

**Teacher Formation and the Knowledge (Re)constructed
from the Narratives of Science and Mathematics Teachers
in Continuing Education**

**A Constituição Docente e os Saberes (Re)construídos a
partir de Narrativas de Professores de Ciências e
Matemática em Formação Continuada**

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ABSTRACT

In this paper, we defend the production of narratives in the context of continuing education as a training tool that enables a reflection about/for/within the pedagogical practice. We aim to identify the teaching knowledge expressed in the narratives in the form of descriptive records and interviews with Science and Mathematics teachers in continuing education who are part of a formative collective, as well as to understand the contributions of the narratives to the formative process of the teacher. To this end, we carried out the Content Analysis of 20 narratives produced by the teachers participating in the training. For the analysis, we established two *a priori* categories: 1) Continuing Teacher Education: an important element for the teacher education; and 2) Reflections on the teaching practice and the (re)constructed knowledge manifested in the narratives. We evidenced that Continuing Education enabled reflective writing, through which teachers attributed meaning to what was experienced, constituting critical and reflective knowledge, also making it possible to (re)build knowledge in a teacher education movement.

KEYWORDS: Teacher education. Records and interviews. Reflective writing.

RESUMO

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Neste artigo defendemos a produção de narrativas no âmbito da formação continuada como instrumento formativo que possibilita a reflexão sobre a/para a/na prática pedagógica. Objetivamos identificar os saberes docentes expressos nas narrativas na forma de memoriais descritivos e entrevistas de professores de Ciências e Matemática em formação continuada pertencentes a um coletivo formativo, bem como compreender as contribuições das narrativas para a constituição docente. Para tal, realizamos a Análise de Conteúdo de 20 narrativas produzidas pelos professores participantes da formação. Na análise estabelecemos duas categorias *a priori*: 1) Formação Continuada de Professores: Elemento importante para a constituição docente; e 2) As reflexões sobre a prática docente e os saberes (re)construídos e manifestos nas narrativas. Evidenciamos que a Formação Continuada possibilitou a escrita reflexiva por meio da qual os professores atribuíram significado ao que foi vivenciado, constituindo saberes críticos e reflexivos, possibilitando, também, (re)construírem os saberes num movimento de aprendizagem docente.

PALAVRAS-CHAVE: Formação docente. Memoriais e entrevistas. Escrita reflexiva.

Introduction

Currently, continuing education for teachers has been the center of debates in roundtables, research, and events in which researchers discuss about Teaching/Education in Higher Education Institutions (HEI). Much has been debated on how teacher formation occurs, which has been an object of intense investigation. Thus, in the current scenario, we are faced with a greater focus on how the teacher formation process occurs in continuing education. We believe it is important to think about these formative processes and their possible repercussions on the teaching practice.

In line with the presented perspective, in this paper, we analyze the narratives of Science and Mathematics teachers in continuing education to understand the teacher formation process. We emphasize the importance of narratives as a tool to promote reflections within and about the teaching practice and that this process, when carried out collectively, allows for the sharing of experiences and changes in teaching practices.

We argue that teacher formation occurs through initial and continuing education and through the experiences in the pedagogical process that take place at school, by sharing episodes with their peers, in the day-to-day experiences or other experiences related to them. In the educational context, it is possible to reconstruct knowledge by sharing experiences among teachers and also in the educational processes in which they participate, since, according to Imbernón (2011), the training that has teachers as its subjects and not as objects allows rethinking and reorganizing the teaching of knowledge objects. In referring to continuing education, we argue that it favors the personal and professional development of teachers, which happens throughout their life and makes it possible to think about the teacher formation process through the reflective teacher formation, based on the assumption

that it is about the/for the/in pedagogical action that the teacher is formed, as proposed by Alarcão (2011).

According to Alarcão (2011, p. 44), "[...] the notion of a reflective teacher is based on the awareness of the capacity for thought and reflection that characterizes the human being as creative being and not as a mere reproducer of ideas and practices that are extrinsic to him." From this conception, we highlight the importance of educational trends, specifically those that use narrative records focusing on the formation of reflective teachers and the (re)signification of their professional practice.

We may noticed, since the "Formative Cycles in Science and Mathematics Teaching", the context in which this research is carried out, that in the continuing education of teachers, narratives or other forms of writing are used to enhance their formation. In this sense, we have shown that the narratives, produced from the formative context of the extension program in which the teachers participate, make it possible to (re)think, (re)configure and (re)signify their performance in the classroom and, moreover, understand the teacher formation process and the reflections about the problems related to the profession.

According to Reis (2008, p. 4), "[...] the contexts of initial and continuing education offer possibilities for the personal and professional development of teachers." We know about the importance of the articulation between initial and continuing education allied to professional practice, in addition to this formation, for their lives and professional practice.

