

PRÓ-LETRAMENTO MATEMÁTICOS: IMPROVING MATHEMATICAL KNOWLEDGE AND PRACTICES OF PRIMARY TEACHERS IN BRAZIL

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Abstract

This article discusses the main features of a nation-wide program promoted by the Brazilian Ministry of Education, aiming at improving the teaching and learning processes in Mathematics in primary education. We present a brief description of the strategies adopted to allow a large number of primary teachers to attend the course at the same time, followed by a discussion of the main features of the program and its influence on fostering the adoption of new practices by teachers.

1. INTRODUCTION

As a response to poor results that Brazilian students have shown both in national and international Mathematics tests, one of the actions taken by the Brazilian Ministry of Education was to an in-service Mathematics course for primary teachers. The **Pró-Letramento¹ Mathematics Program** is being implemented nation-wide, for primary teachers actually teaching in schools supported by local, state or federal government, the ones the program focus its efforts on.

The step to decide how to implement the Program was a crucial one, considering that over 600,000 primary teachers are working in those schools. Priority in attending the program was to states of the Brazilian Federation with lower indicators of economical and educational development. The program is now operational in fifteen states (out of a total of 26) and it is considered a success by all actors involved: the Ministry, the local secretaries of education, the university teams and the teachers who attended it. It is expected that by this time next year the coverage will reach all remaining states. A measure of its success is that the Ministry is already planning, on the strength of the strong demand, new actions directed at the states which have already taken part on it.

The theoretical background for the analysis of the program made in this article relies on researchers who consider the learning of subject content matters as a crucial issue on teachers' preparation (such as Schulman, 1986 & 1987; Ball, 1988 & 1991; Tardif, 2003; Palis, 2006) and on those who pay special attention to the integration of this content knowledge with

¹ More information (in Portuguese) on the Pró-Letramento Program can be found in the Ministry of Education's Secretary of Basic Education (SEB) site: <http://portal.mec.gov.br/seb> (search in "Programas da SEB" – "Pró-Letramento").

actual classroom practices (such as Brousseau, 1997; Ma, 1999; Perrenoud, 1999 (a) & (b); Belfort, 2003; Mandarino, 2006).

2. A BRIEF DESCRIPTION OF THE PROGRAM

The written texts (Brazil, 2007 – 2nd edition) to support the Program were specially written by professionals working in teacher preparation in some of the most prestigious Brazilian Universities. The material is organised in 8 fascicles, six of them dedicated to revisit mathematical contents related to primary school and the other two to techniques of problem solving and of evaluation of students' work.

In order to allow a large number of primary teachers to attend the course at the same time, an interesting system is being applied to promote in-service training. The starting point of the program's implementation is a contact between the Ministry and the educational authorities at state and local county level. Then, state and county secretaries of education appoint local tutors among their permanent staff. These professionals are gathered together (usually at the state capital) to be prepared by a university team for the job of tutoring the program.

Completing the full tutor preparation does not precede the tutoring job at their counties: after the first week (40 hours, out of 180) of tutor preparation, they are charged with starting to implement the program in their regions. This job is supported by the Ministry (which provides the written materials), by the local educational secretaries (that are responsible for organisation, management and structure at local level) and by the university team (who is in charge of academic issues, using distance teaching techniques). From this point on, they intercalate tutoring periods at their counties with monthly tutor meetings, lasting two days (16 hours) each, along with the university team and tutors from other counties.

In those states where our university is in charge, the tutor preparation course lasts about 10 months, allowing time for the university team, together with the group of tutors, to analyse and evaluate the complete program implementation at each of the counties (which lasts about 8 months). The teachers at the local counties take part in 120 hours of the in-service preparation course, of which 80 are spent in group meetings with the tutors and the remaining 40 are spent in adapting, planning, testing and evaluating mathematics activities with their own students. It is important to observe that this course lasts twice as long as their usual pre-service courses of Mathematics at College.

