A STUDY ABOUT THE IMPACT OF A TEACHER TRAINING PROGRAMME IN THE MATHEMATICAL AND DIDACTICAL KNOWLEDGE OF PRIMARY TEACHERS

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BACKGROUND

Our presentation refers to a doctoral study that one of us is conducting about scientific, didactic and curricular knowledge of primary teachers that are attending an in-service mathematics teacher training programme and the analysis of the influence this programme has on their classroom practice.

Our interest in this theme is justified by our personal involvement in the mathematics teacher training programme in the last two years. This programme was established in Portugal, in all the country, by proposal of the Ministry of Education and implemented in each region by universities or schools of education, and aims ultimately for a better mathematics learning of 1st to 4th grade students (ME, 2005). Although it is a national programme, its attendance is not compulsory.

In fact, the low levels attained by Portuguese students in national examinations and international studies like TIMSS in 1996 and PISA in 2003 suggest that something must change in school mathematics in Portugal. This should obviously refer to a high quality teacher training in mathematics.

Teachers of these levels have particular weaknesses in mathematics education, and so the programme intends to develop didactic knowledge directly connected with teaching practice, involving mathematical knowledge and curriculum management associated with task selection and its application in the classroom. Moreover, this programme implies class observations by the instructors, which is not usual in Portugal in teacher education after the pre-service teacher training.

School mathematics must not be reduced to routine facts and procedures, according to international standards and experts (NCTM, 2000). Citing Goldenberg (1999), although this author is not against memorization and does not think that students can only learn through discovery, he claims that, if they limit themselves to memorize, they don’t learn to understand things. Officially, in our country, the main goal of school mathematics is problem solving, reasoning and communication (ME, 2001). However, most of the Portuguese primary school teachers have a traditional view of teaching, where the routine tasks dominate.

Recent research deal with understanding of the specialized and applied nature of the mathematical knowledge for teaching. Ball, Bass, Sleep and Thames (2007) discuss four distinct domains of mathematical knowledge for teaching: common content knowledge, specialized content knowledge, knowledge of students and content and knowledge of teaching and content. These authors clarify specialized knowledge, defining it as a mathematical knowledge that teachers use in teaching that surpasses the curriculum, demanding a deeper and more explicit understanding of the content in order to perform error analysis and explain to students the meaning of content and why things make sense. Van Den Heuvel-Panhuizen
and De Goeij (2007) describe a Dutch in-service training course for mathematics coordinators of primary school teachers, standing up for a need for more subject matter knowledge within education. This course includes mini-lectures, solving mathematics problems, designing teaching activities and analysing student work, watching video recordings of classroom activities, discussing research results and teaching materials. It also includes the professional sharing and reflection, profiting from each other’s experience.

Portuguese programme of in-service teacher training in mathematics proposes to invert the referred teacher practices when recommends the improvement of problem solving and investigative tasks with students which, besides promoting concept understanding, reasoning and communication development, promote making connections among ideas and concepts. On the other hand, it prescribes the planning of teaching sequences and encourages the sharing of teaching experiences among teachers.

In this context, our aim is to analyse the possible influence of the programme in mathematical and didactical knowledge of primary teachers and the consequences of that influence in their classroom practice and in students achievement.

Therefore some questions were raised to be answered by this study:

• How does the in-service teacher training Programme contribute to improve subject, didactic and curricular knowledge of primary teachers in the district of Viana do Castelo?
• How does subject, didactic and curricular knowledge of primary teachers relate to their classroom practice?
• What is the impact of the Programme in classroom practice of those teachers, particularly relating to the type of tasks selected for students work?
• What are the teachers views about mathematics both as a science and as a school discipline and how does that affect their practice?

**METHODOLOGY**

Four teachers involved this year in the teacher training programme will be followed, in their professional activity, this year and next year, aiming a description and interpretation of the influence of the attendance of this programme in their didactical knowledge and classroom practice. The nature of the study problem and the research questions made us decide to choose a qualitative case study research design.

According to Merriam (1988), a qualitative case study is an intensive, holistic description and analysis of a single entity or phenomenon. Case study is particularistic, in that it focuses in a specific situation, and relies heavily on inductive reasoning in handling multiple data sources because it focuses on process, understanding and interpretation.

These cases were chosen because we believe that their study will conduct to a better comprehension of the phenomenon under study (Stake, 1994). The criteria to select them were variety – although not representativeness – in features such as: age, initial or complementary education, professional experience, type of work at school, type of class (one or more years of schooling) and type of attendance in this programme (beginning or continuation).

These four teachers will be followed this and next year in their classroom practice in mathematics. In addition to being the researcher the first author is also their instructor in the programme, and this means that she will meet them in small groups twice a month to help planning classes, discuss strategies, make suggestions and analyse classroom tasks (with a certain caution) and reflect about the classes meanwhile observed.

The data collection consists of classroom observation, interviews and document analysis. During this and next year the first author will be observing four-five mathematics classes of about 90 minutes per teacher. These classes are and will be videotaped and transcribed. In addition field notes are being used. After each class there is a conversation between the teacher and the first author during which we reflect about some features such as pupils’ work,
teacher’s role, reaction to and exploration of the tasks, resources, mathematical activity of the pupils. After transcription, and based on it and on field notes, the first author makes a written report of each observed class regarding the same points in two different features: the observed facts and the researcher comments.

