ISSN: 1815-7696 | RNPS: 2057 | MENDIVE Vol. 23 No. 4 e4352 (October-December)
García Serano, D.; Fernández Peña, C. L. "Differentiated attention at the Pre-University Vocational Institute of Exact Sciences of Pinar del Río".
https://mendive.upr.edu.cu/index.php/MendiveUPR/article/view/4352
2025

Original article

Differentiated attention at the Pre-University Vocational Institute of Exact Sciences of Pinar del Río

La atención diferenciada en el Instituto Preuniversitario Vocacional de Ciencias Exactas de Pinar del Río

Atendimento diferenciado no Instituto Vocacional Pré-Universitário de Ciências Exatas de Pinar del Río

Dunia García Serano[1] 0009-0002-4438-1637 garciadunia@gmail.com
Carlos Luis Fernández Peña[2] 0000-0001-6833-0055 carlosl.fernandez@upr.edu.cu

[1] Pre-University Vocational Institute of Exact Sciences "Federico Engels". Pinar del Río, Cuba.
[2] University of Pinar del Río "Hermanos Saíz Montes de Oca". Pinar del Río, Cuba.

Received: 18/07/2025
Accepted: 14/10/2025

ABSTRACT

The fulfillment of the UN's 2030 Agenda presupposes the implementation of personalized educational experiences that promote justice and equity in the classroom, so that students are accepted and treated as they are. In Cuba, this process is understood as differentiated instruction. Given its importance, this article presents the results of research conducted to verify its quality at the Pre-University Vocational Institute of Exact Sciences in Pinar del Río, based on the experiences of students and teachers in mathematics classes during the period 2021 to 2024. For the research, structured interviews were conducted with teachers and students, which were analyzed using grounded theory. The results showed that actions aimed at motivating students toward the subject do not guarantee that most students maintain a strong emotional connection with mathematics.

Translated from the original in Spanish

Furthermore, there is a marked tendency toward a corrective approach to content, without addressing the root causes of errors or providing tools related to learning strategies. Therefore, it is concluded that the quality of differentiated attention provided in the mathematics class at the institution is one of the causes that provoke attitudes of rejection towards the subject, as well as the lack of confidence and security in their performance, which prevents students from consciously participating in the solution of their own difficulties.

Keywords: mathematics; diagnosis; student; differentiated attention; motivation.

RESUMEN

El cumplimiento de la Agenda 2030 de la ONU presupone la implementación de experiencias educativas personalizadas que promuevan la justicia y la equidad en el aula, de modo que los estudiantes sean aceptados y tratados tal como son. En Cuba, este proceso se entiende como atención diferenciada. Dada su importancia, en este artículo se presentan los resultados de las investigaciones realizadas para verificar su calidad en el Instituto Preuniversitario Vocacional de Ciencias Exactas de Pinar del Río, basándose en las experiencias vividas por estudiantes y profesores en las clases de matemáticas durante el período 2021 a 2024. Para el desarrollo de la investigación, se aplicaron entrevistas estructuradas a profesores y estudiantes, las cuales fueron procesadas mediante el método de la teoría fundamentada. Como resultado, se encontró que las acciones destinadas a motivar hacia la asignatura no garantizan que la mayoría de los estudiantes mantengan relaciones de atracción emocional sólida con las matemáticas. Además, existe una marcada tendencia hacia lo correctivo en el trabajo con el contenido, sin atender a las causas que originan los errores ni proporcionar herramientas relacionadas con cómo aprender. Por ello, se concluye que la calidad de la atención diferenciada que se brinda en la clase de Matemática en la institución es una de las causas que provocan actitudes de rechazo hacia la asignatura, así como la falta de confianza y seguridad en su desempeño, lo que impide que los estudiantes participen de manera consciente en la solución de sus propias dificultades.

Palabras clave: matemática; diagnóstico; estudiante; atención diferenciada; motivación.

RESUMO

O cumprimento da Agenda 2030 da ONU pressupõe a implementação de experiências educativas personalizadas que promovam justiça e equidade na sala de aula, de modo que os alunos sejam aceitos e tratados como são. Em Cuba, esse processo é entendido como ensino diferenciado. Dada a sua importância, este artigo apresenta os resultados de uma pesquisa realizada para verificar a qualidade do ensino diferenciado no Instituto Pré-Universitário Vocacional de Ciências Exatas de Pinar del Río, com base nas experiências de alunos e professores em aulas de matemática durante o período de 2021 a 2024. Para a pesquisa, foram realizadas entrevistas estruturadas com professores e alunos, analisadas por meio da teoria fundamentada. Os resultados mostraram que as ações voltadas para a motivação dos alunos em relação à disciplina não garantem que a maioria dos alunos mantenha uma forte conexão emocional com a matemática. Além disso, observa-se uma tendência acentuada para uma abordagem corretiva do conteúdo, sem abordar as causas raízes dos erros ou fornecer ferramentas relacionadas a estratégias de aprendizagem. Portanto, conclui-se que a qualidade da atenção diferenciada oferecida nas aulas de Matemática da instituição é uma das causas que provocam atitudes de rejeição em relação à disciplina, bem como a falta de confiança e segurança no próprio desempenho, o que impede os alunos de participarem conscientemente na resolução de suas dificuldades.

Palavras-chave: matemática; diagnóstico; aluno; atenção diferenciada; motivação.

INTRODUCTION

The United Nations (UN), in Sustainable Development Goal 4, raises the need to ensure inclusive, equitable, and quality education, as well as to promote lifelong learning opportunities for all. This implies, among other goals, eliminating disparities among students in classrooms.

The UN's 2030 Agenda, from the perspective of inclusive education, aims to provide personalized educational experiences for all, promoting justice, equity, and a more humane society. In this context, all students should be accepted as they are and receive instruction tailored to their needs, according to Villegas *et al.* (2025), regardless of whether they have any disabilities or special educational needs.

According to Rodríguez (2023), inclusive education means placing human beings and their dignity at the center of our concerns. Given its inherent integrity, this form of education is contrary to the values and principles that enshrine any type of discrimination, contempt, or exclusion of fundamental human rights.