We consider narratives to be both the phenomenon/object under investigation and the object of research, since we reflect on the context experienced by the subjects involved in the research process in order to understand the knowledge originating from the pedagogical practice and to understand the personal and professional trajectory of each teacher. We have reflected on how the formation process of the Science and Mathematics teachers occurs and what measures should be taken to transform the educational scenario in which they work, taking into account the narratives as a means to understand the formation process and the professional development of the teachers and their development throughout their continuing education journey. Thus, we point out the aim of this study, which is to identify the teaching knowledge expressed in the narratives in the form of descriptive reports and interviews with teachers in continuing education who are part of a formative collective, as well as to understand the contributions of the narratives to the teaching constitution.

Based on the above, we based this study on the following research questions: What teaching knowledge is expressed in the narratives in the form of interviews and written reports by the Science and Mathematics teachers? What are the implications of the narratives for the teaching constitution?

To that end, this paper provides an understanding of the narratives involved in the teacher formation process. Then, we describe the methodological aspects and present the results and discussions. Finally, we will make considerations about the study carried out.

An understanding of the narratives in the teacher formation

In this section we seek to understand how narratives enable the personal and professional development of teachers, as well as whether they allow a (re)signification of their performance in the classroom. In this sense, we present different designations and understandings of narrative, narrative research and narratives in journal writing based on the following authors: Reis (2008), Clandinin and Connelly (2015), Nóvoa (2007), Porlán and Martín (1997), Alarcão (2011) and Zabalza (1994). Next, we present some authors who discuss teacher education through narratives, such as Nóvoa (1995) and Cunha (1997). We also present some theoretical assumptions proposed by Tardif (2003), in view of our problematization of the teaching knowledge in the data analysis.

The writing of narratives happens as a process and gradually through reflections based on the context in which the teacher is inserted. Through narratives, it is possible to relate the stories and experiences lived, which can be either orally or in written, since we describe, narrate, and reconstruct. Teachers may have difficulties with writing, but if this habit starts in their initial education, it can endure throughout their professional lives. When they are asked to record reflections about their experiences on a blank sheet of paper, they usually ask themselves: What should we write about? Then, initial questions should be proposed, such as: What happened? How? Where? Why? What did I felt/feel happened? When did it happen? (ALARCÃO, 2011).

The writing, which is initially only descriptive, becomes reflective in the course of the process (PORLÁN; MARTÍN, 1997). In this movement, the production of narratives makes it possible to (re)think the classroom practice and, from the reflections made, serve as a transforming agent, because it makes it possible to list decisions to circumvent emerging problems in the educational context.

Narratives, when reflective, allow us to improve the experienced context and bring about transformations in the subject and in his or her practice. They can record not only the facts, but also the physical, social, and emotional context of what was experienced. The production of narratives, as highlighted by Reis (2008, p. 4), provides a space for personal and professional development, because, in this movement, aspects such as "[...] a) questioning their competencies and actions; b) becoming aware of what they know and what they need to learn; c) the desire for change; and d) establishing commitments and setting goals to achieve" are triggered. Also, this type of research "[...] allows for a better understanding of the teachers' knowledge through the analysis of their own words" (p. 6).

The process of thinking about one's own practice is not easy or simple; it happens in a progressive fashion and demands a certain amount of time to retrieve experiences and the willingness to (re)signify the practice. For Connelly and Clandinin (2015, p. 12), "[...] the teacher, when narrating his experiences to others in a reflective manner, learns and teaches", and this is evidenced during the sharing with professional colleagues, since, when narrating, the teacher creates new views and meanings from what was lived and experienced, and also learns and teaches in view of the narratives.

Considering what Clandinin and Connelly (2015) propose, narrative research is a way to understand experience, since they adopt the criteria presented by Dewey (1961) of continuity and interaction. Hence, the two criteria are inseparable, since experience is not only continuous but also interactive, and thus narratives gain prominence in the educational field as a phenomenon to be investigated as a method used in research. In this movement, based on the assumption that we are storytellers by nature, we are encouraged to look at our own history. Therefore, the teacher narrates his or her experience by developing the skill of becoming aware of his or her practice; thus, there is "[...] a tendency that texts and research should be written mostly as if there was no researcher, a person, an 'I' in the process" (CLANDININ; CONNELLY, 2015, p. 167).

The writing of narratives enhances the teacher education based on the experiences expressed in their accounts and on the reflective practice of what is experienced in everyday life at school. By recalling their memories and stories, we believe that the teachers reflect about/for/within their practice, enabling their knowledge to be re-elaborated and their professional identity to be reconstructed. Considering narrative as an important training tool, Cunha (1997, p. 3) emphasizes:

The narrative causes changes in the way people understand themselves and others. By taking some distance from the moment of its production, it is possible, when "listening" to oneself or "reading" one's writing, that the narrator will even be able to theorize about his own experience. This can be a profoundly emancipatory process in which the subject learns to produce his own formation, self-determining his trajectory. This possibility, of course, requires some conditions. It is necessary that the subject is willing to critically analyze himself, to separate biased affective views present on the journey, to question beliefs and prejudices, in short, to de-construct his historical process in order to better understand it.

