

COLLABORATIVE RESEARCH AS A STRATEGY OF PROFESSIONAL DEVELOPMENT OF TEACHERS

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This article reports a study conducted with three Portuguese primary school teachers who participated for two years, along with a professor in a collaborative research project focused on the analysis of their communicative practices in mathematics. The study shows that teachers develop professionally, manifest developments in their forms of collaboration in the group from providing aid and assistance to joint work, and in parallel deepen their teaching knowledge and professional practices.

INTRODUCTION

In Portugal, the primary school teachers (who teach in the first four years of schooling) develop their professional practice in an environment characterized by individualism, more salient here than in teachers from other grade levels. In addition, except in recent years, offers of training in mathematics for these teachers were almost nonexistent. As a consequence, the professional development of these teachers was very conditioned and marked by the initial training.

In this context, it seemed to me important to study the professional development of primary teachers in a collaborative project, focused on their classroom practices in mathematics. Among these practices, because of its importance in the classroom activity and the interest that was manifested by the teachers, the collaborative project was focused on the research of their communicative practices. Therefore, we defined the following problem: How does the teacher development occur in the context of a research project with a collaborative nature, focused on mathematical communication? To address this problem, some questions were pointed out, among which I highlight in this article the role of collaboration in teacher professional development.

The idea of collaboration between teachers is central in this study for two reasons. The first, is that we recognize the collaboration as a dimension of the professional development process (Krainer, 2001). The second is of methodological nature and concerns the need to reach out to teachers, interacting with them over a considerable period of time in order to study a complex process as professional development. So we constructed a work context in which the teachers and the researcher could establish a collaborative professional relationship

THEORETICAL FRAMEWORK

The professional development of teachers and collaboration are key concepts in this study. The professional development is a dynamic process that occurs over the life of the teacher involving diverse types of learning. These learning opportunities arise

both from informal opportunities lived at the school and from formal provided by training programs (Krainer, 2001; Liberman, 1994; Ponte, 1996, 2009). Assuming the complex and dynamic nature of the professional development, raises the question of what develops in this process. Hargreaves and Fullan (1992) argue that the development of teachers can result in: (i) improving knowledge and skills, (ii) self-understanding of his person, and (iii) change in context. Liberman (1994), for his part, says that professional development is a learning process, in which the critical reflection of practices has a decisive role. Deepening the understanding of this process, Krainer (2001) identifies four key dimensions of the professional development of teachers, organized into two binomials: action / reflection and autonomy / collaboration. The professional knowledge is present in both action and reflection, and also emerging from the interaction between them. The professional knowledge that the teacher mobilizes to prepare, execute and evaluate their classes is designated didactic (Ponte, 1996), which covers diverse aspects, such as knowledge of mathematics, learning processes, curriculum and instructional activity. The concept of collaboration is widely used in Education. However, Christiansen et al. (1997) warn that collaboration is a process largely undefined and only partially understood. Stewart (1997) emphasizes that this is a relation in which people with various career paths are engaged in a common work. The author points out its essential elements: the interdependence and a give and take attitude; solutions that emerge as a result of a work of mutual construction that takes advantage from differences; partners who sought to question the stereotypes and find with others new directions; joint ownership of decisions, collective responsibility for the destiny of the work, emergent process through negotiation with the interactions, and the rules for future interactions being constantly updated (Stewart, 1997).

The professional collaboration can be materialized in several ways, depending on the objectives. Harris and Anthony (2001) distinguish two forms. In one, the collegial interactions essentially help to create an environment of emotional support. Teachers present their difficulties, making a kind of catharsis, but there is no real interest in approach them intellectually, analyzing them and studying them. In the other, the interactions contribute to a significant professional development of the teachers involved, which is implied in a job-sharing.

The forms of collaboration among teachers are also examined by Little (1990), which proposes four broad categories: (i) Storytelling and scanning for ideas, (ii) Aid and assistance, (iii) sharing and (iv) Joint work..

In the *storytelling and scanning for ideas*, interactions among teachers are “opportunistic”, since the basic intention is to collect new ideas, swapping brief stories, informal and sporadic. In *aid and assistance* teachers expect more from other colleagues - to help resolve a difficult case, through a precise technique. This form of collaboration is clearly asymmetric and uni-directional, fully preserving freedom of choice of the teacher. The *sharing* takes place through the exchange of materials, methods, ideas and opinions. In this case, there is already some exposure of the

teacher to the rest group, representing a more public form of collaboration. Finally, *work on joint ownership* stems from meetings between teachers signed shared responsibility for the work of teaching (interdependence), the idea of collective autonomy, support for the initiatives and leadership of teachers in relation to professional practice and in membership of the group, founded in professional work (Little, 1990). In all categories, is the most demanding for teachers in terms of responsibility, commitment and time-consuming.

METHODOLOGY

The research methodology follows a qualitative interpretative paradigm, based on case studies of teachers (this article presents some data of them). Over nearly two years, the three teachers in the study (Matilde, Jorge and Ana) participated in a collaborative project with a professor (author of this article), reflecting about and investigating their communicative practices in mathematics classes (this work included sessions of group, observation and reflection of lessons of each teacher, publishing articles and participating in seminars).

