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RE-CONSTRUCTION OF THE MATHEMATICS CURRICULUM IN THE CONTEXT OF THE DIDACTIC KNOWLEDGE OF THE PRIMARY TEACHER

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Abstract: This article aims to socialize the advances of a doctoral study in progress that seeks to answer the question: how does a primary school teacher (re) build the mathematics curriculum in the context of his Didactic Knowledge? The theoretical horizon considers certain investigations focused on the mathematics curriculum, determining some issues associated with the knowledge and professional development of the teacher, issues that allow an approach to the problem, in terms of what it means to (re) build the mathematics curriculum and the didactic knowledge that a primary school teacher must exhibit in order to manage the curriculum in the classroom. Another relevant aspect is the proposed methodology, which is part of a qualitative paradigm, in which the training tasks will constitute a possibility to promote interactions, reflections and possible transformations in the didactic knowledge of the teacher who teaches mathematics in basic education. primary.

Keywords: Mathematics curriculum; professional knowledge, didactic knowledge; professional development.

INTRODUCTION

The experiential reference and the literature review are the source of inspiration that made it possible to pose the research problem to address difficulties associated with the knowledge of teachers who teach mathematics in elementary school.

From the experiential reference, it is observed that some teachers who teach mathematics in elementary school are not specialized in the area, which could be related to some difficulties they present regarding mathematical knowledge, specifically related to random and variational thinking, and the formulation and problem solving. A particular case is evidenced when in the practices of some teachers, it is appreciated that the teaching of

numerical thinking, numerical systems, the exercise and fixation of procedures is usually favored, a situation that partly leaves aside the teaching of other thoughts. and systems that guide the Mathematics Curricular Guidelines of the Ministry of National Education (MEN, 1998), a problem that could be the product of the little or scarce training that primary school teachers have in the area of mathematics, which can be reflected in curricular aspects such as planning and classroom practices.

In the words of Gómez and Velasco (2017), the solution is not a matter of explaining the content of the curricular reference documents through short-term training spaces; In addition to the above, it is necessary to strengthen the initial and permanent training of teachers. Therefore, it can be seen that this difficulty brings into consideration the need to analyze the didactic knowledge of primary school teachers in the process of interpretation and management of the mathematics curriculum, the planning of their educational practice and its implementation in the classroom, through an accompaniment strategy that contributes to the knowledge and professional development of the teacher.

In line with the previous argument, it could be affirmed that teachers have a fundamental role in the design of the mathematics curriculum and in its application in the classroom. However, in the light of Gómez and Velasco (2017), to put the MEN reference documents into practice, “teachers require disciplinary knowledge and mastery to interpret these documents” (p. 278). That is, the teacher uses the curricular documents based on the interpretation that he himself can make of them, and this interpretation depends on how well he understands their content, a situation that is reflected in his classroom practices.

Regarding the theoretical reference, the literature reports that it is necessary to analyze

the knowledge of primary school teachers (Rojas, Flores and Carrillo, 2015) in order to recognize ways of thinking and promote improvements in their classroom practices, and they emphasize that the performance of the teacher who teaches mathematics in primary school, is influenced by professional knowledge, which allows him to design, apply or act against his educational practice. On the other hand, it also reports that the curriculum is an obligatory reference for any approach to improving the educational system (UNESCO, 2016) and the need to relate it to the knowledge and professional development of the mathematics teacher (Carrillo and Climent, 2010).

The difficulties that teachers present with respect to school mathematics in primary education and its impact on the curriculum have been analyzed through studies carried out by some researchers in different countries and contexts. Research such as that of Zapata, Santa and Jaramillo (2018) consider it convenient to generate reflection spaces for the primary teacher, in which interactions that transform their knowledge of teaching and enhance their professional development predominate, where the reflection, determination and action of the teacher to improve their practices could be decisive elements in the transformation of their professional knowledge. In addition, researchers such as Vásquez and Alsina (2015) consider that research on the didactic knowledge of primary school teachers is scarce.