Another form of narrative writing in the formative context, which favors reflections focused on the practice experienced, is called journal (class record book/logbook). The reflective writing in the journals triggers a critical and reflective look, contributing to the teacher education. Porlán and Martín (1997, p. 47) state that "[...] the function of the Journal as an instrument is to transform the new conceptions into a new intervention program, into a new consciously directed and evolved practice." Thus, through writing it is possible for teachers to record their stories and experiences, to select and organize them so that they are not lost in time, as well as to record the experiences that shaped their journeys, the advances, and the possibilities for evolution in the teaching practice.

In this sense, Zabalza (1994, p. 30) points out that "[...] in the narrative that the journal offers, teachers reconstruct their actions, they simultaneously expose (sometimes more clearly than others) what their actions are and what is the reason and the meaning they attribute to such actions." The development of these narratives in journals shapes the teacher subject through the writing in the class record book and through a gradual process of reflection. This can be understood as a teacher training tool when the actions of the teacher are investigated through a critical reflection of the developed practice; but it is worth mentioning that this is not always linked to an investigation. Finally, narratives make it possible to examine the practice, and allow a reflection within and about the practice (ALARCÃO, 2011; GÜLLICH, 2013).

Alarcão (2011, p. 58) asserts that it is important that the faculty members "[...] share their narratives, tell their stories, open them to reconstruction, deconstruction and signification, offer them to other colleagues who, as critical friends, listen to them or read them, question them or elaborate on them." This reflective movement allows the redefinition of teaching practices in a collective process based on the sharing of experiences with professional colleagues. Based on this, it is possible to list the aspects that should be improved and reviewed in their teaching performance. The

teacher is a social being at school, which is why it is important to develop the work in a collective and collaborative manner.

In the research process we aimed to allow the participating actors to have their say, taking into account the journey of the teachers and their analysis through the stories they experienced, considering the training context for Science and Mathematics teachers, since the narrative is configured in different voices and multiple subjects, constituting different meanings according to the narrative produced.

According to Nóvoa (1995), research on continuing teacher education has been highlighted for analyzing questions about the pedagogical practice. In this context of teacher education, which grants voice to the teachers, we consider narratives as tools for self-training based on the history of teachers and their personal and professional experiences, placing teachers back at the center of educational debates.

Also, in order to discuss the continuing education of teachers, we consider the teacher as the promoter of knowledge that comes from his/her practices and, in this movement, we seek to understand how teachers are constituted by giving them voice through the analysis of their journeys, life stories, etc. In this sense, Nóvoa (1995) points out that this new perspective of pedagogical research opposes previous studies that reduce the teaching profession to a set of skills and techniques, generating an identity crisis for teachers and imposing a separation between the professional self and the personal self. In the words of Nóvoa (2007), each teacher has a way of teaching that is directly related to the person he or she is during the teaching practice. The way we choose to teach as a professional reflects how we are. In this sense, the personal self is indissociable from the professional self, that is, "[...] the teacher is the person; and a part of the person is the teacher" (NÓVOA, 1995, p. 15).

We believe that knowledge is plural and comes from several sources: from educational institutions, from the teacher's professional training, from the curricula, and from pedagogical practice. According to Tardif (2003), knowledge is undervalued, because teachers are social beings and their knowledge is social; therefore, they have a function in society; however, although they have a fundamental position in relation to social knowledge, teachers are undervalued in relation to the knowledge they have and that they transmit. The dimension of the teaching profession confers the status that articulates the different social types of

knowledge, which are transformed into school knowledge by means of disciplinary and curricular knowledge, and experiential knowledge, which is the foundation of practice and professional competence, according to Tardif (2003). Supported by what Tardif (2003) sustains in relation to the teaching knowledge coming from the work of teachers in relation to their peers, and taking into account the relationship established in the work environment, we sought to present the knowledge that is mobilized in the teaching profession, and what is its role and function.

According to Tardif (2003), disciplinary knowledge is knowledge offered by universities; it comes from various fields of knowledge that are available to society as a whole. Curricular knowledge comes from the teaching career, when they learn, for example, how to develop a teaching plan, which is composed of objectives, content, and methods that they must learn and apply. Finally, experiential knowledge is developed in the practice of their profession, based on their daily work and knowledge of their environment.

The author points out that initial and continuing education barely affect our formative structures, and that the knowledge that comes from experience is more recurrent when constituting the practice. For this reason, it is important that we invest in positive attitudes. Knowledge is plural, coming from professional training and disciplinary, curricular, and experiential knowledge. Teachers appropriate this knowledge throughout their teaching careers and through reflections on their educational practice; it can also come from training promoted by Higher Education institutions that favor thinking and conceiving education.

