

Pedagogical Strategies used to Enhance Mathematics Performance of Pupils with Moderate Intellectual Disability in Inclusive Settings in Dodoma City Council in Tanzania

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ABSTRACT

This study aims to explore the pedagogical strategies used by teachers in enhancing mathematics performance of standard four pupils with Moderate Intellectual Disability (MID) in Inclusive Settings. The study involved 80 respondents whereby 40 were mathematics teachers, 8 heads of schools and 38 pupils with moderate intellectual disabilities selected from eight inclusive primary schools. The study employed a qualitative research approach in which data were collected using interviews, focus group discussion, observation and documentary review. The study used a case study research design, and the data collected were analyzed descriptively. That's the data from FGD, interviews and observation were coded by using qualitative data analysis software called NVivo. Findings of this study established that there are various pedagogical strategies which can be used in order to enhance mathematics performance to pupils with MID in inclusive setting. The strategies included; brainstorming, small group discussion, utilization of pictures and graphics, games and stories. Also, teacher-made instructional materials, concrete representation, instructional-technology-based, songs, manipulatives, collaborative strategy as well as question and answer. Based on these findings, the study recommends that the government in collaboration with the Ministry of President's Office-Regional Administration and Local Government (PO-RALG) should supply qualified staff in those schools.

Keywords: Pedagogical Strategies; Mathematics Performance; Pupils; Moderate Intellectual Disability

INTRODUCTION

The right to quality education, including access for individuals with disabilities, remains a global priority. [25] highlighted this in its advocacy for inclusive education, which has been reinforced by various global declarations. The 1990 Education for All (EFA) initiative stressed the need for educational systems to accommodate students with disabilities, while the 1994 Dakar Framework underscored the importance of creating conducive learning environments for children with disabilities. The Universal Declaration of Human Rights (UDHR) of 1948 further emphasized this in Article 26, which asserts the right to education for all individuals, including those with intellectual disabilities (ID), regardless of their background or condition. This declaration calls for the removal of barriers that hinder educational progress for students with disabilities in inclusive settings.

Additionally, the 1994 Standard Rules on the Equalization of Opportunities for Persons with Disabilities urged states to ensure that children with disabilities have access to quality education as part of the mainstream education system [27]. Despite these commitments, many children with disabilities remain excluded from education. According to the World Health Organization [35], out of 93 to 150 million school-

aged children with disabilities worldwide, only 20% are receiving education. In Tanzania, out of the 1.7 million children with disabilities, only 5% are enrolled in school [34]. This exclusion is largely due to negative parental attitudes, inadequate disability policies, lack of prioritization in the education sector, and stigmatization from teachers who view children with disabilities as needing special treatment [31] and [18].

To address these challenges, it is essential to eliminate discrimination against people with disabilities. One effective strategy is to develop policies that promote inclusive education as a way to eradicate discrimination in educational opportunities. The Salamanca Declaration of 1994 emphasized that inclusive education can help reduce discrimination against students with disabilities, including those with intellectual disabilities.

Intellectual disability (ID) is a condition characterized by significantly below-average intellectual functioning, coupled with deficits in adaptive behavior, such as self-esteem, money management, and expressive language, which manifest before age 18 and adversely affect educational performance (AAIDD, 2022; Tasse, Luckasson, & Schalock, 2016). Intellectual disability is categorized into four levels based on intelligence quotient (IQ): mild (IQ 55-70), moderate (IQ 40-55), severe (IQ 25-40), and profound (IQ below 25) [33] and [1]. Research has shown that students with moderate intellectual disabilities (MID) are capable of learning and achieving in mathematics if they receive appropriate pedagogical support from teachers, unlike those with severe or profound intellectual disabilities [8].

Inclusive education, as asserted by [22] and [21], provides positive learning outcomes by allowing students with disabilities to learn alongside their non-disabled peers. This approach not only offers equal access to education but also fosters skill development, reduces stigmatization, and promotes positive social interactions [26]. It also enhances social awareness, acceptance, and personal growth among students [23] and [15]. [20] Argue that inclusion in education is a fundamental human right and a critical factor in the socio-economic transformation of communities.

