ACTIO: Docência em Ciências
ISSN: 2525-8923

http://periodicos.utfpr.edu.br/actio

Weaknesses in the methological repertoire of pre-service science teachers

Milena Sávio Pastorini Paz
milena.pastorini2016@gmail.com
orcid.org/0000-0003-1748-4542
Universidade Estadual do Oeste do Paraná (UNIOESTE), Cascavel, Paraná, Brasil

Bárbara Grace Tobaldini de Lima
barbara.lima@uffs.edu.br
orcid.org/0000-0002-6502-7306
Universidade Federal da Fronteira Sul (UFFS), Realeza, Paraná, Brasil

Daniela Frigo Ferraz
daniela.ferraz@unioeste.br
orcid.org/0000-0002-2747-4818
Universidade Estadual do Oeste do Paraná (UNIOESTE), Cascavel, Paraná, Brasil

ABSTRACT

Discussing Teaching Methodology is a complex task. Although there are criticisms regarding the reduction of teacher education to a set of prescriptions, neglecting discussions on methodological aspects implies overlooking important reflections on pedagogical practices. This article presents the results of a qualitative research study that analyzed interviews and reports produced by five undergraduate students enrolled in a Supervised Science Teaching Internship course, with the aim of understanding which teaching methodologies were employed throughout their teaching practice and what these choices reveal about initial teacher education. Based on the information generated and examined through Discursive Textual Analysis (DTA), the final category entitled participants' methodological repertoire was constructed. The results suggest that the participants experience difficulties in understanding what teaching methodologies are, possess a limited methodological repertoire, and demonstrate restricted knowledge of the theoretical foundations underlying the methodologies they adopt in their classes. It is recommended that discussions surrounding this fundamental concept for teaching be expanded, providing opportunities for reflection on new methodological proposals in order to broaden the repertoire of future teachers. Furthermore, the study highlights the importance of ensuring that initial teacher education is not exclusively based on expository lectures, considering that the practices adopted by teacher educators also serve as models for future teachers.

KEYWORDS: teaching methodologies; supervised practicum; teaching practice.

Fragilidades no repertório metodológico de professores de ciências em formação inicial

RESUMO

Discutir Metodologia de Ensino é complexo. Embora haja críticas por reduzir a formação em um receituário, ignorar a discussão sobre aspectos metodológicos implica negligenciar importantes reflexões acerca das práticas pedagógicas. Este artigo é resultado de uma pesquisa de abordagem qualitativa que analisou entrevistas e relatórios de cinco licenciandos que cursaram a disciplina de Estágio Supervisionado em Ciências, com o objetivo de compreender quais metodologias de ensino foram utilizadas ao longo das regências e o que essas escolhas revelam sobre a formação inicial. A partir das informações produzidas e examinadas por meio da Análise Textual Discursiva (ATD), construiu-se a categoria final: repertório metodológico dos participantes. Os resultados permitem inferir que os acadêmicos apresentam dificuldades em compreender o que são metodologias de ensino, possuem baixo repertório metodológico e conhecimento limitado dos fundamentos teóricos das metodologias que adotam em aula. Recomenda-se a ampliação da discussão desse termo que é fundamental para o ensino, oportunizando momentos de reflexão sobre novas propostas metodológicas, a fim de ampliar o repertório dos futuros professores. Ademais, discute-se a importância de que a formação inicial não seja exclusivamente pautada em aulas expositivas, considerando-se que a atuação de formadores também ensina.

PALAVRAS-CHAVE: metodologias de ensino; estágio supervisionado; prática docente.

INTRODUCTION

Discussing the methodological aspects of teaching practice has been the subject of criticism within the educational context, as recalled by Marques (2020), since it would not be appropriate to adopt ready-made recipes for lesson development. Indeed, it is not. However, failing to address Teaching Methodology (TM) may be equally concerning, as pedagogical intentions do not become clear to teachers (Marques, 2020*),* thereby weakening the process of reflecting on their own practice and on students' learning.

It should be noted, however, that this is not a simple discussion. Terminological confusion regarding what Teaching Methodologies are is commonly found in the literature (Santos, 2014; Alves, 2018; Marques & Cunha, 2022; Paz, 2024). Seeking to understand this concept, as Anastasiou (1997) states, is a challenge that brings a certain sense of encouragement, as it is an inexhaustible topic: the more knowledge is acquired, the more one realizes how much remains to be learned. Nevertheless, it is a discussion that promotes important reflections on teaching practice itself.

Considering that discussing Teaching Methodologies is not a trivial matter, but rather constitutes an important opportunity for reflection on teaching practice — since they lie at the core of the work of teachers (Amaral, 2006) and consist of the principles and processes adopted in the classroom to promote learning (Paz, 2024) —, we understand it to be essential to identify and analyze how Teaching Methodologies are perceived and adopted at the moment most conducive to the acquisition of pedagogical knowledge: initial teacher education.

This article originated from a master's dissertation whose objective was to understand the perceptions of undergraduate students in Biological Sciences regarding Teaching Methodologies. Throughout the investigation, the participants were invited to provide examples of Teaching Methodologies they could recall, and their responses presented relevant aspects for the analysis of teacher education. Therefore, this study aims to understand which Teaching Methodologies have been employed by pre-service teachers in the context of the Supervised Science Teaching Internship and how these choices are reflected in their teacher education.

In the following sections, we discuss the theoretical aspects of this pedagogical concept and the importance of understanding it for teaching practice. Furthermore, we present the methodological procedures of the investigation, followed by the presentation and discussion of the main findings.

THEORETICAL FRAMEWORK

Etymologically, methodology can be defined as a term derived from Greek, formed by the combination of three words: *meta* (through or toward), *odos* (path), and *logia* (study) (Manfredi, 1993). Broadly speaking, Teaching Methodology (TM) would be the study of the path taken to achieve a learning objective. However, like any concept, TM is also subject to the historical, social, and political contexts in which it is situated (Manfredi, 1993). Thus, in each time and place, depending on who is speaking and to whom, this term will be understood differently.

