



ANALYSIS OF DIDACTIC OBSTACLES IN MATHEMATICS EDUCATION IN BASIC SECONDARY EDUCATION IN COLOMBIA

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Summary

A thorough analysis of the didactic obstacles in the field of mathematics education in basic secondary education in Colombia is of vital importance to fully understand the challenges inherent in this educational field. By conducting a thorough study of the curricula and curricula used in this area, it is possible to accurately identify how these obstacles influence the learning process of mathematics. In addition, it is essential to explore and carefully examine didactic theories in mathematics, in order to highlight the most effective tools and strategies to overcome these obstacles. In this sense, the use of educational technologies is presented as a key strategy to facilitate the process of teaching and learning mathematics.

It is essential to propose concrete and practical measures, based on the evidence collected, that allow for substantial improvement in the teaching of mathematics in this particular educational context. It is essential to take into account the various factors that contribute to the presence of didactic obstacles, such as comprehension difficulties, lack of motivation, cultural and social barriers, among others. Only through a comprehensive and multidimensional approach can effective pedagogical strategies be implemented that foster students' enthusiasm and understanding of mathematics.

In conclusion, the analysis of didactic obstacles in mathematics education in basic secondary education in Colombia plays a fundamental role in improving the quality of education in this field. Only through a deep understanding and accurate identification of these obstacles, we will be able to overcome them and pave the way towards a more effective and enriching mathematics teaching and learning process for all students involved.

Keywords- involved, motivation, effective, difficulties

1. INTRODUCTION

Mathematics education in Colombia is an extremely fundamental aspect for the optimal academic development of students at the basic secondary education level, which includes from sixth to ninth grade. The teaching and learning of mathematics plays a crucial role in the comprehensive education of young people, providing them with unique opportunities to acquire specific skills and enhance their logical thinking in a significant way. That said, it is imperative to carefully analyze the current context of mathematics education in the country, with the aim of identifying possible didactic obstacles that may hinder the learning process of students. These barriers can range from a lack of adequate teaching resources to a shortage of specialized mathematics teacher training programmes. In this sense, it is essential to propose effective and dynamic strategies that allow overcoming these obstacles and promoting more effective and meaningful learning of mathematics. These strategies



could include the implementation of new pedagogical methodologies, the promotion of contextualized problem-solving, the use of educational technology, and interdisciplinary collaboration between teachers of mathematics and other related fields. In addition, it is important to highlight the importance of an adequate assessment of mathematical learning, which goes beyond traditional written tests and promotes the understanding and application of mathematical concepts in real situations. Teachers should focus on assessing not only students' theoretical knowledge, but also their ability to reason and solve mathematical problems creatively and autonomously. In summary, mathematics education in Colombia requires special and continuous attention, with the aim of improving the quality of teaching and learning of mathematics in the field of basic secondary education. It is essential to work together as a society, involving teachers, students, families, educational institutions and government entities, to achieve solid academic development and guarantee the mathematical success of future generations.

1.1. Context of Mathematics Education in Colombia

In Colombia, mathematics education faces several significant challenges, such as the insufficiency of adequate teaching resources to enrich teaching, the wide gap in teacher training, and the notable lack of motivation on the part of students. These negative factors have a considerable impact on the quality and effectiveness of mathematics education in basic and secondary education. Therefore, it is essential to carry out a thorough analysis of this context, in order to identify the main problems affecting mathematics education in the country. Through this detailed understanding, it will be possible to find solid solutions, which seek to improve and optimize the learning process of students in this vital area of the academic curriculum. Only in this way will we be able to guarantee a solid and quality mathematics education, promoting a solid training and providing students with a better academic and professional future. (Daza-Damian and Souto2022)

2. THEORETICAL FRAMEWORK

In the theoretical framework of mathematics education, the conceptual and methodological basis that supports the teaching and learning of this discipline is established. Different pedagogical currents, research and approaches that have contributed to the development of effective strategies in the teaching of mathematics are analyzed, providing tools to understand the importance and complexity of this area of knowledge.

2.1. Importance of Mathematics Education

The importance of mathematics education lies in its fundamental role in the development of logical thinking, problem solving and decision-making. In addition, it promotes essential skills for the integral development of students, such as creativity, rigor and the capacity for abstraction. Mathematics education is not only relevant in the academic field, but also impacts people's daily lives, strengthening competencies to face challenges in different contexts. (Fernández-Hernández and Andrade-Escobar2021)

The study of mathematics enriches language and reasoning, allowing people to communicate and analyze situations more accurately and efficiently. It also provides the necessary tools to understand complex concepts and solve problems both personally and professionally.

