

IN-SERVICE TEACHER EDUCATION: A COLLABORATIVE BASIS EXPERIENCE WITH NON-SPECIALIST TEACHERS WHO TEACH MATHEMATICS

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This paper reports on a research applied in an in-service teacher education program involving primary level educators when exploring Mathematics and Statistics contents using computers. The problematic was identifying the characteristics of a pedagogical training process that contributes to the development of teaching practice and was discussed the collaborative experience of a group of teachers. The training Project adopted the perspective of practical reflection for social reconstruction, with focus on *action-based investigation* and *comprehension-intended training*. A work team, the Action Group, was set up with four university researchers and five representatives of a public school in São Paulo, where the research took place. The research actors were the principal, the pedagogical coordinator plus three primary teachers. The study concentrates on the application of Statistics principles in information's handling and analysis, using the data base software TABLETOP. Some significant factors were: the partnership between university and school; the constitution of a collaborative group; the support for didactic activities and materials; the project's development in the school allowing for specificities along a continuous and stretched period; the actors' performance in different professional roles. The research showed that it was essential for them the playing of all roles: as apprentice, as teacher, as instructor and as researcher. The gains could be observed in the expansion of their mathematical and statistical knowledge, in the improvement of their computing skills, as well as in the increasing of their autonomy, their critical position and their reflections on curriculum and on the learning and teaching process.

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Introduction

This paper reports on a research applied in an in-service teacher education program involving primary level educators when exploring Mathematics and Statistics contents using computers. The problematic was identifying the characteristics of a pedagogical training process that contributes to the “development” of teaching practice. “Development” is understood here by the way in which teachers reorganize - or adapt - their didactical practices from reflection, action and new reflection about their practice teaching. So that, the inquiry intended to answer the following question: *Which are the significant factors in an in-service teacher education process as using computers for the construction of Mathematics pedagogical practices?*

The investigation was centered on the process of in-service teacher's education. In examining the several forms of training and its paradigms, it could be noticed that education programs are not autonomous, as Pérez Gómez (1997) says, in fact, they are contextualized and their guidelines depend, among other things, on the concepts of Education and Curriculum. That means there are different ways to understand educational practices lead to various forms of education programs.

The adopted model was the “*Practical reflection for social reconstruction*” in which the reflective practice concept is enlarged to consider, besides the reflection in action and the reflection about the action - in the sense of Schön, (1983) -, also the reflection towards the reconstruction of situations in which the action is produced, for reconstruction himself as a teacher and for the reconstruction of the basic assumptions of Education. Is important to emphasize that in this model there is two different theoretical views, as for the first one covers the training programs that advocates a politically engagement, to promote equality, justice and social emancipation. The second one, the *action-based investigation and comprehension-intended* training view – actually used in this research - is the most liberal of theorists who embraces the development of teacher's in-service education oriented by democratic methods and principles, without acting as political activist.

Finally, what is discussed in this paper is the particular collaborative experience of a group of teachers and, at the end; the main conclusions about the influence of collaborative work on the professional development are exposed.

¹This paper relates to the PhD research for the Education Post-Graduation Program, PUCSP, 2004.

The research and the in-service teacher training Project

A work team, called *Action Group* formed by four university researchers² and five teachers of a public school of São Paulo State (Brazil) participated in an in-service training held inside the school. The research actors were the principal Hortênsia, the pedagogical coordinator Violeta and three ordinary teachers Rosa, Margarida, Orquídea³, all engaged in acting as instructors for all schoolteachers members.

The Action Group met during twenty months, weekly basis, to run not only some workshops with pupils and other teachers, but also to assemble working materials and reflecting together about the learning and education process. During these meetings and throughout the whole project, they deal with Mathematical concepts and Statistics principles while analyzing computers databases, developed specifically to the research actors' context.

So that, a qualitative research was developed characterized as a co-generative action-based investigation among collaborative groups. Greenwood e Levin (2000) define *co-generative action-based investigation* as an inquiry built on professional researcher-stakeholders collaboration and aims to develop new knowledge. This type of action research is grounded in the following characteristics:

1. *Participants and researchers cogenerate knowledge through collaborative communicative processes in which all participants' contributions are taken seriously. The inquiry process lead to the construction of new meanings;*
2. *It treats the diversity of experience and capacities within the local group as an opportunity for the enrichment of the research process;*
3. *It produces valid research results;*
4. *It is context centered and aims to solve real life problems.* (GREENWOOD E LEVIN, 2000, p. 96)

The in-service teacher-training project was strategically divided into four “phases” to facilitate the analyses, as described:

Phase 1 –Held in the university, the first meeting discussed the software to be used and the in-service training planning that would be applied to the schoolteachers.