In the words of Velásquez (2014), it is desirable to generate spaces for continuing teacher training, where they reflect on the knowledge required to assume the process of teaching and learning mathematics in primary school. Otherwise, Ponte (2012) states that teacher training spaces, in which teachers consolidate learning from their experiences, their reflections, their interactions and their

participation in social practices, become an opportunity to learn in a group where Both the disciplinary, didactic and pedagogical training needs can be discovered, as well as the strengths or weaknesses of the professional development of each member of the group, promoting the possibility of building knowledge and favoring or transforming, in particular, that professional development.

The ideas exposed so far, in which it is observed, according to the literature review process carried out so far, that there is little information related to the didactic knowledge of the primary teacher and its incidence in the curricular management, for purposes of the development of this study, the following research question is proposed:

How does the didactic knowledge of primary school teachers enable the (re) construction of the mathematics curriculum within the framework of a professional development program?

Considering the previous question, the following objective is proposed:

To analyze the didactic knowledge of primary school teachers, in the (re) construction of the mathematics curriculum within the framework of a professional development program.

METHODOLOGY

Given the characteristics of the research and its objective, the methodology proposed for the study is part of a qualitative paradigm in accordance with the perspectives of Hernández, Fernández and Baptista (2014), as it seeks to analyze an object of a social nature, specifically to analyze the (re) construction of the mathematics curriculum in the context of Didactic Knowledge of primary school teachers in a public educational institution in the city of Medellín.

The study is part of the grounded theory (Glaser and Strauss, 1967). From this

perspective, the purpose is to develop a theory based on empirical data; therefore, it is classified into two designs: systematic and emergent. For the first, some initial categories are proposed through an open coding and, subsequently, by establishing relationships, an axial coding is formulated that enables the definition of a central axis, until reaching a selective coding and proposing a theoretical position. In the second, the theory is a consequence of the relationships established between categories that emerge and are linked to each other.

The design chosen for the doctoral study is systematic, the data obtained in the development of the training tasks constitute initial categories that are permanently compared with the emerging ideas; this comparison enables the definition of properties to generate conceptual categories associated with the didactic knowledge of teachers, in the perspective of Ponte (2012). The research seeks the elaboration of an explanatory position that accounts for the didactic knowledge of the primary teacher in the context of a possible (re) construction of the mathematics curriculum.

To achieve this purpose, training tasks were used as the strategy that allowed collecting data from the voices of the participants.

There is the participation of seven teachers who previously have information about the study in question and consider that they must take advantage of being part of it to enrich both their training and their teaching practice according to their needs and interests, therefore, they agreed to participate voluntarily. of the field work and attend the regular meetings that will be held during a semester. It is intended that the meetings are mediated by reflections on professional identity, learning processes of their students, planning of educational practice, its implementation in the classroom and the

evaluation of their curricular options.

The meetings are mediated by the development of training tasks with a defined structure, but, at the same time, flexible insofar as attention is paid to the needs and concerns expressed by the teachers (Ponte, 2009). In the development of each task three moments are considered; initial reflections, activities framed in the (re) construction of the curriculum and reflection on practice.

In relation to the participating teachers, it is worth mentioning that only one has specific training in the area of mathematics; In addition, they have had little access to professional development or updating programs. Thus, the willingness to take on challenges and respond to the demands of the environment and of their students characterizes teachers, who recognize their training needs as an opportunity in the face of what they need to learn.

It must be noted then that, for the purposes of the development of the doctoral research and to be able to answer the question posed, it is pertinent to frame the study in a systematic design, so that the data obtained in the development of the training tasks and other interactions with teachers are permanently confronted with emerging ideas; This confrontation must enable the generation of properties for the conceptual categories that are elucidated in the field work, possibly associated with the didactic knowledge of the teachers, in the perspective of Ponte (2012), with a view to understanding the object of study. in question.

The analysis of the information will be carried out through a categorization process through the Atlas.ti software, which will allow organizing and codifying the information. As for the academic spaces to achieve the collection of information and build the collective, it is intended to hold regular monthly meetings, lasting three hours, in

which the training tasks are the central reason for the meetings. It is important to highlight that these arise from the needs, interests and problems that teachers face, so it is expected that their design will emerge within the group.