It should be taken into account that TM lies at the core of teaching practice and manifests itself through the other elements that compose it. Even when implicit, methodological choices are always present, revealing their characteristics through more concrete elements (Amaral, 2006). Furthermore, it is important to emphasize that TM provides information about the roles played by teachers and students in the teaching and learning process (Sánchez Blanco & Valcárcel-Pérez, 1993), thereby evidencing the theoretical perspectives that support the choice of a given TM.

In an attempt to systematize what is meant by TM, Paz (2024, p. 54) defines it as the "principles and procedures that support the paths followed by teachers and students in the pursuit of learning." Whether in methodological proposals found in the literature or in those developed by teachers themselves, two dimensions become evident: the theoretical and the practical (Paz *et al.,* 2023). This is because TM is not merely a term that describes processes to be followed in the classroom, but also reveals the theories that are "organized into procedures, implemented through teaching methods" (Paz, 2024, p. 54).

Among the methodological approaches most frequently employed in Science Education are Inquiry-Based Teaching (IBT) (Carvalho, 2013), the Three Pedagogical Moments (TPM) (Delizoicov *et al.,* 2002), Classroom Research (CR) (Moraes *et al.,* 2012), and Problem-Based Learning (PBL) (Lopes *et al.,* 2019).

The methodological approach known as Inquiry-Based Teaching (IBT) places students at the center of the teaching and learning process, engaging them in problem-solving activities and in explaining the phenomena involved, thereby approximating scientific practice (Carvalho, 2013). Its stages—problem presentation, hypothesis formulation, problem-solving, discussion and collective synthesis, individual synthesis, and communication of results—value collaborative work while articulating it with moments of individual reflection. In IBT, mistakes are not disregarded; rather, they are understood as productive elements in the construction of knowledge (Carvalho, 2013*).*

The Three Pedagogical Moments (TPM) constitute a widely disseminated and valued Teaching Methodology. Its origins are rooted in a Freirean conception, grounded in what Delizoicov *et al.* (2011) refer to as the Thematic Approach (TA). As its name suggests, this TM is composed of stages (moments) organized as follows: initial problematization, which involves presenting questions that stimulate reflection and introduce new content; knowledge organization, which aims at constructing critical knowledge grounded in scientific principles; and application of knowledge, in which students are encouraged to relate scientifically constructed knowledge to situations drawn from their everyday lives (Delizoicov *et al.*, 2011).

Classroom Research (CR) is grounded in the dialectical movement of the Pedagogy of the Question, proposed by Freire and Faundez (1985), and is characterized as a process that involves both students and teachers in constructing arguments to answer the questions raised in the classroom (Moraes *et al.,* 2012). Its procedures can be described as cyclical, consisting of the stages of questioning, argument construction, and communication (Moraes *et al.,* 2012*).* Within this approach, knowledge is understood to be produced from a question, a principle that also guides classroom practice.

Problem-Based Learning (PBL), in turn, is a Teaching Methodology (TM) grounded in the teacher's proposal of open-ended problems that can be solved by students in different ways (Lopes *et al*., 2019). This approach values the presentation of situations — whether real or hypothetical — that are related to students' realities, and it is structured around three main stages: problem formulation and analysis, self-directed study, and discussion and sharing of results (Lopes *et al*., 2019*).* All these stages are developed through teacher-guided activities, such as hypothesis formulation and the identification of gaps in students' knowledge.

It is possible to identify both similarities and differences among the aforementioned Teaching Methodologies. In summary, all of them emphasize problematization and the formulation of questions, combining collective and individual moments while enabling students to assume a leading role in their learning process. However, these TMs achieve their objectives through distinct methods, allowing for the use of different teaching strategies and instructional resources so that the teaching and learning process may occur collectively and meaningfully.

It is worth highlighting the conceptual differences among the terms Teaching Methodology, teaching methods, teaching strategies, and instructional resources. As previously discussed, the first is broader in scope and is not restricted to the procedural aspects of lesson development; rather, it reveals the theoretical foundations of teaching practice, even when these remain implicit to the educator (Anastasiou, 1996).

Teaching methods, on the other hand, may be understood as the operationalization of Teaching Methodologies (Manfredi, 1993). Alves and Bego (2020) argue that a method consists of a set of strategies and resources, together with the adaptations and adjustments required by the TM according to the teaching context, thus occupying a more practical level of instructional planning. Libâneo (2006) supports this perspective, defining the method as the "how" of the teaching process.

The classification of this term is not entirely clear in the literature; however, Karling (2016) provides examples that facilitate its understanding by categorizing methods according to the nature of the work involved—from more individualized to more collective forms—while also including an intermediate category, namely socio-individualized methods.

If Teaching Methodology corresponds to the path toward achieving a learning objective, and the method represents the implementation of that path, teaching strategies may be understood as the steps taken toward that objective (Paz *et al*., 2023).

Finally, and no less importantly, instructional resources are materials intended to support the teaching and learning process. In the path analogy, they may be understood as the footwear we choose in order to collectively travel this journey (Paz *et al*., 2023), and for this very reason, they are far from trivial. Technical objects are not dispensable to the teaching process, as they possess agency and become intertwined with human actors during the production and dissemination of knowledge (Oliveira & Porto, 2016).

