https://doi.org/10.28976/1984-2686rbpec2024u10051029

Submitted on 12 april 2024
Accepted on 06 september 2024
Published on 25 september 2024

The Thematization of Practice in the Continuos Training of Science Teachers at a Full-Time School

A Tematização da Prática na Formação Continuada de Professores de Ciências de uma Escola de Ensino Integral

Tematización de la Práctica en la Formación Continua de Profesores de Ciencias en una Escuela Integral

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Abstract

Continuous training is a right given to the education professional who is teaching in schools aiming to ensure the quality of teaching and learning. This way, the present research aims to analyze the Thematization of Pedagogical Practice as a continuous education strategy and verify its effects on the pedagogical practice of Science teachers at a full-time school. The research is of qualitative character, it was characterized as an interventional research because the researcher was her own trainer. Data was collected through a diagnostic questionnaire together with an interview with the Natural Sciences area coordinator. Video recording and subsequent transcription of the Practice Thematization Process and the answers to the final questionnaire were part of the collected data as well. In the interface of the three stages, it was possible to verify that the Thematization of Pedagogical Practice, based on the analysis of the teacher's practice, makes it possible to understand and improve it. In other words, to consider what happened during classes, observing the successes or mistakes to further intervene in the process to improve teaching and learning. Considering the limits of this training strategy, the result allows us to state that a longer time spent by teachers at school proposed by the Full-time Education Program is still not enough to carry out an adequate continuous training by professionals because their responsibilities are many.

Keywords: Science Teaching, Teacher Training, Continuous Training, full-time school, pedagogical practice thematization

Resumo

A formação continuada é um direito dos profissionais da educação, inserido à cultura escolar com objetivo de assegurar a qualidade de ensino e de aprendizagem. Assim, a presente pesquisa tem como objetivo analisar a Tematização da Prática Pedagógica como estratégia de formação continuada e verificar seus efeitos na prática pedagógica dos professores de Ciências de uma escola de ensino integral. A pesquisa adotou caráter qualitativo, se caracterizou como uma pesquisa de natureza interventiva, à medida que a pesquisadora foi a própria formadora. Os dados foram coletados por meio de questionário diagnóstico e entrevista com o coordenador da área de Ciências da Natureza, filmagem e posterior transcrição do processo de Tematização da Prática e respostas ao questionário final. Na interface das três etapas foi possível constatar que a Tematização da Prática Pedagógica, a partir da reflexão sobre a própria prática, possibilita compreender e aprimorar a mesma, isto é, ponderar o que aconteceu durante as aulas, constatando acertos/erros e intervindo de forma a melhorar o ensino e a aprendizagem. Em relação aos limites dessa estratégia formativa, o resultado permite afirmar que a ampliação de tempo de permanência dos professores na escola proposto pelo Programa Ensino Integral, ainda, não é suficiente para realização e apropriação da formação continuada pelos profissionais, uma vez que as atividades da sua função são muitas.

Palavras-chave: Ensino de Ciências, Formação de Professores, Formação Continuada, ensino integral, tematização da prática pedagógica

Resumen

La formación continua es un derecho de los profesionales de la educación, integrado en la cultura escolar con el objetivo de asegurar la calidad de la enseñanza y del aprendizaje. Así, la presente investigación tiene como objetivo analizar la Tematización de la Práctica Pedagógica como estrategia de formación continua y verificar sus efectos en la práctica pedagógica de los profesores de Ciencias de una escuela de enseñanza integral. La investigación adoptó un carácter cualitativo, se caracterizó como una investigación de naturaleza interventiva, dado que la investigadora fue la propia formadora. Los datos se recopilaron mediante un cuestionario diagnóstico y una entrevista con el coordinador del área de Ciencias de la Naturaleza, filmación y posterior transcripción del proceso de Tematización de la Práctica y respuestas al cuestionario final. En la interfaz de las tres etapas se pudo constatar que la Tematización de la Práctica Pedagógica, a partir de la reflexión sobre la propia práctica, permite comprender y mejorar la misma, es decir, ponderar lo que ocurrió durante las clases, constatando aciertos/errores e interviniendo de forma a mejorar la enseñanza y el aprendizaje. En relación a los límites de esta estrategia formativa, el resultado permite afirmar que la ampliación del tiempo de permanencia de los profesores en la escuela propuesta por el Programa de Enseñanza Integral, aún no es suficiente para la realización y apropiación de la formación continua por parte de los profesionales, dado que las actividades de su función son muchas.

Palabras clave: Enseñanza de las Ciencias, Formación de Profesores, Formación Continua, educación integral, tematización de la práctica pedagógica

Introduction

Continuing education is a right for education professionals and is part of the school culture with the aim of ensuring quality teaching and learning. Law No. 9,394 of December 20, 1996 (LDB), which establishes the Guidelines and Bases of National Education, in its Article 62, guarantees teachers the promotion of continuing education, including in the workplace. The school environment and its various situations are seen as a privileged place for reflection on practice, enabling training that makes sense (Law No. 9,394, 1996).

The principles of training basic education professionals include continuing education as a permanent action at school, guided by teachers' practice, as Resolution No. 2 of December 20, 2019 highlights:

> continuing education, which must be understood as an essential component for teacher professionalization, and must be integrated into the daily life of the educational institution and consider the different knowledge and teaching experience, as well as the pedagogical project of the Basic Education institution in which the teacher works (Resolution No. 2, 2019, Art. 6).

However, the existence of legal documents alone does not guarantee the functioning and quality of continuing education in schools. Schools need to invest in studies on continuing education: understanding what it means to educate adults in professional contexts, critically analyzing continuing education practices and incorporating their objectives.

Since 2012, the Comprehensive Education Program (Programa de Ensino Integral — PEI) of the São Paulo State Department of Education has considered continuing education as one of its five premises. The schools belonging to this program have different places and times for continuing education: the Collective Pedagogical Work Hours (HTPC), the Area Pedagogical Work Hours (HTPCA) and the Study Hours (HE). To this end, the General Teacher Coordinator (PCG) and the Area Teacher Coordinators (PCA) act as trainers at the school (SEDUC-SP, 2014c). The guidelines on the development of training for PEI teams, which suggest some training strategies, such as the Thematicization of Pedagogical Practice (SEDUC-SP, 2014a), stand out as another key noteworthy factor.