In order to understand their professional development in this context, data were collected through observation of 10 lessons for each teacher and written records and audio from 28 group sessions of the project, three individual interviews with each teacher, teacher diaries, field notes and written documents (individual and collective). Data analysis followed the data collection, allowing for the ongoing project to identify tensions, problems and issues that were fundamental to the progress of the study. After the data collection, subsequent analysis allowed the de-construction and re-construction of information, leading to the establishment of formal categories.

PRESENTATION AND DISCUSSION OF RESULTS

The presentation of the results is organized into two parts. The first presents data on the negotiation and development of the collaborative project. In the second, I analyze the forms of collaboration experienced by teachers, relating them to other dimensions of professional development.

Negotiation of the project: Thematic and working methods

In the first meeting of the entire team, seeing as the three teachers did not know each other, I tried to ensure that the presentations were not the mere circumstance not too much to bare the individuality of each. Creating an environment of trust, essential in professional relationships of this kind, started from the beginning. Ana, the more experienced teacher, but who had shown less warm in the first approach, was the one that set the tone at the first session of the project, speaking of herself as a professional and as a person - a fact which created a favorable environment for the project. With the aim of establishing a compromise among the participants was distributed in this first session of the group a document with the form of an open and flexible protocol negotiable. The introductory text of this document indicated the emphasis of the proposal:

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The document is a simple proposal to discuss, change, add, and not just a program to be applied to teachers. For this reason, I expected of each team member a critical perspective, in order to adjust and improve. The discussion of the proposed project is not a task that it is finished now, but it is something that continually builds. (Protocol, January. 2002)

It was also clarified that in view of the importance of the subject and the little attention that it has deserved, the project's theme would be the mathematical communication. One sign that the project was not closed and there will be opportunity to negotiate subjects and procedures was the relief that, coupled with the mathematical communication, took the problem solving. The protocol was structured around several aspects: What is proposed? General theme of the research activities to develop, time and resources, benefits for members of the team. Concerning the first aspect, it proposed to:

- Reflect on the professional work they undertake;
- Work in collaboration with other colleagues;
- Develop research work, focused on their lessons, with the support of the entire group (...) (Protocol, January 2002)

In regards to the work philosophy, it seemed important to clarify in this document some guidelines: "Nobody is the sole owner of reason; It is the group that solves problems and make decisions; There is no single leader" (Protocol, January 2002).

At the first meeting, teachers had difficulty making decisions. On the second, a week later, some decisions had already been taken, including the duration of the project which could eventually be extended and the type of activities to be undertaken: a discussion of current topics that are related to mathematics education in the early years, discussion of cases classes, discussion of problems, observation and recording of lessons, preparation of articles, and participation in meetings.

In the course of the project, we can find three phases. The first phase corresponds to the first three months with the team meetings to occur weekly. This was a phase of mutual understanding, essential to creating a relationship of confidence, which were basically two aspects that were more closely related: the discussion of texts about mathematical communication and the reflection on incidents of classroom teachers. This reflection allowed, firstly, build a shared discourse on mathematical communication and, secondly, to identify and formulate problems in their classroom practices, which could serve as a starting point to research work.

The second phase of the project, with about 10 months, developed around the creation of a collaborative research work on teachers' practices. The previous phase helped to identify a set of questions where was applicant the concern of teachers, especially the young ones: What influence do the tasks set out in the process of problem solving? This concern led the group to devise a means of research, which began by building a set of mathematical tasks (problems), that were developed in the

classes of each teacher.. Associated with these tasks, we defined a set of tools for data collection, which went by the diaries, audio and video records and written materials of students. Data collected were analyzed and presented in group sessions of the project. At this stage, there are two moments in the affirmation of the group and represent high levels of exposure, both individually and collectively: (i) the dynamics of a group discussion about the ongoing work at a seminar of teachers of mathematics, and (ii) the construction and publication of an article together.

The third phase of the project, with about 10 months, aimed to promote the professional autonomy of each teacher. During this period, the involvement of teachers was different. Ana, a teacher with more years of service (about 30 years), continued to be strongly committed to the understanding of her practice through research of mathematical communication. The other two younger teachers (Matilde and Jorge, about 5 years in the profession, each) although enthusiastic about the project, have decreased their involvement, replacing the previous research by simply reflection.

