INITIAL TRAINING OF TEACHERS IN BACHELOR'S DEGREES: A DIDACTIC OBSTACLE TO PROFESSIONAL PERFORMANCE IN BASIC PRIMARY EDUCATION.

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Summary

The article originates from the research study, ***Didactic Obstacles in the Teaching of Mathematics at the Primary Level****, which was carried out with the support of the* ***interdisciplinary group Study of Numerical Thinking, Public Policies of Science and Technology, Agricultural Production, Environment, and Problems of Latin American and Caribbean Education****. Its objective is to review the initial training of teachers of the degrees offered by the Popular University of Cesar, such as Bachelor's Degree in Art and Folklore, Bachelor's Degree in Spanish Language and English, Bachelor's Degree in Physical Education, Recreation and Sports. As well as the didactic obstacles that new graduates of these programs face when they graduate from these programs, when facing the reality of primary education in Colombia, particularly in the city of Valledupar. In this sense, some terms and their components are contextualized and how they impact the work in situ, by reviewing research related to the topic, as well as the positions and methodologies, the different epistemological perspectives of research, and those questions that have remained unanswered. All this, in order to be able to elaborate a theoretical construct that allows to contrast the existing theories on the relationship between teacher training and the didactic obstacles present in the teaching of basic primary education.*

Key words*: initial teacher training, didactic obstacles, mathematics teaching, teaching work in primary education.*

INTRODUCTION.

The initial training of teachers who graduate from the degrees offered by the Popular University of Cesar, such as: Bachelor's Degree in Art and Folklore, Bachelor's Degree in Spanish Language and English, Bachelor's Degree in Physical Education, Recreation and Sports; It is oriented towards the specific didactics of each of them, as well as the specific knowledge that they will develop in the practice of their career, but when faced with the reality of the work in situ, they find the need to work on areas of knowledge different from those they were trained, given the current regulations of primary education in Colombia.

In this sense, we ask ourselves where they take their own knowledge of the areas that were not worked on during their professional training, as well as the specific didactics, necessary in their teaching work in basic primary education. For this, we begin with the questions that will serve as guides, what do we call didactic obstacles? What is their role in the teaching-learning process? How important is teacher training in the management of didactic obstacles? The appropriation and social construction of knowledge is a primitive and polyvalent activity, with different supports, routines and epochal interpretations. In the same way, as a guide in this research, it is hypothesized that: the deficient training in mathematics of the primary school teacher is a didactic obstacle that interferes in the teaching-learning process.

In this regard, according to (Brousseau, 1999), the importance of teaching mathematics is highlighted as a tool that initiates the child in rational thinking, for him it has formative properties at the individual level and facilitates the development of collective development skills, highlighting the importance of educational sciences in the teaching and dissemination of mathematics.

On the other hand, there is research that highlights epistemological obstacles and their direct link with the teaching-learning process in the mathematical sciences (Brousseau, 1999), as observed in

the article entitled Epistemological Obstacles and Problems in Mathematics, in which the author mentions the different contributions made by Bachelard and Piaget. who state that indeed, what is considered an error, in addition to being the effect of ignorance and uncertainty, is the product of a history, of a baggage of previous knowledge that the subject possesses, which perhaps evidenced success previously, but that by incorporating new information it is demonstrated that it lacks functionality or veracity in the present, constituting a didactic obstacle.

It should be noted that the didactic obstacles in the teaching-learning process of mathematics in Basic Primary Education in the Municipality of Valledupar, are related to the educational policies of the Colombian State, namely, Law 115, 1994, Decree 1295/2010, Law 1188/2008, Decree 2450/2015, Decree 1075/2015, and Resolution 02041/2016, of the Ministry of National Education and logically taking into account globalization as an omniscient variable in the development of mathematical academic training programs.

In this order, to speak of being a teacher is to highlight a professional who builds repertoires, who must orient himself or herself in the problem he or she seeks to solve (Listón & Zeichner, 1993 read in Pavié 2011); However, nowadays, despite the fact that training curricula are designed based on the development of competencies, in practice the effective resolution of emerging problems is not based on the scientific knowledge that every teacher must handle, but on a mere repetition of "a recipe" as stated (Montero, 2001)

Under this scenario, changes have been generated in the structures of organizational entities of an academic, social, cultural, economic, political, pedagogical, didactic nature, and the quantitative and qualitative growth of science, technology and innovation, have a direct impact on the disciplinary area of mathematics, which leads to changes in the way it is conceived and how it is taught. This leads to the need to advocate for more participatory and interactive processes, where the main actor is the student. That is why, in turn, the construction of mathematical practice requires a transformation in the teacher, as well as in his or her continuous training, with actions that respond to questions that have been posed by various authors and that are presented below.