The Thematization of Pedagogical Practice consists of recording a teaching situation to be analyzed by the trainer together with the teacher. In this way, the teacher's pedagogical practice is problematized, and together, trainer and teacher discuss difficulties and ways to overcome them, based on theory. According to Weisz (2011, p. 101),

> thematization work is an analysis that starts from documented practice in order to make the underlying didactic hypotheses explicit. We call this work Thematicization of Pedagogical Practice because it's about looking at classroom practice as an object that can be thought about.

Given the above, the question that guided this research was: What are the limits and possibilities of the Thematicization of Pedagogical Practice as a strategy for continuing teacher training in the school itself? In order to answer this question, the general objective of this research was to analyze the Thematicization of Pedagogical Practice as a continuing education strategy and to verify its effects on the pedagogical practice of science teachers.

The following specific objectives were proposed: (1) to diagnose the difficulties and training needs of science teachers; (2) to implement continuing training based on the systematization of the diagnosis of these teachers' difficulties and training needs; (3) to evaluate the continuing training offered, considering its influence in the classroom.

Continuing Teacher Education and the Thematization of Pedagogical Practice

Sudden changes in the social, political, economic and cultural contexts have a direct or indirect influence on the teaching profession. The teacher, from being the main source of knowledge in the classroom, has become the mediator of knowledge, needing to get to know each student and understand how they learn, in order to plan and propose pedagogical activities that meet the specificities identified and leave room for the construction of new knowledge (Cruz, 2008).

Faced with this contemporary demand, in order to perform their job with quality and redefine their role, teachers need effective training that acts on their knowledge, with the potential to change their teaching practice.

Several scholars (including Nóvoa, 1997; Imbernón, 2010; Weisz, 2011) consider that continuing education activities have made progress, but point out that there is still much room for improvement. According to Imbernón (2010), in the 1970s, several studies were carried out on continuing education, but the predominance of the individual training model stood out, in which "teachers planned and followed the training activities that they believed would facilitate some learning" (p. 19). Soon afterwards, universities began to organize continuing education proposals, offering training activities (for mechanical purposes), which "served to learn how to apply the latest in teaching techniques" (Weisz, 2011, p. 96). The predominance of techniques heralds the model of technical rationality. Pérez Gómez (1995), referring to the practice of this model, points out: "professional activity is above all instrumental, aimed at solving problems through the rigorous application of scientific theories and techniques" (p. 96). This is a limiting factor, because not all the challenges that arise in teaching processes can be solved by applying theories and techniques.

Nóvoa (1997) adds to these insights into changes in continuing education: he explains that in the 1980s, teacher training was marked by proposals for in-service training. The author states that the democratization of access to public basic education has forced changes:

> The school explosion brought into teaching a mass of individuals without the necessary academic and pedagogical qualifications, creating extremely serious structural imbalances. Under converging pressure from the political establishment and the trade union movement, an attempt was made to remedy the situation through three successive waves of programs: in-service professionalization and in-service training (p. 21).

The focus then shifts to quality and the development of alternative training models, with an emphasis on processes of reflection and analysis of practice. Imbernón (2010) states that, at this time, "action research, a new concept of curriculum, projects, triangulation and reflection in training spread rapidly" (p. 20).

Indeed, in the midst of the analysis of the course and the discussion on continuing education, questions arise, such as, "What is meant by continuing education at school?" "Does in-school training work?" "Does it contribute to building knowledge and improving teachers' pedagogical practice?"

The process of continuing training should begin with a diagnosis of teachers' training needs (Carvalho & Gil-Pérez, 2006). In order to foster changes in attitudes and practices, it is essential to think about the implementation of educational actions and, above all, to take into account the homology of processes (a concept developed by Schön at the end of the 1990s), also known as isomorphism (considered by García, 1999). According to García (1999), it is a question of ensuring, in the training process, a similarity between "the training received by the teacher and the type of education they will later be asked to develop" (p. 29).

Therefore, with a view to a science education in which participation in research activities enables students to learn scientific knowledge, the training process for teachers should be no different. Gois and Ferreira (2018) corroborate this idea by mentioning that the development of student protagonism is related to teachers' continuing education:

> If we want our students to become protagonists in the learning process, it is necessary that in continuing teacher training, the trainer has the role of mediator, promoting reflection on the subject studied and not just a transmitter of information (p. 199).

Thus, the literature shows that teachers should be given the opportunity to be subjects of their own learning and to participate in analysis and discussion of school and classroom situations. To this end, the Thematicization of Pedagogical Practice training strategy was chosen, as it has a number of characteristics: being carried out in the workplace, promoting reflection on the teacher's pedagogical practice, being continuous, which can promote professional development, combining moments of teacher-trainer training, moments of individual study and collective moments with other teachers, with the trainer playing the role of mediator.

This training strategy is developed in a number of stages. The first one consists of recording the teacher's lesson, which can be done through written reports or video recordings. In turn, the second step comprises the selection of passages considered relevant by the trainer, to be watched (in the case of video recording) together with the teacher who gave the lesson. For this stage, the trainer also makes the arrangements for the way this material will be problematized based on the theoretical study carried out by the trainer. The third stage, called "debriefing", consists of a meeting between the teacher and the trainer to watch the video and reflect on it, based on the questions prepared by the trainer. At this stage, the trainer suggests reading a scientific article or book to the teacher. The fourth step consists of collective meetings with teachers from the same area in which the readings are discussed and video clips of the teachers' lessons can be shown for collective reflection, if the teachers agree (Weisz, 2011).

It is Schön's (1997) contention that

> It is not enough to ask teachers what they do, because there are sometimes big differences between their actions and their words. We have to get to the bottom of what teachers do through direct, recorded observation that allows for a detailed description of behavior and a reconstruction of intentions, strategies and assumptions. The confrontation with directly observable data often produces educational shock, as teachers discover that they act according to theories of action that differ from those they profess (p. 90).