Phase 2 – Undergone over the first semester in the school as the initial practical period, when the in-service training in fact started. At this moment, lead by the sense of team developed in the participants, two different groups was formed: the *Action Group* and the *Full-life Group*. In this phase the Action Group started to training the Full-life Group, developed workshops with their students, developed preparatory works for presentation in an educational congress, and understood the investigatory studies over pedagogic practices as part of the project.

Phase 3 – Undergone over the second semester in the school as the consolidation period of the project. The *Full-life Group* started to create didactical sequences to pupils. From that time on, for

² Lulu Healy, Sandra Magina, Sandra Santos and Nielce M. Lobo da Costa.

³ These are all fictional names.

the *Action Group*'s the acting sphere got more amplified, once more than conceiving and developing tasks for the training, they start to following and giving support to Full-life teachers at their work with pupils. At that moment, it was already possible for each member of the Action Group to reflect over his own action as instructors as well as over his colleagues' practices.

Phase 4 – It took the last months of the project at the next academic year, when the *Action Group* could no longer count on the school's pedagogical coordinator neither on the principal as members of the team⁴. With the school new direction, the in-service training re-started under new political and practical conditions. As for *Action Group*'s teachers, that was not only a period of concepts revision and study deep, but also of returning to IT laboratory classes. They started to take on responsibility for classes both with pupils and trainee teachers. As a last activity, the *Action Group* took part in a scientific meeting where its members gave a presentation on the project's experience.

Analysis and outcome

The research data analysis was interpretative, made by triangulation of data (MATHISON, 1988) using four educative dimensions experienced by the research actors. These dimensions were created as analysis categories to understand deeply each role faced during the project, as for: apprentice, teacher, instructor and researcher.

Considered that, and despite the fact that each role played within the studied group was responsible for a unique contribution on the members professional growing; in this paper the instructor role was selected for a close discussion due to the fact that to promote cooperation among the members of the Action Group, this was the most significant role for its aspects of interaction, conflict taken and overcoming.

Apprentice Role –Its importance may be attached to the need of a "re-signification" of what is to teach Mathematics, as well as to the need of a change in the vision regarding children Mathematics learning. Not to say the need of, besides “re-significating” the Mathematics contents to teach acquiring new knowledge, developing data's handling strategies, setting up students IT abilities and, finally, instructing in the use of TABLETOP software (TABLETOP, TM, 1994).

Teacher Role – Contributed with actions such as: intervene as mediator in pupil's learning, observe students' solutions strategies, prepare pedagogic material for a range of activities, discuss it classes

⁴ Both of them, motivated by particular reasons, independently of the project, moved away from the school upon being selected in another governmental aptitude test.

methodology and management, "re-significate" Statistics contents and action-based curriculum, develop new professional skills and, finally, dominate software resources so as to use it as a pedagogic instrument.

Researcher Role –The importance of taking on the role of researcher regarding their professional development could be assessed by occurrences such as of collaborative work group's consolidation, reflection on work practices, reflection about education, development of pedagogic and mathematical knowledge, computing skills, and finally development of self-esteem and confidence.

Instructor Role – It involved, among other aspects, the interaction between both group of teachers as well as the conflicts handling. The beginning of the relationship between both groups was problematic as it happened what Hargreaves (1995, 1998) uses to call "balkanization"⁵. This metaphor describes indeed the different subdivisions that can be found in an educational workplace and might be able to bring difficulties or even jeopardize the constitution of a collaborative working group. In fact, the division into two groups created a distinction of commitment between the members of each one. Teachers of the *Action Group* had to follow a restrict schedule to get fully-dedicated to the project, besides holding meetings with researchers at the university, whereas the rest of the teachers were summoned only to attend classes or local meetings.

Balkanization bears the following characteristics: REDUCED PERMEABILITY – the subgroups keep themselves completely separated, as their knowledge, beliefs and ways of thinking become quite distinct; LONG-LASTING PERMANENCE – very few members exchange group every year. PERSONAL IDENTIFICATION – a kind of "segregation" rises, allowing an identification of one professional with a specific subgroup; POLITICAL NATURE – the exertion of influence are all prerogative of a particular subgroup.

As *Full-life* Group teachers took part in the project on a compulsory basis, attending it during their official period of job, that gave to school, on the one hand, the advantage to reach a broad cluster of participants, but, on the other hand, it did not end up stimulating these teachers to become more engaged or committed to their tasks. As a result, the group's collaboration happened to be little spontaneous, in the sense understood by Hargreaves (1998), and came to be somehow a "forced" one.