Based on the above, since the incorporation of the competency-based approach, the discussion on teacher training has been guided by questions such as: does competency-based training develop better teachers? (Pavié, 2011); What should teacher training be like with respect to pedagogical knowledge? Could it be that the title of bachelor or professor is equivalent to your lifetime experience? (Díaz, 2006); How should a continuing education system for teachers be designed? (Ruiz, 2012) among others.

These questions have been approached from the four aspects of competency-based education, understanding them as behaviorist, functionalist, constructivist and holistic; In this sense, for the purposes of this research, the constructivist epistemological position (Vygotsky, 2007) is selected, for whom learning is an active process, where knowledge is acquired step by step through action, building the learning environment according to the individuality of the learner; emphasizing for the present project, that the subject of study is constituted by the elementary school teacher.

It should be noted that teachers generate theories consciously or unconsciously, which is why they must have a permanent training plan (Tejada, 2000) that allows them to keep their practice and pedagogical knowledge up to date. Hence, one of the most prominent problems of teacher training in the literature is the lack of continuous training, because once university studies are completed, a large part of teachers stop their training, detecting absences and gaps in professional practice "dispersed, diffuse and superficial knowledge to which routine is added, conformism, adverse environmental conditions, lack of training programs and a non-intellectual abandonment that takes hold of the teacher" (Díaz, 2006, p. 94)

In this regard, (Pavié, 2011), (Díaz, 2006) and (Ruiz, 2012) 2012, talk about the challenges in teacher training, highlighting that if teacher training is solid, so will the teacher, on the contrary, when it presents deficiencies or gaps, there is evidence of a limitation in the process of teaching mathematics.

In this same context, in the last decade, proposals for innovative teacher training models have been designed; This author, Murillo 2005 cited by (Díaz, 2006) examines seven experiences of this type

worldwide through the study of recognized universities, coinciding in innovative models of training where the teacher develops his facet as a researcher as part of his reflective process, emphasizing innovative culture with contextualized programs, a clear theoretical framework that responds to a bottom-up approach and a training by competencies. with a theoretical-practical approach, in addition to having a transdisciplinary vision where the training is blended with the support of ICT.

For his part, Ruiz (2012) highlights that the Millennium Development Goals, when talking about the importance of teachers in 21st century education, must develop other transversal curricular skills such as, for example, teaching in multicultural contexts, or attention to other forms of diversity in the classroom.

In this sense, the hypothesis to be validated aims to determine how the lack of continuous education that reinforces the teacher training of the active subject who teaches mathematics can constitute a didactic obstacle that stops the progress of learning in children, or failing that, influences the quality of what is taught.

Seen from these perspectives, Andrade (2011) points out that didactic obstacles are barriers that prevent the acquisition of new knowledge; since, when difficulties cannot be overcome, they become limiting because they prevent progress in the construction of specific knowledge.

However, for Brousseau (1998), the notion of didactic obstacle is part of the transposition that the French philosopher Gaston Bachelard initially made on the epistemological obstacles where problems related to the advancement of scientific knowledge were studied. According to the author, obstacles are not produced by ignorance of knowledge or by an erroneous understanding, they imply the acquisition of specific knowledge that subsequently hinders and obstructs the acquisition of higher-level knowledge and it becomes necessary to know them; "If we think of knowledge in terms of obstacles, because it is in the very act of knowing intimately, hindrances and confusions appear through a kind of functional necessity, which is what produces stagnation and inertia." Bachelard (1976)

In relation to these implications, it can be interpreted that obstacles do not allow the fulfillment of the management of an action, of a purpose or its resolution, they obstruct the realization of an objective; In other words, it makes the problematic situation impracticable, since they are those elements that make it impossible to advance in the construction and appropriation of new knowledge.

Therefore, mathematical didactic obstacles can be seen as the difficulties, inconveniences, limitations and restrictions that hinder the reconstruction and foundation for the appropriation of the new knowledge that is represented in the teaching-learning processes of mathematics.

In the same vein, Durox and Brousseau specified the conditions that knowledge would have to satisfy in order to be declared an "obstacle" in Bachelard's sense and explain the interest of this concept, which should be distinguished from that of "difficulty", since they characterize obstacles as: a knowledge that has a domain of "validity", which resists and reappears. It is also constitutive of knowledge.