Forms of teacher collaboration in group

Throughout the project, the teachers engaged in diverse forms of collaboration, both in terms of what it was intended as the time they occurred. We identified three patterns of collaboration among group members: aid and assistance, sharing and joint work. The aid and assistance has the result of a relationship where there was a clear asymmetry in the participation of the teachers. This form of collaboration was observed in the younger teacher, Matilde, seeking answers to her professional problems through interaction with others. So, she did not attribute significant value to their own ideas for the evolution of the group's thoughts: "Sometimes I feel so [pause] I feel that my participation in the project is [pause] less important"(1.st Matilde interview, February 2002). The emergence of this way of collaboration exclusively in the youngest teacher, is due mainly to the strong feeling of insecurity in the pursuit of teaching: "I think some of my difficulties and insecurities had to do with the fact that I do not feel prepared to discuss some aspects of Mathematics in primary. It was not the Mathematics (...) but in order to make the students acquire this knowledge. "(2.nd Matilde interview, July 2002). About her conception of knowledge, Matilde believed in the existence of a didactic knowledge into practice, in the form of norms. Since she was the only one who had no course specialization for primary school, she believed that her colleagues were more able to gain access to this knowledge

Ana: This idea is important, here in the text, is important, even that. Teaching is really a very complex thing there are no ready-made recipes

Investigator:- The teaching provides us with a set of guidelines that serve as a kind of repertoire that the teacher, in every moment of class, depending on events of the class, will reach for.

Matilde: It's funny that we're waiting for answers to our problems, to solve them ...
(Group session, March 2002)

The evolution of this concept - which has undergone an enhancement of practice through reflection and research as a source of knowledge - coupled with a growing appreciation of some areas of their didactic knowledge, including knowledge of mathematics - a fact that helped her feel more confident in her skills - were responsible for a new way of working, more interactive and transactional, sharing: "Anyway, I feel safer in my work, I feel more competent professionally. I think it goes through a better understanding of the situation and greater attention to what goes on ". (3.rd Matilde interview, December 2002). The sharing was the form of collaboration that the other two teachers, Jorge and Ana, went in first phase of the project. Apart from reflecting on episodes of their classes, the sharing was being enriched, extending the project to various situations, such as mathematical tasks, articles, books, films or texts. The sharing took on a form of collaboration that was halfway between modes of work of individual nature and other modes involving more commitment and time-consuming. These characteristics justify the choices of these two teachers by sharing; therefore they allowed a smooth transition from individual work to another distinct in which there was greater openness and exposure group.

The first phase of the project favored the initiation of collaborative research work through questioning of classes episodes. This form of collaboration that was developed in second phase - joint work - represented an improvement over the shares, because the teachers were involved, as equals, in this work. Associated with collaborative research practices, in this second phase of the project, the group was engaged in two joint ventures that gave greater identity - on one hand, the participation in a group discussion at a meeting of teachers of mathematics and on the other hand, the publication of an article. The joint work, in a different way of the sharing, implied a greater commitment of each teacher with the group, through the division of tasks and seeking common goals to which everyone contributed. Therefore, this phase was the most demanding in terms of the work and time spent in it. In the third phase, and unlike of previous, the forms of teacher collaboration diverged, as shown in Table 1, referring to the entire project:

Phase of collaboraive project				
	1. st phase		2. nd phaase	3. rd phase
Matilde	Aid and Assistance	Sharing	Joint Work	Sharing
Jorge	Sharing		Joint Work	Sharing
Ana	Sharing		Joint work	

Table 1: Evolution of forms of teacher collaboration

In the final phase, while Ana remained co-ownership, the other two teachers returned to sharing. Ana continued research work around the mathematical communication, involving the parents of his students from 1st grade:

During the research study "Parents and mathematical communication, " in several stages, Ana tried to establish a collaborative relationship with me which was based on negotiation, a process of constant adjustments. The meetings with parents was first suggested by Ana, who defended her usefulness - these sessions they became important in how the work came to the course. (Note field, June 2003)

The other two teachers decreased their collaborative involvement, continuing to attend group meetings, reflecting on cases of their classes on various aspects of communication, but without a clear focus. In addition to the group sessions, there were other meetings between Ana and myself, in the development of research "Parents and mathematical communication. ". The divergence of forms of collaboration of teachers in the last phase results of many factors, some structural and other of the conjuncture. The last ones relate to some logistic issues, because in the second year of the project the younger teachers changed to schools farther away from the place of meeting, and had in their classrooms students from more than one year of schooling simultaneously. These reasons, while important, do not seem strong enough to explain the way in advancing forms of teacher collaboration, and therefore need to call to explain other reasons of a structural nature. The continuation of Ana in the co-ownership is based on how she conceived the role of collaboration in their professional development, including the possibility of bringing forward research projects on their practice. In this context the project "Parents and mathematical communication, " through which developed a study aiming to understand how evolve the ability of students to communicate mathematically.

FINAL REMARKS

This study shows that teachers develop their ability to collaborate professionally if they have an appropriate and challenging contexts. The collaborative research seems to be a good framework to progress this capacity and is capable of having their involvement, despite being a little remarkable feature of the culture of primary teachers, where individualism still prevails. To get the forms of collaboration such as joint work appears to be essential to go through other less demanding, based on shared reflections on episodes of classes, usually in a narrative way. The collaborative research is well placed to promote the professional development of teachers because it is based on a genuine search for answers and not the handling of questions for which answers some know in advance - as happens often in other training programs. By deepening the collaboration, the teachers seem to develop also a new sense of professional identity. The collaboration reinforces this idea, insofar as this process becomes an interactive brand teacher, something that gives them more strength as a professional group. The participation of project members in meetings with teachers or the production of articles contributing to the strengthening of professional identity, making them feel as mathematics teachers.

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