In response to these challenges, Tanzania has taken significant steps by signing international declarations and introducing local initiatives, such as the Inclusive Education Policy and the 2018-2021 National Strategy for Inclusive Education (NSIE) [28]. Tanzania's commitment to inclusive education is also reflected in the Disability Act of 2010 and the Sustainable Development Goals (SDGs) of 2015/2030 [29]. Various programs, including the Education Sector Development Programme (ESDP 2016/2017 to 2020/2021) and the Development Plan II (PEDP) 2012/2017, have been implemented to ensure equitable access to education without discrimination [28].

A pilot survey conducted in Iringa Municipality and Dodoma City Council revealed that in two schools in Iringa, 32 students (18 boys and 14 girls) with moderate intellectual disabilities were enrolled in public inclusive primary schools. In Dodoma, 340 students (198 boys and 142 girls) with moderate intellectual disabilities were enrolled in 36 schools between 2018 and 2021 [30]. This demonstrates Tanzania's commitment to adopting inclusive education as a means of eliminating discrimination within its education system.

Despite these efforts, the performance of students with disabilities, particularly in mathematics, remains a significant issue globally and locally. Several factors contribute to poor mathematics performance among students with MID, including learning difficulties, lack of support, unqualified teachers, material shortages, and overcrowded classrooms [11], [19], [14] and [16]. Various nations have implemented strategies to improve mathematics performance among students with MID. In the USA, teachers use video modeling to help students learn functional skills and mathematical operations [6]. In Hong Kong, teachers use computers and calculators to teach basic mathematical functions [5]. Zambia employs task analysis, graphics, stories, and hands-on activities to engage students with intellectual disabilities [17]. In Burundi, active learning and problem-based learning approaches are used, but their effectiveness is limited by large class sizes [4]. In

Tanzania, schools focus on practical problem-solving and have increased the availability of teaching materials to support students with disabilities [9], [13] and [32].

Despite these efforts, the performance of students with MID in mathematics remains low, as indicated by the Standard Four National Assessment results in inclusive primary schools in Iringa and Dodoma from 2018 to 2021. The concept of performance in this context refers to the ability of students to correctly perform basic mathematical skills (addition, subtraction, multiplication, division), as measured by the Standard Four National Assessment (SFNA) in Tanzania.

THEORETICAL FRAMEWORK

In this paper two theories were used namely: Social Constructivism Theory (SCT) and Behaviorism Theory of Learning (BTL). The two theories were used concurrently so as to support each other. The SCT was used to emphasize that knowledge is socially constructed, that was to say pupils with intellectual disability (in this case children with moderate intellectual disability-MID) learn better when interacting with their peers in inclusive settings. Such interaction facilitates sharing of knowledge and experiences among them. On the other side, the constructivists hold that learners can construct their knowledge through their mental processes apart from social interaction. However, the two theories are prominent learning theories widely used to explain how learners learn and each theory has the potential of illuminating the extent in learning can take place in the learning environment amongst learners.

EMPIRICAL REVIEW

Several studies from different parts of the world have focused on the pedagogical strategies teachers use for teaching mathematics in inclusive classrooms. These studies provide insights into various approaches and their effectiveness in different educational contexts.

Goransson, Hellblom-Thibblin, and Axdorp (2015) conducted a study on the conceptual approach to teaching mathematics to students with intellectual disabilities (ID) in Sweden. The study sampled 35 pupils with ID from 60 Compulsory Schools of Students with ID (CSS ID) using purposive sampling. The findings revealed that teachers employed a variety of strategies, including explicit instruction, the use of formal mathematics language, and the Concrete-Representational-Abstract (CRA) approach, as well as fact and computational fluency and word problem-solving techniques. However, the effectiveness of these strategies was highly dependent on the availability of resources within the schools. The study emphasized the importance of adequate funding to ensure that schools have the necessary resources to implement these strategies effectively.

