaboration.

Data collection for the research was carried out through an electronic form and occurred in the week following the closure of chapter 4. This instrument consisted of three open-ended questions that addressed changes perceived by students in their study routines, difficulties encountered, and comments or suggestions.

The responses to that questionnaire were subjected to thematic content analysis by frequency with a posteriori categories (Bardin, 2016). Initially, in the pre-analysis, the data were organized, and a floating reading of the texts produced as responses to the questions was carried out. Next, the coding stage proceeded, where keywords summarizing the central ideas of significant excerpts from the students' speeches were assigned. Subsequently, the generated codes were grouped into thematic categories, guided by the study objectives and emerging from the analyzed texts, using criteria of exclusivity, exhaustiveness, and objectivity (Bardin, 2016). The categories found are presented and discussed in the results and discussions section.

Results and Discussions

For the first open-ended question (*Describe what was the most significant change in your study routine after taking this course*), two analysis categories emerged regarding the changes perceived by the students: "Development of self-awareness" and "Assimilation of study techniques." Table 1 shows the two categories and the corresponding codes with their frequencies.

Table 1 - Categories and codes generated from responses to the open question "*Describe what was the most significant change in your study routine after taking this course*"

Category	Codes (Frequency)
Development of self-awareness	Recognize/Respect internal limits (2)
	Illusion of competence (2)
	Self-regulation (2)
	Procrastination (1)
	Self-awareness with implementation barriers (1)
Assimilation of study techniques	Spaced repetition (3)
	Active recall (2)

Source: author.

When examining the absolute frequencies in Table 1, it is verified that the analysis of the texts revealed that the students, spontaneously, brought more elements related to metacognitive maturation in their speeches than merely to the assimilation of study techniques. This strengthens the view that, within the developed methodology, the main role of the book "Learning How to Learn" was to serve as a didactic mediator for the development of metacognitive skills, helping to expand students' self-perception about mental patterns often unconscious. This becomes clear in some of the students' speeches, which, for anonymity purposes, will be referred to by codes A1, A2, A3, and so on:

> My most significant change in my study routine was starting to give myself time to process things, and that this is also efficient. (A15)

By reporting that they started to "give themselves time to process things", the student evidences an important shift: he stops conceiving learning as a simple linear accumulation of information and begin to understand it as a process that requires planning, monitoring, and self-regulation. In this case, the pause does not represent an unproductive interruption, but a deliberate resource of cognitive regulation, through which the student adjusts their own study pace, creates conditions for content consolidation, and recognizes their limits. It is, therefore, a sign of metacognitive maturation, insofar as the subject begins to observe the functioning of their own thinking and intervene on it in a more strategic way.

Student A2's response also reveals articulation between cognitive monitoring, recognition of internal limits, and strategic adjustments, central elements of self-regulated learning.

> Paying more attention to what I was doing during my studies, and being able to think about how to improve. Perceiving the moments when I function or not (in relation to studies), and thus adapting that. (A2)

By stating that they started to "pay more attention to what I was doing during my studies" and "being able to think about how to improve", the student demonstrates that he developed not only greater awareness of their study processes but also the capacity for evaluative metacognition, that is, observing their own performance and planning improvements. As significant as this is the explicit recognition of "the moments when I function or not", evidencing a sensitivity to their own cognitive and emotional rhythms — which, in the literature, corresponds to behavioral and motivational self-regulation, in which the student learns to adapt their actions to the real conditions of their attention and energy (Boruchovitch, 2023).

This type of regulation is particularly relevant in the university context, as it transcends the mere application of techniques and involves the construction of a strategic learner identity, capable of observing their own performance oscillations and intervening on them. A2's speech illustrates, therefore, how the pedagogical intervention was able to favor not only the technical repertoire but the student's reflective action on their own learning.

When analyzing A12's speech ″Perceiving that not understanding content is not incapacity″, a change in the causal attribution of academic failure is perceived, moving from an internalist and deficit view ("incapacity") to a processual and adaptive perspective. Such perception illustrates the maturation of metacognitive self-regulation, since the student re-signifies error as an integral part of the formative path.