Inclusive education focuses more on promoting students' socio-emotional well-being than simply providing access to academic content, fostering empathy, resilience, and self-esteem. In this regard, García and Chen (2024) assert that educational experiences incorporating emotional education within inclusive contexts have successfully reduced school anxiety and strengthened students' social integration.

Furthermore, equity in education is related to promoting opportunities for all but tailored to the individual characteristics of each student. This should be understood as providing the necessary support to enable each student to reach their full potential (Rojas & Ordóñez, 2024). It is important to emphasize that equity in education is meaningless without eliminating barriers that limit participation. These barriers range from adapting materials to using technologies that facilitate learning.

Equity does not mean offering the same to everyone, but rather ensuring that each person receives the necessary support to reach their full potential. Accessibility refers to the elimination of physical, technological, and methodological barriers that limit participation, including everything from adapting materials to using technologies that facilitate learning (Rojas & Ordóñez, 2024).

Inclusive education must be based on a pedagogical model that recognizes the right of all students to access quality education under equal conditions, regardless of their differences. This model must eliminate the obstacles that hinder everyone's participation and learning, thereby promoting equity and justice in education.

By recognizing and valuing diversity, the aim is to integrate all students into the same educational environment, providing them with the necessary tools and support to reach their full potential. Equity and access are essential components of this approach, ensuring that all students, regardless of their background and abilities, have equal opportunities for learning and growth.

In a world where diversity in the classroom is the norm rather than the exception, the need to adapt education to the individual needs of each student is becoming increasingly crucial. However, to

effectively address these needs, teachers must understand what distinguishes individual differences within the student group; that is, they must understand the nature of individual differences and how these differences are supported by theory.

The concept of individual differences is associated with the concepts of personality, intelligence, cognition, motivation, learning styles, and other terms in psychology. These are the individual conditions that can significantly hinder or facilitate the achievement of learning objectives.

Regarding the determining factors in learning, Vera *et al.* (2023) point to motivation, memory, and comprehension, to which we should also add temperament, cognitive processes such as perception, thought, language, and learning strategies and styles. However, these factors are not aspects whose influence on learning is readily apparent, but it is no less true that the different ways in which they manifest in each student distinguish their individuality in the process of personality formation, and therefore, in their learning. It is necessary to point out that the belief among teachers that these factors do not have a determining influence on learning has resulted in them not always being considered when addressing individual differences within the collective nature of the process.

Furthermore, Escobedo Cisneros (2025) and Aguilar Vega *et al.* (2025) state that the key to a quality educational response for students lies in the implementation of differentiated pedagogical strategies. Differentiated instruction in education refers to a pedagogical approach that emphasizes the individual differences of learners and seeks to adjust teaching activities to meet the needs of everyone. For UNESCO (2020), differentiated education is "paying special attention to learners' prior knowledge, needs, abilities, and perceptions during the teaching and learning process. It is, therefore, learner-centered education" (p. 5).

This approach considers each student to be unique, with different learning styles, interests, abilities, and developmental paces. Therefore, it involves abandoning the idea that there is a single, uniform teaching method for all students. Differentiated instruction recognizes diversity and strives to provide learning experiences tailored to each student's individual characteristics. According to Velasco *et al.* (2023), "the foundations of differentiated instruction are based on the idea that learning is more effective when it is adjusted to the needs and abilities of each student" (p. 8059). In this sense, differentiated instruction promotes an inclusive learning environment, recognizing and valuing individual differences, and thus fostering teaching, learning, and student motivation to engage in their own transformation. Implementing differentiated instruction strategies in the classroom means

moving beyond traditional processes and transforming the educational process into an experience where students are truly valued, placing them at the center as protagonists of their own learning and personal growth.

From a mathematics education perspective, it is necessary to identify two types of differentiation: internal and external. Internal differentiation refers to the work done in the classroom or activities geared toward independent study, while external differentiation relates to work done outside the classroom, more focused on the study of mathematics. Both strategies are aimed at fostering learning.

Currently, mathematics education faces several challenges, such as personalized learning, addressing student diversity, and adapting to technological advancements. Thanks to these advancements, various alternatives exist that can offer innovative solutions to improve the quality of teaching mathematics.

Differentiated instructional strategies should be designed to promote conceptual understanding and reduce limitations, such as the anxiety often associated with learning mathematics. These strategies should generally be aligned with a constructivist approach to learning, making it necessary to integrate cognitive learning theories with effective teaching practices to overcome traditional barriers in mathematics education.

In terms of differentiated instruction, this should be preventative, defined as the process in which the teacher teaches in a way that empowers the student, in an active role, to transform mathematical information. This approach seeks to address the individual needs of students at high risk of failure, structuring lessons to prevent future difficulties and adapting to each student's learning profile.

In this regard, it is essential to create a classroom environment where students feel safe to express their mistakes. A non-threatening climate fosters openness and a willingness to learn from errors, thus promoting a more effective and positive learning process.

Regarding differentiated instruction, from a general perspective, Mejía and Botero (2022) propose a strategy for inclusive education that fosters the success of all students, without distinction. Among the actions they propose are:

- Formative assessment to obtain continuous feedback on the learner's progress and to be able to recognize strengths and areas that need additional support.
- Flexible grouping with the intention of organizing students into small groups based on their needs and abilities, to provide differentiated instruction.
- Cooperative learning, to foster cooperation among students so that they can support each other and learn from one another.
- Individual tutoring, to provide personalized attention to each student.
- The use of educational technology, which provides digital tools and resources that allow for personalized learning, such as adaptive programs and online learning environments.

From the perspective of mathematics didactics, it is necessary to identify two types of differentiation: internal (related to the work done in class or geared towards independent work) and external (in extracurricular work, more focused on the study of mathematics), both aimed at promoting learning.

Currently, mathematics education faces several challenges, including personalized learning, addressing student diversity, and adapting to technological advancements. These technological advancements offer various alternatives that can provide innovative solutions to improve the quality of mathematics education.

Differentiated pedagogical strategies should be designed to foster conceptual understanding and reduce limitations such as anxiety generated by mathematical learning, generally aligned with a constructivist approach to learning; therefore, it is necessary to integrate cognitive learning theories with effective pedagogical practices to overcome traditional barriers in mathematics teaching.