We argue that the narratives, when socialized by the teacher in the teaching collective, have a formative potential due to the knowledge produced, which comes from the experiences, life stories, and the journeys taken, and that this knowledge constitutes the identity of the teacher throughout gradual and continuous training. Thus, the next section addresses the methodological aspects to develop and analyze the research on the narratives coming from a collective of teachers in training.

Methodological Aspects

This research adopts a qualitative approach, with characteristics of a narrative research. As data, we used the narratives that present indications of the constitutive teaching process. The data were collected through 6 narrative interviews and 14 training records written by 20 teachers, respectively from the Science and Mathematics areas, from different regions of the Northwest of the State of Rio Grande do Sul, who participate in a continuing education program called *Ciclos*

Formativos em Ensino de Ciências e Matemática (Formative Cycles in Science and Mathematics Teaching) at Universidade Federal da Fronteira Sul – Cerro Largo Campus. These trainings take place monthly at the university at different times for Science and Mathematics teachers. In these meetings, teachers have the opportunity to reflect on their school, academic, and professional journeys based on formative dialogues and the production of narratives of experiences in continuing education and in the specific context of the work of the teacher.

From this perspective, the teachers participating in the Mathematics group produced, at the request of the instructors, a descriptive report in which they should write about their work, what guides their teaching action in the classroom and positive and negative aspects of the teaching work, as well as about the training meetings and the reasons why they keep participating in them. In addition, the teachers were asked to write how the discussions and studies carried out in the training meetings have been part of their teaching activities. In the narrative interviews, the Science teachers were invited to engage in a dialogue about aspects of their training, occupation, and professional performance.

We used the Content Analysis (CA) as a procedure to analyze the narratives, which is a method of text analysis widely used in qualitative research. The CA consists of three steps: pre-analysis, exploration of the material and treatment of results and interpretation, as recommended by Bardin (1979). In the pre-analysis stage, the reports and interviews produced by the Science and Mathematics teachers were read, in order to highlight the excerpts corresponding to the teaching knowledge, which is the focus of this study. When exploring the material, we grouped the record units into two categories established *a priori* that are similar for categorization. Then, we evaluated the initial set of categories, aiming to identify whether they reflect the purpose of the research and, finally, in each one of the categories we processed the information from the narratives and the discussions with the theorists that support the work.

In the narrative excerpts, we identify the teachers such as T1 (Teacher 1), T2 (Teacher 2), up to T20 (Teacher 20), in order to meet the ethical principles, keeping their identity confidential and anonymous. We emphasize that the data were constituted by narrative interviews – T1 to T6 – and training records – T7 to T20.

Results and Discussion

The narrative writings, expressed in the records and in the narrative interviews in this paper, are assumed as formative strategies, because, when linked to the facts

narrated by the teachers, they strengthen relationships arising from the knowledge mobilized and the experiences lived in the classroom. This movement promotes them as (self)formative, and also as reflective professionals, researchers of their own practice and capable of carrying out transformations in their pedagogical practice.

The analytical movement was based on two categories established *a priori*: 1) Continuing Education for Teachers: an important element for the formation of teachers; and 2) reflections on the teaching practice and the knowledge (re)built and manifested in the narratives. Thus, in the analytical process, we tried to dialogue with the references that deal with continuing teacher education, narratives, and teaching knowledge, articulating them with the excerpts presented in the two categories.

Continuing Education for Teachers: An important element for the formation of teachers

In this category, we present the results and discuss the excerpts that deal with the interaction between undergraduates, university teachers, and teachers of Basic Education in the context of continuing education, to (re)think about aspects of the practice and the teaching formation of the research participants that are involved in the formative process. In the narrative of T1, it is evident that

Continuing education only expanded it more, it made me see that my classroom, my class was not only about transmitting knowledge. Even before continuing education, I had this idea of transmitting knowledge. After this training and the reflections, the texts and everything else I had this other view. I need to work more, expand more, I have to build on my knowledge, not transmit it (T1)⁴.

We noticed the concern about the changes that have been occurring in education and about the most important and relevant aspects to be a good teacher. It was possible to see that the teacher (re)signified the notion in relation to the (re)construction of historical-socially constructed knowledge, assigning to herself the role of building more knowledge involved in the teaching and learning processes.

According to Nóvoa (2002, p. 38-39), "[...] to be in a formative process implies a personal investment, a light and creative work on one's own paths and projects, with a view to building an identity, which is also a professional identity", as we can observe in the excerpt from T1.

P2 reports: "[...] I always look forward to the meetings. For me, the training meetings, my goodness gracious, I always think about exchanging notes, exchanging experiences." We understand that this exchange of experiences is enriching, because it allows teachers to go back in time to rethink their practice, (re)configuring

their work, mirroring what worked and what can be improved in the development of their classes and also in the dialog with their peers, seeking to establish new ways to teach.

