

# Effect of Recreational Activities on Mathematics Achievement and Self-Efficacy of Students with Mild Intellectual Disabilities in an Inclusive Classroom in Calabar Metropolis, Cross River State, Nigeria

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**Abstract:** *Aims:* The research work looked at the effect of recreational activities on Mathematics achievement and self-efficacy of students with mild intellectual disabilities attending an inclusive classroom in Calabar Metropolis of Cross River State, Nigeria. The research objectives were identified to guide the investigation. Two research questions were developed, each of which was transformed into a null hypothesis. A literature review of the study variables was conducted, and research gaps were outlined.

*Method:* The study design was a 2x2 factorial. The design was quasi-experimental and non-random. A sample of 120 students with mild disabilities (60 students were taught using recreational activities, identified on one hand, while another set of 60 were randomly selected and received teaching through the traditional method) in SSI classes within Calabar Metropolis, Cross River State, Nigeria. Data collection was based on a mathematical Achievement Test (MAT) and a Mathematics Self-Efficacy Rating Scale questionnaire (MSERSQ). The research design is based on two hypotheses. Reliability of the SES was assessed using Cronbach's alpha. 88, and the MAT reliability was calculated using the Kuder-Richardson formula 20 (KR-20), which gives an index of. 86. Descriptive statistics were employed to answer research questions, and Analysis of Covariance (ANCOVA) was employed to test the null hypotheses.

*Results:* The results of the analysis using ANCOVA revealed that mild intellectual disabilities students had performed better in mathematics achievement when they were tutored with recreational activities than those who received tutoring with traditional approach (F-ratio = 165.140,  $p < .050$ ), with partial eta squared of 0.585 (moderate effect) and self-efficacy (F-ratio= 724.919,  $p < .050$ ) with partial eta squared of .862 indicating high effect.

*Conclusion:* The study concluded that high academic achievement and self-efficacy of students with mild intellectual disabilities depend on the level of effective participation in recreation activities involving teachers in the teaching of mathematics concepts.

**Keywords:** Recreational activities, Academic achievement, Mild intellectual disabilities, Mathematics, Self-efficacy. Inclusive classroom.

## INTRODUCTION

Mild Intellectual Disability (MID) is a diagnostic category associated with limitations in cognitive functioning and adaptive behavior. People with MID generally have an IQ of about 50-70, which is below

average. Such constraints can affect several aspects of life, including school progress, relationships with peers and others in the environment, and the ability to take care of oneself. However, people with MID can frequently live fairly independently with appropriate support and services. MID is usually assessed using standardized IQ measures and is diagnosed when children obtain an IQ  $\leq 70$ , indicating intellectual disability. MID is diagnosed in childhood or

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adolescence and significantly impacts learning and development across the lifespan [1].

Sluggish processing speed, difficulty comprehending abstract ideas and reasoning, and problems with puzzle-solving may be seen in children with MID. They usually need some extra time and additional help to understand new concepts, especially in math. Being able to use math's is fundamental to day-to-day life and opens up a world of possibilities as well as further study and career options. Yet, individuals with MID often face difficulties in understanding mathematical concepts, solving problems, and applying what they have learned. Such students often cycle through frustration and fear when faced with mathematics, resulting in low achievement and reduced self-confidence. This decreased self-efficacy influences not only their willingness to participate in mathematics, but also their generalized attitude towards learning and school [2].

Adaptive behavior of students with MID is assessed using standardized instruments that evaluate how well an individual function in everyday life compared to peers. The assessment procedure of children with MID consists of a comprehensive evaluation, which includes:

**Standardized Intelligence Testing:** Standardized intelligence instruments, such as the Wechsler Intelligence Scale for Children or the Stanford-Binet, are used to assess cognitive ability and determine the student's MID status.

**Using Adaptive Behavior Scales:** Tests such as the Vineland Adaptive Behavior Scales look at the student's adaptive skills in important skill areas, such as communication, as well as self-care, social skills, and daily living skills.

**Administering Academic Assessments:** These assessments can help identify learning styles at pinpoint areas where students might struggle in math and reading, and may include curriculum-based or standardized tests.

**Informal Data Collection:** Collecting informal data through interviews, observations, and discussions with teachers, parents, and students can provide deeper insight into strengths, difficulties, and the interplay within social contexts.

**Collaborating with a Team of Specialists:** Collaboration among psychologists, special educators,

speech-language pathologists, and occupational therapists yields a more comprehensive evaluation.

Effective interventions for students with MID should be tailored to their individual needs and may include: Individualized Education Plans (IEPs), differentiated Instruction, Social Skills Training, Behavioral Intervention, and recreational activities. For students with MID, it is important to incorporate recreational activities into the curriculum, as they contribute to increased self-efficacy and mathematical achievement, as well as opportunities for informal practice. Recreational activities include the things people do in their spare time to relax and have fun.

Recreational activities encompass a wide range of voluntary activities individuals engage in during their leisure time for enjoyment, relaxation, and personal fulfillment. These activities can be categorized as physical, social, and creative and promote health, enhanced cognitive growth, self-efficacy, academic achievement, and quality of life [3].