In terms of differentiated instruction, this should be preventative, defined as the process in which the teacher teaches in such a way that the student, in an active role, transforms mathematical information. This approach seeks to address the individual needs of students at high risk of failure, structuring lessons to prevent future difficulties and adapting to each student's learning profile. In this sense, it is necessary to emphasize the importance of creating a classroom environment where students feel safe to express their mistakes. A non-threatening climate fosters openness and a willingness to learn from errors.

Differentiated instruction in mathematics involves adapting methods, resources, and assessments to the needs of each student, considering their strengths and weaknesses. García (2023) highlights its

importance but also points out the need for a unified model for its application in this subject and the lack of teacher training in specific strategies.

Differentiated attention, in the current educational context, is consolidated as an indispensable approach to guarantee truly inclusive and quality teaching and, above all, as a fundamental pedagogical need to respond to the diversity that characterizes students in the school context, which should not be understood as a set of isolated or improvised actions, but as a planned, systematic and preventive process, which starts from the recognition of the individual characteristics of the students and is oriented to the development of their potential.

On the other hand, Orosco Toribio *et al.* (2023) link learning styles to academic performance and reinforces the importance of adapting teaching to individual differences. In this regard, the use of technologies that allow for the creation of personalized learning paths, real-time progress assessment, and the adaptation of content to each student's cognitive style could be beneficial, presenting a valuable opportunity.

For their part, Apolinario-Parrales *et al.* (2024) propose a strategy for improving the solution of mathematical problems that includes a substantial relationship between explanations, exemplifications and cognitive impulses to students, as well as the posing of inquiry activities and problems.

Alulema *et al.* (2025) proposes a strategy for improving activities that reinforce and expand mathematical knowledge, in accordance with their general objective. It coherently integrates three phases that guide teachers in achieving this general objective, using an appropriate logic:

- Diagnosis of mathematical knowledge needs and potential of students.
- Development of activities to reinforce and expand mathematical knowledge.
- Development and evaluation of activities with a flexible didactic integration.

Aimacaña-Aimacaña (2024) highlights as a purpose "the application of academic reinforcement to achieve better performance in students" (p. 49). This author also points out that it is essential to consider the time students require to understand or assimilate the content, and therefore this should be considered as one of the factors to consider for the design and development of activities to reinforce and expand knowledge.

Analyses conducted to date show that, in terms of differentiated instruction, especially in mathematics classes, there is a wide range of possibilities for its implementation, all aimed at making mathematical content more accessible to students. In Cuba, this process is regulated by the educational system; however, its implementation is not uniform across all schools or subjects. Therefore, it is interesting to understand how this process unfolds in one of the flagship educational institutions in Pinar del Río. In this regard, the authors of this article present the results of research conducted on the differentiated instruction received by students at the Pre-University Vocational Institute of Exact Sciences in Pinar del Río, based on the students' experiences in mathematics classes during the period from 2021 to 2024.

MATERIALS AND METHODS

This research was purely qualitative, due to the need to show how the two main groups participating in the educational process at the Pre-University Vocational Institute of Exact Sciences in Pinar del Río (IPVCEPR) think about and experience differentiated instruction. For this reason, the research begins by defining the categories on which the search for information is based.

Definition of the categories that served as the basis for the information search

For the development of the study, differentiated attention to mathematics at IPVCEPR was defined as the process developed by the mathematics teacher to respond to the individual needs of each student based on the information captured in the diagnosis, referring to their limitations and potential for learning the content of the subject, in order to maximize their achievements in fulfilling the objectives planned in the pre-university course.

This definition allowed the following categories to be identified for the study:

I. Diagnosis.
II. Response given by the teachers to the individual needs of each student.
III. Achievements in meeting the objectives set for the subject at the pre-university level.

For the purposes of this investigation, diagnosis will be understood as to the A systematic, continuous, and comprehensive process carried out by the teacher, using certain scientific research resources, with the objective of knowing the levels of development achieved, the limitations and the potential of each student, in order to classify them according to their needs and make decisions about

educational strategies that allow differentiated attention that promotes the fulfillment of the objectives planned for mathematics in pre-university education.

The response to the individual needs of each student is defined as the didactic actions carried out by the Mathematics teacher to correct the limitations of the students and the development of their potential, in relation to their interests towards the subject, the procedures for learning and the skills related to the mathematical content of the grade; based on work in the zone of proximal development and the leading participation of the students, so that it allows them to achieve the objectives proposed in pre-university teaching.

For the study of this category, three subcategories were determined:

II.1. Actions taken by the teacher to develop an interest in mathematics.
II.2. Actions taken by the teacher to teach how to study mathematics.
II.3. Actions taken by the teacher for the development of mathematical skills.

Actions for the development of interests towards mathematics were defined as the intrinsic and extrinsic motivation actions that the teacher uses to respond to the individual needs of each student, in relation to the progressive integration of the affective and the cognitive, so that they establish solid emotional attraction relationships with mathematics that allow them to recognize its usefulness for life and their future profession and, to that same extent, strive to seek new and deeper knowledge in the subject.

The actions to teach how to study mathematics were defined by the actions that the teacher develops to respond to the individual needs of the students, related to how to learn mathematics, how to become aware of their learning needs, how to participate in the solution of their own difficulties, what resources they need to learn mathematics, as well as to enhance self-assessment and exchange about their own study activity.

Actions for the development of mathematical skills refer to the differentiation actions that the teacher develops to respond to the individual needs of the students in working with the skills associated with the mathematical concepts, propositions and procedures that converge in the contents of this subject in pre-university.

The achievements in meeting the objectives planned for the subject in the pre-university level were defined as the progressive improvement of the results obtained by the students, in the aspects that guarantee the learning of mathematics, as well as the results that show the improvement in the learning of the content at the pre-university level.

Information search process

The information was gathered through structured interviews with teachers and students. The interviews were conducted in groups, organized by academic year for the students and by the 11 mathematics teachers at the institution. The student sample was selected from the 30 clusters corresponding to the 30 teaching groups at the Pre-University Vocational Institute of Exact Sciences of Pinar del Río during the 2023-2024 academic year. Of these, 27 clusters were selected, with a margin of error of 7% and a confidence level of 95%. From each of these clusters, five students were selected using simple random sampling, for a total of 135 students.