In the school working culture there are two different types of professional behavior: the *individualism* and the *collegiality* (Hargreaves, *ibid.*). The first one consists of private activity

⁵ The *balkanization* term was inspired in the experience that the former Yugoslavia state went through when, despite being considered the pearl of East Europe, and as result of the country's break-up, was turned into the setting of religious and ethnic conflicts whose long-standing suppression could not prevent the outburst of a bloody war.

divorced from group, and the second one is characterized by authentic interactions between colleagues so as they can work in concert, by taking common decisions and planning shared actions; the dialog allows exchanging ideas and having an involvement with all participants and in general, comes about voluntarily, or by means of some teachers' spontaneous initiative. It is completely different of the *artificial collegiality*, which occurs due to either some administrative structure's demand or a compulsory joint effort between teachers, whose aim, on the role, is to implement proposals made by other professional ambits rather than by the teachers' real one.

Balkanization and artificial collegiality got more pronounced as project started to develop. Evidence to that is provided by the analysis of pedagogic coordinator's speeches. According to her, one of coordinator's roles is to promote the interaction between teachers so they could develop collective works, but interaction hardly is obtained, as teachers are used to go through with their duties by themselves. They do not want to get exposed neither "*owe an explanation to no one*" (Violeta-1^o interviewed). In another remark, she pointed out that, in general, teachers "*do not show nor even talk about their pedagogic approaches*", what gave her a clue of the solitary aspect of their job. Teachers are quite open to accept proposals arisen from meetings with the coordinators' group. However, it seems they do not care about bringing them at a later stage into the classroom. She concluded that teachers might consider these activities as useless or senseless to pupils. Based on Violeta's statement, it is therefore noticeable the occurrence in her school of an *artificial collegiality* behavior among teachers. Quite recognizable it is also the occurrence of a "forced" collaboration, as teachers were supposed to adopt pedagogical proposals which had not been defined by themselves and whose strategic line of action neither had been drawn by their own. However good the coordinator's intention, or interesting the activities, the action-curriculum kept dissociated from the planning and creation process, what could explain, at the end of day, the teachers considerable resistance. That was the situation faced by Action Group' members as they undertook the educational training of *Full-life Group's* teachers.

Below a Mathematics discussion is presented as an example of a collaborative experience, in which decisions were all taken together, providing moments of intense learning, of reflection over the extent of this very learning, and of reflection over the thorough knowledge of the discussion points. Doubts were exposed and clarified, and any inconsistency between what one had previously thought and what he obtained from the software as feedback was also discussed. The figure below refers to a situation and its data follow a route called *New issues for exploring Todos.TDB data basis*, whose content is related to "proportion".

Faced with the question "*Which place married people proportion is bigger: in the countryside or in the capital?*" the group came up with two distinct answers.