The excerpts from teachers T2, T3, T4, T7, T11, T12, and T19 show the importance of continuing education and the triad that articulates the schoolteacher, the teacher trainer, and the university, as well as the undergraduate students, as exemplified by T3:

A moment to discuss and find a common denominator, discuss, compare the thoughts of the trainers, the thoughts of the schoolteachers, their insertion at the school, what the school context is like, because very often the undergraduate student doesn't know what happens at school without this exchange, this conversation with the schoolteacher (T3).

In this sense, the immersion of undergraduate students in initial training allows for dialogue with school and university teachers who participate in continuing education, which is necessary for them to get to know the school reality experienced in order to understand the school routine. The exchange of ideas between the professionals who are in the process of continuing education make it possible to expose in the dialogue the anxieties, the concerns, the difficulties, and other aspects surrounding the educational reality, with the assumption that this exchange will also reflect on the professional who is in the process of initial training.

According to Zanon (2003, p. 268), the

triad contributes to the professional development in the context of the undergraduate degree, insofar as it questions the students and also the educator for an attitude of questioning in face of the complexity of the teaching practice, of education, knowledge, learning, training, practices, the relationship between theory and practice, in its relations, also, with the knowledge of the professional practice.

Other formative records are not as significant, such as the statement from T4, who reports that she participated in meetings promoted by the institution to which she belongs, however, in her words, the trainings were "[...] *very empty*" (T4). This explains that there was no connection with the reality experienced. According to Diniz-Pereira (2011, p. 213), it is "[...] important to understand the professional practice as a place of training and production of knowledge and to establish a connection between university training institutions and basic education schools." In this sense, the "Formative Cycles in Science and Mathematics Teaching" contribute to the performance of the teacher in the classroom, and she also emphasizes the interaction already mentioned with the university in the triad format, as we can see in the following excerpt: "[...] *I think it is a very good training, this interaction with the*

university, with the teachers, then the teachers from outside come, we exchange ideas, we talk about frustrations, what is working, for me it is a training model that is working very well" (T4).

Thus, we understand that the writing of the narratives leads to discussions that refer to thinking and producing critical knowledge in the process of Continuing Education of Science and Mathematics teachers and constitutes a formative tool, since it leverages epistemological reflections for personal and professional development which reflects on the teaching constitution, as argued by T6 in relation to the formative process: *[...]It helps us to recall a lot of what we know or don't know, to think again, anyway, it is always important to think about training, about how we should teach.*

Currently, we experience in the classroom students with different profiles and who are inserted in a technological world, and, in this sense, we believe that the continuing education contexts must provide a formative space that allows us to reflect and qualify the pedagogical practice, that allows us to create projects linking school and community, and that the teacher can give meaning to his or her pedagogical intervention, which can favor teaching, awaken the student's interest, and bring him or her closer to the context in which he or she is inserted. According to Tardif (2003, p. 37), "[...] the teaching practice is not only an object of knowledge of the educational sciences, it is also an activity that mobilizes several types of knowledge that can be called pedagogical knowledge" and that lead the teaching practice, and one way to draw students' attention to learning is to provide teaching in an interdisciplinary way, allowing a more qualified learning of the concepts explored by the teacher. In line with this perspective, T9, in her narrative, contemplates the importance of being in constant training during her teaching career, and points out that the training meetings were based on *"[...] practical situations, from everyday life that could be interesting to students and we went deeper into them; there were many debates, hypotheses, but the coolest thing is that I concluded how important it is to work with Mathematical Modeling"* (T9). We assume that the assumptions of Mathematical Modeling come from the teacher training; thus, it constitutes an important disciplinary knowledge to be inserted in the contexts of teaching and training.

The narrative record enabled the teachers in continuing education to go back in time and trigger feelings of students in training in search of new learning, thirsty for

reading, writing, and new knowledge to qualify their practice in the classroom. For her,

the teacher is the one who is always looking for something to learn and add to his professional life. [...] the Journal and the Mathematical Modeling was what made me think and feel like a student again, because I had to read about the issues, research, study and exchange ideas and opinions with a colleague from my class and my school, not to mention that to make the Journal and the report for the book I had to write a lot, which, for me, was the most difficult part. I think that we teachers of exact sciences do not practice writing much, which makes it a little difficult (T10).

We realized the need to understand that the continuing education of Science and Mathematics teachers, when articulated to the professionalization process, favors a formative cycle that allows sharing experiences coming from the classroom and (re)configure the teachers' perspective in relation to the academic-professional training. This formative movement corroborates what Tardif (2003, p. 12) argues, that all "[...] teacher knowledge is a social knowledge. The statement from T10 also provides reflections about reading and writing, as a process that requires more attention from teachers of different areas of knowledge.