Mathematics education fosters the ability to think critically and analytically, which is essential in an increasingly digitized and globalized world (Vargas et al.2022) The development of mathematical skills facilitates the understanding of data and statistics, allowing people to make informed decisions in various aspects of life, from financial planning to risk assessment.

In addition, mathematics education promotes systematic and methodical problem-solving. Through the study of different branches of mathematics, such as algebra, geometry, and calculus, the ability to break down a complex problem into a series of simpler and more approachable steps is developed. This skill is essential both in the academic field and in daily life, as it allows you to face challenges with confidence and find effective solutions.



In summary, mathematics education plays a fundamental role in the integral development of people, strengthening key skills such as logical thinking, problem-solving, and decision-making. In addition, its importance transcends the academic field, significantly impacting daily life and preparing individuals to face challenges in various contexts. It is crucial to promote and value mathematics education, as it contributes positively to personal growth and the progress of society in general. (Vásquez & Cabrera, 2022)

2.2. Didactic Theories in Mathematics

Didactic theories in mathematics offer solid and grounded conceptual frameworks for a deep and comprehensive understanding of how mathematical knowledge is constructed and, even more importantly, how this fascinating discipline should be taught. From theoretical approaches such as constructivism, realistic mathematics education, and the theory of didactic situations, various pedagogical perspectives are explored and analyzed in detail that guide and orient in a precise and effective way the planning of lessons, the selection of educational methods and resources, as well as the evaluation of mathematical learning in students of basic secondary education in the wonderful country of Colombia (Manjarrés et al., 2021).

3. DIDACTIC OBSTACLES IN MATHEMATICS EDUCATION

Didactic obstacles in mathematics education are those factors that hinder the teaching and learning process of this discipline (Alvarez et al., 2021). They can manifest in different forms and have a negative impact on student development. Examples of these obstacles include a lack of understanding of fundamental concepts, anxiety and fear of math, and a lack of motivation to learn and practice math. It is of vital importance for the education system to address and overcome these obstacles in order to improve the quality of mathematics education in basic secondary education in Colombia (Bohorquez Lambraño & Perez Casiani, 2021). A lack of understanding of key concepts can make it difficult for students to make proper progression, which in turn can affect their performance in other math-related areas. Anxiety and fear towards math can inhibit students' skill development and confidence, which in turn can affect their participation and engagement in the classroom. In addition, a lack of motivation to learn and practice math can cause students to disconnect from the subject and lose interest in developing their math skills. This can have long-term consequences, as math skills are essential in many areas of life and in various professions. To address these obstacles, it is critical that teachers are trained and updated in effective didactic approaches tailored to the individual needs of students (Ihnatova et al. 2022). It is also important to foster a positive and safe learning environment, where students feel comfortable to express their doubts and make mistakes without fear of being judged. Another effective strategy is to use diversified educational resources that help students visualize and understand math concepts in practical and relevant ways. This can include the use of interactive activities, games, real-world examples, and exercises that encourage problem-solving. In summary, in order to improve the quality of mathematics education in basic secondary education in Colombia, it is necessary to identify and address the didactic obstacles that hinder the teaching and learning process. By doing so, meaningful learning can be promoted, students engaged and motivated, and appropriately prepared to meet mathematical challenges in their daily lives and future careers. Overcoming these obstacles will not only benefit students, but also the education system as a whole.

3.1. Definition and Types of Didactic Obstacles

Didactic obstacles in mathematics education can be defined as the barriers that hinder the process of teaching and learning this subject. Among the most common types of obstacles are conceptual obstacles, related to the understanding of mathematical ideas; attitudinal, which refer to students' emotions and attitudes towards mathematics; methodological ones, which have to do with the teaching strategies used in the classroom. In relation to conceptual obstacles, it is important to note that they can manifest themselves in various ways and affect both students and teachers (Dumulescu et al., 2021). Some of the most recurrent conceptual difficulties include confusion between similar terms, lack of understanding of



logical processes, and inability to correctly apply mathematical algorithms. To overcome these obstacles, it is essential that teachers identify the specific difficulties of each student and design teaching strategies adapted to their individual needs. It is also important to foster a classroom environment that promotes active participation and collaborative work, so that students can share and discuss their ideas, clarify their doubts and build mathematical knowledge together.