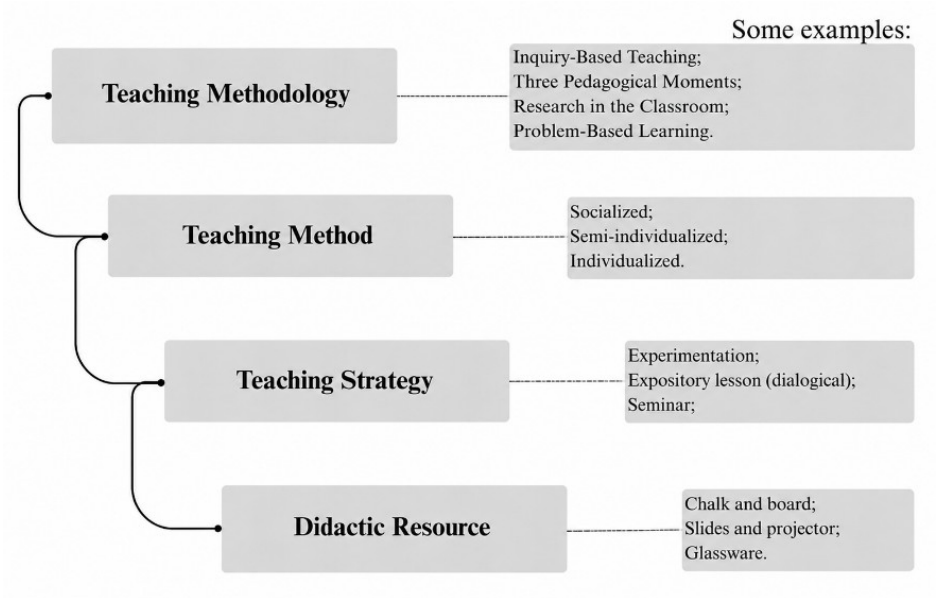
It is important to emphasize that teaching strategies and instructional resources are not partially neutral elements of instructional planning; when

incorporated into a Teaching Methodology, they come to embody and reveal its theoretical dimension (Amaral, 2006). Thus, the same resource or strategy may be employed within different TMs, reflecting distinct perspectives, whether more traditional or more critical (Paz, 2024). Therefore, what defines a traditional lesson is not, for example, the presence of teacher exposition itself, but rather the theoretical assumptions underlying the Teaching Methodology within which such exposition is situated.

In order to systematize the concepts briefly presented and to illustrate them, Figure 1 was developed.

Figure 1

Examples of Teaching Methodologies and Other Fundamental Concepts of Teaching Practice.



Source: Prepared by the authors (2026).

Diversifying the paths to teaching—in other words, adopting methodological pluralism—is an essential factor for students' learning (Lustosa, 2017). Laburú *et al.* (2003) suggest that the richer the intellectual, methodological, and instructional environment offered by the teacher—in terms of variety—the greater the chances of promoting meaningful learning for the majority of students. Considering that individuals do not learn in the same way, such diversity broadens the reach of the teaching process. Therefore, understanding the theoretical foundations of Teaching Methodologies and possessing an adequate repertoire of these approaches constitute a fundamental part of teacher education, which is a central aspect of the present investigation.

METHODOLOGICAL PRECEDURES OF THE RESEARCH

This article originates from a master's dissertation in Science Education that adopted Phenomenology as its epistemological principle, that is, a way of analyzing the modes of appearance — or perception — of phenomena (Zahavi, 2019).

The participants involved in the production of information were undergraduate students enrolled in a Biological Sciences teacher education program at a public university in the state of Paraná, Brazil, who completed the Supervised Science Teaching Internship course during the 2021 academic year. Therefore, this is a basic research study with a qualitative approach and an exploratory purpose, since such studies "have as their main objective the improvement of ideas or the discovery of [...] new ideas" (Oliveira *et al.,* 2006, p. 5).

The investigation was conducted in two stages: (1) analysis of the internship reports, focusing on lesson plans, reflections, and final considerations regarding the internship process; and (2) semi-structured interviews, an instrument that allows for the dialogical construction of information (Zanette, 2017). Following the invitation, five undergraduate students agreed to participate in the study; thus, the *corpus* of analysis consisted of five internship reports and five transcribed semi-structured interviews.

Discursive Textual Analysis (DTA) was adopted as the analytical procedure for interpreting the information produced, as it contributes to the understanding of texts and discourses concerning the phenomenon under investigation (Sousa & Galiazzi, 2018). DTA can be understood as a process of meaning construction in which new understandings of the phenomenon emerge from a cycle composed of three stages: (1) deconstruction of texts; (2) categorization; and (3) capture of the emergent new (Moraes & Galiazzi, 2016).

The deconstruction of texts consists of unitization, that is, the fragmentation of the material into small excerpts that reveal aspects of the phenomenon under study. In DTA, these excerpts are referred to as units of meaning (UMs). Subsequently, the process of establishing relationships among these units begins, leading to the formation of initial categories. These categories are later grouped according to their similarities and affinities, resulting in intermediate categories and, finally, final categories. The capture of the emergent new occurs through the elaboration of a descriptive and interpretative metatext, whose purpose is to reveal new meanings related to the phenomenon (Moraes & Galiazzi, 2016). Within this metatext, the information generated from the *corpus* of analysis is described and interpreted in light of a dialogue with other authors. The construction of the categories that supported the elaboration of the metatext in the present study was systematized in Table 1.

Table 1

Research Coding System.

Initial Categories	Intermediate Categories	Final Category
Criteria for adopting a Teaching Methodology (13 UM)	Teaching Methodology adopted during the teaching practicum (28 UM)	Weakness in the methodological repertorie of pre-service teachers in the undergraduate Science Education course Biological Sciences (36 UM)
Justification for adopting the Teaching Methodology in the teaching practicum lesson plan (9 UM)		
Teaching Methodology adopted during the teaching practicum (6 UM)		
Exemples of Teaching Methodology (8 UM)	Understanding Teaching Methodology (8 UM)	

Fonte: Autoria própria (2026

For the organization of the information, and as an important part of the DTA analytical process, a coding system was established consisting of the type of document (Interview – I; Report – R), the interview sequence (Arabic numerals from 1 to 5), the identification of the Unit of Meaning (UM), and the order in which it appeared in the document. In addition, the UMs originating specifically from the lesson plans prepared by the participants were identified, as exemplified in Table 2 below.