Consequently, it is necessary to emphasize that the collection and analysis process occur practically in parallel. This way, the episodes associated with professional knowledge, which occur in the development of training tasks in the classroom and in the daily environments of teachers, offer data that generate categories, which must be analyzed permanently. It seeks the establishment of relationships and the selection of concepts, which allow to base a theoretical position against the transformation of said knowledge.

For the information collection process, communities will be formed with the participating teachers, in which the collaboration and observation of the practice, in the perspective of Ponte (2012), will guide the objective of the meetings. The data collection will be carried out through tools such as: observations, field logs, individual and group interviews, annotations of episodes on the interactions that arise between teachers and with students, video records, audios, material prepared by teachers and class plans, among other records, that reveal elements that are the object of analysis for the definition of categories.

In addition, emerging information will be considered, which for some reason had not been foreseen and which can help to elucidate in detail the nature of the transformation that the teacher faces, to analyze how early algebra could lead to transformations in the professional knowledge of the teacher of Algebra. primary. Each of these records will be used with the authorization of the participants, previously signed, in which they express their full consent.

The analysis process begins with the structuring of the data, through their organization and the transcription of the material, with a view to analyzing and interpreting the information collected that accounts for the transformation process of professional knowledge; this analysis must be subject to criteria of rigor or quality, such as: internal validity, external validity, reliability and objectivity (Vasilachis, 2006).

Consequently, the analysis process allows generating a system of categories, in which the information collected will be codified through a characterization that will allow data to be classified, which can be presented through diagrams, conceptual maps, charts, matrices, among others, that allow define how these records are linked to theory, to validate or answer the research question. Due to the relevance of the data in the doctoral study, it is necessary to specify the scenario that will lead to the generation of these; To this end, some postures in relation to the training tasks are presented below.

INFORMATION COLLECTION PROCESS

For the data collection process, techniques are used in accordance with the field work that will be carried out jointly with the teachers; among them, are the development of training tasks, which in the perspective of Ponte et al. (2009), involve problems and activities, which are offered to teachers so that they have the opportunity to deepen the knowledge they must teach their students and the way they can teach it; These encourage reflections on the interactions that emerge in classroom practices and with peers.

The tasks not only constitute one of the scenarios for the collection of information in the research, they could also reveal issues associated with the teacher's didactic knowledge and each of its dimensions

contemplates according to (Ponte, 2012) the complexity of what the teacher knows and what he does with that knowledge. That is why the proposed training tasks will be designed according to the training needs expressed by the group of teachers regarding the mathematics curriculum.

As mentioned above, one of the scenarios that will enable the collection of information is determined by the training tasks, which in the perspective of Ponte et al. (2009) are defined as problems and activities, which are offered to teachers so that they have the opportunity to deepen their knowledge about what they must teach their students and how they can do it; These encourage reflections on the interactions that emerge in classroom practices and with peers.

Training tasks, which could well be referred to as professional learning tasks, “are complex tasks that create opportunities for teachers to reflect on pedagogical problems and their possible solutions through processes of reflection, knowledge sharing and knowledge construction” (Ponte et al., 2009, p. 193). In this doctoral study, they

constitute the central reason for the meetings with teachers, given that “these tasks are at the center of mathematics teacher training and determine what teachers are learning, along with various ways of working, dynamics and contexts.” (Ponte et al., 2009, p. 185).

This way, the training tasks reveal issues associated with the teacher’s professional knowledge, defined by Ponte (2012) as didactic knowledge, which offers a perspective in which four dimensions are integrated, namely: knowledge of educational practice or educational processes. of work in the classroom, of mathematics for its teaching, of the students and their learning process, and of the curriculum. Each of them contemplates the complexity of the teaching task in different configurations, from what the teacher knows to what he does with that knowledge.