In Nigeria, [10] investigated the perceived efficacy of teacher-made instructional materials in promoting learning among mathematics-disabled children. The study, which involved 155 mathematics-disabled pupils from 25 selected schools in the central education zone, used quantitative methods, including mean, standard deviation, and t-test statistics for data analysis. The findings indicated that teacher-made instructional materials significantly enhanced the learning experience for these children. The materials allowed pupils to interact with physical objects, which appealed to their sensory organs and improved their learning outcomes. The study concluded that while teacher-made instructional materials are beneficial, some pupils may still struggle with mathematics despite their use.

[20] supported the use of explicit instructions in developing computational skills, including multi-digit addition, subtraction, multiplication, and division. This approach aligns with Vygotsky's (1978) theory of cognitive development, which emphasizes step-by-step instruction. Mosimege also highlighted the use of games as a pedagogical tool, suggesting that games, when combined with teacher assistance and guided

manuals, can enhance specific talents and make learning more engaging. The study concluded that these strategies help engage students' sensory organs, making learning more effective through hands-on activities, pictorial mathematics, and manipulatives.

In Qatar, [2] found that problem-solving strategies are commonly applied to pupils with intellectual disabilities. Teachers provide verbal and gestural cues to help pupils recall and apply their schemas, promoting critical thinking and problem-solving skills. This approach is particularly effective for developing creativity and cognitive abilities in pupils with ID. However, the success of this strategy relies on the teacher's training and expertise in working with pupils with intellectual disabilities.

[3] The use of story-based teaching strategies in American schools for teaching mathematics and science to students with moderate and severe developmental disabilities. This approach involves creating stories around familiar contexts, such as malls or movies, and using them to introduce key mathematical concepts. The study found that pairing key vocabulary with picture symbols enhanced students' comprehension, making story-based strategies particularly useful in teacher-centered classrooms.

[12] explored the effectiveness of building early numeracy skills in students with intellectual disabilities through systematic and repeated instruction. This story-based math approach emphasizes interaction with more knowledgeable peers, highlighting the importance of social interaction in the learning process. The study supports Vygotsky's theory of social constructivism, which suggests that knowledge is constructed through social interaction.

[7] conducted a mixed-methods study in Kenya to examine the influence of teachers' instructional practices on the performance of pupils with intellectual disabilities. The study involved 109 students and found that a combination of teacher-centered and learner-centered strategies was most effective. This approach facilitated the sharing of experiences and knowledge between teachers and learners, enhancing the overall learning experience.

In Tanzania, [24] investigated the challenges faced by teachers when teaching learners with developmental disabilities in Morogoro. The study used a sample of 22 respondents and found that teachers employed various strategies, including the use of pictures, songs, role play, and team teaching. Additionally, the study revealed that teachers often divided students into groups to simplify teaching and improve communication. However, the study also found that while teachers were proficient in describing these strategies orally, they struggled to apply them effectively in the classroom. This raised concerns about the quality and qualifications of teachers, as well as the availability of resources to support these strategies. The study concluded that hands-on learning and practical engagement are more effective for students with MID, as they tend to be more active learners who benefit from doing rather than listening.

METHODOLOGY

The study utilized a qualitative research approach, which enabled a thorough exploration of social phenomena in natural settings, particularly focusing on the experiences of teachers and pupils with moderate intellectual disabilities (MID) in mathematics. This approach was chosen for its ability to provide deep insights into how pedagogical strategies are applied in inclusive classrooms, influenced by the specific needs of the pupils. The research employed a single case study design, which was particularly suitable for generating detailed, descriptive information about the effectiveness of these strategies within the context of Dodoma City Council.

The target population for the study included Head Teachers, Mathematics Teachers, and pupils with MID from inclusive primary schools in Dodoma City. The sample size comprised 80 participants: 8 Head Teachers, 32 Mathematics Teachers, and 40 standard four pupils with MID. Systematic sampling techniques

were used to select eight schools from the 36 inclusive primary schools in the area, while purposive sampling was employed to choose key informants. Data were collected through interviews, focus group discussions, observations, and documentary reviews, providing a comprehensive understanding of the pedagogical strategies and their impact on pupils' mathematical performance.