In the reports of teachers T11, T12, T14, and T19, it is explicit that Continuing Education allowed the search for new knowledge and enhanced the personal and professional development of the teachers participating in the research, as stated by T11.

Whenever possible I took courses to improve my professional and personal training, updating and improving my work. I started the course realizing that it was an opportunity to update myself and find new ideas for my teaching practice. Many times, we didn't have the opportunity to gather our area to discuss our practice, and this course allowed us this possibility (T11).

We can highlight that the “Formative Cycles in Science and Mathematics Teaching” allow studies, reflections, and writings based on the situations experienced; they are starting points that allow records that constitute learning through the narrated experience. This becomes clear during continuing education, when teachers are always searching for the new in the classroom and writing helps them to place themselves in a reflective way about the teacher they want to become.

In this sense, T11 clarifies the importance of Continuing Education as a potential for his personal growth and professional development, as well as the sharing of knowledge and experiences that the “Formative Cycles in Science and Mathematics Teaching” allow him through the interaction with other professionals in

the area and by triggering reflections that may favor transformations in his pedagogical practice.

Teachers T10, T11, T16, and T19 point out that they have always participated in Continuing Education courses. T10 says: *"I have always taken courses as a form of professional and personal development."* T16 points out: *"I have participated in many workshops, courses, seminars, and trainings in the field of education."* In addition, T15 writes: *"[...] we go through several difficulties and, so to speak, several stages, but always seeking to improve ourselves and bring innovations to the classroom. I have always participated in congresses, seminars and training courses."* Finally, in this same perspective, T19 narrates: *"I am always trying to improve in my profession; I have taken many courses in my area [...]. I really enjoy participating in our meetings, because I learn new things, and also the exchange of experiences with other colleagues is very rewarding and adds to our daily work."*

These excerpts show the importance given to Continuing Education by several participants, and the search for updates and teaching alternatives that are provided by formative opportunities and spaces that empower the teacher, allowing him/her to bring differentiated practices to the classroom context and, in this way, qualify the teaching and learning processes.

Reflections on the teaching practice and the (re)constructed knowledge manifested in the narratives

The knowledge of teachers is constituted throughout the teaching profession. In this movement of writing narratives, the knowledge is (re)constructed in the interaction of the actors involved in the formative process, when they share their experiences and reflect on what is experienced in the classroom; also when teachers assume the posture of narrating a pedagogical experience, since the narrated stories allow the subject to go back in time and have different looks.

T1, in turn, reports: *"[...] I would do the logbook, I would usually record things like... the things that distressed me, the things that didn't work out, what happened in the classroom. So I had that, I always did that, and, I felt the need to do it."* From the account it is possible to understand that T1 presents her experiences and feelings related to her teaching practice by expressing in her narrative facts that happen in the daily routine of the classroom. In this way, her narration can be understood as a reflection method.

Regarding the journal writing process, T2 describes the difficulties regarding reflective writing, as she presents it in her narrative: *"[...] in the beginning I care about*

the logbook; the professors at the university would insist; I did it, but I did it because I had to do it, because I had to hand it in." T3 states that, initially, she reported the activities in a descriptive manner, but did not reflect on the practice developed:

What is the purpose of this? How can this also contribute to my training and to my action and my performance in the classroom? So the logbook for me is something that also makes us think, it makes us write and think about what we are doing, because, oftentimes, in the daily life of the teachers, they turn on the autopilot and go, and do not reflect on what they are doing, on their actions, on their performance itself (T3).

After realizing the potential of journal writing and how essential this tool is to reflect on/within the practice in order to (re)configure and (re)think about her pedagogical action, it became clear, for T3, the importance of reflecting on what she records through her writing.

T4 highlights the merit of writing and the act of writing to be able to reflect more, but reports that she finds it difficult to write about her practice because, during her initial training, she did not experience this movement. In that sense, T5 point out that *"[...] it is important to sit down and write; I see this, I realize this, it makes me grow; sometimes we can't do it, and sometimes we are there and putting on paper, writing what we did is a much bigger challenge than being there at school and doing it"*. Thus, we realize that the lack of a writing habit creates difficulties in reporting the practices experienced in a reflective way. In this sense, T5 also points out the following: *"For me it is difficult to write; although I reflect, it is always in my head, I think a lot about it, writing, it materializes that and sometimes it hurts, sometimes it hurts to write that."*

Narratives have been highlighted as important in formative spaces that enhance reflective writing. For Reis (2008), the narrative is used in contexts of investigation of the teaching practice itself. Güllich (2013, p. 30) reiterates that narratives are an important element of training:

the role of narratives in training is especially striking, because it causes the habit of writing to be developed from the beginning of the training, as well as the research on the practice itself shapes the profile of the teacher in training. Over time, the process tends to make writing become part of their formation/constitution, assuming the desired form: research in the teaching action.