The first two individual interviews to each participant have already taken place in the beginning of this school year and in February. One more will be conducted at the end of this school year and this process is to be continued next year. All these interviews are semi-structured and are and will be audiotaped and transcribed. The guidelines of the already made interviews have been: for the first, personal and professional identification, reasons for enrolment in the programme, relationship with mathematics as a student and as a teacher; factors that mostly contribute to students difficulties in mathematics and mathematical knowledge of primary teachers; for the second, personal valorisation of different learning experiences such as problem solving, investigation tasks, routine exercises; manipulative materials influence in learning and work organization forms in the classroom as well as evaluation of the teacher training programme till the moment, relating to differences between this programme and other attended training programmes, training sessions and observed classes.

SOME PRELIMINARY RESULTS

This study is still in the phase of data collection.

We will only share some preliminary ideas collected in the interviews that reflect some of the participants views, which we will organize in the following domains:

Relation with mathematics while student

All of the participants had at least 11 years of mathematics learning before the teacher formation programme. None of them has been a good math student, especially in upper years of schooling. One likes the subject, another never liked it and the other two have with math a mixed relationship of “love/hate”.

Mathematics instruction in teacher education

Although with an initial teacher training in different schools/systems, all of them claim a very weak math instruction on what concerns “what really interests for their formation as primary teachers”. One of them even sustained that she never had math classes (but she did!). One of the teachers has had complementary specialized training in mathematics and Portuguese language.

Factors that contribute to students’ failure in mathematics

Some factors put forward are mainly personal or academic, like: The child fails once and after that he/she feels unable; children have no habits of work, they are very absorbed with television, games and internet and they are incapable of learning by heart and retaining; lack of reading and interpretation skills in Portuguese language are an obstacle; children are not trained to think; the teacher doesn’t like math so he/she doesn’t explore it conveniently. Other ones are mainly affective or social, like: the importance of the affective relation with the teacher; the prevalent culture in family and society in general sustaining fear of this discipline, that is considered very difficult, only to be understood by a few, which excuses them for a bad result; lack of expectations towards school from parents; parents transmit to children a certain dislike about knowledge, as work is only conceived as a means to earn money; However, one of them sustains that math is now a more stimulating topic and so we can be in a turning point.
Aims of mathematics teaching and learning
At this point opinions diverge. One of the participants firstly remembers the practical contribution of the discipline in daily life, referring the value of calculation and mental calculation. The others mainly reinforce thinking and reasoning development, although they also refer practical features and one of them the importance of being a tool to other sciences. It may be interesting to register that the first opinion corresponds to the teacher that has less teaching experience in mathematics (almost none), a lower quality pre-service math instruction and no in-service math instruction.

Typical math class
All of the teachers refer a subject matter exposition followed by practice (sheets of exercises, textbook) and mainly individual work. Sometimes they use manipulative (or they “begin to use”) and children work in small groups, but they refer that in such type of organisation it is more difficult to control noise. One of the teachers refers to a collection of materials/tasks that she has organized over time and uses when adequate. This teacher displays at the beginning of the study a more structured teaching practice in mathematics, using manipulative materials mainly constructed with children and that they keep carefully – abacus, tangram, sheets of paper modelling halves, thirds etc – and habits of exploring math content in an interdisciplinary way. She more often uses dyad organisation of the classroom.

Role of different tasks
All of the participants claim that routine exercises, problem solving and investigations complete themselves, none of them being more important than others because each of them has a different role in children education, and so all of them must be used. Yet, since the question has been made in a general way, already referring the name of the tasks, it doesn’t help to decide if they really distinguish their meaning, especially concerning investigation tasks.

Difficulties/Needs
1) To know more adequate strategies of teaching/learning.
2) To know how to explore manipulative. One teacher refers that she knows that they are a means, not a goal, but she doesn’t know how to use them to guide children towards a better comprehension of mathematics and a larger level of abstraction.
3) To know how to teach through problem solving; there is recognition of its importance but insecurity on how to do it.
4) To “dress” the new roles of the teacher: propose, organize, make questions.

Reasons for programme attendance
Relating to the programme, the participants recognize that it was because of the awareness of their weaknesses, especially in didactical knowledge, that they decided to inscribe themselves. The preceding items of difficulties/needs constitute the main reasons to programme attendance willingness.
They also refer the need of exchanging ideas, not to be alone, not to fall into routine.
Quoting one of the participants: “I believe that I can change myself. That’s why I am here”.

First impressions of programme attendance
The four teachers have a very positive opinion of this programme, stressing the following features:

1) Comparing to other teacher training programmes, the most important difference is doubtless the existence of supervised classes. Relating to these classes, everyone assumes having felt some fear or uneasiness before them. Although they know that the main reason of this supervision is helping and collaboration between teachers and instructor, they cannot help thinking that they risk exposing themselves and therefore
much more courage is needed to attend this type of instruction than others. It is interesting to refer that elders pay more attention to this risk of exposure. But overcoming this discomfort, they consider that the need of using the suggested tasks or others with the same goals ultimately conducts to practice changing.

2) Relating to the small group work twice a month, the younger and less experienced claims that is “absorbing” everything and gives value to shared reports of classroom experiences. The others also stress the importance of being very practical, turned to teachers’ real needs. Quoting one of the participants: “To learn theories we read a good book, but what we do here we can’t learn in books!”

3) One of the participants claims as a consequence a better relationship between colleagues referring to sharing of materials and experiences.

In synthesis, these teachers know things are changing in mathematics teaching and learning, they even know the direction of the changing – the new role of the teacher, the focus on problem solving, the importance of manipulative as a means, etc. What they actually don’t know yet is how to integrate this knowledge in their practice.

REFERENCES


