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THE INFLUENCE OF INITIAL TEACHER TRAINING IN FUTURE TEACHERS' PERCEPTIONS ABOUT MATHEMATICS TEACHING AND LEARNING

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ABSTRACT: Assuming that teachers' knowledge about mathematics teaching and their beliefs and conceptions about mathematics and about mathematics teaching and learning are related (Ball, 1991; Thompson, 1997), that future teachers' beliefs act as previous knowledge in their formative experiences (Tardif, 2002) and that those beliefs are dynamic, once its confrontation with others beliefs can modify them (Vila and Callejo, 2006), we are developing a longitudinal study which intends to determine the influence of undergraduate degree on Primary Education in conceptions that students, future teachers, have about mathematics and about mathematics teaching and learning processes.

In this paper, we present preliminary data obtained in academic year 2012/2013 from two different groups of students, future teachers, of the undergraduate degree on Primary Education of Paula Frassinetti School of Education: a students' group at the beginning of its teacher training studies and a students' group at the end of this study cycle.

Key words: Teachers training, primary education, mathematics, conceptions

INTRODUCTION

Developed by Freema Elbaz, Alba Thompson and Deborah Ball and recognized by, the first studies on conceptions about mathematics and its influence on teaching and learning of this discipline in the various levels of education contributed decisively for a deeper understanding by the mathematics educators community of which factors should be taken into account in its curricular development, allowing to identify the enablers or hindering elements in its teaching and learning. In the early 80s, personal beliefs were identified as filters of all kinds of teachers knowledges: according to Elbaz (1983), a knowledge guiding their practice; Ball (1991) emphasizes the interaction between teachers' knowledge about mathematics and their conceptions about this subject, referring to his influence on their practices, belief also supported by Thompson (1997).

The formative practices experienced by students in their academic pathways and conceptions associated with them are identified as decisive not only in their academic achievements but are of particular relevance in their future professional practice. In this context, Tardif considers future teachers conceptions as previous knowledge regulators, both from their training experiences as from their results, considering that their professional practice is based on judgments interiorized from school traditions and in their lived experience, from which the past enables them to clarify the present and anticipate the future (Tardif, 2002). More recently, Vila and Callejo stated that beliefs develop from experiences and perceptions and enhanced the dynamic character of perceptions, since they can be modified by experience or contrast with other perceptions (Vila & Callejo, 2006).

Aware that beliefs about mathematics are mainly built in the school and that they define the vision and the application given to mathematics and assuming that they have an important role in future teachers training, in school year 2012/2013 we implemented a longitudinal study which main objective is to determine the influence of the undergraduate degree on Primary Education in future teachers conceptions about mathematics and about the teaching and the learning of mathematics.

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THE CONTEXT

In a more scientific approach or emphasizing educational knowledge in the specific area of mathematics, the undergraduate degree on Primary Education - necessary condition to obtain qualification for teaching in Preschool Education and in 1st or 2nd cycles of Primary Education - includes mandatory courses in mathematics in its training components. The curricular structure of this undergraduate degree includes six courses (summing 30 ECTS credits) focused on Mathematics and Mathematics Education: Development of Mathematical Logical Reasoning, Numerical Structures, Geometry Topics, Introduction to Statistics, Mathematics Communication and Didactics of Mathematics.

The first of these curricular units, Development of Mathematical Logical Reasoning, provides an initial contact with the specificities of the processes of construction and development of the main logical-mathematical structures. The following four courses (Numerical Structures, Geometry Topics, Mathematics Communication and Introduction to Statistics) are allocated to the training component of the teaching of mathematics, and include the presentation and exploration of concepts, relations, operations and logical-mathematical representations, covering mathematical knowledge needed to the desirable mathematics best practices in Primary Education. The organization and the construction of educational and didactic knowledge in the specific area of mathematics - essential to the design and implementation of educational contexts that promote the development of logical and mathematical reasoning in the areas of early childhood education and in the aim of the 1st and 2nd cycles of primary education - justify the inclusion of the course of Didactics of Mathematics in the last semester of the undergraduate degree on Primary Education curricular structure.

METHODS and PROCEDURES

The data we present has been obtained in academic year 2012/2013 from two different groups of students, future teachers, of the undergraduate degree on Primary Education of Paula Frassinetti School of Education, in Porto, Portugal: a students' group at the beginning of its teacher training studies (Group 1) and a students' group at the end of this study cycle (Group 2). Data collection was carried out in September 2012 in Group 1 (before any formative action related to mathematics, their teaching and their learning) and in Group 2 in June 2013 at the end of those students' graduations.