The aim is not to evaluate the teacher's attitude, but to ensure learning. As a result, teachers have the opportunity to work with reality, to observe the students in their learning process, as well as their teaching practice. Imbernón (2010) states that:

> If teachers accept that they can learn from observation, they will see that change is possible and that it will become effective through successive observations, as this is a way of encouraging change both in their teaching strategies and in their students' learning (p. 33).

Therefore, observation needs to walk hand in hand with reflection, because the Thematicization of Pedagogical Practice guides its development and, through critical analysis of the records, the teacher who observes their practice identifies potential and thinks about the weaknesses of the teaching and learning process. Lerner et al. (2007, p. 103) state that "analyzing classroom situations is perhaps the strategy that provides the most data for reflection. It helps the teacher to identify problems, to think about possible solutions, to investigate".

In São Paulo Comprehensive Education Program schools, the pedagogical coordinator is responsible for promoting in-service training for teachers and, as such, will need to lead reflections on pedagogical practice. In order to carry out the Thematicization of Pedagogical Practice, you must first analyze the records, make clippings, select fragments, devise discussions, approach and study the theory contained in the documented situation. Lerner et al. (2007) contribute to this reflection by emphasizing the importance of the trainer's previous work:

> The greatest challenge for the trainer is to resist the temptation to discuss everything that happens in the classroom during the analysis. An important first step is to identify the aspects that are relevant. [...] You have to be able to grasp the central points and know where you want to "put the teacher's gaze" in order to trigger an important reflection (p. 105).

From the perspective of reflection on practice, the pedagogical coordinator must ensure problematization through questioning, asking questions that mobilize knowledge about student learning, in order to allow for the construction, deconstruction and/or reconstruction of the teacher's action.

After monitoring the class and recording the insights, the Thematicization of Pedagogical Practice works with formative feedback, a moment in which there is a discussion about what happened in the class. The pedagogical coordinator proposes problematizing questions, as well as studying and debating the theory related to the problem, and finally plans a new activity together with the teacher, which will be observed in another class.

According to Scarpa (1998), it is of paramount importance to emphasize that, in the Thematicization of Pedagogical Practice, theory must be considered as a function of practice:

> We thematized practical situations, considering that theory was indispensable in the training and effective performance of teachers, but it had to be a function of practice and not the other way around, because teachers' real problems arise from their daily practices and it is from this reality that they need to improve their knowledge (p. 77).

Analyzing the possibility of transformation resulting from reflection on practice, it can be said that the Thematicization of Pedagogical Practice is not just about observing a lesson. New follow-ups should be planned and, with each formative feedback, the records already discussed should be revisited, building a formative path. From this point of view, it is necessary to constantly (re)view classroom practices, in such a way that this new way of seeing allows them to be modified (Monteiro, 2008, p. 115).

In order to strengthen the formative action, the Thematicization of Pedagogical Practice could consider a larger number of participants. The records can be presented and discussed with a group of teachers, school staff or teachers from the same subject area, in a pedagogical meeting (HTPC or HTPCA), and "this openness in the classroom is necessary to advance in the awareness of one's own actions, as well as to cooperate with colleagues in the development of knowledge that will result in better teaching situations" (Lerner et al., 2007, p. 127). For this to happen, the teacher who has agreed to thematize their practice needs to authorize it, feel confident and clear about the purpose directly related to learning.

The Thematicization of Pedagogical Practice also promotes group discussion, with a view to the professional development of teachers through socialization, analysis and collective reflections. For Augusto and Amaral (2018), "collective work and the exchange of experiences with colleagues and specialists is a way to strengthen the teacher's identity and alleviate teacher malaise" (p. 22).

In line with this, Nóvoa (1997) adds that "training practices that take collective dimensions as a reference contribute to professional emancipation and the consolidation of a profession that is autonomous in the production of its knowledge and values" (p. 27).

Thus, in this context of a training strategy that contributes to professional development, the IEP points to the need to carry out a training process that qualifies teachers' practice, based on progress in student learning.

Methodology

The approach chosen for the research was qualitative, since the intention was to learn about the results of the formative action that considers the Thematicization of Pedagogical Practice strategy, systematically monitoring the actions of science teachers in the classroom and at school. According to Ludke and André (2013), qualitative research "involves obtaining descriptive data, obtained in the researcher's direct contact with the situation studied, emphasizes the process more than the product and is concerned with portraying the perspective of the participants" (p. 14).

According to the classification of Teixeira and Megid-Neto (2017, p. 1056), this research can be called "interventional in nature". Unlike classic interventional research, which aims to transform a social situation or the context of the participants, and decisions are made by all those involved, from the definition of the objectives, interventional research, in the words of the authors, is:

> Project-based investigations in which the research priorities are defined entirely by the researchers, involve planning, application (execution) and analysis of data on the process developed, generally trying to delimit the limits and possibilities of what is tested or developed in the intervention. [...] The objectives are not necessarily aimed at transforming a reality, but often at making contributions to the generation of knowledge and practices, involving both teacher training and issues more directly related to teaching and learning processes, such as testing pedagogical and curricular principles (interdisciplinarity, contextualization, transversality, evaluation, etc.) and teaching resources (p. 1068).

In this research, the researcher made her own teacher training practice her object of investigation, which she already carried out as a pedagogical coordinator at a school in the Comprehensive Education Program.

The study was carried out in a full-time public school in a city in the interior of São Paulo. In the Comprehensive Education Program (PEI), teachers accept the full and integral dedication regime (RDPI), are present in the school unit for 40 hours a week and have more space and time to improve their training. In order to guarantee the quality of the training, PEI has trainers in the different areas of knowledge: the Area Coordinating Teachers (PCA) and the General Coordinating Teacher (PCG), who are responsible for conducting ongoing training for the school team. The Manager's Booklet, "Training the Teams of the Comprehensive Education Program", indicates the Thematicization of Pedagogical Practice as a training strategy that contributes to the process of continuing teacher training (SEDUC-SP, 2014a).