3. ANALYSIS OF THE MAIN FEATURES OF THE PROGRAM

In this section, we discuss features of the program that may explain its success. They are:

3.1. The course revisits the mathematical contents teachers need to teach.

Most primary teachers in Brazil learned Mathematics as a series of procedures to be memorised, with little conceptual understanding and no connections between contents. They naturally reproduce this conception when acting as teachers. The program, on the contrary, adopts a series of strategies to foster a conceptual point of view about Mathematical contents. For instance, teachers are invited to work in small groups and try by themselves a series of

activities planned for primary students, aiming at conceptual understanding. Strategies such as the analysis of this kind of activity allow teachers to revisit primary mathematical contents from a different perspective, and motivate them to apply these ideas in classroom. It is expected that, by the end of the program, the mathematical knowledge acquired by most teachers should enable them to better understand the nature and the structure of the contents they must teach, along with some of their inner connections, applications and possible generalisations.

3.2. Development of study habits.

In-service courses in Mathematics for primary teachers in Brazil are infrequent and usually ask them to attend meetings focused on educational or didactical issues. This program, on the contrary, asks the teachers to study mathematics and its didactics, not only during the meetings. Each meeting ends with reading material and several tasks being assigned. The group discussion of these tasks and of the effect of them in their own classrooms is the starting point of the subsequent meeting.

3.3. Development of study groups at the counties.

Research in teacher's practices in Brazil has shown that primary teachers do not share their classroom routines in Mathematics with their pairs – “Maths lessons with doors closed” (Mandarino, 2006). Of course this situation is not a feature that makes mathematics classes any different of classes in other subjects, nor is it a cultural disposition of Brazilian teachers alone: Shulman (1987) refers to it when he says that, unlike other areas of activity, “...teaching is conducted without an audience of peers. It is devoid of a history of practice”. The program meetings offer an opportunity to modify this cultural disposition, aggregating a new important motivational role. They allow teachers to share difficulties and analyse successes, to discuss their own lessons and to interchange experiences. The break from “mathematical isolation” has been considered by teachers as one of the program's most important features.

3.4. Significant modifications in teachers practices.

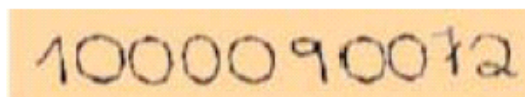
As new conceptual knowledge is being constructed, a correspondent new didactical approach is developed by teachers. The program texts provide them with plenty of suggestions that can be adapted to their local conditions. In doing so, the program grants the teachers several opportunities to plan and experiment class activities, to reflect upon their results and to communicate them to the group. The teachers attending the program evaluate that the critical discussion of these experiences largely contributes to the improvement of their didactical practices.

3.5. Valorisation of students' work.


Since memorisation of procedures is not the main focus of Mathematics lessons anymore, right or wrong answers cannot be the main focus of teachers' evaluation of students' work. In order to contribute to this transformation, the program provides them with actual examples of

children's work to discuss. Figure 1, translated from the first fascicle (natural numbers), page 9, shows an example of this.

Mariana, seven, made an attempt to write down the year her mother was born: 1972. Here is the final result, and her comments:

A photograph of a child's handwritten work on a piece of paper. The number '1000090072' is written in dark ink. The first five zeros are grouped together, and the last two zeros are also grouped together, with a '9' in between. The number is written on a light-colored background.

The "zero" – it gives you "one thousand". If the "one" is not a companion to the "zero", it is not "one thousand" – it is "one" !



GROUP TASK 5
Let's analyse Mariana's work. What is correct? What is not correct?

Figure 1: Example of task aiming at the valorisation of pupils' work.

This sort of task allows teachers to analyse typical mistakes made by kids when constructing mathematical concepts and representations, as well as unconventional solutions to problems presented by students. Teachers are also encouraged to bring samples of their pupils' work to be discussed within the group.

