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Qualitative Study: Mathematics Teachers' Strategies in Delivering Geometry Material in Inclusive Classes

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ABSTRAK

This study aims to explore geometry learning strategies used by mathematics teachers in inclusive classrooms at the junior high school level. Geometry, as part of the mathematics curriculum, has a high level of abstraction, thus demanding a pedagogical approach that is adaptive to the diversity of cognitive and socio-emotional functions of students, especially those with special needs. This study used a descriptive qualitative approach with data collection techniques such as in-depth interviews, classroom observations, and documentation studies. Data analysis was conducted based on the Miles and Huberman model, with attention to the qualitative validity principles of Lincoln and Guba. The findings indicate that teachers implement learning differentiation strategies through content modification, the use of multisensory media, assistive technology, and a collaborative project-based approach. This approach aligns with the principles of Universal Design for Learning and the theory of multiple intelligences that encourage instructional flexibility. However, limited pedagogical training, workload, and lack of institutional support are significant challenges. Teachers' critical reflection as reflective practitioners plays a crucial role in designing inclusive and contextual learning innovations. This study recommends strengthening teacher capacity through ongoing training and cross-stakeholder collaboration to achieve academic equity in inclusive mathematics education.

INTRODUCTION

Inclusive education is an educational paradigm that recognizes student diversity as a reality that must be accommodated in daily learning practices. In this context, every student, including those with special needs, has the right to equal access, participation, and academic achievement. This aligns with the principles of Universal Design for Learning (UDL), which emphasize the importance of flexibility in material delivery, student engagement, and assessment methods. Therefore, mathematics teachers are required to design learning strategies that can reach various student learning profiles, particularly in inclusive classes characterized by heterogeneity in cognitive and socio-emotional functions.

One of the main challenges in implementing inclusive education in mathematics learning is the abstract nature of the material, particularly in the realm of geometry. Geometry, as part of the mathematics curriculum, demands spatial thinking skills, visual imagination, and mastery of the often non-concrete concepts of shape and space. For students with intellectual disabilities or visual impairments, visual and symbolic representations in geometry can be a significant cognitive barrier (Hariyanti et al., 2025). Therefore, conventional approaches that overemphasize lectures and symbolization need to be reviewed and adapted to the principles of differentiated learning.

Teachers play the role of designers of adaptive learning environments and facilitators of students' cognitive processes. In inclusive classrooms, teachers not only deliver material but also must be able to modify the content, process, and learning products (Nafisah et al., 2025). Strategies such as the use of concrete teaching aids (manipulatives), assistive technology, interactive visual media, and collaborative project-based learning have been shown to improve students' understanding of geometric concepts. These adjustments are not merely an expression of compassion, but rather a manifestation of pedagogical strategies based on academic equity (Husniati et al., 2020).

Previous research has shown that actively engaging students in the exploration of space and shape through multisensory activities can improve conceptual understanding and long-term memory retention (Purba et al., 2025; Putri & Fitriyani, 2024). In an inclusive context, this approach also supports students' socio-emotional development by encouraging interaction and collaboration between students of varying abilities. Therefore, geometry teaching strategies cannot be separated from the affective and social aspects, which play a crucial role in creating an inclusive and empowering learning environment.

However, various field studies show that not all teachers are pedagogically and psychologically prepared to face the complexities of inclusive classrooms. Limited specialized training, administrative burdens, and a lack of support from professional support staff hinder teachers from designing optimal learning strategies (Dasar, 2025; Khalil et al., 2024). This situation calls for increased teacher capacity through ongoing professional development programs based on contextual needs and collaboration between stakeholders.

A qualitative approach to examining mathematics teachers' strategies is crucial for understanding the complex and layered empirical realities of inclusive classroom practices (Demo et al., 2021). Through in-depth interviews, classroom observations, and documentation, researchers can reconstruct pedagogical dynamics that are not always reflected in formal curriculum or policy documents. Such studies make a significant contribution to building a practical knowledge base that is applicable and relevant to local school contexts (Moleko, 2022).

Furthermore, qualitative studies also allow for the identification of innovative strategies that may be unwritten or not yet formally documented. These strategies often emerge from teachers' critical reflection on the real needs of students in their classrooms. For example, using a spatial narrative-based approach to explain the concepts of symmetry or rotation, or integrating visual arts to strengthen students' understanding of geometric shapes with visual and kinesthetic learning styles. These strategies demonstrate that geometry learning in inclusive classrooms is not only about technical modifications but also about pedagogical creativity.