FINDINGS AND DISCUSSION

Brainstorming: Brainstorming was recognized by both HTs and MTs as a strategy that fosters critical thinking and problem-solving skills. Despite this, its practical application was limited. Teachers reported that brainstorming was challenging to implement with pupils with MID due to their slower learning pace and the demands of the strategy. FGDs and classroom observations indicated that brainstorming was rarely used, largely due to large class sizes and constraints imposed by the competence-based curriculum. This observation contrasts with previous research that highlighted brainstorming as a strategy capable of enhancing creative thinking and performance.

Small Group Discussion: Small group discussions were identified as a valuable strategy for sharing ideas, problem-solving, and providing personalized attention. This approach allows pupils with MID to benefit from peer support and active participation. However, its implementation was hindered by challenges such as overcrowded classrooms and insufficient teacher training. Although teachers acknowledged the potential of small group discussions, they faced difficulties in applying this strategy effectively. Pupils with MID expressed positive feedback, noting that small group discussions facilitated support and collaborative learning. Teachers and pupils alike valued this approach, but its application was inconsistent due to practical limitations.

Pictures and Graphics: The use of pictures and graphics was praised for making abstract mathematical concepts more accessible. Visual aids help in comprehension and engagement, benefiting pupils with MID by providing concrete representations of mathematical ideas. However, challenges included limited resources and the need for better training to use visual aids effectively. Despite these issues, both teachers and pupils found visual aids to be motivating and helpful. Although pictures and graphics were mentioned in lesson plans, their actual use in the classroom was infrequent. The positive impact of visual aids supports the principles of Universal Design for Learning (UDL), suggesting that their proper integration can significantly enhance mathematics performance for pupils with MID.

