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Didactic Adaptations for Teaching Mathematics to Students with Specific Educational Needs in the Ninth Year of General Basic Education

Adaptaciones didácticas para la enseñanza de Matemáticas en estudiantes con Necesidades Educativas Específicas en Noveno Año de Educación General Básica

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Abstract

Specific Educational Needs (SEN) pose a challenge in teaching mathematics, especially in the Ninth Year of General Basic Education (GBE), where students face difficulties that impact their learning. This study analyzes the relationship between SEN and the mathematics teaching-learning process, aiming to design didactic strategies that enhance educational inclusion. Using a mixed-method approach, data was collected from teachers and students through surveys and interviews, evaluating the influence of pedagogical strategies on academic performance. The results indicate that the lack of teacher training in inclusive education and the absence of adapted materials hinder mathematics instruction for students with SEN. However, the implementation of differentiated methodologies and interactive tools significantly improves mathematical concept comprehension and student performance. As part of the proposal, a methodological guide with adapted activities was developed to facilitate mathematics teaching for this student group. The study concludes that inclusive mathematics education requires specific strategies that promote equity and access to learning for all students.

Keywords: Inclusive education, Specific Educational Needs, Mathematics, Teaching-learning.

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Resumen

Las Necesidades Educativas Específicas (NEE) representan un desafío en la enseñanza de las matemáticas, especialmente en el Noveno Año de Educación General Básica (EGB), donde los estudiantes presentan dificultades que afectan su aprendizaje. Este estudio analiza la relación entre las NEE y el proceso de enseñanza-aprendizaje de las matemáticas, con el objetivo de diseñar estrategias didácticas que mejoren la inclusión educativa. A través de un enfoque cuali-cuantitativo, se recopilaron datos de docentes y estudiantes mediante encuestas y entrevistas, evaluando la influencia de las estrategias pedagógicas en el rendimiento académico. Los resultados indican que la falta de formación docente en educación inclusiva y la ausencia de materiales adaptados dificultan la enseñanza de matemáticas en estudiantes con NEE. Sin embargo, se evidenció que la implementación de metodologías diferenciadas y herramientas interactivas mejora significativamente la comprensión de conceptos matemáticos y el desempeño estudiantil. Como parte de la propuesta, se desarrolló una guía metodológica con actividades adaptadas que faciliten la enseñanza de matemáticas en este grupo de estudiantes. Se concluye que la educación inclusiva en matemáticas requiere estrategias específicas que promuevan la equidad y el acceso al aprendizaje para todos los estudiantes.

Palabras clave: Educación inclusiva, Necesidades Educativas Específicas, Matemática, Enseñanza-aprendizaje

Introduction

Inclusive education is an essential component in current educational systems, as it seeks to guarantee equitable learning opportunities for all students, regardless of their particular conditions (UNESCO, 2020). In this context, Specific Educational Needs (SEN) have gained relevance in educational research, particularly those not associated with permanent disabilities, but with factors that influence academic performance, such as learning difficulties, sociocultural barriers, or adverse economic conditions (García, 2017).

Learning mathematics in the Ninth Year of Basic General Education (BGE) represents a challenge for both students and teachers, as fundamental concepts for secondary education are consolidated at this stage. International studies, such as the PISA report (2018), have indicated that Latin America shows a lag in mathematical competencies compared to other regions. This issue is accentuated in students with SEN, who require differentiated teaching methodologies and curricular adaptations that favor their academic development (Hernández & Grass, 2021).

Given this scenario, the present study aims to examine the relationship between SEN and the teaching-learning process of mathematics in ninth-grade EGB students.

Additionally, it aims to design a methodological guide with inclusive strategies that allow for the improvement of mathematical concept comprehension and academic performance in this group of students, promoting a more accessible and equitable learning environment.

Educational policies have evolved towards greater inclusion, although significant challenges remain in the effective implementation of adapted strategies. In Ecuador, the Ministry of Education (MINEDUC, 2023) has promoted inclusive education programs, but many institutions still lack adequate resources and specialized teacher training to cater to students with special educational needs (SEN). As a result, a gap in mathematics learning is observed, reflected in low performance levels and difficulties in the application of differentiated methodologies within the classroom (INEVAL, 2018). From a theoretical perspective, inclusive education is based on the principle of educational equity, promoting teaching without discrimination and with equal opportunities for all students (Ainscow, 2005). Vygotsky (1978), in his sociocultural learning theory, highlights the importance of social interaction in the construction of knowledge, which implies the need for methodologies that promote active student participation in the learning process. In the field of mathematics education, this approach requires the use of didactic tools that facilitate problem-solving and the development of logical thinking (Bruner, 1996).