Thus, it is crucial to position teachers as active participants in inclusive educational change, not simply as implementers of policy. The strategies they use in

teaching geometry reflect the interaction between pedagogical beliefs, understanding of student characteristics, and resources available in the school environment. Qualitative studies of teacher practices can inform more contextual policy formulation and training guidelines based on the real needs of teachers in the field.

METHODOLOGY

This study uses a descriptive qualitative approach to deeply explore mathematics teachers' strategies in teaching geometry in inclusive classrooms. This approach was chosen because it captures pedagogical phenomena within complex naturalistic and social contexts. According to Creswell and Poth (2018), this approach is effective for understanding subjective meanings and interaction dynamics in educational practices, particularly in diverse learning environments such as inclusive classrooms.

The research was conducted at a public junior high school in an urban area that has implemented an inclusive education policy. The primary subject was an experienced mathematics teacher, with additional informants consisting of regular and special needs students. Data collection techniques included in-depth interviews, participant observation, and documentation studies of learning materials. The researcher acted as the primary instrument, actively interpreting and reflecting on field data.

The analysis process refers to the Miles and Huberman (2014) model, which includes data reduction, data presentation, and simultaneous conclusion drawing. The validity of the results was maintained through the criteria of trustworthiness, credibility, transferability, dependability, and confirmability. To maintain ethical integrity, this study involved informed consent, maintained participant anonymity, and upheld the principle of nondiscrimination.

Theoretically, this study reinforces Tomlinson's (2014) view on the importance of differentiated instruction in heterogeneous classrooms, where teachers need to adapt learning strategies to meet the needs of all students. The findings of this study are expected to contribute to the practice of inclusive, contextual, reflective, and transformative pedagogy in mathematics learning in elementary and secondary schools. **(Times New Roman, 12, Regular, space 1)**

RESULTS AND DISCUSSION

1. Differentiation of Geometry Learning Strategies in Inclusive Classes

Differentiating geometry learning strategies is an essential pedagogical effort in heterogeneous inclusive classroom environments. The diversity of student characteristics requires teachers to adapt their learning approaches, methods, and techniques so that every student, both regular and special needs, has equal access to geometry materials. A mathematics teacher stated,

> *"If I only use one teaching method, like lecturing or practicing problems on the board, children with special needs will definitely fall behind. I have to find a different approach so everyone can participate."*(Mathematics Teacher, Interview, May 15, 2025).

This statement shows that teachers have professional awareness of the importance of instructional flexibility.

Modifying teaching materials is a fundamental strategy in differentiation efforts. Teachers need to simplify, enrich, or restructure content to suit students' individual

learning needs. For example, students with cognitive disabilities might present spatial concepts through concrete representations and simple narratives, while students who demonstrate higher learning readiness are given additional conceptual challenges. An inclusive teacher explained,

> *"For students who have difficulty reading or understanding abstractions, I create a story version or use concrete objects. But for children who catch on quickly, I give them additional challenges"* (Inclusive Teacher, Interview, May 17, 2025).

This strategy shows attention to the meaningfulness of learning for each individual. Multisensory media plays a significant role in supporting students' cognitive processes, especially those with sensory impairments or varying learning styles (Shabrina et al., 2025). Concrete teaching aids such as geometric models, tactile images for visually impaired students, and assistive technology such as screen reader applications and digital boards are utilized to facilitate visual and kinesthetic understanding. The accompanying teacher stated,

> *"Props like cubes or blocks are really helpful. If they can touch or see things directly, they understand better. We also provide visually impaired children with raised images and audio explanations via an app.""* (Special Assistant Teacher, Interview, May 18, 2025).

This reflects the importance of sensory channel diversity in geometry learning. Varied instruction is implemented to reach students with varying abilities in receiving and understanding information. Teachers deliver material through verbal communication, visuals, and kinesthetic demonstrations. Additionally, strategies such as individual instruction or peer tutoring are used to ensure the active engagement of all students. (Bulu, 2023). One teacher stated,

> *"I usually convey instructions in three ways: speaking directly, writing on the board, and sometimes demonstrating the steps with hand gestures. This helps children who have difficulty focusing or have language issues."*(Mathematics Teacher, Interview, May 19, 2025).

This statement demonstrates an awareness of the importance of multimodality in conveying information.

The implicit application of Universal Design for Learning (UDL) principles is also evident in teaching practices. UDL principles encourage teachers to provide a variety of representations of material, ways of expressing understanding, and engagement strategies. One teacher explained,

> *"I realize that one method isn't enough. That's why I try to create activities that students can choose for themselves, such as drawing shapes, making structures out of straws, or presenting. This way, children can demonstrate their understanding in their own way.""* (Inclusive Teacher, Interview, May 20, 2025).