In this perspective, when writing, teachers are (self)training themselves, because when reflecting on the narratives of their life stories and experiences arising from the paths taken in teaching, they assume themselves as reflective teachers. In this scenario, by sharing their experiences and classroom experiences, they

understand their practice, resignifying it, which is formative and a means of teacher formation.

In the following excerpt, T5 describes her teaching practice and how the content is conducted in the classroom context.

It's important that they understand the concept, so I don't worry about the time, so I have... this is what sometimes ends up frustrating me because I don't get much out of it, because... [...] it's in the schedule, that's it, and then there is this issue, so I think, I take the general theme of this subject, of this block, and I try to break down the concepts and then try to get to the best way for them to understand it (T5).

This teacher is very concerned with the curricular knowledge and the specific knowledge pointed out by Tardif (2003). We can see in her writing that to develop the content, she does not limit herself to the time used, but seeks to work in a way that students attribute meaning to what is being addressed. In relation to curricular knowledge, the teacher seeks to achieve the objectives expressed in the teaching plan, explaining in detail the concepts so that students can effectively understand what is being addressed. This curricular knowledge is evidenced when the teacher searches for the best way to meet the teaching plan, which is composed of objectives, content, and methods to be developed.

We observed that the organization of the teacher is a distinguishing feature, since she works with central themes and approaches the concepts in a detailed manner. This movement enhances teaching without neglecting the applicability of the objects of knowledge, by developing activities that enable students to better understand the concepts she explores. Tardif (2003) highlights the knowledge of teachers as fundamental in the configuration of their professional identity. Each piece of knowledge is the result of a teacher's professional life history, which is reflected in his or her teaching action. Teachers reinvent themselves, making use of their disciplinary, curricular, and experiential knowledge, mobilizing and transforming it in different situations. Thus, there are questions about the nature of this knowledge and how teachers mobilize it in the act of teaching and in their pedagogical action.

When dealing with aspects considered important to be a Science teacher, in the statement from T6, it is possible to evidence in her practice the valorization of curricular/disciplinary knowledge and experience, since she reports to be necessary:

Scientific knowledge, you have to know more and more, more reading, the historical part of the contents, you have to prepare yourself more and more, when you have a longer journey you improve every year, you can always seek something more, so scientific knowledge and also pedagogical knowledge, try to innovate;

whether we like it or not we are very traditional, so it is important to seek alternatives, to use ICTs; I think it helps a lot to make models, experiments (T6).

From the excerpt it is clear that T6 is committed to the diversity of knowledge. For the teacher, it is important to look for differentiated didactic strategies to engage students. She points to the use of experiments in the classroom as a way to attract the attention of students to the concepts being explored. In this sense, the disciplinary knowledge coming from the university and her training is explicit, since the formative process experienced enhances these reflections and, from there, the transformation of this knowledge takes place. We also observed the knowledge from experience, because as time goes by in the teacher's journey, she strengthens her teaching practice.

We also call attention to the pedagogical knowledge arising from reflections on the educational practice, when the teacher says that the participation in the “Formative Cycles in Science and Mathematics Teachings” makes *“[...]the teachers investigate their practice, which is very interesting; to be inside the current concepts, to exceed and accept what the teachers know and try to make them change; finally, their conceptions, to reflect; so it is very interesting”* (T6). We understand that the participation in the collective training allowed T6 to investigate her own practice, changing her conceptions, as well as favoring reflection on it.

Under this same perspective, T7 explains that:

If the teacher shows knowledge and passion for what he or she does, this helps the work in the classroom a lot, and inspires a large part of the students. Our training meetings, [...] help us realize and see new horizons, trying to get out of the ordinary and work in a different way, and thus try to show the student that mathematics is not so complicated and that it is important and necessary in our daily activities (T7).

The passage presented deals with an experiential knowledge, when it makes evident the mastery of the knowledge of the subject taught and the taste for the chosen profession, mirroring the students in the continuity of their studies. We highlight that the training enables the transformation of the pedagogical knowledge, when the teacher reports that the search for new knowledge is necessary so that there are changes in her classroom practice, as well as considering the context of the school where she works and, finally, the disciplinary knowledge, when we highlight the combination of knowledge that make up the teaching practice.

We emphasize, in the analysis of the narratives, that the knowledge built by teachers is plural and manifests itself as a "combination" of knowledge coming from

continuing education and practice (TARDIF; LESSARD; LAHAYE, 1991; TARDIF, 2003). When writing about some lived experience, the teacher reorganizes, relives, and reflects on the experience, which makes the writing of narratives an instrument of (self)formation. In this sense, T8 reports:

I chose to be a teacher, and as a teacher I believe, like Socrates, that "I know that I know nothing", I am not ready and finished, fortunately I am in constant transformation, development, and I need to constantly update and recycle myself, which is only possible through study, lots of study. Studying requires dedication, time, which is often difficult given the current situation of the teaching professional at school, but it is necessary to seek it. When we discuss different issues in our training, we can exchange experiences, and the testimony of a colleague's practice often serves as an idea, a light for the realization of another activity within the particular reality of each participating teacher (T8).