RESULTS

Considering the scenario of ideas that have emerged so far, in the process of developing training tasks with the group of teachers, it is possible to assume that the reference documents

Moment	Projection
Moment of initial reflections.	Exchange of ideas about the work to be done, mediated by the reflections that may arise from previous meetings and the expectations of new meetings.
Activities framed in the reconstruction of the curriculum.	Development of activities related to the way of managing the curriculum in practice, implies the identification and recognition of the aims and main objectives of the teaching of mathematics, materials, resources, among others, aspects that evidence the decision-making on the practice.
Reflection about practice	Recognition of the presence or need for long- and medium-term planning, such as the planned plan for each class session, the preparation of the tasks to be carried out and all those issues related to the conduct of activity in the classroom.

Table 1. Moments that will mediate the design of training tasks.

Own elaboration to illustrate the structure of the training tasks, in correspondence with the didactic knowledge of the teacher (Ponte, 2012).

that guide the mathematics curriculum in Colombia are fundamental and cannot be ignored. However, various actors contribute to its construction, including the teacher, who performs it at different levels, moments and contexts. However, to take advantage of the curricular role of the mathematics teacher, it is important to reflect on the work processes in the classroom, framed in didactic knowledge, that is, knowledge of mathematics, knowledge of the curriculum, knowledge of students and their learning processes; and knowledge of educational practice.

Knowledge related to educational practice constitutes a fundamental component that includes knowledge of work processes in the classroom; this knowledge is the core of didactic knowledge (Ponte, 2012), and in it the planning of teaching converges with everything that this encompasses. Additionally, Ponte (2012) estimates that knowledge of educational practice has a direct and close relationship with others, and although they are all linked to each other, it seems that this is configured as the center of the position exposed for didactic knowledge.

In this sense, it is important to recognize that the national reference documents by themselves do not constitute a curricular proposal, they must be articulated with the approaches, methodologies and strategies defined in each educational institution within the framework of the institutional educational project; neither the learning curricula nor the basic learning rights replace the curricular curricula of each educational institution (MEN, 2017). Therefore, it is essential that these documents be taken up by groups of teachers, so that they are the object of analysis and a starting point in processes of re-signification of their pedagogical practices.

In this order of ideas, it would be valid to think that the analysis of the teacher's performance regarding his learning and

didactic knowledge could be a decisive element in the management of the mathematics curriculum and, in this sense, it becomes important and convenient to think about the need to generate reflection spaces for the primary teacher, in which interactions that transform their teaching and enhance their knowledge and professional development predominate. The foregoing could benefit teachers to the extent that they are able to reflect on the planning of educational practice, its implementation in the classroom and the evaluation of their curricular options.

This is how, in terms of what the teacher knows and how he teaches what he knows, Ponte (2012) considers that the articulation between mathematical content and pedagogical knowledge contributes to the development of professional knowledge and that it probably contributes theoretically and methodologically to teaching practice.

CONCLUSIONS

Although didactic knowledge is not a new issue in the field of mathematics education research, it could be somewhat novel in the (re) construction of the mathematics curriculum in the context of the didactic knowledge of the primary teacher. In this sense, it is convenient to think about the urgency of generating reflection spaces for the teacher who teaches mathematics in primary school, in which interactions that transform their knowledge about teaching and enhance their professional development predominate.

In relation to the above, teachers not only need to know how to interpret and manage the mathematics curriculum in primary school, they must also know mathematics, but this disciplinary knowledge is not enough, and, in this sense, other analyzes must be raised in the study. doctoral in progress. Consequently, the knowledge and professional development

of teachers allow us to glimpse the role of the teacher in the planning of educational practice and its implementation in the classroom, their beliefs and professional identity. It is worth reflecting, as researchers, on the conditions and possibilities for practicing primary school teachers, with or without specific training in mathematics, to respond to the manifest need to evaluate their curricular options.

The actions of the training process sought to promote professional development and the mobilization of professional knowledge of the Mathematics teacher based on empirical reflections on her own performance in the

classroom. Revealing and understanding the mathematical and didactic knowledge of teachers constitutes an important field of research in teacher training, especially when practice is considered as a starting point for the construction of professional teaching knowledge. The reflections of the practices registers can provide moments of collective discussion that debate on mathematical and didactic questions, proposing and exploring new pedagogical proposals and, with it, developing or (re) constructing the knowledge necessary for the teaching practice.

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