This approach demonstrates the flexibility of instructional design as a response to learner diversity.

Furthermore, the application of multiple intelligences theory supports the implementation of more personalized differentiation strategies. Teachers strive to identify students' intelligence tendencies, whether visual-spatial, kinesthetic, musical, or interpersonal, and adapt learning methods accordingly (Cindyana et al., 2022). One teacher stated,

> *"I have a student who's good at drawing, so he prefers learning geometry through pictures and diagrams. He also enjoys movement, so I have him create geometric shapes using his body or objects around him."*(Elementary School Mathematics Teacher, Interview, May 21, 2025).

In this way, the learning process becomes more meaningful and participatory, and provides space for the actualization of each student's unique potential.

2. Dynamics of Pedagogical Interaction between Teachers and Students

Pedagogical interactions between teachers and students play a crucial role in determining the effectiveness of geometry learning in inclusive classrooms. The communication patterns developed by teachers must be adaptive and communicative, encompassing simple verbal language, conceptual visualization, and the use of body language that supports the understanding of students with diverse learning needs. A mathematics teacher explained,

> *"I try to use simple language and visualize geometric concepts through pictures or props, so that my students who have difficulty reading or understanding instructions can still follow along."*

This statement emphasizes that communication strategies that are oriented towards student needs can minimize obstacles in the learning process.

The affective support provided by teachers contributes to the formation of constructive psychosocial relationships. Teachers who are empathetic, appreciate students' efforts, and respond positively to mistakes create a comfortable and open learning environment (Tamamah, 2025). This environment is crucial for students to develop self-confidence and intrinsic motivation in understanding abstract concepts such as geometry. One teacher stated,

> *"I always try to greet all students with a smile and start the class with a little motivation, because I believe a good mood is the key to them being willing to try and not being afraid of making mistakes."*

This shows that the role of teacher affection has a direct impact on students' mental readiness to participate in learning.

Managing inclusive classrooms requires teachers to apply differentiation strategies that take into account students' cognitive and social diversity. Adaptation of teaching methods is achieved through the organization of study groups, the provision of concrete learning media, and the design of a physical classroom environment that supports collaboration (Rasyad & Wulandari, 2024). One resource person stated,

> *"I usually group students based on their social and cognitive abilities. Students who are quick to grasp the material can help their peers who take longer, but I always guide them to avoid dominance."*

This reflects the teacher's role as a regulator of classroom dynamics that is fair and responsive to individual needs.

Increasing active student participation is an indicator of successful pedagogical interactions. Teachers must be able to create interactive, student-centered learning activities, such as group discussions, simple experiments, and geometry-based educational games (Basic et al., 2021). This type of learning design provides space for exploration while fostering students' emotional engagement with the material. One teacher stated,

> *"When I use geometry games, all the students become enthusiastic. Even the usually passive children become eager to join in and answer questions."*

These findings suggest that active participation can be fostered through approaches that are enjoyable and stimulate horizontal interaction.

Collaboration between students is also a key component in building an inclusive and supportive learning environment. Teachers need to design learning that allows each student to contribute according to their abilities. A group-based approach that considers individual roles appropriately can boost students' self-confidence and develop social skills. One informant explained, "I always emphasize that every child has strengths. When they work together, I see the children learn to listen to each other and begin to respect each other." This kind of collaborative practice builds social cohesion and encourages a culture of mutual respect in heterogeneous learning.

3. Challenges and Teacher Reflections in Implementing Inclusive Strategies

Implementing inclusive learning strategies in geometry presents multidimensional challenges that require adequate pedagogical and structural capacity. The first challenge stems from internal aspects of teachers, particularly limited pedagogical competencies consistent with the principle of inclusivity. Most teachers have not received formal training that equips them with instructional differentiation skills, the use of adaptive media, or an understanding of the Universal Design for Learning (UDL) approach. Raihan et al. (2025) emphasize that UDL is an essential approach to ensuring equal access to learning, especially for students with special needs. Without mastery of this approach, teachers tend to use uniform learning methods that are not accommodating to diverse learning needs. An elementary school mathematics teacher stated,

> *"I am often confused about how to convey material on spatial shapes to blind students because I have never received special training on this matter."*(Interview, Teacher AR, 2025).

In addition to competency aspects, high workloads also undermine the effectiveness of inclusive learning strategies. Teachers are required to prepare different materials simultaneously, adapt to individual student characteristics, and conduct inclusive assessments. Munawir et al. (2025) stated that inclusive learning is not merely about the physical integration of students with special needs, but also about recognizing diversity as a key principle in pedagogical practice. Teacher B emphasized,

> *"Teaching an inclusive classroom is like preparing two curriculums at once. I have to adapt the material for both regular students and students with special needs, but my time is limited."*(Interview, Teacher F, 2025).