The processing of the information originating from the interview was carried out following the grounded theory procedure.

RESULTS

Results of the analysis related to diagnosis as the basis of differentiated care

1- The diagnostic process in the educational context shows inconsistencies in terms of the frequency of its updates, due to the scarcity of reliable sources used to obtain information, the lack of consensus among teachers regarding the indicators used for the comprehensive development of the diagnosis; with less emphasis on the emotional and social sphere, which limits decision-making on educational strategies to be used and feedback on the effectiveness of the actions taken to address the needs. according to their development and potential.

The interviews with the teachers revealed a lack of consensus regarding the sources of information to be used for developing the diagnostic assessment. They also considered some sources unreliable. For example, some stated, "I consider the secondary school's pedagogical resources unreliable", while others noted that "through observation, we can detect some behavioral patterns in students that may affect their learning, but this doesn't provide enough information". Regarding the use of indicators for a comprehensive assessment of students, there was no consensus on which indicators

to consider. The emotional and social spheres were less frequently explored; however, the teachers acknowledged their importance and attributed the lack of exploration of these spheres to a lack of time, even though they reported systematically updating this aspect. Among the arguments that support this conclusion are, for example: "in my experience, there are no established indicators", others point out that: "we do not always take into account the emotional and social sphere", "I would like to include satisfaction surveys, psychological, sociometric techniques such as psychometrics and sociogroups, and make more home visits".

Regarding the classification of students for the purpose of providing differentiated instruction, the teachers interviewed showed no consensus on the matter. Among the criteria they discussed were: "I classify them into three levels: medium, high, and low, according to their average", "I use retention criteria based on grades", "I believe that students should have more than 85 points; therefore, a student who achieves a grade below 85% is at a low level, a medium level is between 85 and 90 points, and students with grades higher than 95 to 100 are high-achieving", and "For my part, I believe they should be classified as students with difficulties, average students, and students with potential".

Regarding the ongoing updating of the diagnostic assessment, the interviews with teachers revealed that updating the assessment is a continuous process required by the school for faculty meetings, although they do not perceive it as part of the classroom. This is evident in statements such as: "the school establishes the comprehensive diagnostic assessment at the beginning of the school year", and "every two weeks in faculty meetings and at the end of the school year".

Regarding decision-making about educational strategies that allow for differentiated attention in accordance with developmental needs, although the teachers interviewed acknowledge that they make decisions based on the diagnosis, the most common approach is individualized attention provided both inside and outside the classroom through the provision of exercises tailored to each student's needs for remedial work. For example, some teachers stated that: "if the diagnosis reveals that a student can solve a logarithmic equation but cannot complete the solution because their difficulties stem from content in previous grades, then the strategy is redesigned to present exercises to address this situation".

On this point, the student interviews indicate that not all teachers are consistent in addressing the development of learning strategies for their students. For example, some students said: "My teacher

doesn't consider how we learn. He gives us a certain number of exercises (half an alphabet), and we must bring in the ones we can't do to do them, but there are so many, and he keeps changing the content. He asks you to redo the material two days after teaching it, and you still haven't understood anything. When I ask him to explain it another way, he doesn't. He doesn't look for solutions for me, and I'm always left behind". Another student said: "I like to read from the book. I'd like to learn through competitions. I'd like to go to the board. The teacher needs to make it more fun". Among the students, there were also those who acknowledged the teachers' work. For example, they stated that "the teacher always explains things in a way that's appropriate for the class, and if someone is struggling, she explains it for them too". Others call for more systematic instruction. Some students said, "We could work with feedback, with occasional exercises on past material. Instead of just leaving us working on the material we're currently teaching". However, this situation is less complicated in twelfth grade, where students recognize the work of their teachers. For example, "My teacher calls a student who is struggling to the board, asks them questions to help them learn, but at the same time, he's evaluating them", and "The student who doesn't understand is the one who goes to the board".

In the case of the periodic evaluation of the effects of differentiated instruction provided to students, it was found that teachers do not evaluate the effects of differentiated instruction themselves. They consider it good or bad based on students' progress or setbacks in assessments; generally, they rely solely on the results of assessments they and other entities conduct. In this regard, the opinions expressed in the interviews with teachers included: "systematic evaluation and reassessment clearly lead to significant changes; students become aware of the importance of mastering mathematical concepts and that preparation is necessary", "in most cases there is progress, but there are some cases where this is not the case, and strategies are implemented to prevent them from falling behind", and "some students fail and drop out of the grade due to inadequate preparation".

Analysis of the responses given by teachers to the individual needs of each student

1- Teachers have a limited view of motivation towards the subject at the pre-university level, which does not guarantee that most students maintain strong emotional attraction relationships with mathematics, which would allow them to recognize its usefulness for life and their future profession and, in this way, strive to seek new and deeper knowledge.

The study conducted on actions to develop students' interests in mathematics concluded that, while teachers do employ intrinsic and extrinsic motivational strategies to foster interest in mathematics, these strategies are not implemented according to the principles of inclusion and equity. This assertion is corroborated by the fact that the interviewed teachers justify this approach by citing the complexity of providing sufficient motivation to encompass all students' needs and interests. For example, some teachers stated, "It's difficult because at this age, students already have very clear interests". This contrasts with the opinions of the interviewed students, who acknowledge that teachers do address their interests and motivations, although in tenth grade, the more advanced students do not feel adequately stimulated. For example, they state that: "I haven't been able to see the practical use of the content I'm receiving in Mathematics", while the eleventh graders say that "my teacher does take it into account for me, he shows videos of the practice", "I don't know why I have to learn everything they give me if it's not useful for life", "I want to study Medicine and I don't see a connection with what I'm learning in Mathematics", the twelfth grade students say that: "I would like them to connect it more to daily life".

Although some steps are being taken to achieve inclusive, differentiated instruction with a degree of equity, the use of assignments that promote the need to delve deeper into the study of subjects, based on their connection to different professions, is limited and does not reach all students. This assertion, according to interviews with teachers, confirms that they focus their attention on students interested in STEM fields or engineering, failing to stimulate interest in the rest. For example, they stated: "We have students who want to study engineering and STEM fields, and we give them differentiated activities, participation in knowledge-sharing events, and more challenging exercises. Some students are even guided toward preparing for competitions", "Those who want to study engineering are given more difficult individual study exercises to better prepare them".