Research participants included the teachers responsible for teaching the subject of Science, the Area Coordinator Teacher (of Natural Sciences), as well as the General Coordinator Teacher, a professional who played a dual role: trainer, who introduced the Thematicization of Pedagogical Practice into the daily school life of Science teachers, and researcher.

Data was collected by means of questionnaires with all the science teachers at the participating school; an interview with the coordinating teacher for the area of natural sciences and mathematics; observation and filming of the classes taught by the science teachers; and dialogues defined with the science teachers in the formative feedback from class observations. For the data analysis procedure, the responses of the participating teachers were transcribed, organized and analyzed in depth, based on relevant theoretical references (Gois & Ferreira, 2018; Carvalho & Gil-Pérez, 2006; Imbernón, 2010; Nóvoa, 2001; Queiroz et al., 2015; Del Arco, 2018; Silva, 2019). It is important to note that the research was submitted to and approved by the Human Research Ethics Committee.

The data presented in this work refers to: a questionnaire and interview to diagnose the training needs of the teachers taking part in the research, observations and filming of these teachers' lessons, feedback meetings on the lessons observed and filmed to reflect on their own teaching practice, study/exchange of experiences with peers and, finally, a questionnaire for the teachers to evaluate the training action. The phases of data collection are presented below.

Diagnostic Phase

To organize the training course, a diagnosis was made of the teachers' training needs. Through a questionnaire, the participants highlighted their difficulties. In preparing the diagnostic questionnaire, the General Teacher Coordinator (PCG) considered the aspects present in the class monitoring protocol, available on the Foco Aprendizagem Platform (launched by the São Paulo State Department of Education), namely: organizational, pedagogical, teacher-student relationship and learning assessment.

The questionnaire, with open-ended questions, was organized into three sections, with the purpose of: in section 1, identifying the difficulties of each teacher, what is negatively interfering in the development of teaching; in section 2, validating the training offered in the school unit, checking if the organization, time and strategies used are meeting the needs of the teachers and supporting the (re)organization of teaching practice; in section 3, verifying the expectations of the teachers, if what they identify as a need is being considered and if it can contribute to overcoming the difficulties highlighted.

Data collection took place in 2020, when the Covid-19 pandemic broke out. For this reason, it was decided to ask the teachers to answer the diagnostic questionnaire again, in order to see if there had been any changes in remote teaching in relation to the teachers' difficulties, if the needs had remained the same or had changed as a result of changes in context and the scenario of the activities now being carried out.

Another item taken into account when designing the training path was the result of the semi-structured interview conducted with the Teacher Area Coordinator (PCA) for Nature Sciences and Mathematics, which focused on the difficulties and training needs identified by the professional. The proposed questions were as follows: 1. Do you

identify any difficulties common to teachers in the area during class and study time? 2. How do you identify the training needs of teachers in your area? 3. How do you rate the training provided in your area of expertise? 4. Do you have any proposals for improvement or correction, with a focus on continuing training for teachers in your area?

After systematizing the diagnosis, the trainer studied the references and planned the training actions to address the needs identified, with the participation of the teachers (drawing up the continuing training plan).

Reflection-Mediated Phase of Teacher Training

Alongside the teachers taking part in the research, the trainer organized a schedule for monitoring their classes, observing and filming them in order to understand the difficulties presented by the students and record their teaching practice. With regard to the frequency, each teacher was monitored for three classes and the observations were given back.

In order to give formative feedback on the monitoring of classes, a study timetable was scheduled and an online meeting was set up. The meetings were organized with the aim of reviewing the points highlighted in the diagnostic questionnaire, watching the filmed lesson and reflecting, in partnership with the teacher, on the records of the observations (description of the activities carried out: potentialities and points of attention).

After accompanying the teachers in the development of their lesson, PCG studied the records and planned the formative feedback meeting, in other words, analyzing the teachers' pedagogical practice in the video, looking for a basis in academic theories and thinking of questions that could be asked to promote reflection and the improvement of practice.

Before finalizing the feedback, an agreement was drawn up, which defined guidelines for improving the teacher's pedagogical practice, such as the study of references during study hours and the scheduling of class follow-ups to monitor the results of the agreement on the teacher's pedagogical practice.

From the second lesson onwards, data was collected to investigate the impact of continuing education on the teacher's pedagogical practice, which was also done by filming the lesson.

After building a relationship of trust with the teachers during the reflective analyses at study times and with the aim of encouraging interaction about ideas and difficulties, the General Teacher Coordinator promoted a group discussion at the Collective Pedagogical Work Hours by Knowledge Area (HTPCA), a time for collective training by knowledge area.

Training Evaluation Phase

The aim of this stage was to evaluate the Thematicization of Pedagogical Practice as a continuing education strategy. This strategy was suggested in the Training the Teams of the Comprehensive Education Program document and adapted to the needs of the research.

To this end, at the end of HTPCA, an evaluation instrument was used in which the teacher had to answer the following question: Does the Thematicization of Pedagogical Practice contribute to your teaching practice? Justify your answer with an account of the training you took part in. Due to the proposed remote teaching at the beginning of 2021, it was answered via WhatsApp.

Based on the analysis of the participants' responses, we sought to understand the results.

Data Analysis Procedures

The guidelines pointed out by Duarte (2004) on how to proceed with data analysis were adopted, namely: ordering the empirical material collected during fieldwork; interpretation; organization into themes; cross-referencing the material with theoretical references. According to the author, "throughout the process of analysis, the empirical material will be read/viewed/interpreted in the light of the scientific literature of reference for the researcher, who produces theory articulated to the set of scientific productions with which he identifies" (p. 223).

In this way, these procedures allowed for an organized description of the data that emerged from the questionnaires, the interview, the observations/filming and the meetings, which made it possible to interpret, based on the literature, the continuing education of science teachers at a comprehensive school. It should also be noted here that the analysis of the data collected also considered the theoretical conceptions and main ideas of the researchers Queiroz et al., 2015; Del Arco, 2018; Silva, 2019. In this case, it was decided to read and compare works on the themes of "Continuing Education in the schools of the Comprehensive Education Program" and "Thematicization of Pedagogical Practice as a strategy in the continuing education of teachers".

