

Formative contexts in science teaching courses: mapping of theses from 2014 to 2022

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Abstract

Considering that the constitution of knowledge necessary for teacher education is directly related to the context of teacher education, this work that is now presented constitutes a current panorama of the context of initial teacher education in the scope of courses related to science teaching. Thus, the objective was to identify the different contexts of the initial teacher training courses in this teaching area, starting from the following question: which formative contexts constitute the initial training of teachers in science teaching courses? Regarding the methodology, we are facing a study with a qualitative approach of the narrative review type of the literature. The results observed are specifically related to the curriculum, supervised internships, initial training programs for teaching and context of insertion of the future professional.

Keywords: Teaching. Teacher training. Science teaching. Training context.

Contextos formativos nos cursos de ensino de ciências: mapeamento de teses de 2014 a 2022

Resumo

Considerando que a constituição de saberes necessários à formação docente relaciona-se diretamente ao contexto de formação dos professores, este trabalho constitui-se como um panorama atual do contexto de formação inicial de professores no âmbito dos cursos relacionados ao ensino de ciências. Assim, objetivou-se identificar os diferentes contextos dos cursos de formação docente inicial da referida área de ensino, partindo do seguinte questionamento: quais contextos formativos constituem a formação inicial de professores nos cursos de ensino de ciências? Em relação à metodologia, estamos diante de um estudo com abordagem qualitativa do tipo revisão narrativa da literatura. Os resultados observados estão relacionados especificamente ao currículo, ao estágio supervisionado, aos programas de formação inicial à docência e ao contexto de inserção do futuro profissional, às práticas pedagógicas dos docentes-formadores

que potencializam a interdisciplinariedade e aos conhecimentos epistemológicos que influenciam de modo indireto.

Palavras-chave: Ensino. Formação de professores. Ensino das ciências. Contexto formativo.

1 Introduction

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Teacher training in Brazil goes back centuries. Throughout this history, there has been a great deal of research that has focused on various issues relating to teacher training. Among these studies, the curriculum of degree courses has been the focus of discussion, raising questions about the profile of these future professionals.

In the field of teacher training, a curriculum structure is the basis of the training knowledge of these professionals. Important changes in current practices in relation to teacher training have taken place since Law 9.394 of 1996, which establishes the National Education Guidelines and Bases Law (LDBEN). Since then, teacher training policies have been added to improve the training scenario.

Documents such as the National Curriculum Guidelines (DCNs) for teacher training have emerged as a restructuring of educational change and conception, reformulating degree courses and internships. An excerpt from the resolution of the National Education Council (CNE/CP) of December 20, 2019 points to a change in the courses and establishes the "Initial Training at Higher Level of Teachers for Basic Education" (BNC-Formação) and has as reference the implementation of the National Common Core Curriculum for Basic Education (BNCC).

In these training contexts, it is important to highlight the constitution of the knowledge necessary for teacher training. According to Tardif (2014), there are three considerations about teacher training: the first is related to the professional training of individuals with the right to explain their own training, the second is linked to the specific knowledge of their training and the knowledge that comes from it, and lastly, training through disciplinary logics.

Therefore, the aim of this study is to identify the different contexts of initial teacher training courses in science teaching based on a narrative review of the literature. We

started with the following question: what formative contexts constitute initial teacher training in science education courses?

After an initial presentation, we describe the theme in question, "training contexts in initial teacher training", and then how we searched for the papers and, consequently, the results, discussion and final considerations..

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2. Initial teacher training and its formative contexts

Some studies present in their results the problematization of teaching practice in aspects related to problem situations and narratives of their contexts. According to the study by Monteiro (2021), the learning and knowledge narrated by future teachers makes it possible to observe the potential and singularities, forming a link between specific training contexts and other meanings of professional knowledge.

This is important because, according to Tardif (2014), the important evidence and phenomena in teaching knowledge are actually used in the workplace. This knowledge is classified by the author as 1) teacher knowledge, 2) social sources of acquisition and 3) ways of integrating it into teaching work.