The aforementioned authors conclude that an obstacle is manifested by errors that appear in the daily work of teaching, which do not originate by chance; However, due to their recurrence, they can be consciously recognized and modified, consequently, when incorporated with the previous learning, it becomes a competence or domain that generates different actions in the teaching-learning process of mathematical knowledge.

It is concluded, then, that these errors come from difficulties that originate in teaching, to name a few: methodological, curricular or conceptual. Federici (2004) In general terms, didactic obstacles are all those specific problematic situations that oppose the construction, reconstruction, foundation and foundation of mathematical knowledge within the teaching-learning process.

In addition to this, Plaza, González and Vasyunkina (2020), when referring to the didactic obstacles of mathematics teaching, express that these are a barrier that prevents moving forward, forcing us to look for alternatives to face the physical or mental situation that delays the normal development of the learning process. Likewise, Andrade (2011) states that they originate in the processes of induction, making it impossible to overcome epistemological obstacles, understood as the elements that allow us to see things in a new way.

Therefore, according to these authors, a didactic obstacle refers to a previously acquired prior knowledge, not to the absence of it, by virtue of the fact that this information becomes insufficient or unsupported when it is visualized to provide meaning to the resolution of problems that imply a higher degree of knowledge, thus being able to as its name indicates, hinder the appropriation of new mathematical knowledge, understanding that it is iterative and recurrent, since it is part of the teacher.

Emphasizing the didactic obstacles, Brousseau (1998) states that they are determined by three typologies, whose structures are categorized into different origins according to the development of the subject and the incursion into specific cultural models, distinguishing into: Ontogenetic, epistemological and didactic.

In this sense, ontogenetic obstacles are those that have to do with everything related to the limitations of the subject at some point in his development, therefore, they come from the specific genetic conditions of the human being. In other words, they coexist in correspondence with the limitations and characteristics of each individual and are directly related to their neurophysiological development.

Likewise, when the obstacle has its origin in the mathematical discipline itself, it is recognized as epistemological, which occurs when the understanding of a certain mathematical concept interferes with the understanding of a more complex one, recognizing among them, the difficulty of the concept of conceptualizing zero, relative numbers, the conceptual leap between natural numbers and rational numbers, among others, situations that have been presented as historical particularities in its conceptual development.

That is to say, they are part of the learning process, which rather than avoiding, requires the teacher to have tools of the teaching process, in such a way that he can assume responsibility for the gearing of new knowledge.

Finally, there are didactic obstacles, as pointed out (Brousseau, 1998), such as those that have their origin in the strategies used in teaching to try to support the learning of specific mathematical notions; but not in cognitive development or in the discipline itself. That is, they are acquired, or appear by the condition of teaching, or by the choice of a particular theme or axiomatic.

On the other hand, Andrade (2008) points out that, in the case of didactic obstacles, understood as difficulties that prevent progress towards the construction of new knowledge originating in the methodology and in the traditional conception, they represent, together with the experimental method, the conceptual scheme on which modern science is based and in which technology gravitates, there are close interactions between them; For this reason, it is required that teachers strengthen their pedagogical work through constant and updated training that allows them to face challenges to support students to overcome obstacles and appropriate knowledge. Additionally, Brousseau (1999) points out that the way in which teachers manage to overcome the different didactic obstacles that arise, helps them to modify their status, their training and their relations with society.

In short, for the author "the notion of obstacle has a tendency to extend outside the strict field of epistemology: in didactics, in psychology, in psycho-sociology, etc." (p. 4), which is why it is necessary to deepen studies that continue to provide information on the subject, typifying the causes and reasons for its existence.

Consequently, these obstacles can be overcome and accepted, not as something that should not have appeared, but as an instance whose appearance is useful and interesting, since it allows the acquisition of new and better knowledge, as expressed by Espinoza, Barbé and Gálve (2011); Di Blasi Regner, M. et al. (2003); Abrate, Pochulu and Vargas (2006), among others.

Based on the above, the lack of a renewed and permanent training process with contributions from the different updates to the teacher who teaches the mathematics course, can constitute a didactic obstacle that interferes with the optimal teaching-learning process; by anchoring it to a previous knowledge received in their initial formation, which, as mentioned above, had its use in the past but is ineffective in the present.

In this vein, globalization has generated changes in research and in the construction of mathematical knowledge; This means that a teacher of the 21st century has before him the challenge of being permanently updated, turning the teaching exercise of mathematics into a transdisciplinary knowledge, through the execution, exchange and construction of knowledge.