Such change has profound implications both for learning and for teacher education. By recognizing that "not understanding" is not equivalent to "being incapable", the student develops tolerance to error and cognitive resilience, fundamental elements of self-regulation that allow the learner to persist in the face of difficulties, experiment with different strategies, and maintain motivation even in the face of obstacles (Schelini, 2023). From the perspective of teacher education, this self-perception is even more valuable, as it can model a pedagogical posture that does not label students as "incapable", but understands them as subjects in the process of constructing knowledge, susceptible to temporary blocks that demand didactic mediation and adaptive strategies.

The speeches of students A11 and A4 bring the denaturalization of a cognitive bias, the illusion of competence, a phenomenon in which the learner overestimates their mastery of content due to superficial study strategies such as passive rereading or underlining, which generate illusory familiarity without deep comprehension (Bjork, 2013).

> It was learning to control so as not to have an illusion of competence. (A11)

> I learned to manage my time in studies and get out of the illusion of competence. (A4)

This recognition requires the student to critically monitor the quality of their own learning, distinguishing between sensation of familiarity and effective mastery.

It is important to emphasize that overcoming the illusion of competence is not limited to changing techniques, but involves a restructuring of self-perception as a learner. Both A11 and A4 express active control ("control so as not to have", "get out of the illusion"), evidencing a transition to strategic self-regulation in which the student replaces passive strategies with active ones (active recall, self-explanation) and learns to evaluate the real effectiveness of their study. This process, as highlighted by Barbara Oakley (2015), is essential for lasting learning, as it allows the student to build solid "memory chunks" instead of passing illusions. In the context of teacher education, this competence is even more strategic, as it enables the future teacher to identify when their students are trapped in this cognitive trap and guide them toward more effective study practices.

To finalize the analysis of the category "Development of self-awareness", the apparently simple speech of student A14 is analyzed:

> Knowing when I am procrastinating or not. (A14)

Far from being a mere descriptive statement, this self-perception represents the emergence of a behavioral self-regulation mechanism in which the student begins to monitor their own patterns of action (or inaction) and intervene on them consciously.

A14's answer, thus, evidences that the student developed not only declarative metacognition ("I know what procrastination is"), but procedural metacognition ("I know when I am procrastinating"), allowing him to regulate their behavior in real time.

Regarding the category "Assimilation of study techniques", the speeches of students A1, A13, and A9 reveal a change in the conception of efficient study, transitioning from the widespread belief of "intensive study" to the strategic understanding of "spaced repetition":

> I believe that spaced study, I usually studied for several hours thinking I would have better performance, so one of the book's teachings helped me understand that studying throughout the week is better. (A1)

> Not studying uninterrupted for hours, but rather establishing moments of pause for rest and reflection. (A13)

> The most significant change in my life after the classes was understanding that I also need a break in the middle of my studies, and not just a long period of study without pauses and only content. (A9)

The common element in these three speeches evidences a cognitive restructuring, in which students deconstruct the naive belief that temporal volume of study equals quality of learning. Spaced repetition, as presented by Barbara Oakley (2015), optimizes long-term memory consolidation by exploring natural intervals of partial forgetting, creating ideal conditions for active retrieval and formation of lasting "conceptual chunks".

This advance is particularly significant because it directly confronts one of the most persistent myths in student culture — that more hours equal more learning — replacing it with a neuroscientific understanding that the temporal distribution of study, combined with strategic pauses, maximizes working memory efficiency and synaptic consolidation.