Still in this perspective, a study by Silva and Rios (2018) sought to analyze the learning of teaching from the insertion of teachers in initial training in the daily school routine. In it, they observed through the Institutional Program for Teaching Initiation Scholarships (Pibid) that undergraduates' learning is built at school, in which practice becomes a mechanism for reflection in order to build the knowledge of being a teacher.

In this respect, it is also important to emphasize the importance of reflecting on practice during the training process, since praxis is fundamental in all moments of professional activity. Praxis is indispensable to the role of the educator, since it is in praxis that the subject sees him/herself and, through this, modifies his/her practice (MENEZES *et al*, 2022).

Other authors, such as Carvalho and Junior (2018, p. 421) corroborate this idea by stating the following:

Learning through observation is extremely important in teacher training, as it is a time to get to know how other professionals work, inserting the future teacher into the reality of the professional community of teachers. However, the training process should not be limited to just this type of learning, as the practice observed should be reflected on, reworked and instrumentalized, going beyond the specific situation that generated it. In this sense, there is a need to move beyond this context, promoting interventions that make it possible to develop reflective thinking and promote the development of teacher autonomy.

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Based on reflections on teacher training, it is possible to think of a professional with various types of "knowledge from their life history, society, the school institution, other educational authors, places of training, etc." (TARDIF, 2014, p. 64), constituting an active teacher in their professional and social trajectory.

In the study by Dattein, Gullich and Zanon (2017), through the reflective narratives of Science and Biology students, evidence was found of the constitutive actions of the research subjects and processes permeated by theoretical and practical, scientific and everyday knowledge, interwoven through writing in logbooks..

3. Methodology

In this study, we used a narrative review (CASARIN et al., 2020), which is characterized by a broad search for research, i.e. a state of knowledge. This method allows us to analyze several studies with different methods, providing a synthesis of their narratives. The research is qualitative and longitudinal.

For this work, we used the mapping of the productions of the Digital Library of Theses and Dissertations (BDTD) in the year 2022, in which the following search equation was used "Initial training" OR "teaching" AND "science teaching". We selected 233 theses and dissertations from the last eight years in which the terms appeared in the title or abstract. However, the dissertations were excluded and only the theses were selected, totaling seven in the end.

The reason for choosing the BDTD platform was that it is an official platform that brings together academic work from a variety of Brazilian universities, and therefore offers great research potential for the subject proposed in this study; the choice of only theses

was justified by the fact that this is the highest level of academic research resulting from an academic title in Brazil.

4. Results and Discussion

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Table 1 below shows the results of the theses on the authors, year of defense, titles and results found in the research of different Graduate Programs from 2014 to 2022.

Table 1- Summary of theses with Author, Year, Title and Results

Author/year	Title	Results
(LIMA, 2022)	Interdisciplinarity in the pedagogical practices of teacher-trainers in field education degree courses in the area of natural sciences	The partnership experienced in the course between its peers - teacher trainers, students and communities - enables the teacher trainers' pedagogical practices to be constantly reframed, based on the teachers' knowledge and, consequently, their professional identity.
(HIDALGO, 2019)	Epistemological orientations of science teachers in initial training: an analysis of conceptions of science, science teaching and their interrelationships	Teacher training courses must refocus their actions on the objectives that govern their main activity, that is, teaching, so that reflections on science and science teaching become more expressive from the earliest grades.
(SOUZA, 2018)	Relational dimensions of teaching provided to undergraduate chemistry students at UEL	Providing subjects that introduce the future teacher to the school context from the very first year, so that he/she gets to know his/her future profession better and can devote himself/herself to it during the course.
(RAMOS, 2018)	Pedagogical sequence for training science and biology teachers	They showed that undergraduates are insufficiently prepared in relation to the scientific content to be taught in the context of basic education, such as botany, and the knowledge required for teaching, as well as their simplistic conceptions of science and why to teach science, and the concepts and processes of teaching and learning.
(CARVALHO, 2018)	Professional development of future teachers: crossings that intersect in training contexts	Training contexts centered on the school have the potential to reshape practice based on the analysis of actions, in collaborative work, as well as providing an opportunity to become aware of conceptions, performance and the way of understanding the profession.