Table 2

Research Coding System

Coded identifier	Explanation
IISC01	Interview with Intern (II) + Science Class (SC) + 01
IRSC01	Internship Report (IR) + Science Class (SC) + 01
IRSC01UM36	UM 36 excerpt from Internship Report 01 from the Science Class
IISC01UM27	UM 27 excerpt from Interview with Intern from 01 the Science Class
IRSC01UM42-LP	UM 42 36 excerpt from Internship Report 01 from the Science Class, specifically from the Lesson Plan

Source: Prepared by the authors (2025).

As this study involved human participants, the research project was submitted to the institution's Research Ethics Committee and, following approval, received protocol number 81462724.5.0000.0107. Throughout the analysis, quotations from the units of meaning are presented within quotation marks, accompanied by their respective coded references. The metatext corresponding to the final category, "Participants' Methodological Repertoire," is presented in the Results and Discussion section, articulating the participants' perceptions —presented in quotation format — with the theoretical references that underpin this research.

RESULTS AND DISCUSSION

In order to understand which Teaching Methodologies (TMs) have been employed by pre-service teachers in the context of the supervised internship and how these choices are reflected in their teacher education, participants were asked during the interview to list examples of TMs they could recall. The most frequently cited responses were the "*Three Pedagogical Moments*" (IISC05UM41) and "*Inquiry-Based Teaching*" (IC04UM48 and IC05UM41).

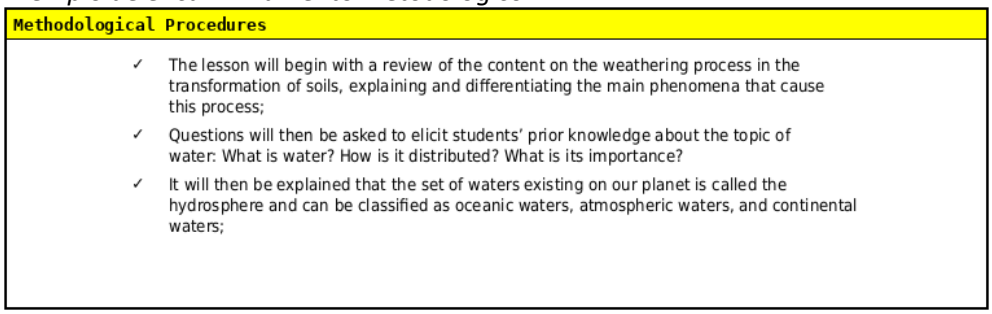
Not all lesson plans explicitly identify the TM employed; participants reported that "*lesson planning prioritized the use of different methodologies*" (RC05UM02). Upon analyzing the lesson plans of participant C05, it was found that the TMs mentioned as examples were the same ones used during the teaching practicum stage. Their implementation, however, occurred only partially, encompassing only some of their theoretical principles.

The Three Pedagogical Moments (TPM) undoubtedly constitute the TM most frequently adopted by the interns. In some lesson plans, TPM appears explicitly, although associated with theoretical frameworks different from those originally proposed, as in the case of RC05UM12, in which the participant uses "Giacomini and Muenchen (2015)" to support the adopted TM.

In other lesson plans, TPM appears implicitly within the methodological procedures; that is, it is not explicitly named, but its procedural dimension becomes evident in the participant's lesson planning, as illustrated in the figure presented below.

Figure 2

Exemplo de encaminhamento metodológico.



Source: Prepared by the authors, translated from RC02UM07 (2025).

Participant C02 proposes a brief review of the discussion from the previous lesson, once again explaining the concepts that had been addressed. Subsequently, a problematization movement is suggested, followed by the organization of knowledge through exposition. However, it is evident that the participant does not actually carry out a problematization process; rather, they merely elicit students' prior knowledge. This points to a superficial understanding of what the act of problematizing entails, as well as of the methodological approach itself.

Although not explicitly mentioned, it is considered that the knowledge application stage—according to the adopted methodological proposal—was planned through the use of a series of questions to be answered by the students: "*Finally,*

questions concerning the content will be developed as an extracurricular activity, relating them to the content addressed in the textbook" (RC02UM07).

In the case of participant C03, the supervising teacher requested a "*theoretical explanation of the content"* (IC03UM41), and, in an attempt to meet this demand, the undergraduate student understood that the best approach would be an expository lesson ("*Because how could I do it differently, right?"*), recognizing that the Three Pedagogical Moments (TPM) constituted a Teaching Methodology that would allow for this. A similar justification was presented by participant C05, who stated that TPM had been used in order to "*explain the content well"* (IC05UM39).

The Three Pedagogical Moments were initially referred to simply as pedagogical moments and constitute an alternative approach to teaching practice aimed at promoting problematization and fostering in students the need to acquire new knowledge (Delizoicov & Angotti, 1991; Delizoicov *et al.*, 2011). Their theoretical foundation is rooted in a progressive educational perspective based on dialogue and the problematization of knowledge (Muenchen, 2010).

Delizoicov *et al*. (2011) distinguish three pedagogical moments, each with specific and distinct functions: initial problematization, knowledge organization, and knowledge application. These are the moments that give the proposal its designation as the Three Pedagogical Moments (TPM). It is a flexible proposal that allows for broad implementation, and the use of different teaching strategies is recommended, especially during the first and second stages of the methodology, according to what the teacher considers most appropriate for the content being addressed (Delizoicov & Angotti, 2000).

Thus, we understand that the inclusion of an expository lesson within one of the Pedagogical Moments is plausible, provided that it is not restricted to a teacher-centered monologue (Muenchen, 2010). However, it is observed that this TM is sometimes included in lesson plans merely to justify the use of exposition. When analyzing UM IC05UM39 *("[...] then I moved on (sic) to an experimental lesson"*), it becomes apparent that the TPM are employed to "explain the content well," while the experimental lesson is treated as if it constituted a different Teaching Methodology. Nevertheless, nothing prevents the use of an experimental teaching strategy within a lesson structured according to the TPM.