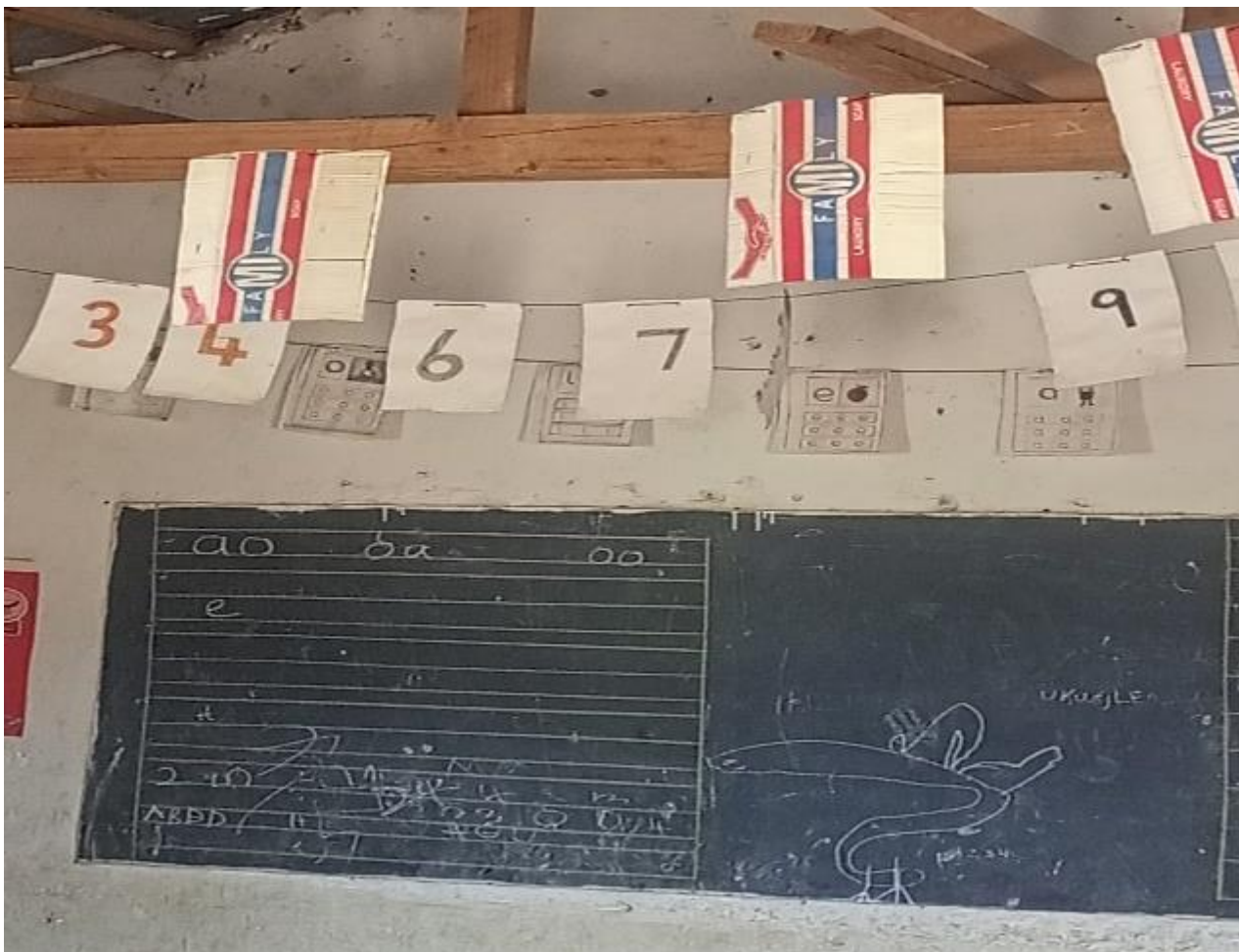
Games: Games emerged as a significant pedagogical strategy for improving mathematics performance among pupils with moderate intellectual disabilities (MID) in inclusive classrooms. Both head teachers (HTs) and mathematics teachers (MTs) highlighted that games offer an interactive and engaging way to teach abstract mathematical concepts, making them more accessible. HTs noted that while games are beneficial, their application is infrequent due to large class sizes and a lack of teacher motivation. This sentiment was echoed by MTs, who pointed out that time constraints and overcrowded classrooms often hinder the effective use of games. Despite these challenges, pupils with MID reported enjoying mathematics lessons that incorporate games, which help them understand concepts better and encourage peer interaction. Overall, while games have proven effective in engaging students and enhancing learning, their implementation is constrained by practical limitations such as class size and curriculum demands.

Stories: The use of stories was recognized as an effective pedagogical strategy for enhancing mathematics performance among pupils with MID. Stories provide a narrative approach that connects mathematical concepts to real-life contexts, making the material more relatable and understandable for students. HTs and MTs agreed that storytelling helps pupils grasp abstract concepts by linking them to familiar scenarios. However, some MTs expressed concerns that storytelling might conflict with the competence-based, learner-centered curriculum. Pupils with MID enjoyed lessons that included stories, finding them both engaging and

educational. Despite their effectiveness, the implementation of storytelling faces challenges such as time constraints and ensuring the accuracy of mathematical content. Overall, storytelling proves to be a valuable strategy for making mathematics more accessible and engaging, though it requires careful integration into the curriculum.

Teacher-Made Instructional Materials: Teacher-made instructional materials were identified as a valuable strategy for enhancing mathematics performance among pupils with MID. These materials allow for customization and differentiation, catering to the diverse needs of students. HTs and MTs highlighted the benefits of using these materials but noted that their use is inconsistent due to resource constraints and varying levels of teacher engagement. Pupils with MID reported that lessons were more understandable and engaging when teacher-made materials were used. However, observations revealed that some materials were of poor quality and not well-organized. Despite these challenges, teacher-made instructional materials offer significant advantages for personalized learning and active engagement. To maximize their effectiveness, it is crucial to address issues related to resource limitations and material quality.