Regarding the proposed assignments designed to satisfy diverse cognitive interests in mathematics, it was found that the equitable and inclusive nature of differentiated instruction is compromised. This is because the assignments are geared toward the cognitive interests only of high-achieving students; the remaining additional assignments are primarily for students struggling with the content and do not address any cognitive interests. This was confirmed in interviews with teachers who primarily work with high-achieving students interested in the subject. These teachers acknowledged that the assignments given to struggling students only serve to address the difficulty and not to spark interest in the subject. This is evident in statements such as: "I mainly give assignments to students who want to study certain science fields", "That's because they already have established

interests, and therefore it's difficult to change how they think", and " I first have to help struggling students solve their problems, so I give them other exercises".

Regarding the use of scientific societies to motivate the study of mathematics, it was found that this resource is not being used optimally to spark interest in the subject, as it fails to connect students with varying levels of academic performance in mathematics to this type of activity, thus affecting the equitable and inclusive nature of differentiated instruction. This is evidenced by the fact that, of the 130 students in the sample, only 38 (29%) belong to these societies, all of whom are high- or average-achieving students.

2- The actions that the teacher develops to respond to individual needs related to how to learn mathematics do not guarantee that most students can self-assess their activity in relation to the subject and, in this way, understand what resources they need to learn and participate consciously in solving their own difficulties.

Regarding strategies for teaching mathematics, it was found that, in the case of actions aimed at making students aware of their learning needs, the teacher's work is generally based on solving exercises with little student involvement in the reflective process of considering what they learned, what they still need to learn, and how to overcome these difficulties. Interviews with teachers on this topic revealed that, in general, teachers do not see the classroom as a space for reflection that would involve students in recognizing their difficulties and needs so they can collaborate in improving their learning process. They also tend to overuse personal criticism from the teacher. This is confirmed by their statements that "it's difficult in this sense because students don't recognize when you tell them they have difficulties", and "even when you show them, they're wrong, they get upset when teachers tell them about their difficulties in a small group setting". These statements were corroborated by the students interviewed. For example, tenth and eleventh grade students indicated that: "the teacher is the one who tells me the difficulties I have", "you know you make mistakes, but that doesn't always mean you're labeled as a student with difficulties", "sometimes the teacher labels me as having difficulties, and yet I don't consider that I have them", "teachers are the ones who determine which students have difficulties based on the grades on the written question, and sometimes I make a mistake and they already label me as having difficulties", "I know what I have difficulties with because I always do poorly on the teacher's assessments".

Regarding the actions teachers take to involve students in addressing their own math learning difficulties, it was found that the teacher dictates how, when, and where these difficulties will be resolved. This assertion was corroborated in interviews with teachers, which concluded that students are not active participants in decision-making regarding the actions, tasks, and goals for overcoming their own difficulties. This conclusion is supported by statements such as: "Once we complete the written questionnaire, we submit a report to the faculty proposing a system of actions for working with students who have difficulties", and "My students already know what actions I take with students who have difficulties, and they don't complain".

The interviews with the students confirm that they do not have an active role in identifying and resolving their difficulties, with statements such as: "the teacher tells us everything we are going to do to solve the difficulties, he is the one who knows", "my teacher sends a student who had a difficulty to the board, asks him questions so that he learns, but at the same time he is evaluating him", "the student who doesn't understand is the one who sends him to the board", "the teacher sends me to the board so that I can better understand my difficulties and eradicate them", "my teacher brings directed exercises, according to the students' difficulties", "I wish the remedial work wasn't the same".

Regarding the actions taken by the teacher to provide students with the procedures to achieve efficient learning, it was concluded that there are few contributions to enable them to know and identify for themselves how to learn mathematics; there were no visible strategies where the teacher provides resources for study, with the work on solving exercises generally being the fundamental method, in no case are resources provided for learning (making diagrams, concept maps, comparison between groups of exercises, grouping of exercises and problems by solution method or other criteria of interest).

The interviews with teachers revealed that while they are familiar with various strategies for teaching mathematics, they consistently blame the students for not utilizing them. Generally, they lack awareness of their students' learning styles and make limited contributions to equitably and inclusively providing students with the resources they need to support their learning. For example, teachers stated that: "students use them very little", "students learn things by rote", "they use few learning strategies in mathematics", "conceptual work is very weak", "at the end of each unit, we almost always create a logical diagram, and we know the student has to do it", " through observation,

we assess students' abilities, and the teacher develops strategies for each student, both in class and in remedial activities", and "memory is not very developed in this subject".

On this point, the students mention that their teachers mostly assign exercises, with very few strategies and procedures to help them learn better. They believe that "a teacher's style greatly influences how we learn", "mine isn't systematic with the use of strategies, he just gives exercises", "when my teacher uses figures or GeoGebra, I understand better", "I know what I'm struggling with, but it's difficult for me and I don't know how to learn that material", "I wish the priority for students with difficulties wasn't the same", and "I'd like the exercises to be explained when they're done on the board".

Regarding the teacher's actions to encourage students to self-evaluate their work, how they do it, and their achievements, it was found that both the opportunities provided, and the resources offered by the teacher to enable students to develop this skill are scarce, with only high-achieving students benefiting. In interviews, teachers acknowledged the importance of self-evaluation of their work and how they do it, as it would contribute to the development of students' thinking. However, they justified the lack of this practice in class by claiming that only high-achieving students can do it well. The teachers stated that: "it is very important that for each exercise the student completes, they can evaluate how they did it and explore alternative solutions", "students struggle to explain or evaluate their work because they lack the mathematical language skills to do so", "students no longer want to talk", "when working in pairs, I have them reflect on what their partner did, but it is the more advanced students who are best able to do the reflection", "we primarily do this when it is an exercise that presented difficulties for most of the students". For their part, the students interviewed acknowledged that they don't always value their own work, believing that the teacher is the one who does it best, which is reflected in the following statements: "I find it difficult to explain what I did, even though I know how to do it", "at the end of the class, the teacher tells us what we had the most difficulty with, with the help of the teaching assistant", "the teacher makes us explain what we did and asks us questions", "math exercises are always about solving".