Students were requested to fill out a questionnaire survey proposed by Godino (2004). With a Likert type scale, students had to specify their level of agreement or disagreement with 9 statements, according to the following convention: completely disagree; disagree; neither agree nor disagree; agree and completely agree.

All students were informed about the objectives underlying the preparation and implementation of this study and their anonymity was guaranteed.

RESULTS and FINDINGS

The sample consists of 148 individuals and is almost entirely composed of female students (about 97% of respondents).

Table 1 presents those participants characterization:

Table 1. Sample Description

Variables	N	Gender		Age	X
		Female	Male		
Group 1.	70	68	2	17-30	19.5
Group 2.	78	75	3	20-27	21.9
TOTAL	148	143	5		

The answers provided by the questionnaire survey somehow reflect conceptions and representations revealed by these students about mathematics teaching and learning processes. In fact, data presented in Figure 1 allow not only some considerations regarding the conceptions expressed by these students about mathematics teaching and learning approaches but also provides information that can relate those conceptions with the students' formative level.

The overwhelming majority of these students believe that the teaching of mathematics should be initiated with the exploration of simple concepts and direct procedures and these should gradually progress to more elaborate

conceptualizations and procedures (item that collect over 80% of responses of partial or total agreement). Regarding the implementation of any process of math instruction, the two groups responded in a similar way: only about 5% of students in each group disagrees with the need of progression in the activities level of difficulty and the opposite view is expressed by about two-thirds of students in each group, which partially or totally agree with the necessity of such progress.

More than 90% of respondents of both groups agree partially or completely by considering that one of the duties of the teacher is to provide feedback about the activities carried out by students; it seems to have no significant differences in the responses provided by the two groups in these two items.

Half of the respondents from Group 2 consider that teachers should act quickly in classroom disagreements in order to prevent disruptive behaviors but that figure rises to two-thirds in Group 1 responses. In both groups, none of the respondents are in complete agree with the conception of the teacher as someone who decides what is and is not correct; we should note, however, that about 40% of the students in Group 2 expressed not agree or disagree with teacher's role as judge.

A significant number of these students associate autonomy to individual work - 65% of students in Group 1 and 70% in Group 2 converge in partial or total agreement that performing tasks individually promotes students autonomy -, but the percentage of respondents in Group 2 who established this explicit link is almost half the rate that occurred in Group 1.

About half of the students from both groups responded neither agree nor disagree on the influence of the use of non-standard procedures in learning the standard ones, and disagreement with the existence of this influence is similar in both groups (answer selected by nearly one-third of the students).

Noteworthy is the difference in perceptions expressed by the two groups on the mathematical abilities of young children. In Group 2, almost 80% of the responses indicate that these students disagree that the lack of experience and knowledge makes young children unable mathematically, whereas this figure drops to under 50% in the answers of students in Group 1. The statement that good organization and appropriate sequencing of classes are necessary conditions for children to understand mathematics collects the partial or complete agreement of over 60% of responses in both Group 1 and Group 2.

In Figure 1 we can find a graphic representation of the responses provided:

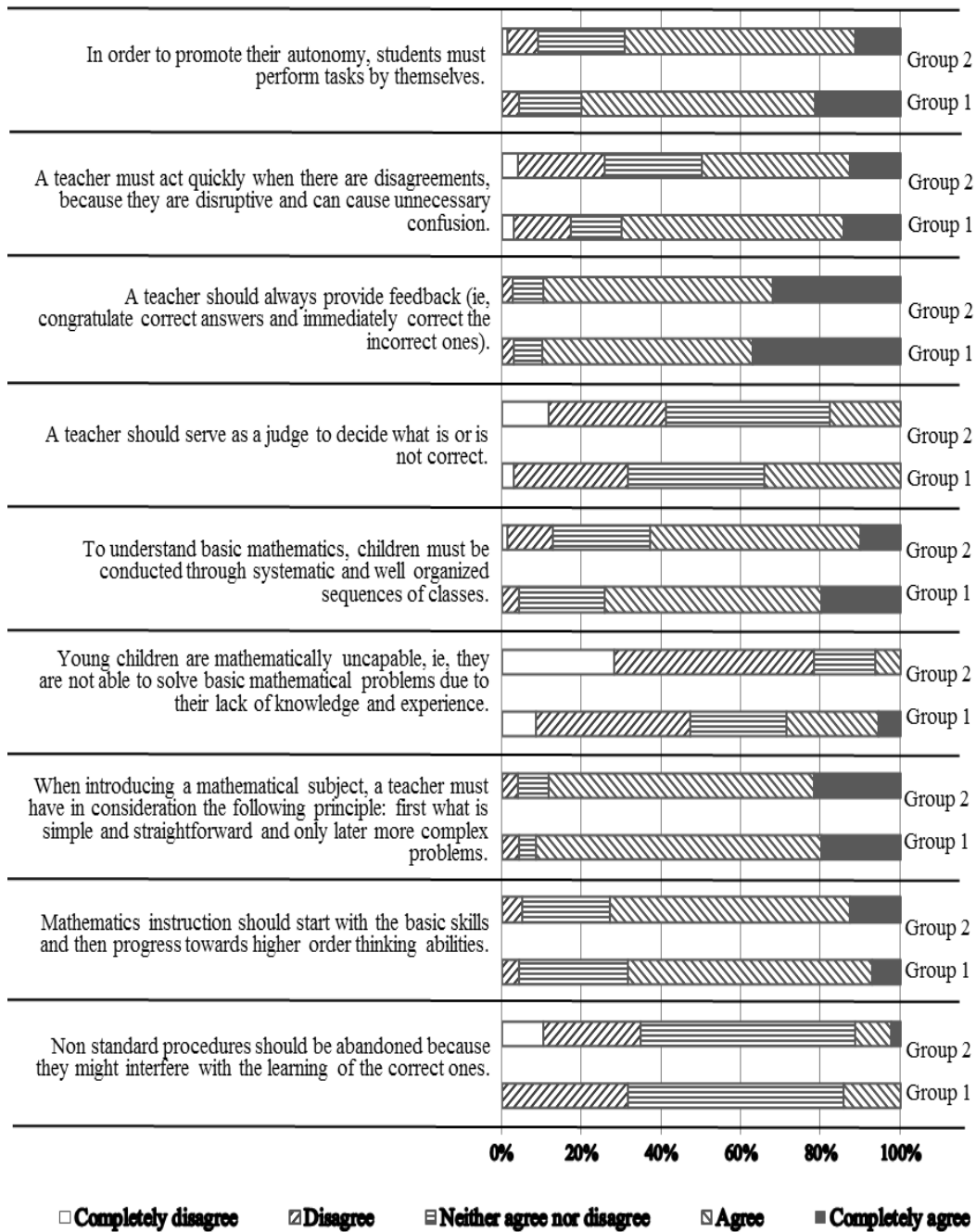


Figure 1. Participants Conceptions about Mathematics Teaching and Learning Processes

CONCLUSIONS

It is known that both students as classes in which they participate are influenced by the vision of the teacher who teaches mathematics. The clash of a teacher with his own vision of mathematics seems to us a key moment in the construction of their professionalism: the participation of these future teachers in this study can already be considered as an important contribution in this construction.

For its part, it is recognized some reciprocity in the process of elaboration of conceptions: first, the training experiences lived by students in learning mathematics play a decisive role in their conceptions of this discipline, about the context of their learning and about their own learning abilities; moreover, the constructed and

(re)constructed conceptions - in particular as a result of these formative processes - are also responsible for the mathematical approaches that they will bring for their students when teaching.

The questions proposed to these students allowed the presentation of these preliminary data, making possible to access and describe some of the processes of change of conceptions along their learning paths.

The perceptions expressed by students, future teachers, who participated in this study are largely the product of their own mathematical experiences, prior to its entry in the undergraduate degree on Primary Education, for one group, and also a consequence of its attendance in that course, for the other group. The value of teaching methods that emphasize the implementation of training sequences that depart from simple and direct approaches and progress to more elaborate conceptualizations may indicate that some of the most striking trends and current math education, such as problem solving, performing research tasks and projects in the mathematics classroom (NCTM, 2007; Ponte *et al*, 2007), may not have been experienced by these students or not been experienced by them as effective methods for mathematical learning.

It is also interesting to note that although they refer to individual work as a way of promoting autonomy, these students also understand how essential is the task of the teacher in providing feedback as soon as an incorrect answer is given, which can somehow indicate some lack of autonomy in activities development, pointed as one of the objectives for the discipline of mathematics already in Primary Education (Ponte *et al*, 2007).

From the analysis of these cases emerged a deeper knowledge about the relationship established at two levels: the action between the students and the learning and development of their students, and between the action of teachers and the development of students.

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