Finalizing the analysis of the texts produced in response to the first open question, the responses of A3 and A10 will be addressed, which explicit the assimilation of a counterintuitive study technique by the students — active recall:

> I believe active recall in the construction of knowledge chunks. (A3)

> Now I try to use recall more frequently to study. (A10)

Active recall directly challenges student intuition by proposing that, instead of passively rereading material (which generates illusion of competence), the student should actively retrieve content from memory without initial consultation, testing their gaps and strengthening neural connections through the cognitive effort of remembering. The spontaneous choice of this technique by A3 and A10 — without explicit guidance to mention it — indicates not only superficial assimilation but strategic internalization, especially when A3 connects active recall to the construction of "knowledge chunks", recognizing its role in the hierarchical and lasting organization of memory.

For the second open question "What difficulties did you encounter in applying the presented techniques?" two analysis categories emerged: "Changing or establishing habits" and "Alternating between modes of thinking". Table 2 summarizes these categories and the codes created.

Table 2 - Categories and codes generated from responses to the open question "What difficulties did you encounter in applying the techniques?"

Category	Codes (Frequency)
Changing or establishing habits	Procrastination (3) Create weekly reading routine (3) Reward good habits (1)
Alternating between modes of thinking	Getting out of focused mode (3) Entering focused mode (1)

Source: author.

When analyzing the frequencies presented in Table 2, it is clear that the greatest difficulty of students in applying study techniques is due to the persistence of entrenched habits, especially procrastination, a phenomenon identified by A3, A13, and A15 as the main obstacle:

> Precisely the breaking of the "routine" of harmful habits: procrastination. (A3)

> Procrastination still continues to be a barrier to be overcome by me. (A13)

> Procrastination. (A15)

The recurrence of procrastination as a difficulty is not surprising, as it represents one of the habits most resistant to change. A3's speech is particularly elucidating in explicitly recognizing the need to "break the routine of harmful habits", evidencing awareness not only of procrastinatory behavior but of the habitual nature of the problem — which already constitutes a significant metacognitive advance.

This pattern confirms findings from the literature on behavioral change: creating or altering habits is not an easy task (Cristo, 2015). However, the fact that students spontaneously identify this obstacle demonstrates that the pedagogical intervention sensitized them to the problem, creating the initial conditions for its progressive overcoming.

The creation of the weekly reading habit was also cited by three students (A10, A4, A16) as the main barrier:

> Doing reading every week. (A10)
>
> Reviewing content weekly to remember it. (A4)
>
> Reading (A16).

The simplicity and convergence of these responses, all centered on the difficulty of initiating and maintaining regular reading, reveal a common structural obstacle among university students: the lack of a programmed reading habit. Unlike procrastination (more behavioral), this barrier is structural and cultural, rooted in the absence of reading routines in previous schooling and in competition with immediate digital entertainment.

This pattern confirms findings on barriers to the reading habit: perceived lack of time (despite being possible reorganization), discomfort with continuous reading, and preference for fragmented stimuli from social networks. The pedagogical intervention was successful in making this barrier conscious, but habit creation requires prolonged consistency.

One of the students also identified difficulty in rewarding good habits as an obstacle:

> (...) one of the parts of the book talks about how we can use rewards to our advantage, however the reward has to be something you really like. (...) However, this needs to be valuable for the individual, otherwise it doesn't work. (A1)

A1 understands that generic rewards fail due to lack of individual emotional value, essential for consolidating habits. In teacher education, this perception is formative, as it can enable the future teacher to understand that motivation is not uniform: what reinforces one student may be irrelevant to another, requiring pedagogical differentiation in mediating desirable behaviors.

The last category of analysis, "Alternating between modes of thinking", expresses the students' difficulty in trying to develop two complementary cognitive movements: getting out of focused mode and entering diffuse mode — concepts introduced by Barbara Oakley (2015) to describe how our brain alternates between concentrated and relaxed thinking. Focused mode privileges logic, sequential analysis, and deliberate problem-solving; diffuse mode, activated in states of relaxation, allows creative connections, unexpected *insights*, and consolidation of ideas.

As getting out of focused mode or entering diffuse mode are symmetric operations (although technically distinct), the expression "getting out of focused mode" is conventionally used here for both, except for the expression "entering focused mode", treated separately.