3.6. Decentralisation of qualified staff.

Last, but not least, by preparing tutors who are part of their permanent educational staff, the program empowers local educational authorities to carry on themselves with the process of mathematical preparation for primary teachers in their charge. The strong preparation of tutors is one of the program's central features. The direct support from the University given to tutors during the whole process of the first attempt of implementation of the teacher's preparation course at the counties allows the university's team to keep them under constant supervision and evaluation. During the periodic tutor meetings, they are asked not only to present a report of their work and samples of their tutored teachers' work, but also to plan the subsequent meetings at their counties. The tutor meetings are one of the program's strong points: group learning experiences and opportunities to share the productions of their tutored teachers and the correspondent students' work are clearly a strong motivational factor for the tutors.

4. DISCUSSION

This section presents a critical discussion program. As our university's team is in charge of the program in four different states of the Brazilian federation, it is possible by now to recognise common challenges faced by several counties in different states.

The first issue of importance is the choice of the tutor. As tutors are nominated by local authorities and play a central role in the program, an inadequate choice can seriously endanger the program in the county. Aware of this possibility, at the very beginning, the Ministry asks state and local county authorities to indicate tutors who are either mathematically qualified secondary school teachers or, at the very least, have concluded a

College preparation as primary teachers (most of primary teachers in Brazil have still been prepared in a pre-college course).

On the other hand, even when the tutor fits the recommended profile, there is also the risk of the tutor quitting the program, leaving the county with no possibility for continuity. Although it is rare that a tutor quits the program, a few of those who actually did reported lack of working conditions in their counties as a primary motive for their decision, which raises a second important issue: the level of commitment of the local authorities with the program.

It has been observed by us that teacher's performance in the course is strongly correlated to the actual level of commitment displayed by the county authorities. Where this is evident, and the conditions are available for the realisation of the meetings under favourable circumstances, the effect on teacher's performances can be very evident. On the other hand, even under unfavourable circumstances, many tutors do display a surprising level of commitment to the success of the program, and manage to establish a relationship with their tutees that results in work of high quality from the group. Unfortunately, a situation like this can work only for a limited period, after which discouragement takes its toll.

Without a full understanding of the importance of achieving success in the program by all the actors involved it could not succeed for long. Therefore, the main asset of the program can at times be also its greatest weakness: when it involves all players responsible by actions relevant to what is going on in the classroom it also triggers a process of mutual interference that, in most cases, proves extremely motivating to every one involved.

Most of all, it is important to notice that the program breaks the feeling of isolation that can suffocate the teacher at the end of the chain – notably when teaching Mathematics is concerned. As a consequence, tutor meetings are replete of interesting reports and recollections of classroom situations. Also, and the Ministry staff often reports back to the University teams, several spontaneous approval messages are received by them either from teachers attending the program or from county educational authorities. But a chain can be broken at any of its links, so it is important to exert great care and spend a lot of effort to keep it whole – not an easy proposition when you are talking of over 5,000 counties nationwide...

To conclude in a cautionary note, we must say that, at best, we are starting a process. Teaching, particularly teaching maths, involves an extremely elaborate and complex set of skills. The teacher population itself is changing at a very fast rate so that, if a steady diet of quality in-service training is not achieved somehow, hard results for the greater part of the student population could not be overly evident in the future. But, at least for the time being, and for the first time in our memories, we feel we have genuine cause to be hopeful.

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POINTS FOR DISCUSSION AT DG7:

1. A common question asked by teachers was “*why did we not attend a course like this during pre-service preparation?*”. Is it possible to reproduce some of the main features of the Pro-Letramento Mathematics Program during a pre-service preparation course?
2. How important is it to provide teachers with opportunities to analyse children’s work? To what extent this kind of activity, combined with conceptual understanding, can contribute to modify teachers’ conceptions towards Maths lessons and students’ work?