Figure 1: Teacher made Instructional Materials in inclusive classrooms



Concrete Representation: Concrete representation is a pedagogical strategy that uses physical objects to help pupils with moderate intellectual disabilities (MID) understand mathematical concepts. Interviews with head teachers (HTs) and mathematics teachers (MTs), as well as focus group discussions with MTs and pupils, revealed its effectiveness. HTs noted that while concrete representations are highly beneficial, they are infrequently used due to large class sizes and limited teacher motivation. For instance, HTs from inclusive primary schools pointed out that although concrete representation aids in understanding difficult concepts, its application is limited. MTs similarly recognized that while concrete representation enhances

comprehension, its use is hampered by resource availability. Pupils with MID reported that using tangible materials significantly improves their understanding and problem-solving skills. The strategy is praised for providing a multisensory learning experience, though its effectiveness is constrained by issues like resource scarcity and the need for better integration into lesson plans.

Instructional Technology: Instructional technology, including interactive whiteboards, educational software, and mobile applications, was identified as a valuable strategy for improving mathematics performance among pupils with MID. HTs and MTs highlighted the potential of technology to engage and motivate students by providing interactive and multimedia-rich learning experiences. For example, HTs mentioned the use of tablets like 'VISHIKWAMBI,' which facilitate personalized learning but are limited by issues such as insufficient data bundles and electricity problems. MTs acknowledged the advantages of instructional technology in tailoring content to individual needs, although challenges such as limited resources and technical support hinder its widespread use. The findings suggest that while instructional technology holds promise for enhancing mathematics education, overcoming barriers related to technical support and teacher training is crucial for maximizing its benefits.

Songs: Songs were found to be an engaging pedagogical strategy for teaching mathematics to pupils with MID. By incorporating rhythm, melody, and repetition, songs help reinforce mathematical concepts and improve learning. HTs and MTs reported that songs create a supportive learning environment and enhance motivation. However, some teachers noted that songs might not align with the competency-based curriculum demands. Pupils with MID appreciated the use of songs, finding them enjoyable and effective for understanding mathematical concepts. Despite their benefits, challenges include finding suitable songs that match curriculum requirements and integrating them effectively into lessons. Overall, songs offer a promising approach for making mathematics more engaging and memorable for students with MID.

Manipulatives: Manipulatives, or physical objects used to represent mathematical concepts, were identified as an effective strategy for enhancing mathematics performance among pupils with MID. They provide a hands-on, multisensory learning experience that helps students grasp abstract ideas. HTs and MTs noted that manipulatives promote conceptual understanding and engagement but are often underused due to resource limitations and time constraints. Pupils with MID expressed enthusiasm for activities involving manipulatives, which they found helpful in understanding and solving mathematical problems. While manipulatives offer significant benefits, challenges such as inadequate resources and the need for effective integration into lessons must be addressed to optimize their use.

Collaborative Teaching/Learning: Collaborative teaching and learning emerged as a valuable strategy for improving mathematics performance among pupils with MID. This approach fosters peer interaction, cooperation, and social skill development by having students work together and support each other's learning. HTs and MTs highlighted that collaborative activities promote active engagement and address diverse learning needs. However, challenges include managing group dynamics and ensuring equitable participation, particularly in classrooms with limited teacher resources. Despite these challenges, collaborative teaching provides a supportive and inclusive learning environment that enhances both academic and social-emotional development for students with MID.

Question and Answer: The question and answer strategy was found to be an effective pedagogical tool for enhancing mathematics performance among pupils with MID. This approach encourages active participation, critical thinking, and problem-solving. Interviews with HTs and MTs indicated that this strategy helps tailor instruction to meet diverse needs and improves student engagement. Pupils with MID also expressed increased confidence and understanding when involved in question and answer sessions. Although this method promotes engagement and retention, its effectiveness is limited by the extent to which it is used and the challenges of aligning it with curriculum standards.

CONCLUSION

The study highlights that while brainstorming, small group discussions, and visual aids are recognized as effective pedagogical strategies, their practical application in inclusive classrooms is inconsistent. There is a need for improved implementation practices, teacher training, and resource allocation to enhance the use of these strategies and improve mathematics performance for pupils with MID. Overall, the question and answer strategy is beneficial for enhancing mathematics performance, but its application should be carefully managed to ensure it meets educational goals.

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