It can be inferred that the expository lesson, although widely criticized by the participants and frequently associated with a "traditional TM," constitutes a space of greater security for the interns. Krasilchik (2008) highlights that, in addition to this sense of security, there is also an economic factor involved, since a single teacher can instruct a large number of students.

Inquiry-Based Teaching (IBT) was also cited as an adopted TM, as reported in IC02UM352: *"There were two practical lessons that I carried out with the students using Investigative Teaching... It was Inquiry-Based Teaching."* The participants justified the adoption of IBT as a way of promoting more "meaningful" experimental lessons: *"I did not give any hints. They carried out all the procedures themselves, and they were more surprised and interacted more" (IC02UM356); "(I used) inquiry-based teaching [...] and let them try to think about how we conduct an experiment"* (IC05UM42).

In the reports presented, IBT is understood as a way of increasing students' autonomy in experimental lessons by moving away from rigid protocols and promoting an environment in which they can "think [...] speak [...] read [...] write" with critical awareness and authorship (Carvalho, 2018, p. 766). This approach shifts the focus from the teacher to the student, but it does not imply the absence of teacher intervention. It is important to emphasize that IBT is grounded in Vygotskian assumptions, highlighting the active role of the teacher as a mediator responsible for guiding the investigative process and facilitating the appropriation of new knowledge (Carvalho, 2013), going beyond simply allowing students the freedom to carry out activities on their own.

Furthermore, an association between IBT and experimental lessons was observed. However, this is not the only teaching strategy that may be employed within this TM. According to its theoretical foundations, different types of problems may be proposed by teachers for students to solve, such as experimental problems, investigative demonstrations, and non-experimental problems (Carvalho, 2013). Reducing IBT to an "experimental practical lesson" reveals a superficial understanding of its theoretical dimensions.

Participant C04 points out that one of the limitations to the use of IBT is related to students' age, associating the degree of freedom in investigative activities with students' maturity and justifying the non-adoption of this TM because the internship was conducted in elementary education: *"I could try it in high school, for example, because students have a little more self-control, but with children, if I leave them free without a predetermined objective, it does not work"* (IC04UM51).

The IBT approach involves different degrees of freedom in problem-solving within Science Education, ranging from Level 1, which is more teacher-centered, to Level 5, in which students formulate and solve the problems themselves, the latter being less common in elementary education (Carvalho, 2018). Although the author does not directly relate the degree of freedom to students' age, it is understandable that classes with little prior experience of less directive Teaching Methodologies may initially face difficulties. For this reason, it is essential that teachers be prepared to deal with the challenges and unforeseen situations of everyday school life, since "each classroom, each moment is a complex challenge [...]" (Laburú *et al.,* 2003, p. 254).

However, attention must be drawn to the way participants perceive IBT and investigative activities, namely, as if they were devoid of guidance, approximating the idea of simply "*putting (sic) the objects there"* (IC04UM51). Considering IBT as a Teaching Methodology without previously defined learning objectives reflects, at the very least, a naïve understanding of the proposal.

As with the justifications for adopting the TPM, the justifications related to IBT —as well as the way this TM is perceived—remain superficial, revealing a lack of deeper engagement with its theoretical dimensions. IBT appears to be understood as a way of breaking away from the "traditional" model; thus, if the traditional model is perceived as having a rigid structure, IBT is sometimes interpreted as involving a disorganized classroom structure. It is important to emphasize, however, that flexibility should not be confused with a lack of structure.

Generic terms were also presented as examples of Teaching Methodologies, such as "*active methodology*" (IC03UM45), which was understood as though it

constituted a single methodological proposal. The same occurred with the so-called *"traditional methodologies"* (IC04UM48). It is quite common that, when asked to provide an example of a TM, participants respond with "active methodologies" (AMs). However, this is a broad and general term encompassing a diverse set of methodological approaches whose central objective is to promote students' protagonism and autonomy. In this sense, it is relevant to reflect on the theoretical foundations that support this broad umbrella of AMs and to discuss the extent to which other classifications of TMs, such as traditional methodologies, may also aim to foster student autonomy.

When examining the theoretical references that underpin the popular term active methodologies, it can be observed that, according to Berbel (2011), they consist of approaches that employ real or simulated experiences with the purpose of enabling learners to solve challenges arising from essential activities of social practice in different contexts. However, when analyzing the examples of AMs found in the literature, it becomes clear that they constitute a heterogeneous set of proposals. Some display a higher degree of structuring regarding the theoretical and procedural dimensions that guide them—such as Problem-Based Learning (PBL)—whereas others do not properly constitute Teaching Methodologies, being more closely aligned with what are understood as teaching strategies, such as case studies. Paiva (2020, p. 17) supports this interpretation by stating that AMs are not "uniform either in terms of their theoretical foundations or their methodological models."

It seems that when we refer to AMs, we are actually referring to a varied set of Teaching Methodologies, teaching strategies, and possibly even instructional resources that are not restricted to a classroom organization based exclusively on teacher exposition (at least from a theoretical standpoint), thereby providing greater opportunities for student involvement in the teaching and learning process. It is necessary, however, to make an important reservation: the choice of an active methodology, regardless of whether it refers to a Teaching Methodology or a teaching strategy, does not necessarily imply a change in the teacher's educational paradigm. In other words, a teacher whose theoretical repertoire is grounded in technicist conceptions may employ an active methodology in the classroom and still orient their practice toward objectives such as achieving greater efficiency with less effort.

We also consider the term traditional methodologies to be overly generic, since it provides little clarification regarding what these Teaching Methodologies actually are and what their theoretical dimensions entail. This term is often used imprecisely and is frequently confused with the expository lesson. In this sense, rather than classifying a TM as traditional, it would be more appropriate to characterize teaching practices according to the theoretical perspectives—traditional or otherwise—that underpin them.