Analysis of Results

Section 1 of the diagnostic questionnaire, called "Difficulties", sought to verify what each teacher identified as a training need, considering four different aspects of teaching practice as follows: 1. Organizational: managing class time and space; 2. Pedagogical: related to teaching processes and strategies; 3. Teacher-Student Relationship: pertinent to actions, with a focus on interaction and mediation of learning; 4. Learning Assessment: refers to the monitoring of student learning.

Figure 1

Synthesis of the training needs of science teachers at a comprehensive school, indicated in the diagnostic questionnaires and in the interview with the PCA

Teachers	Features	On-site teaching needs	Remote learning needs	Needs according to the PCA
Teacher A	Organizational	Space optimization	Time optimization	Classroom Management
	Pedagogical	No difficulties highlighted	No difficulties highlighted	No difficulties highlighted
	Teacher-student relationship	No difficulties highlighted	No difficulties highlighted	Interpersonal relationship management
	Learning Assessment	No difficulties highlighted	No difficulties highlighted	No difficulties highlighted
Teacher B	Organizational	Time optimization	No difficulties highlighted	Time management
	Pedagogical	Teaching and learning processes and strategies	Information for adapting the curriculum with guidance for an online approach	Curriculum management
	Teacher-student relationship	Interpersonal relationships	No difficulties highlighted	Interpersonal relationship management
	Learning Assessment	Assessment tools	No difficulties highlighted	No difficulties highlighted
Teacher C	Organizational	No difficulties highlighted	No difficulties highlighted	Classroom management
	Pedagogical	No difficulties highlighted	No difficulties highlighted	Absent or mistaken approach to concepts
	Teacher-student relationship	No difficulties highlighted	No difficulties highlighted	Interpersonal relationship management
	Learning Assessment	No difficulties highlighted	No difficulties highlighted	No difficulties highlighted

The overview presented in Figure 1 shows the differences between the training needs pointed out by the teachers and by the PCA. Regarding training needs in classroom teaching, the reports of the difficulties faced in the classroom by teachers B and C do not establish a relationship with the observations of practice highlighted by the PCA. Regarding training needs in remote teaching, few difficulties were presented. Teacher A pointed out the challenge of dealing with online class time, and teacher B reported insecurity in carrying out work based on the curriculum.

As Gois and Ferreira (2018) point out, it is the responsibility of the teacher trainer to systematize the diagnosis of teachers' training needs, considering that the professional "must be able to analyze, reflect and look at the needs of the group of teaching professionals, taking into account the difficulties encountered in the classroom, and valuing them in their knowledge during their professional career" (p. 198).

The identification of teachers' training needs must be linked to the attribution of meaning to what they do, thus making it possible to make an accurate diagnosis, that is, without the influence of aspirations that do not contribute to the qualification of teaching practice. In this case, teachers A and B's reflections on the planning and development of teaching in the classroom and remotely can be considered.

The teachers refer to doubts about the organization of the students in the classroom and sufficient time to guide learning based on the curriculum, in the same way that the PCA proposes, supported by the monitoring of activities and lessons by the professionals, in the development of classroom management and the curriculum. These notes suggest a correlation with the ideas of Carvalho and Gil-Pérez (2006) on the training needs of science teachers, since in order to know how to manage their students' work, teachers need training that enables them to make informed decisions, as can be seen in the following excerpt: "when their role ceases to be that of simple transmitters of knowledge [...]. In this case, they will have to continually face contradictory demands, such as the need to give the teams enough time [...]" (Carvalho & Gil-Pérez, 2006, p. 51).

In addition to the organization and pedagogical processes mentioned above, the teachers' responses also highlight the fact that they did not identify any difficulties in relation to certain aspects of pedagogical practice. In this respect, Carvalho and Gil-Pérez (2006) mention overcoming common sense ideas about teaching and learning science as an inherent training need for teachers of this subject. In the authors' own words,

> On the one hand, we have seen how science teachers have a whole series of ideas, behaviors and attitudes about teaching/learning problems that can be obstacles to innovative teaching activities, insofar as these are spontaneous conceptions, uncritically accepted as part of "common sense" teaching. Nevertheless, we have also seen examples of how "unconditioned reflection", i.e. collective work with a minimum of depth around the problems posed, leads to analyses and proposals that coincide to a large extent with the results of all educational research (p. 29).

In view of this, the PCG (researcher) insisted on identifying difficulties, proposing to cover aspects of pedagogical practice at the beginning of the Thematicization of Pedagogical Practice, with the aim of making it possible to highlight and confirm training needs based on the observation of concrete teaching and learning situations.

The Thematization of Science Teachers' Pedagogical Practice

After diagnosing the teachers' difficulties, they observed and filmed the science lessons of the three teachers. They chose the 6th, 8th and 9th years of elementary school to be observed by PCG. The content covered in these classes was homogeneous and heterogeneous mixtures, astronomy and energy. The first class was taught in person, and the next two were taught remotely.

During the feedback sessions, the PCG would watch the selected lesson with the teacher and ask him about the difficulties that occurred. Teacher A and Teacher B were more open to analysis, whereas Teacher C, at first, was more resistant to admitting that there were any difficulties. Before ending the meeting, Professor C asked to highlight a difficulty. In his words, there is a note about the student's behavior in the online class.

> I'll tell you in advance, I think the difficulty I have in remote teaching is using the students' dynamics to favor my lessons, but it's hard to do this. You don't know if the student is participating or just listening. We need to find a way to get them to participate, to talk, to think, to study the subject with us. It's difficult (Teacher C, Debriefing 1).

Once teachers A and B recognized their training needs, the PCG suggested studying inquiry teaching as a way of preparing learning activities and improving student participation in class. The proposal was not extended to teacher C due to the fact that he had recently considered it a difficulty, and it was agreed that the next lesson monitoring and formative feedback would continue to reflect on his own practice and confirm the difficulty(ies).

Figure 2 summarizes the results of the first training meeting with each teacher.