However, the challenge seen from the individuality of the teacher is to generate strategies that allow these barriers to be overcome, facilitating the acquisition of new knowledge built on a strengthened practice focused on the construction of knowledge from the very meaning and pure meaning of mathematics. To this end, there must be an integration between the educational policies of the state, the institution and the actions of the teacher, focused on raising the academic level.

Considering the above interpretations, according to Espinoza, Barbé, (2011) the mathematical didactic obstacles result from the teaching-learning process between the actors of the teacher/learner binomial, emphasizing that they develop from the discussion of the concepts of real events and not simply to the repetition or transmission of what has been learned, concepts, theorems, Schemes, propositions, principles and contextual situations typical of mathematical activity.

From there that, according to Bracho (2012) Teacher training is a spearhead element in the management of professionals with scientific competences, capable of promoting the creation of new knowledge by implementing strategies and actions framed in science, technology and innovation, generating significant knowledge in the student.

Therefore, education in a post-pandemic scenario requires reconsidering the existing paradigms in the system and especially in the teacher who teaches mathematics, specifically what concerns training, recognizing him or her as responsible for promoting new processes, aligned with coherence with the interests of students and the academic-social context in which they will work. promoting spaces that contribute to the use of meaningful learning experiences, through continuous training and permanent updating of their work.

Bibliography

[1] Abrate, Pochulu and Vargas. (2006). Errors and difficulties in mathematics: Cause analysis and work suggestions. 1st ed. Buenos Aires: Universidad Nacional de Villa María.

[2] Andrade. (2011). Didactic obstacles in mathematics learning and teacher training. Latin American Committee on Educational Mathematics., In Lestón, Patricia (Ed.), Acta Latinoamericana de Matemática Educativa (pp. 999-1007). Mexico City.

[3] Andrade, C. (2008). From the hand to the brain; on the construction of signless rationals (Q+) based on Federici's didactics of mathematics. Bogotá: Fondo de Publicaciones del Gimnasio Moderno.

[4] Bachelard, G. (1976). The formation of the scientific spirit. In G. Bachelard, The Formation of the Scientific Spirit (p. 15). México: Siglo Veintiuno, edtores, S.A. 5 ed.

[5] Bracho. (2012). Research culture and scientific production in private universities in the municipality of Maracaibo, Zulia state. Maracaibo. Edo Zulia: REDHECS. CITY.

[6] Brousseau. (1998). Théorie des situations didactiques. France.

[7] Brousseau. (1999). Mathematics education and didactics, in mathematics education. Mexico.

[8] Brousseau, G. (1989). Les obstacles épistémologuiques et la didactique des mathématiques. Construction des savoirs.

[9] Di Blasi Regner, M. et al. (2003). Difficulties and Errors: A Case Study. . Brief paper presented at the II International Congress of Mathematics Applied to Engineering and Teaching Mathematics in Engineering. Buenos Aires, Argentina.

[10] Diaz, A. (2006). The competency approach in education. An alternative or a disguise for change? Educational Profiles, vol. XXVIII, no. 111. Instituto de Investigaciones sobre la Universidad y la Educación Distrito Federal, México, pp 7-36 Instituto .

[11] Espinoza, Barbé, Gálve. (2011). Limitations in the development of mathematical activity in elementary school: the case of school arithmetic. Pedagogical Studies XXXVII, No. 1: 105-125, 2011.

[12] Federici, C. (2004). A didactic construction of the Decimal Numbering System. Bogotá: In press.

[13] Law 115. (1994). General Education Law. (Article 5 Purposes of Education). Law 115. General Education Law. Ministry of National Education of Colombia.

[14] Montero, L. (2001). The construction of professional teaching knowledge. Rosario: Homo Sapiens Ediciones.

[15] Pavié, A. (2011). Teacher Training: Towards a Definition of the Concept of Teacher Professional Competence. Interuniversity Electronic Journal of Teacher Training, 14(1), 67-80.

[16] Piaget. (1983). Structuralism. Spain: Oikos-tau s.a. ediciones.

[17] Plaza, González, Vasyunkina. (2020). Obstacles in the teaching and learning of mathematics. Systematic review. Technological University of Pereira (Colombia), Central Unit of Valle del Cauca.

[18] Ruiz, G. (2012). The Comprehensive Reform of Basic Education in Mexico (RIEB) in Primary Education: Challenges for Teacher Training. Revista Electrónica Interuniversitaria de Formación del Profesorado, Zaragoza, Spain, vol. 15, no. 1, pp. 51-60.

[19] *Vygotsky. (2007). Thought and Speech. Buenos Aires:: Ediciones Colihue.*