Another TM cited as having been adopted during the teaching practicum was "*pedagogical didactics*" (IC01UM31), which appears to be an individual construction developed by the participant, combining elements recently learned in teaching-related courses: "*because it was still very fresh in our minds from the methodology course, the issue of Historical-Critical Pedagogy, right? [...] where I reviewed prior knowledge, introduced a problematization, and then developed the content"* (IC01UM47).

The designation presented by participant C01 is not commonly found among the Teaching Methodologies consolidated within Science Education. Nevertheless, it cannot be considered incorrect, since it represents an individual construction of the methodology adopted during the Supervised Internship. However, an analysis of the lesson plan reveals procedural congruence with other TMs, such as the Three Pedagogical Moments (TPM). In this regard, we agree with Amaral (2006), who argues that teachers, in their everyday practice, also develop methodological proposals, thereby producing intellectual work that is "the consequence of a social process, but also that the (re)construction of teaching methodology is undeniably inspired by academic formulations" (p. 12).

Nevertheless, a certain conceptual confusion can be identified regarding what is understood by Teaching Methodologies (TMs) and Pedagogical Trends (PTs), as illustrated by the reference to Historical-Critical Pedagogy in IC01UM47. This aspect is central to the analysis, as it reveals that the undergraduate students clearly intended to promote lessons that fostered student protagonism and valued prior knowledge during their teaching practicum. However, these concepts still appear to be insufficiently consolidated for the participants.

It is important to reiterate that a Teaching Methodology may be understood as a set of principles and procedures that support teaching practice (Paz, 2024), while each Pedagogical Trend conceives of TM in a distinct manner. In a traditional PT, for instance, TM tends to be understood as a set of standardized procedures, whereas in a liberating PT there is an emphasis on problematizing social reality with a view toward its transformation (Mizukami, 1986). In this sense, when participants classify an expository lesson—which is, in fact, a teaching strategy—as a "traditional TM," they demonstrate that they do not fully understand the differences between the concepts of TM and PT. Furthermore, they reveal a lack of knowledge regarding the foundations that characterize what it means for an approach to be "traditional," indicating that these concepts have not yet been fully appropriated by the participants.

Another aspect mentioned by the participants relates to methodological choices based on the content to be taught in the classroom, more specifically, the difficulty inherent in teaching certain topics, as observed in IC01UM13. In this excerpt, participant C01 reports that they would be teaching lessons on "chemical equations and reactions" and had been warned by the supervising teacher: "*And the teacher said that it was not really possible for us to be very didactic in the lesson because the students do not really pay attention [...] it has to be more of that traditional approach, you know? us standing at the front, talking [...] and having them copy from the board".*

Student behavior was considered an important factor in methodological decision-making; however, according to the participant's perception, the nature of the concepts to be taught would require a more expository and "less didactic" Teaching Methodology. This UM suggests that pre-service teachers experience difficulties in conceiving lesson plans for certain contents—considered more complex—without relying predominantly on exposition as a teaching strategy.

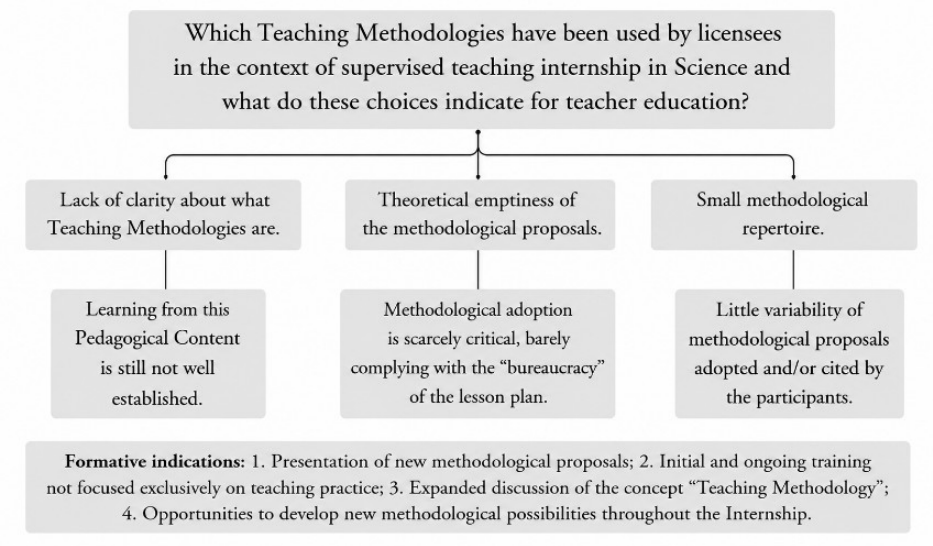
It can therefore be observed that concerns regarding methodological choices are more strongly associated with apprehensions about teaching specific scientific concepts than with aspects related to how students learn. In this sense, one may

question whether the latter aspect—learning grounded in scientific evidence—should not constitute the starting point for every lesson plan developed by teachers.

Throughout the analysis and discussion of the information produced, several points deserve particular attention, such as the lack of clarity regarding what Teaching Methodologies are, the theoretical impoverishment of methodological proposals, and the participants' limited methodological repertoire. These considerations were systematized in Figure 2, presented below. Furthermore, based on the discussions undertaken, it is understood that there are several educational recommendations that may contribute to addressing or mitigating the identified issues, which will be discussed in the following section.

Figure 3

Summary of the results and educational recommendations.



Source: Prepared by the authors (2025).

It is evident that the participants experience difficulties in identifying Teaching Methodologies (TMs), which may indicate that their understanding of this type of pedagogical content has not yet been fully consolidated, as if the term were entangled in multiple meanings (Paz *et al.,* 2025). This aspect highlights the need to expand and deepen discussions surrounding a concept that is so fundamental to pedagogical practice.