(SILVEIRA, 2017)	Analysis of the conceptual guidelines and training goals in the Institutional Program for Scholarships for Initiation into Teaching Science	Pibid Interdisciplinary in Sciences works on the five types of conceptual orientations that are challenges in the reality of the program, such as: the comparison with Compulsory Supervised Internships (ESO) and the lack of articulation with them; institutional and budgetary dependence on the program's funder; and the use of knowledge from practice by undergraduate courses.
(FRAIHA-MARTINS, 2014)	Meaning of science and math teaching in scientific-digital literacy processes	Formative aspects i) Teaching with research in class; ii) Integration of specific knowledge inherent to the early years; iii) Partnership(s) in teaching; iv) Recursiveness and feedback of communication in class. Along the same lines, I consider the existence of formative elements that indicate that they are driving forces behind the development of differentiated teaching proposals and ideas about teaching in the early years of schooling: These are: i) The methodological perspective of Inverted Symmetry; ii) The development of Meta-Teaching throughout training; iii) Systematic production of teaching plans.

Source: Own elaboration, May/2023.

Thus, the works presented by the research source highlighted the need for future teachers to have subjects in their training curriculum, from the first semesters onwards, aimed at immersion in the future working environment.

Initial teacher training is a vast field of possibilities. Lima's work (2022) aimed to understand how the pedagogical practices of teacher-trainers on the Nature Sciences Field Education Degree (LEdoC-CN) enhance the interdisciplinary perspective in initial teacher training. The results were that the teacher trainers developed interdisciplinary activities and actions that enhance the interdisciplinary perspective in initial teacher training, leading us to see that collective work and shared teaching enable dialogue, the exchange of knowledge and learning between teacher trainers with the possibility of materializing this training.

In Hidalgo's (2019) study, the attempt to understand the epistemological orientations about science and its teaching, and their re-significations among initial teacher

training courses in Biological Sciences, is evident, considering that by understanding these orientations, as well as their interrelationships, it is possible to shed light on possible developments in order to improve this course. The results found that the epistemological orientations that underpin the students' conceptions of science teaching and science influence each other indirectly, i.e. the re-signification of one conception does not necessarily attest to the re-signification of the other, although it can help in the process.

With a view to comprehensive teacher training, the work by Ramos (2018) identified that undergraduate students, specifically in science and biology, had insufficient preparation in relation to the scientific content to be taught in the context of basic education. This finding may have many factors related to performance in their training, i.e. the training context may be influential, as well as containing variables related to the success or failure of this individual.

Another result that should be highlighted is the fact that PIBID in science teaching courses complies with the program's guidelines, but lacks articulation with supervised internships. It was also found that the training contexts centered on the school provided democratic work and a broader way of understanding the profession (SILVEIRA, 2017).

Lastly, there are training elements that have been shown to drive the development of differentiated teaching proposals and ideas about teaching in the initial years of schooling: i) The methodological perspective of Inverted Symmetry; ii) The development of Meta-teaching throughout training; iii) Systematic production of teaching plans (FRAIHA-MARTINS, 2014).

In initial teacher training courses, the curricula generally leave the internship component at the middle or end of the course. Thus, we believe that this complexifies the practical training of the trainee, as many factors are associated with the professional's training context, such as the lack of integration in the pedagogical disciplines with the internship, a traditional trend in universities, where there is still a lack of effective monitoring and supervision by the teachers responsible for the internship disciplines (FRANÇA DE BARROS; BARROS, 2022; BREMM; SILVA; GÜLLICH, 2020).

In addition, the data resulting from this research also showed that science and biology undergraduates graduate without fully integrating scientific knowledge with practice. In this sense, Corrêa Pires and Malacarne (2018), in their study carried out with graduates from pedagogy courses who work with science teaching, identified that initial training contributes theoretical and practical-methodological knowledge to teacher training, but in terms of specific knowledge, it is still very superficial.