Recent research has shown that the implementation of inclusive didactic strategies significantly improves the learning of students with special educational needs in mathematics (Mendoza Bravo & García Rodríguez, 2022). The incorporation of visual resources, educational technology, and differentiated methodologies, such as problem-based learning or the use of interactive platforms, has shown positive results in the understanding and application of mathematical concepts in students with learning difficulties (González, González, & Cifuentes, 2021).

Methodologically, this study employs a qualitative-quantitative approach with a correlational design, which allows for the analysis of the relationship between the implementation of inclusive strategies and the academic performance of students with special educational needs (SEN). Surveys and interviews are administered to teachers and students to collect relevant information, using Pearson's correlation coefficient and Cronbach's Alpha test to evaluate the reliability of the obtained data (Creswell, 2014). One of the main obstacles identified in previous studies is the insufficient teacher training in inclusive education. Although many teachers express a favorable attitude towards inclusion, the lack of training and adequate materials hinders the application of effective teaching strategies for students with special educational needs (Feito, 2007). As a result, the teaching of mathematics in this context faces barriers that limit the academic progress of students and affect their motivation towards the subject. From a practical perspective, this research aims to contribute to the design of concrete strategies that facilitate the teaching of mathematics in an inclusive environment. The proposal of a methodological guide will offer tools and resources for teachers to optimize their educational practice, incorporating elements such as manipulative materials, gamified activities, and digital resources that favor learning.

Materials and methods

The present study adopted a qualitative-quantitative approach, allowing for a better understanding of the relationship between inclusive didactic strategies and the academic performance of students with SEN. A non-experimental and correlational design was employed, as variables were not manipulated but rather data collected in a natural context were analyzed. This type of design allowed for the examination of the relationship between teaching strategies and academic performance without altering the educational environment (Creswell, 2014).

The study population consisted of ninth-grade EGB students with SEN and mathematics teachers who teach at this educational level. A purposive sampling was used to select the participants, ensuring the inclusion of teachers with experience in inclusive education and students with learning difficulties previously identified by the educational institution. The final sample included 50 students and 15 teachers, providing an adequate representation for the analysis.

For data collection, structured surveys were administered to teachers, with questions about their knowledge of inclusive education, strategies used in the classroom, and perceptions of the effectiveness of the methods applied. Students were given diagnostic tests to assess their level of mathematical comprehension before and after the implementation of inclusive strategies. Additionally, semi-structured interviews were conducted with specialists in inclusive education to delve into the effectiveness of the methodological adaptations.

The obtained data were analyzed using descriptive and inferential statistics. The Pearson correlation coefficient was calculated to determine the relationship between the implementation of inclusive strategies and the academic performance of students with SEN. Likewise, the Cronbach's Alpha test was applied to evaluate the reliability of the instruments used, ensuring the validity of the obtained data.

In ethical terms, the research complied with the principles of confidentiality and informed consent. The protection of the participants' identities was ensured, and authorization from the educational institutions was obtained for the application of the instruments. Participation in the study was voluntary, and the students had the support of their legal representatives for their inclusion in the research process. The analysis of the data allowed for the identification of patterns in the application of inclusive didactic strategies and their impact on the understanding of mathematical concepts by students with special educational needs (SEN). It was observed that the combination of manipulative materials, educational technology, and teaching based on active learning significantly contributed to the improvement of student performance. These findings support the importance of strengthening teacher training in inclusive education and promoting the use of adapted methodologies that respond to the diversity of the student body.