Corroborating this partial understanding of what TMs are, the participants demonstrate a limited methodological repertoire and a superficial understanding of the foundations of the TMs adopted throughout the teaching practicum. The participants report primarily employing the Three Pedagogical Moments (TPM) and Inquiry-Based Teaching (IBT). The justification for adopting TPM is associated with the possibility of using expository lessons—understood as a space of greater security—whereas IBT is associated with experimental practical activities.

Within this context, there appears to be a lack of in-depth understanding of these proposals, which seems to indicate a largely uncritical methodological adoption, at times oriented merely toward fulfilling lesson plan requirements. Such

a scenario is characterized by theoretical impoverishment, not only regarding the meanings attributed to TMs but, above all, concerning their underlying foundations.

Another aspect that deserves reflection concerns the belief that certain contents require the use of a "traditional methodology," characterized by a teacher-centered dynamic, whereas other contents, considered simpler, would allow for the adoption of active Teaching Methodologies.

When examining Science Education, it is possible to recognize the existence of contents with varying levels of abstraction—some more readily learned and others more complex, particularly those related to extreme scales of time (such as biological evolution) or size (such as molecules and atoms). However, this classification of content as "easier" or "more difficult" is reductionist, as it disregards the multiple dimensions involved in the processes of teaching and learning science. It is important to emphasize that there are different ways of approaching the same content, all of which are directly related to the theoretical assumptions that underpin teaching practice. Therefore, it is not necessary to resort to a traditional teaching perspective.

The Supervised Internship constitutes a valuable opportunity for experimenting with new methodological possibilities, allowing interns to gain deeper knowledge of different proposals and reflect upon their application in the contexts in which they teach. However, this largely depends on the autonomy granted by internship supervisors, who also play a fundamental role in the education of preservice teachers (Garda *et al.,* 2023), avoiding unnecessary restrictions on the performance of teachers in initial training during the teaching practicum.

In order to adopt more diversified Teaching Methodologies, it is first necessary to know them. This highlights the need to broaden the methodological repertoire within teacher education as an alternative to practices excessively centered on exposition. The presentation of different methodological proposals throughout initial teacher education, combined with an in-depth and reflective study of their theoretical and procedural dimensions, may contribute to the development of more creative and meaningful instructional planning. However, this issue can only be addressed if teacher education itself values methodological pluralism.

In this sense, all teacher educators must assume the responsibility of providing plural learning experiences. Not only professors working in the field of Education, but all those involved in teacher preparation need to diversify their pedagogical practices, since "the ways in which teacher educators act function as a 'hidden curriculum' of teaching methodology" (Gimenes & Oliveira, 2014, pp. 192–193).

With regard to teacher education processes, it is important to emphasize the need to understand what scientific research reveals about learning, moving toward what Martín (2024) refers to as evidence-informed teaching. This perspective does not consist of the mechanical application of methods or strategies deemed effective; rather, it involves planning teaching situations that articulate the classroom context with knowledge produced through scientific research on learning. To achieve this, both initial and continuing teacher education must be grounded in a scientific approach to teaching and learning.

FINAL CONSIDERATIONS

The present study aimed to understand which Teaching Methodologies have been employed by pre-service teachers in the context of the Supervised Science Teaching Internship and what these choices reveal about teacher education.

Based on the discussions presented, the urgency of developing a more adequate understanding of pedagogical knowledge is highlighted, particularly with regard to the concept of Teaching Methodology, the expansion of the methodological repertoire of pre-service teachers, and the theoretical deepening of the methodological approaches adopted within the context of the supervised internship.

As a means of addressing these issues, greater investment is recommended in the presentation of new methodological approaches for Science Education, promoting opportunities for reflection on the teaching of scientific content in a more critical and meaningful manner. However, we recognize the need for methodological pluralism to permeate the entirety of initial teacher education, which requires the commitment of all teacher educators, including professors in the field of Education, instructors of subject-specific disciplines, internship supervisors, among others.

It is also recommended that both initial and continuing teacher education promote reflection on whether pedagogical planning—within the Supervised Internship as well as in other educational contexts—takes into account an evidence-informed approach to teaching. In other words, it is necessary to question whether teaching practices have been designed on the basis of scientific evidence regarding learning.

Although the information generated in this study does not allow for broad generalizations, it may contribute to important reflections on teacher education. Furthermore, a limitation of this investigation lies in the fact that the participants were not followed throughout their educational trajectories, which would have made it possible to observe potential conceptual changes and the maturation of their professional teaching identities — an aspect that constitutes a promising avenue for future research.

ACKNOWLEDGMENTS

The first author would like to thank the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) for the financial support provided under Funding Code 001.

NOTES

This English version corresponds to a translation of the original manuscript submitted in Portuguese, entitled “Fragilidades no repertório metodológico de professores de Ciência em formação inicial” translated by Beatrice Elaine dos Santos who holds a Master’s degree in Language Studies from UEPG – Ponta Grossa *Campus*, and to whom we extend our thanks for her contribution.

REFERENCES

Alves, M. (2018). *Características, elementos e importância do planejamento didático-pedagógico: uma revisão de termos e conceitos na área de ensino de ciências* (Dissertação de mestrado, Universidade Estadual Paulista).

Alves, M., & Bego, A. (2020). A Celeuma em Torno da Temática do Planejamento Didático-Pedagógico: Definição e Caracterização de seus Elementos Constituintes. *Revista Brasileira de Pesquisa em Educação em Ciências*, 20, 71-96.

Amaral, I. A. (2006). *Metodologia do ensino de ciências como produção social.*

Anastasiou, L. G. C. (1997). Metodologia de ensino: primeiras aproximações. *Educar em Revista*, 13(13), 93–100.

Berbel, N. A. N. (2011). As metodologias ativas e a promoção da autonomia de estudantes. *Semina: Ciências Sociais e Humanas*, 32(1), 25–40.

Carvalho, A. M. P. (2013). *Ensino de ciências por investigação: condições de implementação em sala de aula.* São Paulo: Cengage Learning.