In addition to the training meetings, this teacher seeks to deepen her knowledge in other moments, which allows her precious time for study and exchange of experiences. From the perspective of T8, Continuing Education occurs in her trajectory as a teacher, since she is always in search of new knowledge in order to (re)signify her teaching self. Hence the importance of constantly keeping up-to-date in the field of education and interacting with professionals in the area in which they work to share experiences that surround the school context. We notice that the knowledge is being transformed as the teacher seeks to update herself in the formative process, which allows her to (re)configure her performance as a teacher, just as she reflects on her own practice, since it is in the classroom environment that the teacher is constituted, but also considering the long trajectory and the experience that she has acquired during her teaching career.

In the narrative of T12, it is evident the concern with quality teaching and, therefore, the need for improvement and training focused on the classroom context:

A constant challenge is to make my classes enjoyable and the content more interesting and meaningful for students. To make them perceive in their studies a possibility of growth as a human being, to make them conscious and critical citizens active in the society in which they live (T12).

We emphasize the formative opportunity provided by the Cycles as a possibility to awaken in the teacher the view that we must take into consideration the context, the scenario in which the lesson takes place, its conduction, the behavior of the students, their knowledge, emotions, reflections, actions, among other aspects. In this writing we notice that the teacher establishes approximations with the facts

described and with the reality experienced by the narrator, according to Zabalza (1994).

Cunha (1997, p. 39) points out that the "[...] narrative is not the literal truth of the facts, but rather, it is the representation that the subject makes of them and, in this way, it can be transformed into reality itself". In this perspective, when writing, the teacher learns and (re)constructs knowledge with classroom practice.

In narrative writing, the art of evoking and remembering leads the subjects to choose and evaluate the importance of representations about their identity, about the formative practices they have lived through, about the power exerted by others over them, about strong situations that marked choices and questions about their learning, about the role of the other and the context over their choices, about the patterns built in their history and about the barriers that need to be overcome in order to live more intensely and committed to themselves (SOUZA, 2006, p. 143).

Thus, narratives allow teacher training through storytelling, reading, and writing, enabling dialogue with the authors involved in the process and favoring reflections on what was experienced in the pedagogical practice, as well as establishing reflections about the different knowledge involved in the teaching processes.

In the environment of the "Formative Cycles in Science and Mathematics Teaching", we see the importance of the movement of reflections being organized in a collective manner, in the interaction of the subjects that make up the group of teachers, in the voices that constitute them, and in the knowledge that is mobilized. In this sense, the teacher, since his insertion in the classroom, witnesses the experiences with students and colleagues, which allow him to investigate his own practice through writing, since these favor reflection and awareness of knowledge, considering that, in this movement, the formation of the teacher takes place from the knowledge that is being built and rebuilt over time and in the development of his practices.

Conclusions

This study aimed to identify the teaching knowledge expressed in narratives in the form of descriptive memoirs and interviews of Science and Mathematics teachers in continuing education belonging to a formative collective, as well as to understand the contributions of narratives to the teaching constitution. To this end, through the analysis of the narratives produced by Science and Mathematics teachers, we defined two *a priori* categories: 1) the Continuing Education of Teachers, which is an

important element for the formation of teachers; and 2) the reflections on the teaching practice and the knowledge (re)built and manifested in the narratives.

In the first category we identified elements that contemplated the importance given to Continuing Education for (re)thinking pedagogical practice and alternatives that favor, in the classroom context, differentiated practices, qualifying the teaching and learning processes. We emphasize that the training context in which the teachers participated allowed them to record their anguish, difficulties, advances, limitations, and other factors arising from their teaching practice, which were textualized in the narratives, revealing reflections on the experiences they had in training and at school and marking a movement of teacher constitution.

The second category deals with the reconstructed and transformed knowledge from continuing education. We emphasize that teaching knowledge is constituted in the teaching career and is transformed during the teacher's professional career, based on his/her experiences and on the interactions established among the elements that make up the teaching profession. We recognize, in this category, the presence of curricular, disciplinary, and experiential knowledge in the narratives, since, by writing or talking about their training and their work, teachers make this knowledge explicit and, by doing so, they transform it and become teachers who reflect on their practice.

Finally, we point out that narratives, whether oral or written, reveal the knowledge of teaching and promote reflections on the practice, and, therefore, become an important element of the teacher formation. The process of teacher formation can occur through countless elements, but we call attention, in this research, to the production of narratives in contexts of continuing education of teachers, since we have shown that the reflective writings are relevant to the/in the formative process.

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