Figure 2

Overview of the training needs pointed out by science teachers, based on reflection on their own practice

Teachers	Training difficulties/needs pointed out by the teacher	Suggestions
A	Fostering students' active participation in class	Reading research on inquiry teaching, suggesting the authors Carvalho and Sasseron
B	Work on the curriculum proposal with the participation of the students and organize the division of time between activities	Reading the book "Ensino de Ciências por investigação: condições para implantação em sala de aula" ("Teaching science through investigation: conditions for implementation in the classroom")
C	Enable students to participate in online classes	Reflection on remote learning and its challenges

Figure 2 shows that the difficulties related to organization — structural issues in the classroom — were revealed through teaching practice as well as the diagnostic questionnaire. It also points out the difficulties associated with preparing learning activities. The three participating teachers mentioned the impasse of planning activities based on the curriculum of the year/grade and encouraging the active and effective participation of students in the teaching and learning process.

Carvalho and Gil-Pérez (2006) also noted the need to know how to prepare activities capable of generating effective learning, as revealed by the responses of science teachers, relating this knowledge to the possibility of constructing knowledge and, consequently, presenting this need as a priority in the training of science teachers, bearing in mind that "when you want to organize learning as the construction of knowledge by students, it is no longer a question of preparing some activity, but of designing the development of themes based on activities to be carried out by students" (Carvalho & Gil-Pérez, 2006, p. 42).

In relation to planning learning activities and complying with the curriculum, Driver and Oldham (1986, cited in Carvalho & Gil-Pérez, 2006) state that the essential thing is "to know the curriculum not as a set of knowledge and skills, but as a program of activities through which this knowledge and skills can be constructed and acquired" (p. 42).

Through the second Thematicization of Pedagogical Practice, it was possible to address the training needs pointed out by the teachers. On these occasions, they were able to analyze and discuss classroom situations in order to come up with alternatives for improving practice and student learning. Figure 3 below summarizes the results obtained at this stage of the training program.

Figure 3

Overview of the conclusions of the formative feedback from the follow-up of class 2

Teachers	Focus of formative debriefing	Study	Suggestions
A	Planning learning activities and student participation	Recommended reading in the Thematicization of Pedagogical Practice 1 (Inquiry Teaching)	Planning lessons based on problems and with room for discussions.
B	Student participation and lesson planning based on the curriculum	Theory related to the practice of questions in science classes	Considering intentionality in lesson planning
C	Difficulty(ies)/Training Needs	Discussion on teaching practice and student participation	Planning the lesson and strengthening the teacher-student relationship

According to Figure 3, during participation in the formative action: teacher A considered improving student participation through lesson planning with problems and space to discuss the answers with the students; teacher B proposed putting into practice the study on intentional work, focusing on developing student participation through questions; teacher C recognized the difficulties related to pedagogical practice and committed to planning didactic interventions.

In addition, considering teacher A's explanation at the time of monitoring the study, the work overload is noticeable, since the professional mentions the number of activities to be carried out and their influence on the act of studying.

The following is a summary of the monitoring of classes and formative feedback from the third formative action carried out individually with the teachers, highlighting some transformations in the participants' practice. Figure 4 below shows the results of this stage of the training program.

Figure 4

Synthesis of the formative debriefing from the follow-up of class 3

Teachers	Suggestions put into practice	Teacher's Perception/ Assessment	Perception/Assessment of PCG
A	Presentation of problematic questions and space for discussion of students' conclusions	By observing his own class, he identified mistakes and points for improvement	Training needs related to the practice of inquiry teaching, as well as the critical analysis of traditional teaching
B	Intentional planning and implementation of questions in lessons	He noted the importance of student-centered lesson planning	From the moment he considered planning lessons with a focus on what students need to do to learn, complying with the curriculum ceased to be a challenge
C	Prior contact with students and lesson planning	He realized that he had not planned the previous lessons as a good learning situation	Through the filming, he became aware of aspects that occurred in the classroom and were not perceived, and was ready to plan interventions

An examination of Figure 4 reveals that the reflective analysis of classroom situations influenced the planning of subsequent lessons. It also shows that formative action needs to be stepped up to enable teacher A's professional development, assuming that traditional teaching may be interfering with the development of the inquiry teaching approach.

It should be emphasized here that the participating teachers are trying to move away from the logic of transmission, but this does not mean that they have made satisfactory progress towards implementing inquiry teaching, as there is a pronounced distance from theory. From the teachers' reports, it was possible to see the superficiality of their understanding of the approach. Therefore, in order to work within this limit, time is needed to study the theory in detail, which was not possible in three formative debriefings.

Thematicization of Science Teachers' Pedagogical Practice: Group Discussion

The purpose of the group discussion was to analyze excerpts from teacher A's third lesson, in order to exchange experiences (replicate good practices) and deepen our knowledge of teaching practice. To do this, the science teachers and the PCG met in a Google Meet room.

The choice of lessons for group discussion took into account the opportunity to understand and improve one's own practice. In other words, excerpts from teacher A's lessons were selected, taking into account her training needs and the possibility of exchanging experiences and learning with her peers. It is important to note that, before planning the meeting, it was agreed with teacher A that she would use the records of her lessons.

At the beginning of the meeting, the PCG proposed that the group analyze two excerpts from the footage of teacher A's lessons, the sensitizations proposed in the second and third lessons, validating the focus on student participation: optimizing space/time and planning learning activities. Before watching the video, the teachers were encouraged by the PCG to report on what they do to raise awareness among students at the beginning of their lessons.

When analyzing the answers, we found that most teachers propose awareness-raising activities to encourage student participation and the development of an active stance in the teaching and learning process. As far as teacher A is concerned, we can see that she reproduced the activities as presented in the São Paulo Curriculum.

According to Gois and Ferreira (2018, p. 198),

> More than just presenting information, the teaching activity is based on promoting learning from the teaching activity. This requires teachers to reflect on their teaching practices in the social context of the contemporary era. Part of this reflection lies in the potential of the moments of interaction between teachers, in the meeting between peers, where experiences are exchanged and their knowledge is socialized.