Regarding the actions organized by the teacher to facilitate exchanges between students of varying developmental levels about their experiences in studying mathematical content, it was concluded that: these exchanges are primarily based on reflection on what they have learned in class, with student-teacher interaction being the predominant form of interaction; more advanced students mentor less advanced students, although the mentoring student does not receive guidance; and

teamwork is also utilized. This conclusion was reached after interviews with the teachers revealed a clear understanding of how to implement this approach, as evidenced by statements such as: "the actions we develop involve working in pairs or small groups, which allows for exchange among students", "we also mentor low-achieving students", and "the mentoring is based on a system of exercises designed to guide students with difficulties". Conversely, the students feel that students with difficulties are not given the attention they deserve: "the teacher is led by the intelligent ones, when they answer he continues and at least I get left behind", "my teacher doesn't want us to work with the person next to us, he says the test is not a team effort", "I understand better when my classmates explain things to me".

3- The differentiation actions that the teacher develops to respond to individual needs in working with skills associated with mathematical content do not guarantee the inclusion and equitable development of students, since they are fundamentally corrective in nature, generally using common tasks for all students, without addressing the causes that originate the errors during the solution of the proposed tasks or promoting development and creativity.

In the case of actions for developing mathematical skills, the proposed system of exercises is generally corrective rather than preventative, as it waits for the student to make a mistake and then addresses it. It is always the teacher who detects the error, and although there are types of exercises that allow for working with the errors that can be made, they are not used because they are not part of the grade level's objectives. For this reason, individualized attention is not given to addressing the errors students make in solving previous tasks; generally, a common system of exercises is used for all students. In the interviews with teachers about how they address errors, it was observed that past experiences are not considered. For example, some teachers stated that: "Ideally, the student should be able to detect the error, and from that error, develop a strategy so that the student can face a similar one", "Theorem proofs, which helped in working with errors, are no longer relevant", "It is also very important to know why the error is made, but due to time constraints, it is difficult for us because of the number of students we have", "We don't consider an error in the lesson plan; in my view, we don't assume that a student will make the error in a given exercise. When the student makes it through negligence or haste, that is when we declare that it must be corrected", "The book has some exercises that allow for the search for the error, and yet they are not used because they lack the structure of the exams", "In order to save time and achieve a goal, these exercises are sometimes omitted".

Meanwhile, students feel they receive support when they make mistakes, and that the most important attention is given during designated sessions for students with difficulties. However, in these sessions, they continue to do the same things as in the regular class, which is corroborated in the interview through statements such as: "Students' mistakes aren't always addressed correctly", "In my case, I've gone to the board with questions, and instead of explaining, the teacher tells me to sit down. They don't explain, and I feel bad because I'm not learning, and they send someone else", "My teacher sets aside a class time to help students with more difficulties and gives them exercises to solve those difficulties. They explain and give different exercises, and depending on their grades, they move up a level", "The teacher makes me go back and review, and that's when I realize the mistake. She asks me questions until I understand, and sometimes she gives me exercises related to the mistakes I made so I can work on it and figure it out", "The teacher reviews the entire exercise again, step by step, and explains", "Why did that mistake happen?", "Those who make mistakes are even asked about it in the hallways, and that's how it is done", "The teacher gives me several exercises and tells each person which one to do", "She manages to involve both the advanced and the less advanced students so that the one who makes a mistake doesn't feel bad".

Some students stated that the actions taken by teachers do not always enable the gradual elimination of errors; for example, there were statements such as: "sometimes I don't want to go to the board, because if I make a mistake the teacher tells me a lot of things", "when I make a mistake the teacher sends someone else to solve it", "the mistakes I make are almost always due to difficulties with content from previous grades", "the teacher should explain the exercises in a way that everyone can learn", "I continue to have difficulties when he gives me a different exercise".

Regarding the proposed system of individual practical exercises, it is generally clear that increasing levels of difficulty are taken into account, but it fails to address individual needs. Those interviewed justify this by stating that: "although I plan the same class, it doesn't turn out the same when I actually teach it", "ideally, there would be a class plan for each group", and "the time dedicated to it in the program hinders individualized planning of the exercises".

Teachers are not systematic in addressing the individual development of mathematical reasoning through a logical sequence of questions and prompts designed to eliminate difficulties students may encounter while solving a problem. The teachers interviewed do not acknowledge difficulties in this area; they state that: "each student is supported based on their specific difficulties", "they are asked questions until they become aware of their difficulties", "I prioritize the students with the most

difficulties and send them to the board to work more effectively", "that's where they learn". This aligns in some aspects with the statements of the students interviewed; for example, they state that: "if a student makes a mistake, they send other students to help until they get the correct answer", "the teacher sends me to the board so I can better understand my difficulties and overcome them", "the teacher sends me to the board, and when I make a mistake, she asks me questions, and that's how I learn". However, there are students whose experiences do not coincide with these approaches, for example: "the teacher doesn't know how to attend to me, he lets himself be led by the intelligent ones", "when someone does not understand the content he does not explain with different methods".

The proposed assignments for classroom and extracurricular work, designed to encourage students to express their creativity as fully as possible, are limited to high-achieving students and primarily focused on completing exercises. Interviews with teachers revealed that fostering creativity is not a priority in student learning. They stated that, for example, "only high-achieving students enjoy these kinds of activities", and "in twelfth grade, we use a system of exercises and encourage them to work towards the ones marked with an asterisk, but only the high-achieving students do them". Other teachers justified their approach by citing the significant difficulties students face. Statements made included: "I prioritize students with difficulties so they can overcome them, because the level of preparation students bring with them is very low", and "these students like to be given everything; they don't want to think much".

Interviews with students show that this indicator is not being developed, based on the following criteria: "I would like them to give me exercises where I have to reason, the teacher always does one exercise and all the others are the same, just changing the numbers", "My teacher gives me difficult exercises, but we can't always discuss them in class because he has to attend to students with difficulties".