Carvalho, A. M. P. (2018). Fundamentos teóricos e metodológicos do ensino por investigação. *Revista Brasileira de Pesquisa em Educação em Ciências*, 18(3), 765–794.

Delizoicov, D., & Angotti, J. A. (1991). *Física.* São Paulo: Cortez.

Delizoicov, D., & Angotti, J. A. (2000). *Metodologia do ensino de ciências.* São Paulo: Cortez.

Delizoicov, D., Angotti, J. A. P., & Pernambuco, M. M. C. A. (2011). *Ensino de ciências: fundamentos e métodos* (4ª ed.). São Paulo: Cortez.

Garda, C. M. A., Wirzbicki, S. M., & Lima, B. G. T. de. (2023). Estágio curricular supervisionado em ciências e biologia: compreensões de licenciandos e professores orientadores. *Actio*, 8(3), 1–25.

Gimenes, G., & Oliveira, O. B. (2014). A formação docente na visão de professores formadores. *Educação em Foco*, 18(25).

Karling, A. A. (2016). *A didática necessária*. São Paulo: Ibrasa.

Krasilchik, M. (2008). *Prática de ensino de biologia.* São Paulo: Edusp.

Laburú, C. E., Arruda, S. M., & Nardi, R. (2003). Pluralismo metodológico no ensino de ciências. *Ciência & Educação*, 9(2), 247–260.

Libâneo, J. C. (2006). *Didática*. São Paulo: Cortez Editora.

Lopes, R. M., Alves, N. G., & Filho, M. V. S. (2019). Características gerais da aprendizagem baseada em problemas. In R. M. Lopes, M. V. S. Filho, & N. G. Alves (Orgs.), *Aprendizagem baseada em problemas: Fundamentos para a aplicação no ensino médio e formação de professores*. Rio de Janeiro: Publiki.

Lustosa, M. S. (2017). *A contribuição do pluralismo metodológico no ensino de Ciências Naturais: Um estudo realizado com alunos de uma escola pública da Paraíba* (Dissertação de mestrado, Universidade Estadual da Paraíba).

Marques, C. (2020). Por que discutir metodologia na escola contemporânea? *Caderno Marista de Educação*, 9(1).

Marques, G. Q., & Cunha, M. B. (2022). Abordagem, metodologia, método, estratégia, técnica ou recurso de ensino: como definir a aprendizagem baseada em problemas? *Revista Prática Docente*, 7(1), e018.

Martín, H. R. (2024). *Como aprendemos? Uma abordagem científica da aprendizagem e do ensino* (3ª ed.). Porto Alegre: Penso.

Mizukami, M. G. N. (1986). *Ensino: as abordagens do processo*. EPU.

Moraes, R., & Galiazzi, M. C. (2016). *Análise textual discursiva* (3ª ed.). Ijuí: Editora Unijuí.

Moraes, R., Galiazzi, M. C., & Ramos, M. G. (2012). Pesquisa em sala de aula: fundamentos e pressupostos. In R. Moraes & V. M. R. Lima (Orgs.), *Pesquisa em sala de aula: tendências para a educação em novos tempos* (3ª ed.). Porto Alegre: EDIPUCRS.

Muenchen, C. (2010). *A disseminação dos três momentos pedagógicos: um estudo sobre as práticas docentes na região de Santa Maria/RS* (Tese de doutorado, Universidade Federal de Santa Catarina).

Oliveira, M. C., Ponte, V. M. R. P., & Barbosa, J. V. B. (2006). Metodologias de pesquisa adotadas nos estudos sobre Balanced Scorecard. *Anais do Congresso Brasileiro de Custos - ABC*.

Oliveira, K. E. J., & Porto, C. (2016). *Educação e Teoria Ator-rede: fluxos heterógenos e conexões híbridas.* Ilhéus: Editus.

Paiva, M. R. F. (2020). *Metodologias ativas de ensino: novas práticas, antigas reproduções? Uma análise à luz da crítica marxista* (Dissertação de mestrado, Universidade Estadual do Ceará).

Paz, M. S. P., Ferraz, D. F., & Lima, B. G. T. (2023). Os pilares das metodologias de ensino: aspectos teórico-práticos do fazer docente no ensino de Ciências. *Ensino e Tecnologia em Revista*, 7(2), 625–636.

Paz, M. S. P. (2024). *Metodologias de ensino e seus desdobramentos: percepção de professores em formação inicial em Ciências Biológicas* (Dissertação de mestrado, Universidade Estadual do Oeste do Paraná).

Paz, M. S. P., Lima, B. G. T., & Ferraz, D. F. (2025). Puxando os fios da meada: incongruências teórico-práticas no uso de metodologias de ensino na formação inicial de professores em Ciências Biológicas. *Amazônia: Revista de Educação em Ciências e Matemáticas*, 21(46).

Sánchez Blanco, G., & Valcárcel-Pérez, M. V. (1993). Diseño de unidades didácticas en el área de Ciencias Experimentales. *Enseñanza de las Ciencias: Revista de Investigación y Experiencias Didácticas*, 11(1), 33–44.

Santos, E. R. (2014). *Análise da produção escrita em matemática: de estratégia de avaliação a estratégia de ensino* (Tese de doutorado, Universidade Estadual de Londrina).

Sousa, R. S., & Galiazzi, M. C. (2018). O jogo da compreensão na análise textual discursiva em pesquisas na educação em ciências: revisitando quebra-cabeças e mosaicos. *Ciência & Educação*, 24(3), 799–814.

Zahavi, D. (2019). *Fenomenologia para iniciantes.* Rio de Janeiro: Via Verita.

Received: Oct. 20, 2025.
Approved: May, 5th, 2026.

DOI: https://doi.org/10.3895/actio.v11n2.21031

How to cite:
Paz, M. S P.; Lima, B. G. T.; Ferraz, D. F. (2026). Weaknesses in the methological repertoire of pre-service Science teachers. ***ACTIO***, 11(2), 1-18. https://doi.org/10.3895/actio.v11n2.21031