Next, the teachers watched the awareness-raising session proposed by teacher A, in the second lesson accompanied by the PCG, at which time she asks the students about the origin of the Earth and, in the first answer given, explains that she will not confirm it, as they will learn from the development of the study guide. When asked what they would highlight from the analysis of the excerpt they watched about the proposal and the engagement of the students, the teachers were initially afraid and remained silent, but with the encouragement of the trainer and returning to the formative objective of the meeting, the participants began to interact.

When considering the notes and answers, it is possible to infer that the teachers established a relationship between the activity with questions, the interventions made by the teacher and the active participation of the students, and also suggested activities

to encourage student performance and learning. With regard to the alternatives that emerged from the group discussion, Imbernón (2010) points to "collaborative, dialogic, participatory learning, i.e. analyzing, testing, evaluating, modifying in a group" as one of the principles underpinning continuing education (p. 66).

After the aforementioned discussion, the teacher whose lesson had been filmed made some notes, while teachers B and C observed and proposed new reflections on the lesson planning:

> After the formative debriefing with the PCG, I'm pushing harder and with each answer I keep asking why. What's difficult is remote teaching, the time it takes for the online class to instigate and solve the scripts, and also to plan a more explanatory script. We want to work in the way that investigative activity should be worked, but in remote teaching we get stuck in time (Teacher A, class discussion 2).

> Do you know what you should have paid attention to? You (trainers) have always said it and I hadn't realized it: there's the objective of the lesson, in which we highlight the skills to be worked on, we want to do something well done and complete, and we end up not focusing on the verb of the skill, like, for example, if it was to identify something, we've also included investigating, relating etc. in the activities (Teacher C, class discussion 2).

> There are many details at stake in PEI, and we don't have the time to prepare a quality lesson. But we get used to it (Teacher B, class discussion 2).

> Now, at the end of my lessons, the students are discussing the skill with me. When teachers understand the verb of the skill to be worked on, the lesson will be easier and more practical, and they won't waste a lot of time (Teacher C, lesson 2 discussion).

Although teachers A and B pointed out that, in their day-to-day school life, there is a lack of time to study and plan lessons, PEI guiding document, entitled "Training the Teams of the Comprehensive Education Program", states that "there are many times in the schools participating in the Comprehensive Education Program that can be dedicated to training" (SEDUC-SP, 2014a, p. 37). He also adds that "it is important that the times are planned and systematized with the training needs in mind" (SEDUC-SP, 2014a, p. 17). Furthermore, teacher C emphasized that the lack of time can be alleviated by adapting teaching practice, arguing that teachers often plan their lessons taking into account a development beyond that required by the skill to be worked on in class.

In other excerpts, the teachers say,

> I noticed that the teacher asked the question; she realized that the students didn't answer and asked the question again. The question was changed so that, somehow, they were able to answer and carry out the activity, in other words, it made them actually participate. (Teacher C, class discussion 3).

> After the conversation with the PCG, I changed my class and realized that I can design and develop activities that encourage participation, so I can also monitor the students' learning. When the student mentioned the pearl in class, I took the opportunity to study it further, asking him to explain how it is formed. Before, I would have thought that I would have wasted time with the student's interference and explanation. (Teacher A, class 3 discussion).

> He didn't waste any time; in fact, he gained time, because the student's explanation was fantastic, he even went into detail about the toxin. Look how much they could learn together! Through the activity with probing questions and paraphrasing, the teacher was able to get the students to bring out the knowledge they know, so that it could then be deepened. (Teacher B, class discussion 3).

In this sense, according to Nóvoa (2001), collective training actions favor the construction of cultures of cooperation. According to the author,

> the effort to think about the profession as a group implies the existence of spaces for sharing beyond school boundaries. It is about participating in pedagogical movements, being present in broader dynamics of reflection and intervention in the education system (p. 4).

The debates in the analysis of the third lesson were also opportune to provide the PCG with evidence of changes in teaching practice; in the reports and testimonies, the teachers revealed the reasons that led students to learn, highlighting lesson planning and approaches that consider teachers as subjects of knowledge.

Evaluation of the Thematization of Teachers' Pedagogical Practice: Final Questionnaire

In order to evaluate the effects of the Thematicization of Pedagogical Practice, the participating teachers were asked to answer the final questionnaire. It is important to mention that the teachers' participation in filling in the questionnaire took place after the group discussion. After assessment of the effects of the Thematicization of Pedagogical Practice, the teachers highlighted:

> I've changed a lot by re-watching parts of my lessons and talking to you about how to stimulate the student. It's a pity that due to the large number of activities, we don't get to review the lessons very often. It's difficult to attend classes. Research in science is really rewarding. Working on parts of lessons in the ATPC, with all the teachers, would give us the chance to create better lessons (Teacher A, final questionnaire).

> In your feedback, you've made me realize that I'm following the right path when it comes to my students' learning, because I ask them a lot of questions during my lessons, so that they can be the subjects of their own thoughts. Of course, for a more interactive and dynamic lesson, I still have a lot to learn (Teacher B, final questionnaire).

> The meetings provided a great deal of learning, making me rethink my practices and contributing to a self-evaluation in search of progress in my own teaching practice. The group discussion dynamics provided participants with a critical analysis of their teaching practices, thus helping them plan their next actions. This may lead lead to the suggestion that class follow-up meetings, which are usually held only with the teacher and their coordinator, should now be held in groups. The meetings were very efficient and productive (Teacher C, final questionnaire).

From the excerpts above, it can be seen that the teachers have come to value reflection on practice and have presented the possibility of learning, expanding and changing the way they do pedagogy. During participation in the Thematicization of Pedagogical Practice, a limitation was also mentioned: the time it took to carry out frequent analysis of class records, especially the filming.

Discussion of Results

According to Queiroz et al. (2015), thinking about continuing teacher training, based on the Thematicization of Pedagogical Practice, makes it possible to "weave a network of threads, in collective practices, with a view to a formative and continuous diagnosis of pedagogical and school processes, in order to qualify teaching and learning" (p. 91). However, the authors present some challenges that may influence the recognition of the Thematicization of Pedagogical Practice as a process of continuing education, including: "overcoming the resistance of some teachers who consider the moments of study as a punishment and not as something beneficial, capable of contributing to teaching" and "awakening new skills in teachers with a view to improving the quality of teaching" (Queiroz et al., 2015, p. 91).