Teacher training requires greater breadth to meet the needs of professionals and the educational system. From this perspective, there is the Institutional Program for Teaching Initiation Scholarships (Pibid) and the Pedagogical Residency, which place students in the future work environment, enabling a new perception of being a teacher, seeking to form a teacher who acts in their field of work in a critical and reflective way (OLIVEIRA; OBARA, 2018).

Throughout the history of education in Brazil, studies focused on the history and philosophy of science have recognized the relevance of this subject, as it leads to critical and contextualized learning of scientific concepts. Thus, the study by Almeida et al. (2022) on science training courses (Chemistry, Physics and Biological Sciences) in initial teacher training showed that Chemistry and Physics courses have a compulsory subject throughout teacher training, while in the biological sciences, there is no compulsory History and Philosophy of Science subject in the curriculum.

The research by Rossi and Mello (2022) identified that active methodologies in science classes have shown important results in terms of concentration and the re-signification of content, making it a pleasurable and satisfying time to learn.

It is also important to highlight the reflections on initial teacher training in science teaching, since studies show that teachers present and reflect on their pedagogical practice even in initial training, which can contribute to overcoming their limiting situations (FREIRE; NASCIMENTO, 2021). The teacher training in science courses presented by some teachers suggested a reformulation of the courses and continuing training in relation to work activities and those focused on experiments in the field (GRAFFUNDER; CAMILLO,

2021). These changes are ways of valuing future professionals, individuals who, above all, are agents of transformation in society.

These social transformations can be in various contexts such as political, economic, cultural and others. Thus, the study by Thiengo et al. (2022) sought to identify the contributions of Freire's legacy in initial teacher training courses in science, noting that there is an importance of the author's works in initial teacher training, however, there are methodological gaps in the central approach of Freire's studies.

In this context of initial teacher training, some difficulties and anxieties were pointed out in the text by Hentges and Moraes (2019), that in the curriculum of teacher training courses in the distance modality, a technicist rationalization was found in the training process, which can influence the teacher identity focused on the technical, failing, perhaps, to understand the cultural diversity in which the teacher lives and interacts.

Another scenario that can be presented is the new role of science teachers in curricular and pedagogical organization, especially with regard to the National Common Curriculum Base (BNCC) and high school reforms. From this perspective, Branco and Zanatta (2021) point to the problem of the secondary nature of the content and the role of the teacher, implying an emptying and precariousness of teaching.

Following these essays on identifying the training contexts in initial teacher training courses in Science, we listed variables such as: curriculum, supervised internships, initial teacher training programs. The pedagogical practices of teacher trainers enhance the interdisciplinary perspective and epistemological knowledge influences it indirectly, i.e. the re-signification of one concept does not necessarily attest to the re-signification of the other, although it can help in the process. Below are the considerations on the work carried out.

5. Final considerations

This study sought to identify the training contexts in science teaching courses in initial teacher training by identifying some of these contexts (curriculum, supervised internships, initial teacher training programs, etc.). The pedagogical practices of teacher-

trainers enhance the interdisciplinary perspective and epistemological knowledge influences it indirectly, i.e. the re-signification of one conception does not necessarily attest to the re-signification of the other, although it can help in the process). In view of this, it is important to highlight the contributions in the educational sphere and, specifically, in teacher training, enabling collaboration strategies for teacher training courses.

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Therefore, motivation is important in the teaching and learning process in the various training contexts in order to make the future teacher emancipated through the aspects presented in their initial training. It should be emphasized that it is important to experience the knowledge necessary for their training, which will be essential in their teaching practice.

The points made can contribute to a reflection on teacher training, in which the spaces and contexts of the science teaching courses they are being trained in can have a vision aimed at understanding these phenomena. The results found are specifically related to the curriculum, supervised internships, initial teacher training programs and the context in which future professionals are placed.

As a research gap on this subject, we would point out that the work needs to be expanded both in terms of databases and repositories, thus presenting a wider range of discussion and data sources. In this way, the effect of possible phenomena linked to the initial training of science teachers can be pointed out and discussed in academic circles in greater depth.

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