This condition shows that teacher capacity is not only determined by knowledge, but also by managerial ability in designing flexible learning processes under limited time and resources.

External challenges also weaken the effectiveness of inclusive strategies implemented by teachers. The lack of structural support from educational institutions, particularly in the form of operational policies, the provision of supporting staff, and adaptive learning resources, is a significant inhibiting factor. Although Minister of National Education Regulation No. 70 of 2009 regulates the implementation of inclusive education, its implementation at the school level is often not accompanied by the provision of professional staff such as shadow teachers or special teaching aids. Teacher C explained,

> *"There are two inclusive children in my class, but no accompanying teacher. So I have to be extra attentive, and that makes it difficult to divide my focus."*" (Interview, ST Teacher, 2025).

On the other hand, the limited availability of teaching media capable of concretely visualizing geometric concepts for students with visual or cognitive disabilities is also a problem. Teacher DN explained,

> *"We don't have any special teaching aids for children with special needs. If we had tactile spatial models, it would be very helpful."*

This fact shows that the implementation of inclusive education requires systemic support, not just personal commitment from teachers.

In response to these various obstacles, teachers reflected on the strategies they had implemented. Reflection was conducted through an evaluation of the successes and failures of the methods used, particularly in reaching students' conceptual understanding of geometry material. Teacher E stated,

> *"Initially, I taught all students the same method, but it turned out that students with learning disabilities didn't understand. Finally, I tried a visual approach and used real objects"* (Interview, TA Teacher, 2025).

This statement demonstrates professional awareness of the importance of differentiation as part of equitable learning practices. Instructional differentiation is a concrete form of teacher response to the diversity of student readiness, interests, and learning profiles (Becerra Sepúlveda et al., 2024; Larios & Zetlin, 2023). Thus, reflection serves as a medium for teachers to develop strategies that are more adaptive to student heterogeneity.

Furthermore, this reflection has spurred pedagogical innovations based on educational technology and cross-sector collaboration. Some teachers have begun utilizing visual software like GeoGebra or interactive video media to explain spatial concepts. Furthermore, the involvement of external professionals such as therapists, educational psychologists, or parents has become part of collaborative strategies to deliver more meaningful learning. Teacher F stated,

"I invited a child therapist to discuss the appropriate approach. It really helped me understand the characteristics of inclusive students" (Interview, Teacher Y, 2025).

These efforts demonstrate that the success of inclusive strategies depends not only on teachers as individuals, but also on a supportive educational ecosystem.

Based on this description, geometry learning strategies in inclusive classrooms face substantial challenges, both internal and external. However, the existence of pedagogical reflection and collaboration-based innovation demonstrates that teachers have the adaptive capacity to overcome these obstacles sustainably. This aligns with the concept of reflective practitioners, where teachers are positioned as professional actors who continuously learn through the interaction between practice and reflective thinking (Savira et al., 2023). Thus, inclusive learning strategies are not only a pedagogical responsibility but also a transformational practice that requires structural support, consistent policies, and systemic strengthening of teacher capacity.

CONCLUSION

Differentiating geometry learning strategies in inclusive classrooms requires a high level of flexibility, creativity, and responsiveness from teachers in addressing diverse student characteristics. Each learning step is designed to enable both regular and special needs students to meaningfully access the material through content modifications, multisensory media, and varied instruction. Communicative and empathetic pedagogical interactions contribute to a supportive learning climate, where teachers adapt language, media, and affective approaches to encourage active student participation. The use of Universal Design for Learning principles and multiple intelligences theory serves as an implicit framework that guides differentiation strategies that are more adaptive to students' learning profiles. The main challenges faced by teachers lie in limited pedagogical competence, high workloads, and minimal structural support from educational institutions. Although regulations govern the implementation of inclusive education, its implementation is often not balanced with professional resources such as assistant teachers and adaptive media. In these conditions, teacher reflection is key to identifying shortcomings in the strategies used and finding new, more effective approaches. This reflective process encourages innovation based on educational technology and collaboration across stakeholders, including parents and external professionals. Teachers no longer act solely as instructors but also as facilitators and mediators in a complex learning ecosystem. Schön's concept of the reflective practitioner serves as the epistemological foundation for transforming inclusive learning practices. Thus, geometry learning strategies in inclusive classrooms are not simply pedagogical accommodations, but a manifestation of a professional commitment to justice and equal access to education

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