Three students reported difficulty getting out of focused mode:

> My biggest difficulty was understanding that it was time to stop, getting out of focused mode to try to relax and enter diffuse mode. (A9)

> Going to diffuse mode can be difficult when you NEED to perform a task on time. (A2)

> Sleeping/napping when studying for a long time is more difficult to reconcile. (A12)

These answers reveal the inherent conflict in alternation: A9 struggles to recognize the "right moment" to pause; A2 faces external pressure ("NEED to perform on time"); A12 faces difficulty "turning off focused mode" when already concentrated. This pattern confirms that alternating modes requires not only technique but temporal metacognition — knowing when focused effort turns into unproductive exhaustion.

One student highlighted difficulty entering focused mode:

> many! my problem with concentration is bigger than I thought. (A7)

A7's speech points to a concentration deficit, common in contexts of digital distraction and attentional fatigue, evidencing that the problem is not only "maintaining focus", but initiating it in the face of challenging tasks.

Finally, students were also able to make comments and suggestions about the experience they had throughout the pedagogical proposal.

The students' final comments evidence a largely positive evaluation of the intervention, with a predominance of expressions of approval of the book, methodology, and class conduct. A5's speech — "It was very good and I really liked the book" — and A6's — "Methodology, the book, and the professor are excellent" — indicate a favorable reception of the proposal in its different components, suggesting coherence between the adopted material, didactic organization, and teaching mediation.

A7's speech adds an important element to the analysis, as it not only praises the approach but also recognizes its formative relevance at different levels of education:

> I believe that this approach to the discipline is very interesting. It is a good method to be used in higher education and also in high school. It helps to leave old habits aside and work better on the dynamics of learning, which is often a poorly managed overload. (A7)

At the same time, by stating that the proposal helps to "leave old habits aside" and "work better on the dynamics of learning", the student associates the intervention with changes in study practices and the reorganization of inefficient routines. This comment is particularly relevant because it suggests that the experience was perceived as capable of mobilizing reflection on consolidated habits and on the very management of learning.

A8's comment — "Professor your classes are incredible I really like the discussions in class, could you bring a more complex book" — shows appreciation for the dynamics of the classes and, simultaneously, indicates a desire for theoretical deepening. It is a suggestion that, more than a criticism, points to greater intellectual involvement with the proposal, revealing interest in texts of greater conceptual density. In this sense, A8's observation signals that the intervention was well accepted to the point of raising expectations of amplification of the level of complexity of future readings.

On the whole, the records reveal strong engagement with the dynamics, recognition of its formative value, and an openness of preservice teachers to even more instigating intellectual challenges.

Final Considerations

The pedagogical intervention analyzed in this study demonstrated feasibility to reposition the Scientific Methodology course as a privileged space for metacognitive development in initial teacher education. By mediating the reading of "Learning How to Learn" (Oakley, 2015) with handwritten summary activities, discussion, and self-

questioning, it was possible to sensitize preservice teachers to cognitive processes often unconscious, promoting greater self-awareness about self-regulation mechanisms and study strategies.

The results reveal two complementary movements: on one hand, metacognitive development expressed in the denaturalization of cognitive biases such as illusion of competence and procrastination, in addition to strengthening self-regulation mechanisms and self-awareness about one's own learning processes; on the other, assimilation of evidence-based study techniques, spaced repetition, and active recall, confronting naive beliefs about continuous intensive study.

The identified barriers, especially the creation of a programmed reading habit and alternation between focused and diffuse modes, confirm common structural obstacles in higher education, rooted in previous school trajectories and competition with digital entertainment.

For teacher education, the potential of this approach is particularly revealing. By experiencing for themselves the challenges of self-regulation, preservice teachers can develop sensitivity to mediate similar processes in their future students, overcoming reductionist views of teaching as mere knowledge transmission. The Scientific Methodology course, far from being limited to technical norms, thus emerges as a fertile field to integrate epistemology, cognition, and pedagogy.

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