The actions teachers take, in response to each student's difficulties and potential, to promote the transfer of prior knowledge to new situations are only partially successful. This is because, when these actions are implemented, the student's individual needs are not considered, so the new knowledge is not properly assimilated, leading to further difficulties. Generally, students transfer knowledge unconsciously, based on their own development, rather than through explicit teacher intervention. Interviews with teachers confirm a lack of clarity regarding what it means to promote knowledge transfer. This conclusion is based on statements such as: "The students who struggle with each subject are almost always the same, making it difficult for them to learn the new material", and

"We conduct activities outside of class to address students' difficulties, but there is very little time between lessons, so we have to cover the new material".

The students interviewed, when referring to this aspect, stated that: "I need them to review the content given previously, in order to understand the new ones", "not all students have the same way of learning or grasping the content given in class", "it takes me longer to master the content", "I don't know how to learn the new material if I have little preparation from previous grades and I keep doing poorly on the assessments I take".

Regarding whether the teacher considers individual development when conducting assessments, it was found that, as a general trend, assessments are applied equally to everyone within the same timeframe, with little attention paid to qualitative assessment and the developmental nature of this process, according to each student's potential. In interviews with teachers, they justified this approach based on the premise that: "the entrance exam is the same for everyone", "written questions best measure a student's knowledge"; however, students felt that "in systematic oral assessments, the teacher asks me questions to help me do well". Despite this, some students expressed opposing views, highlighting that: "they have two classes, and by the third, they're already asking written questions, knowing I didn't understand, and I almost always do poorly", and "I'm a struggling student, but sometimes I do things well, and the teacher doesn't even notice".

Teachers do not always take advantage of their students' potential in both classroom and extracurricular activities to structure support for low- and average-achieving students in their study of mathematical content. Interviews revealed that this approach is not being used because it does not yield the expected results. This is attributed to inadequate selection of students for these activities and insufficient preparation. This conclusion is reached because teachers stated: "I don't always achieve good results because some students resist it", and "I can't always prepare the most advanced students to carry out these activities". However, students stated: "The classes are sometimes tedious; I would like to be used to help others", and "Sometimes I can't get help at night when I need it".

Analysis of student achievements as a result of differentiated instruction in the mathematics classroom

1- Students with difficulties in eliminating errors make slow progress, which affects their confidence and security in their performance, generating attitudes of rejection towards the subject that prevents them from consciously participating in the solution of their limitations and choosing careers related to mathematics.

Regarding the gradual elimination of errors that hinder the learning of grade-level mathematical content, the students interviewed indicated that they have not yet achieved the progress they aspire to in mastering mathematical content. In this case, the students made statements such as: "I still feel like I'm not progressing at the same pace as other students in my group", "I don't think I'm making progress; I still fail many written questions", and "I've improved, but I still haven't caught up with the best in my group, and I want a career where math is essential". These statements are linked to aspects related to confidence and security in tackling tasks, participation in solving their own problems, and the choice of careers related to mathematics, among others.

Regarding the progressive gain of confidence and security in carrying out the activities specific to the subject, it was found that not all students achieve the same results, indicating that the principles of equity and inclusion are compromised. This conclusion was confirmed through interviews with students; they stated that "not all students have the confidence to ask questions", "and they are left with doubts", "I don't like to ask questions because the teacher blames me for not paying attention and in the end doesn't explain anything", and "I have gained confidence; I've done better".

Regarding the regular participation of students in addressing their own needs in learning mathematics, it is found that not all students feel part of the solution to their difficulties, which is confirmed in interview a, where they state that: "in the Mathematics class the teacher helps them to find their difficulties and solve them", "they are given tasks but are not told why they have to solve them, they are given tasks and are told why they have to solve them and they say that the teacher points out the difficulties, but does not ask them to find out how to solve them".

Regarding student participation in extracurricular activities related to mathematics, it is found that, based on the potential of the students, their participation in activities related to mathematics is not sufficient, since of the 130 students interviewed, only those considered by their teacher to be of high

or medium performance participate in activities related to mathematics, highlighting that 100% of the students considered to be of low performance do not participate in any of these activities.

In the case of the progressive improvement in exam grades for the subject, this improvement is not significant for students who struggle with the course. Interviews with these students show stagnation or regression in their results, and some even fail to meet the minimum passing grade requirement. Inconsistency is observed in the results of systematic assessments, indicating a lack of follow-up and achievement of learning objectives in the work carried out by the instructors. This is corroborated by statements such as: "I always get the written questions wrong", and "I feel like I'm not progressing because I always get low grades".

Regarding the choice of mathematics-related careers, the trend indicates that mathematics does not fully capitalize on the motivational orientation of students, especially those who do not perform well academically and others who, even with good results, do not consider it. This is evidenced by statements such as: "that's for gifted students", "I don't think it's my preference because I don't need it in my career", "I know it's important, but I wouldn't want to have to deal with it for life".

Regarding student satisfaction with the attention given to their needs, students generally acknowledge the support they receive; however, their satisfaction is not complete, indicating a lack of equity and inclusion in the support provided. This diversity of opinions is evident in the student interviews, where they stated: "I would like there to be more dialogue between students and teachers", and "I recognize that it's not always the teacher who should go to the students; students also have to go to the teacher, but they still lack confidence". Some students acknowledge the teachers' preparation and the attention they provide to students; for example, they stated: "The teachers are well-prepared, and they prepare us well", and "In my group, we are happy with the preparation we receive; we know that the teachers strive to teach us and give us many exercises". However, there were also cases with opposing views, such as: "I am not satisfied with the remedial courses; they are monotonous".

DISCUSSION

The ideas presented by the authors of this article emphasize the need for schools to uphold the aspirations of the UN's 2030 Agenda, not only to meet the goals set by this international organization, which Cuba has adopted, but also because these aspirations are at the heart of the Cuban education

system. In this sense, they agree with Villegas *et al.* (2025) that the system adapts to the needs of its students, regardless of whether they have any limitations or special educational needs.

The Cuban education system is inherently inclusive, based on justice and equity, which aligns with the ideas of Rodríguez (2023), García and Chen (2024), and Rojas & Ordóñez (2024). Based on these ideas, a scientifically grounded monitoring of the differentiated instruction provided by schools to each student is essential, particularly in more complex subjects such as mathematics.