On the other hand, attitudinal obstacles also play a fundamental role in the process of teaching and learning mathematics (Bächler Silva & Pozo-Municio, 2020). Many students experience anxiety, fear, or frustration when faced with math problems, which can limit their ability to understand and apply math concepts and procedures. These negative attitudes toward math may be influenced by previous experiences, erroneous beliefs, or social stereotypes. To address these obstacles, it is essential to promote a positive attitude towards mathematics by valuing students' efforts and achievements, positive reinforcement, creating a safe and trusting environment, and connecting mathematical content with situations in everyday life that are meaningful to students.

In addition to conceptual and attitudinal obstacles, methodological obstacles also represent a challenge in the teaching of mathematics. These barriers are related to the teaching strategies used in the classroom and can limit students' access to mathematical knowledge. (Chacón et al. 2020) Some of the most common methodological obstacles include the lack of variety of teaching resources, the absence of meaningful contexts to apply mathematical concepts, and the limited active participation of students in the teaching process. To overcome these obstacles, it is important for teachers to use a wide range of teaching resources that allow students to visualize and manipulate mathematical objects, as well as to encourage the resolution of real problems that require the application of the knowledge acquired. It is essential that teachers also encourage active participation and collaborative work, allowing students to share ideas, ask questions and build knowledge together.

In summary, didactic obstacles in mathematics education are barriers that hinder the process of teaching and learning this subject. Conceptual, attitudinal, and methodological obstacles represent the most common challenges faced by both students and teachers. To overcome these obstacles, it is essential that teachers design teaching strategies tailored to students' individual needs, promote a positive attitude towards mathematics, and use a variety of teaching resources and methodological strategies that encourage active participation and collaborative work. This will allow students to develop a solid understanding of mathematical concepts and acquire the skills necessary to apply them in different contexts.

3.2. Factors Contributing to Teaching Barriers

Several factors can contribute to the emergence of didactic obstacles in mathematics education. These include the lack of adequate teacher training, the overload of content in the curriculum, the lack of teaching resources or the absence of a student-centred pedagogical approach (Hofmeister & Pilz, 2020). Identifying and understanding these factors is essential to implement effective strategies that help overcome obstacles and improve mathematics teaching in basic secondary education in Colombia. First, it is important to note that the lack of adequate teacher training can be a determining factor in the emergence of didactic obstacles. A teacher who is well prepared and up-to-date in mathematics teaching methodologies will be able to effectively transmit mathematical concepts and processes to their students (Basar et al., 2021). It is therefore essential that initial and continuing education programmes for teachers include specific content related to mathematics teaching. In addition, the overload of content in the curriculum can also hinder the teaching-learning process of mathematics (Yasmin et al., 2020). On many occasions, teachers find themselves under pressure to cover a large number of topics in a limited time, which does not allow them to delve into the concepts and develop students' mathematical understanding adequately. It is necessary to rethink and make curricula more flexible in order to prioritise the most relevant content and enable meaningful learning. On the other hand, the lack of teaching resources can limit the possibilities of teaching mathematics. Teachers need to have tools and materials that allow them to carry out



practical, manipulative and playful activities in the classroom. These resources should also be adapted to the needs and characteristics of the students, promoting active participation and interest in mathematics. Finally, it is essential that there is a student-centered pedagogical approach to overcome didactic obstacles in the teaching of mathematics (Basar et al. 2021). This approach involves considering the abilities, interests and learning rhythms of each student, allowing for personalized and differentiated accompaniment. In addition, collaborative and participatory strategies that encourage critical thinking, problem-solving and the construction of knowledge in an active way must be promoted. In summary, the appearance of didactic obstacles in mathematics education can be mitigated by identifying and understanding the factors mentioned above. Adequate teacher training, flexible curriculum, access to teaching resources, and the implementation of a student-centered pedagogical approach are key elements to improve mathematics teaching in basic secondary education in Colombia. This will make it possible to overcome obstacles and promote meaningful and participatory learning in the area of mathematics.

4. CASE STUDY: MATHEMATICS EDUCATION IN BASIC SECONDARY EDUCATION IN COLOMBIA

In the context of mathematics education in Colombia, it is identified that curricula and study programs in basic secondary education play a fundamental role in the formation of students. The analysis of these reveals that there are challenges in terms of the articulation between content, teaching methodology and evaluation, which can generate didactic obstacles. In addition, the need to update curricula to incorporate innovative pedagogical approaches that promote meaningful and relevant learning for students is evident.

