


Different Ways of Conceptualizing Mathematical Content for Prospective Primary School Teachers

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ABSTRACT

Changes in today society and in the development of technology demand a greater interest in mathematical knowledge in education and didactic research on professional work. Recent research seems to confirm that mathematics is still under-worked. This is the starting point from which the interest in studying the mathematical knowledge is necessary for the professional development of perspective primary school mathematics teachers arises. The study of mathematics curricula for the training of prospective teachers in different universities and their historical evolution will provide those with necessary criteria to organize, formulate, and develop the mathematical content of this didactic point of view and to establish the diagnosis of the systematic and the subsequent intervention in the teacher training institutions. According to the recommendations of the researches and other scientific events, the basic concepts and properties of mathematics should be included in the curricula of study programs for primary school teacher training.

KEYWORDS

Curriculum, Mathematics, Mathematics Education, Primary School Teachers, Teacher Training

1. INTRODUCTION

Several research and studies highlight that prospective primary teachers, after taking the subjects of mathematical education, continue to show certain lack of mathematical knowledge or have not even exceeded the level of pre-university studies. Despite everything, this level of knowledge allows them to solve exercises and problems in their exams, moreover, in some cases it has also been possible to arouse in them an intellectual interest and even motivate them. However, with this insufficient background, the future teacher does not manage to delve deep enough into a mathematical content to be able to plan his teaching and manage learning successfully. To solve this problem, the curriculums of teacher training faculties and mathematical education subjects must be organized according to a list of content that guarantees the acquisition of mathematical skills and competencies that allow future teachers to develop their teaching activity.

In this study we will analyze, establishing a comparison between them, whether the teacher training curricula at the University of León (ULE) and University “Kadri Zeka” (UKZ) contain and develop the mathematical contents necessary to form a good teacher of Primaria.

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2. MATHEMATICAL AND DIDACTIC CONTENT OF MATHEMATICS

The lack of skills of teachers in knowing and teaching mathematics is a concern among the teacher training community, so the academic field seeks to establish what are the knowledge and professional competences of the prospective teachers of mathematics. Determining these requirements remains a goal of didactic research, especially since the 1980s. These researches are based on the conjecture “the knowledge and professional competences of the professor of Mathematics must be acquired through different scientific domains: Mathematics, Didactics of Mathematics and Educational Sciences” (Socas, 2011). In recent years, several international studies (TIMSS 2015, PISA 2012, etc.) have shown differences in mathematical performance between countries due to a many different factors. Among the important factors of the mathematical performance of students are teachers and their mathematical training, the curricula and the assessment that different countries give to mathematics (Thaqi, 2009). In these studies, it has been shown that the differences between countries are greater than expected, although similar curricula are developed.

On teachers and their mathematical training, Shulman (Shulman, 1986) points out for the first time the importance of teaching the specific subject in teacher training. He determined three categories of professional knowledge: *Knowledge of the specific subject matter*; *Knowledge of pedagogical content knowledge* and *didactic knowledge of the content*; and *curriculum knowledge*. Subsequently, Bromme (Bromme 1988, 1994), describes the qualitative characteristics of the five major areas of professional knowledge, which he calls *Knowledge of Mathematics as discipline*, *Knowledge of Mathematics as a school subject*, *Philosophy of School Mathematics*, *Pedagogical Knowledge* and *Specific Pedagogical Knowledge of Mathematics*. These and other studies propose that the professional knowledge of future teachers is not simply a conglomerate of these domains of knowledge, but an integration of them. Considering the Primary teacher also as a math teacher (we know that Primary teachers in addition to Mathematics teach other subjects in their professional practice), and from the perspective of the work that a math teacher must develop, Llinares (Llinares et al. (2000) have identified different components, from which the domains of base knowledge derive, which are necessary to teach Mathematics and which must be taken into account in the training programs: *Knowledge of Mathematics*, *Knowledge on learning mathematical notions* and *Knowledge of the instructional process*. Subsequently, Llinares (2004 and 2009) proposes the articulation of three systems of activities or tasks to develop the knowledge and professional competences of the future math teacher: (i) analyze, diagnose and give meaning to the mathematical productions of his students; (ii) plan and organize mathematical content to teach; and (iii) manage mathematical communication in the classroom.

After all these considerations, the key question must be asked: *when can we say that a teacher is competent to teach mathematics?* An answer to that question is offered by Niss (Niss, 2006), who describes the competent math teacher as one who effectively and efficiently is able to help his students build and develop mathematical skills. In a concrete way it describes six teaching and pedagogical competences in relation to mathematics: curriculum competence, teaching competence, competence of the interpretation and analysis of learning, evaluating competence, collaborative competence and competence of vocational training. Also, Socas (Socas, 2007) gives an answer from the logical-semiotic approach and proposes that the professor of mathematics in the field of Primary education should take as a starting point the consideration of the relationships that occur between the mathematical content curriculum, the student and the teachers of mathematics. The relationships that take place between these three elements develop in a context characterized by the social, cultural and institutional aspects.

On the other hand, although the *didactic* term of mathematics is relatively new, a lot of research has already been developed in this regard and in different content areas. Perhaps the biggest problem is the difficulty of determining what constitutes knowledge of mathematical content and the relationships between knowledge of pedagogical content and that of matter. Models such as Grossman's (Grossman, 1990) have tried to elaborate in more detail Shulman's definition of the knowledge of the mathematical content that the future teacher needs. Different authors have analyzed this knowledge in relation

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