A study of the differentiated instruction process must consider key aspects such as: diagnosis, the responses given by teachers to the individual needs of each student, and the students' achievements in meeting the objectives set for the subject. These aspects align with the ideas of Mejía and Botero (2022), who point to a differentiated instruction strategy that includes formative assessment, flexible grouping to organize students into small groups based on their needs, cooperative learning, individualized tutoring, and the use of educational technology that provides digital tools and resources to personalize learning.

It is also agreed that, for the search for information related to differentiated attention, we agree with Alulema *et al.* (2025), who relate differentiated attention strategies to actions associated with the diagnosis of mathematical knowledge, needs and potential of students, the development of reinforcement and expansion activities of mathematical knowledge, development and evaluation of activities with a flexible didactic integration.

In relation to the behavior of the variables studied during the research, it was found that the diagnostic process in the educational context shows inconsistencies in terms of how to do it, when to do it, and why to do it, which is contrary to the ideas *of* Alulema *et al.* (2025), who propose directing it towards mathematical knowledge, needs and potential of the students.

In the case of reinforcement activities such as: motivation, error resolution and deepening in the mathematical content, limitations were found related to inclusion, equity; as argued by Rodríguez (2023), Velasco et al. (2023) and García and Chen (2024), as well as the preventive treatment of future difficulties that students will present.

The actions that the teacher develops to respond to the individual needs related to how to learn mathematics do not guarantee that the majority of students can self-assess their activity in relation to the subject and, in this way, understand what resources they need to learn and participate

consciously in the solution of their own difficulties, which contradicts the references of Orosco Toribio *et al.* (2023) in relation to the need to take into account the role of learning styles with academic performance and how to adapt teaching to individual differences in this direction.

The research results confirm the slow progress of students in solving their difficulties, in relation to the transformation of the factors that condition learning, which affects the confidence and security in their performance, generating attitudes of rejection towards the subject that prevent them from consciously participating in the solution of their limitations and choosing careers related to mathematics.

REFERENCES

Apolinario-Parrales, M. R., Zamora-Vinces, M. J., Ortiz-Aguilar, W., & Hernández-Hechavarría, C. M. (2024). Estrategia para el mejoramiento de la solución de problemas matemáticos por estudiantes de cuarto grado de la Escuela Nuestra Señora de Fátima. *Maestro y Sociedad*, 21(1), 22-28. https://mEaestroysociedad.uo.edu.cu/index.php/MyS/article/view/6337

Alulema Alulema, L. I., Moreta Rivera, L. M., Ortiz Aguilar, W., & Hernández Hechavarría, C. M. (2025). Estrategia para el perfeccionamiento de actividades de refuerzo y ampliación del conocimiento matemático en el cuarto grado de la Educación General Básica. *Maestro y Sociedad*, 22(1), 452-465.

Aimacaña-Aimacaña, A. (2024). El ciclo didáctico del proceso enseñanza-aprendizaje de la matemática y el desempeño escolar de los estudiantes de Educación Básica Superior de la Unidad Educativa Vicente León. Universidad Tecnológica Indoamérica. https://repositorio.uti.edu.ec/bitstream/123456789/6548/1/AIMACA%C3%91A%20AIMACA%C3%91A%20AMPARO%20DEL%20ROCIO.pdf

Escobedo Cisneros, J. M. (2025). Diferenciación pedagógica en la enseñanza de matemáticas con enfoque en la formación de futuros profesores. *Revista Neuronum*, 11(2), Edición especial, CIMA-México. https://eduneuro.com/revista/index.php/revistaneuronum/article/view/564

García, J., & Chen, E. (2024). Buenas prácticas desde la gestión para la promoción de la educación inclusiva. *Innovaciones Educativas*, 26(41), 114-131. https://doi.org/10.22458/ie.v26i41.5191

Mejía-Cadavid, L. I., & Botero-Escobar, Á. M. (2022). El blog: una herramienta para mejorar la lectoescritura en el aula. *AiBi Revista De Investigación, Administración E Ingeniería*, 10(1), 108-114. https://doi.org/10.15649/2346030X.2592

Orosco Toribio, E. G., Orosco León, O. E., Salguero Alcala, G. K., & Vega Vilca, C. S. (2023). Estilos de aprendizaje y rendimiento académico en estudiantes de una universidad nacional peruana*. Horizontes. Revista de Investigación en Ciencias de la Educación,* 7(31), 22-31. https://doi.org/10.33996/revistahorizontes.v7i31.658

Rojas, E., & Ordóñez, Y. (2024). Diseño de Estrategias Educativas para la Inclusión de Estudiantes con Necesidades Físicas Especiales (NEE) en Entornos Escolares. *Dominio de Las Ciencias*, 10(3), 2353-2364.

Rodríguez, J. (2023). La importancia de la diversidad y la inclusión en el ámbito educativo. *Estudios y Perspectivas Revista Científica Multidisciplinaria*, 3(2), 16-47. https://doi.org/10.61384/r.c.a.v3i2.30

UNESCO. (2020). *Informe de seguimiento de la educación en el mundo, 2020: Todos y todas sin excepción*. https://doi.org/10.54676/WWUU8391

Velasco Suárez, G. A., Guerrero Medina, M. P., Fonseca Fonseca, I. S., & Basantes Jara, J. A. (2023). La educación personalizada. Un enfoque efectivo para el aprendizaje. Ciencia Latina Revista Científica Multidisciplinar, 7(2), 8059-8074. https://doi.org/10.37811/cl_rcm.v7i2.5942

Villegas, G. N, Velásquez, C. D, Villacís, X. H., & Vinces, L. S. (2025). Estrategias diferenciadas para la enseñanza de matemáticas en aulas inclusivas. *Revista Científica Arbitrada Multidisciplinaria PENTACIENCIAS*, 7(2). (Edición Especial I), 44-55.

Vera Arias, M. J., Nevárez Loza, R., Beltrán Ayala, L. A., Vera Vera, J. E., & Mendoza Vega, A. Y. (2023). Revisión Teórica de los Aspectos Fundamentales que Influyen en el Aprendizaje. *Ciencia Latina Revista Científica Multidisciplinar*, 7(5) https://doi.org/10.37811/cl_rcm.v7i5.8725

Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.