Regarding the continuing education offered by the Comprehensive Education Program schools, according to Del Arco (2018, p. 108), the following can be highlighted:

> as a potentiality, that the training of the Comprehensive Education Program (PEI) tries to place the teacher as the agent and subject of their training in the sense that it gives them the autonomy to direct their own training process; with regard to the challenges, the very fact that the continuing training of PEI teachers prioritizes training proactivity, that is, that it is the sole responsibility of the teacher, seems to devalue collective training [...] it remains primarily directed to the specialties of the teachers, which individualizes and particularizes even more.

According to Silva (2019), the continuing education oriented by the PEI highlights, as differentials, the times and spaces to guarantee the formative action in the school, in practice, it is not considering the needs of the school and the teachers, emphasizing that: regarding space, in practice, the school is not being the most important nucleus for the development of formative actions, "the space of the school where the trainings take place is lacking in material resources that ensure greater comfort and more pleasant

organization for teachers" (p. 189); as for time, it is not enough for study and professional development, "the time for training is guaranteed by law, but ends up being pulverized, manipulated and used to carry out orientation activities, training, bureaucratic and administrative tasks" (p. 189).

Based on the analysis of the results of this research, compared to the ideas of the research on the Thematicization of Pedagogical Practice and the Continuing Education of teachers in PEI schools presented above, it was observed that, in this research, the teachers: identified the difficulties related to pedagogical practice when they watched the video-recorded excerpts of their classes; agreed with the study proposals and sought to put the (re)constructed knowledge into practice; were active subjects in the training process, observed the classes, realized that pedagogical practice could be improved or modified, and proposed interventions focused on improving teaching and learning; participated in and valued peer discussion, highlighting the ease of learning from the exchange of experience and planning corrective actions for the problems identified during the discussions. On the other hand, they seemed to have issues with implementing inquiry teaching, as proposed by the IEP; they didn't have much time to take care of training in the workplace and they became even busier with the combination of activities proposed by the IEP and remote teaching tasks;

This confirms that time is a limiting factor in the development of continuing education, including through the use of the Thematicization of Pedagogical Practice strategy. It is worth emphasizing that the participating teachers did not show any resistance to the study, nor did they make any effort to do the readings and studies indicated, as can be seen in the records of the formative feedback. We can justify this result as being due to the pandemic, in which teachers accumulated duties, leaving little time for reading and studying.

Concluding Remarks

The process of analyzing the effects of the Thematicization of Pedagogical Practice as a continuing education strategy for science teachers at a state comprehensive school was very challenging. In order to put the training strategy into practice, adaptations had to be made, since there have been many changes in teaching during the pandemic.

In remote teaching, with all the necessary adjustments, it was considered that the training strategy Thematicization of Pedagogical Practice made it possible to develop reflective practice and improve pedagogical practice, in order to resignify practice. However, the fact that the school, which belongs to the Comprehensive Education Program, has offered teachers more time at the school (40 hours a week - 8 hours a day) and is guided by a premise focused on continuing education may not be a guarantee that educators have enough time to take care of their education. This is something that needs to be investigated further. These findings will be justified by a summary of the results of the data collection stages.

The analysis of the diagnosis of the difficulties and training needs of science teachers, prior to the Thematicization of Pedagogical Practice, showed that the majority of science teachers indicated the optimization of time and space as a difficulty; on the other hand, they did not perceive a need related to guiding students' work. Most of the difficulties and training needs highlighted were not based on reflection on their own practice, which is evident when teachers report no difficulties in developing the teaching and learning process. In addition, some indications of difficulties imply an interest in carrying out training that is driven by the desire to do or learn something that is not essential to improving teaching practice. In order for the participants to reflect more deeply, they needed an approach that would enable them to critically analyze the record of their practice in class, which happened when they watched the footage.

Teachers' participation in the Thematicization of Pedagogical Practice showed that, by observing their classroom practice, they seemed to recognize the problems of real teaching contexts, as well as their training needs. After a critical analysis of a sequence of lessons recorded using the classroom monitoring protocol and filming, professional development and changes in teaching practice were considered. For better results, it might be necessary to carry out the training process uninterruptedly, as well as giving teachers more time to study and carry out a range of activities related to their continuing training. Inquiry teaching, based on the theoretical references of Sasseron (2018) and Carvalho (2013), is still very much in its infancy. The group discussion strengthened self-assessment and the planning of interventions to improve teaching and learning, which we can consider positive, since the teachers showed motivation to improve or change their teaching practice when they exchanged experiences with their peers.

The data collected through teachers' participation in the final questionnaire in which they evaluated the training they received showed that, after getting involved with the Thematicization of Pedagogical Practice, the professionals positively evaluated the training strategy adopted, highlighting learning more through collective analysis and discussion.

If the aim is to intensify continuing education through the thematization of pedagogical practice training strategy, it is essential to ask the school to evaluate its organization and teachers' working conditions, especially the availability of time to carry out studies and training and professional development activities.

The Thematicization of Pedagogical Practice brings together important conditions, pointed out in the literature, for teacher training to be effective: taking place in the teacher's own workplace, in this case the school; promoting reflection on one's own practice; and moments of collective exchange between teachers. The addition of moments for collective theoretical study and discussion among the teachers could overcome teachers' difficulties in terms of individual theoretical study.

Further research into the Thematicization of Pedagogical Practice, as a training strategy, investigating the experience of other schools, Area Coordinating Teachers and General Coordinating Teachers in Full-Time Education schools, or not, could contribute to a better understanding of its results and to the qualification of continuing teacher education.

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Editor in charge: Aline Andréia Nicolli

Translation by: Raquel Rossini

Journal financed by Associação Brasileira de Pesquisa em Educação em Ciências — ABRAPEC

Manifestation of Attention to Good Scientific Practices and Exemption from Interest and Responsibility

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