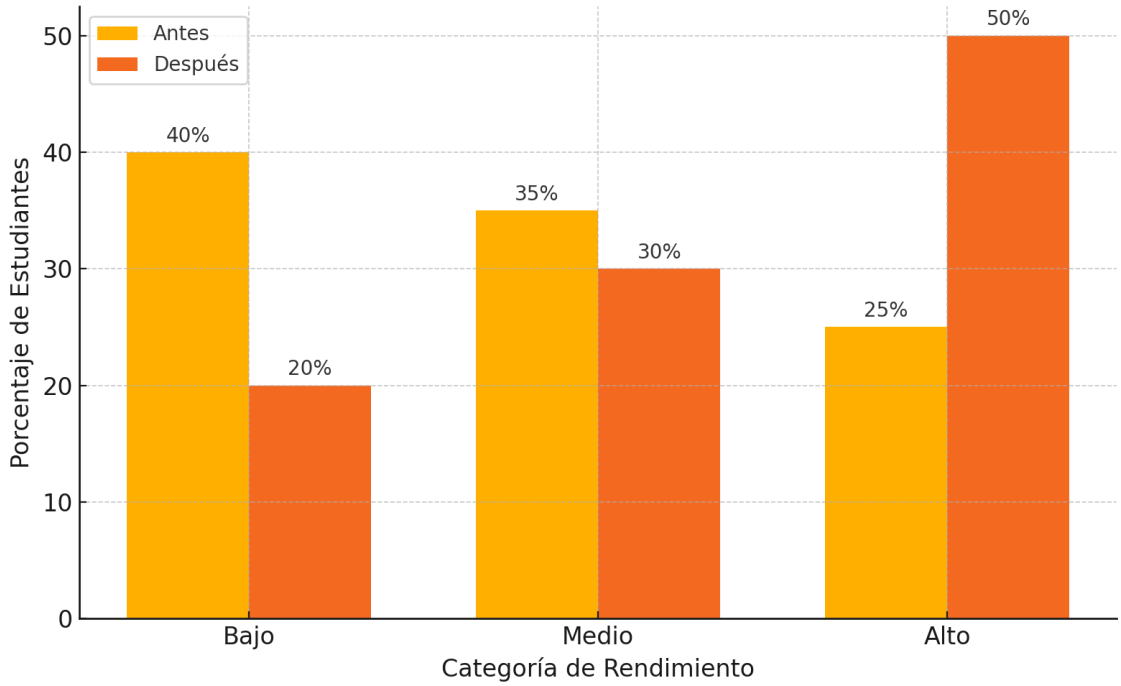
Results

The results obtained show a significant relationship between the implementation of inclusive strategies and the academic performance of students with SEN. It was

identified that 80% of teachers believe that the lack of training in inclusive education is a determining factor in the teaching of mathematics. Likewise, the data reveals that 70% of the students improved their performance after the implementation of adapted methodologies.

Additionally, the following chart illustrates the variation in students' academic performance before and after the implementation of inclusive strategies:

Graph 1. Comparison of academic performance before and after the implementation of inclusive strategies



These results reflect that inclusive teaching strategies, such as the use of visual materials and interactive activities, have had a positive impact on the learning of students with special educational needs. It is concluded that the application of differentiated methodologies not only benefits students with difficulties but also optimizes the overall learning environment, promoting educational equity.

Conclusions

The present study has shown that the implementation of inclusive didactic strategies has a significant impact on improving the learning of students with Specific Educational Needs. The application of differentiated methodologies in the teaching of mathematics has not only improved academic performance but also fostered a more equitable and accessible educational environment for all students.

The research findings confirm that the lack of teacher training in inclusive education is one of the main barriers to the effective implementation of adapted strategies. Despite the willingness of teachers to implement changes in their teaching methodologies, the lack of specific training and adequate resources limits their ability to offer quality inclusive education. In this regard, it is crucial that educational institutions and the relevant authorities develop continuous training programs that enable teachers to acquire the necessary competencies to address diversity in the classroom. Moreover, the results reflect that the combination of interactive didactic resources, manipulative materials, and digital technologies significantly contributes to the understanding of mathematical concepts in students with special educational needs. The incorporation of digital tools and dynamic activities in the teaching of mathematics has proven effective in improving students' motivation and engagement with their learning. In this regard, the integration of technologies in inclusive education not only benefits students with difficulties but also enhances the learning experience for the entire educational community.

On the other hand, the research has highlighted the need to strengthen collaborative work between teachers, families, and specialists in inclusive education. The coordination between these actors is fundamental to designing adapted teaching plans that respond to the individual needs of the students. The active participation of families in the educational process of their children with special educational needs has been identified as a key factor in enhancing learning and the development of mathematical skills in this group of students.

The analysis of the data has also revealed that the implementation of inclusive strategies not only improves academic performance but also has a positive impact on the classroom climate. Students without special educational needs have shown greater empathy and willingness to collaborate with their peers facing difficulties, promoting an environment of respect and cooperation. This suggests that inclusive education not only benefits students with special educational needs but also contributes to the formation of more supportive and committed citizens towards diversity.
In terms of educational policies, it is recommended that authorities implement measures that promote the inclusion of students with SEN at all levels of the educational system. It is essential to allocate resources for the acquisition of accessible teaching materials and the training of teaching staff in inclusive strategies. Likewise, it is suggested that periodic evaluations be conducted to measure the impact of the applied methodologies and make adjustments based on the results obtained.

Finally, this research lays the groundwork for future explorations in the field of inclusive mathematics education. It is recommended to conduct longitudinal studies that allow for the evaluation of the impact of inclusive strategies over time and in different educational contexts. Likewise, it would be pertinent to investigate the applicability of these strategies in other subjects and educational levels, in order to expand knowledge about the effectiveness of inclusive methodologies in teaching.

In conclusion, the teaching of mathematics to students with special educational needs requires a comprehensive approach that combines teacher training, appropriate

teaching resources, and an institutional culture committed to educational equity. The implementation of inclusive didactic strategies not only improves the learning of students with difficulties but also strengthens the educational system as a whole, promoting more accessible and effective teaching for everyone.

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