4.1. Analysis of Curricula and Programs of Study

The analysis of curricula and study programs in mathematics education in basic secondary education in Colombia shows a diversity of approaches and contents that have a direct impact on the quality of teaching. Opportunities are identified to strengthen coherence between learning objectives, pedagogical methods used and assessment strategies applied. It is necessary to review the relevance of the topics addressed, the sequence in the presentation of the contents and the connection with the reality of the students in order to overcome didactic obstacles and promote significant learning in mathematics.

5. TOOLS AND STRATEGIES TO OVERCOME DIDACTIC OBSTACLES

One of the key tools to overcome didactic obstacles in the teaching of mathematics in basic secondary education in Colombia is the use of technologies. These can include specialized educational software, interactive applications, online platforms for tutoring, and multimedia resources. The integration of these technologies in the classroom makes it possible to diversify teaching strategies, motivate students and provide a more visual and practical approach to the understanding of mathematical concepts, thus overcoming possible learning barriers.

5.1. Use of Technologies in Mathematics Teaching

The use of technologies in the teaching of mathematics in basic secondary education in Colombia has proven to be an effective strategy to overcome didactic obstacles. Implementing interactive software, simulations, educational videos, and online tools not only increases students' interest in the subject matter, but also makes it easier to understand complex concepts. In addition, access to online resources expands opportunities for practice and self-assessment, promoting more autonomous and meaningful learning in mathematics.

6. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the didactic obstacles in mathematics education in basic secondary education in Colombia are extremely varied and complex, ranging from limitations in teachers to significant deficiencies in educational materials. To achieve a significant improvement in the teaching of mathematics at this educational level, it is of vital importance to implement innovative and efficient strategies that promote the comprehensive development of mathematical competencies in students, while encouraging the constant training of teachers in terms of innovative pedagogical methodologies



in tune with current times. It is also imperative to carry out a thorough review and adaptation of existing school curricula and curricula, in order to effectively address the obstacles identified and ensure quality and relevant learning in mathematics for students at this crucial educational stage. We cannot underestimate the importance of overcoming these obstacles and working together to offer a strong, equitable, and stimulating mathematics education to all students in Colombia.

6.1. Synthesis of Didactic Obstacles in Mathematics Education

The synthesis of didactic obstacles in mathematics education in basic secondary education in Colombia reveals that the main challenges include the lack of specialized training of teachers in mathematics, the scarcity of adequate teaching resources, the gap between mathematical content and the daily life of students. These obstacles negatively impact student learning and require concrete actions to be overcome. It is critical that teachers receive more comprehensive and in-depth training in the field of mathematics, so that they are better prepared to teach these concepts effectively. In addition, work must be done on the development of and access to modern and updated teaching resources, which adjust to the needs and levels of the students. It is important to create clear connections between mathematical content and the real lives of students, so that they can see the usefulness and relevance of what they are learning. It is also necessary to encourage greater student participation and motivation, through practical and dynamic activities that make mathematics more interesting and attractive. In summary, urgent and systematic attention to these educational obstacles is required, through the implementation of policies and programs that address these challenges in a comprehensive and effective manner. This will improve the quality of mathematics education in basic secondary education in Colombia and guarantee a better future for students.

6.2. Proposals to Improve Mathematics Teaching

To improve the teaching of mathematics in basic secondary education in Colombia, various strategies are proposed, such as the implementation of specialized teacher training in mathematics, the incorporation of innovative educational technologies in the classroom, and the creation of contextualized and motivating teaching materials. Likewise, it is suggested to strengthen the link between mathematical content and the real environment of students, thus promoting meaningful and applicable learning in their daily lives. In addition, it is essential to encourage the active participation of students through practical activities and interactive learning experiences. This will allow them to build their own knowledge and develop mathematical skills more effectively. In addition, it is proposed to establish strategic alliances with institutions and organizations dedicated to the promotion of mathematics teaching, to access resources and programs that enrich educational practices in this field. The implementation of formative and continuous assessments that provide constant feedback to students is also proposed, allowing them to identify their strengths and areas for improvement. In the same way, it seeks to promote the participation of parents and the community in general, so that they become allies in the teaching-learning process of mathematics. In conclusion, improving mathematics teaching in basic secondary education will require a combination of strategies and actions that promote a comprehensive and dynamic approach. These measures, together with the commitment and collaboration of the different actors involved, will contribute to forming competent and confident students in the mastery of mathematical skills, preparing them to face the challenges of the future and contribute to the development of Colombia.

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