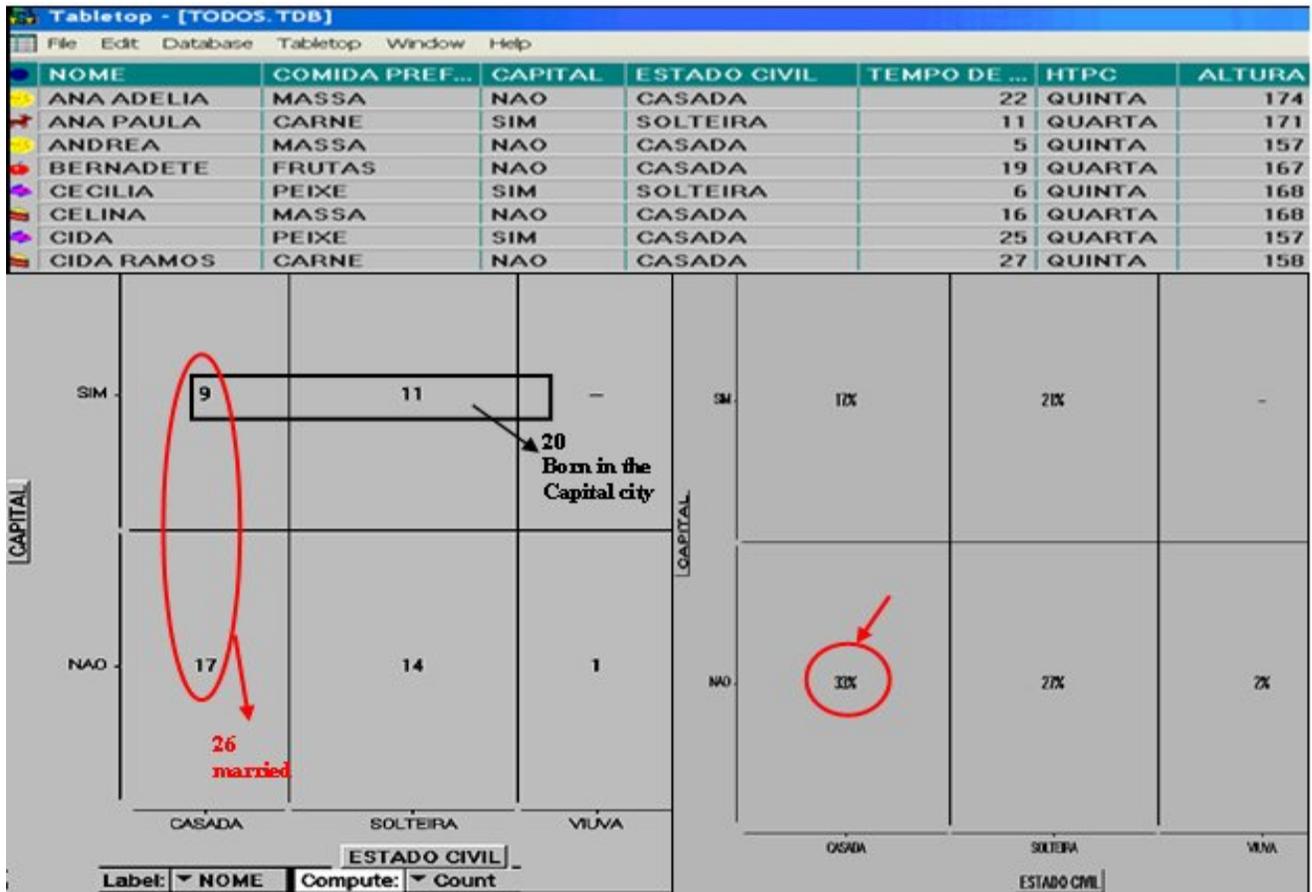


Figure 1: Data basis TODOS. TDB fragment and Graphs from CIVIL STAGE X CAPITAL CITY

As shown by the graphic in Figure 1, one can conclude that there are 26 married people, 9 of whom born in the capital and 17 in the countryside. Therefore the expected proportions are: $\frac{9}{26}$ e $\frac{17}{26}$. However, a doubt arose: given that, 20 people are born in the capital, and that 9 of whom are married, so $\frac{9}{20}$ e $\frac{11}{20}$ might be the answers. After a round of says, as transcribed below, the question to *Full-life Group* was changed for the following one: *Which is the proportion of married people born in the capital?*

Sandra Magina – *Is it true that people in the capital get married more than people from countryside?*

Margarida – *Within those who were born in the capital or in the interior, I realized that there were 17 married people who were born in the countryside and 9 married ones who were born in the capital, then the answer is that we have more married people who were born in the countryside. A proportion of 33% born in the countryside and 17 who were born in the capital. What comes to 9 to 26, because here there are 26 married, 25 singles and 1 widow. Just 2% of widow, that will come to 2% of the total, then I put it in the total, but I did not put the data here, it comes to 26 that would be 33%, 17 married*

Lulu – *Because the 33% means out of 52, it is not the percentage of married ones. So the first thing you will do is to look at the numbers, sure, it is clear that comparing 26 with 9 means that you have more married people who were born in the countryside. (EN 23)*

Overall, the instructor role contributed to: “re-significate” the role of the educator and of education itself, prepare pedagogic material, act as a mediator within teacher’s learning process, observe other teachers’ strategic proceedings, develop new skills on computing, and reflect over the group’s practices and theoretical background.

Conclusions

At the beginning of the in-service training, Action Group’s members gave priority to act mainly as apprentices, trying to become skilled at specific computing tools. Gradually they started to take on other functions and adopt a critical and questioning posture, by exposing their own didactic-related concerns. Once consolidated the group, each and every one got engaged in preparing and developing the workshops as well as in sharing decisions in a more intensive way. Afterwards, the responsibility to the workshops’ running was exclusively of the school’s teachers.

Some contributing characteristics of this school-university partnership for the success of the Action Group’s collaborative work were 1º) the school’s professionals voluntary participation, 2º) the equalitarian relation between the members of the group, that is to say, its non-hierarchical aspect, 3º) the guarantee that each participant could have a say, 4º) the establishment of a relation based on trust, 5º) the acceptance gained by teachers’ pedagogic practices at the group’s discussions, 6º) the possibility of the use of every project’s materials and documents by all group’s members, and 7º) the presence within the school of the university’s researchers throughout all stages of the project.

Based on the data analysis, the collaborative working group can be considered as a context for professional development, as indicated by the chart below.



Figure 2:: Collaborative work and professional development

The major factors in this particular process were: 1º) the educational training having been run within the school and planned according to its specificities, 2º) it having been scheduled for a long period and run on a continuous basis, 3º) it having boosted the creation of didactic activities and pedagogic materials, and 4º) having used computing tools associated with other educative resources throughout the tuition.

To the teachers' professional development was crucial to try and take on the roles of apprentice, teacher, instructor or researcher, because these "performances" allowed them as members of a collaborative working group not only to amplify their mathematician knowledge, but also develop computing skills, acquire autonomy and confidence, and adopt a critical posture on teaching practices as well as on the national curriculum and on the learning and teaching process.

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