To assess the effect of recreational activities on teaching and learning, especially in Mathematics, teachers can observe how students become engaged, their level of participation, and how they relate during social activities, to develop a sense of self-efficacy that enhances achievement in Mathematics.

Standardized assessments and classroom evaluations reveal persistent gaps in understanding basic mathematical concepts, operations, and problem-solving strategies. Conventional teaching approaches may be less effective at supporting the special learning needs of MID students. Inadequate differentiation in teaching, the absence of stimulating and interactive learning opportunities, and poor access to resources may lead to academic difficulties and feelings of underachievement [4, 5]. The combination of low achievement and self-efficacy could lead to significant social and emotional consequences for students with MID. Traits of these students may include elevated anxiety, lack of motivation, and poor self-esteem, exacerbating their academic performance and social relationships.

The use of recreational activities is important because it enables learning in an interactive and engaging environment [6]. That is, this approach aims to address issues with traditional ways of teaching mathematics by correlating active student involvement, intrinsic motivation, and learning self-efficacy with a

mastery goal orientation. According to Pathania *et al.* [7], the use of adaptive recreational activities in teaching improves learning outcomes and increases student engagement. The flexibility of this model allows it to be tailored to multiple learning styles and needs, which is an important resource for educators who strive to promote academic performance and the inner desire to learn among children.

It has been shown by Anggraeni and Budiharti [8] that, in recreational activities, teaching and learning Mathematics can be improved or maintained, providing support and opportunities for appropriate learning tasks and processes. The study by Moral-Sánchez *et al.* [9] found that students who engage in recreational activities have better academic performance and higher self-efficacy. The powerful influence of leisure activities on learning and understanding can help students understand much better. Additionally, recreational activities are used to make learning more engaging and help learners better understand the principles of mathematics.

## LITERATURE REVIEW

### Recreational Activities and Mathematics Achievement

Alsahhe and Bragazzi [10] explored the effects of PE (physical education) games on mathematics achievement and comprehension among schoolchildren with intellectual disabilities (ID) in Riyadh, Kingdom of Saudi Arabia. The subjects were 33 students with ID in an inclusive public middle school in Riyadh City. Participants were divided into an experimental and a control group based on their individual ID level. In the treatment group, students were taught math during PE classes; in the control group, they had regular math classes. The results showed that posttest scores for all participants in both groups were significantly higher than their pretest scores, and that the experimental group showed greater progress after the treatment. The current study emphasizes the need to integrate PE games into math classes to increase academic success, particularly in mathematics. Furthermore, Demirel [11] investigated the effect of therapeutic recreational gymnastic exercises on fundamental motor skills of hearing-impaired children (aged 6-9 years). There were 18 children in total (12 boys and 6 girls), equally distributed across the experiential condition (3 girls, 9 boys) and the control condition (3 girls, 6 boys). Pre- and post-intervention (a) gross motor development

tests, i.e., 25m walk, run, hop, run hopping by turns on one leg and jumps with other remaining outstretched in front of him or her; standing long jump; dribble between slalom poles located at 3-m interval in zigzag path 15× slalom poles; throwing tennis ball through an adjustable basketball hoop set for overarm throw from distance of 2 meters); stationery standing catch (the child catches the thrown ball from another child who throws the ball under hand movement), kicking dice attached to bouncing net frame when held down close to side comparing right-to-left time contact during a 30-second play of kicking tennis ball which remained stationary on bench 10 including catching hurled object; kick from wrist smooth dart 2 performed against stationary target group courses number pairs differed only by size). A "Special Exercise Training Program" was also developed, including 50-75 min training sessions twice a week for 10 weeks. Post-test fews were given after completion of the physical fitness training program on the Gross Motor Development test items. The data were managed and analyzed in SPSS (version 20) using frequency distributions, the mean, and nonparametric statistical tests, including the Mann-Whitney U-test. Results Significant differences (-value < 0.01) were observed when compared to the control group. This shows the influence of recreational gymnastic exercises on learning.

Beqaj *et al.* [12] sought to determine the physical and motor correlates of functional performance in youth with DS. The study included 44 children and adolescents aged 3 to 18 years with DS, recruited in a cross-sectional study. Functional skills (PEDI-CAT), gross motor function (GMFM-88), balance (PBS), fine motor skill performance (Nine-Hole Peg Test), and grip strength (hand-held Jamar dynamometer) were measured among participants; body mass index was considered. Descriptive statistics, Pearson's correlation, and stepwise linear regression were applied in statistical analysis. The findings showed that fine motor skills and grip strength were the important predictors of functional performance. With the exception of BMI, all measurements were significantly correlated with one another. Subjects were significantly below normative values for all 4 PEDI-CAT domains, with social/cognitive being the least developed and mobility skills being their greatest strength. This investigation underscores the predictive value of fine motor skills and grip strength for functional performance in children and adolescents with DS, and provides evidence that physical change alone will not fully account for variability in motor function or activity,

a finding already reported by other studies. Given that our findings demonstrate a reciprocal relationship between the physical, motor, and activity domains amongst this population.

In the same vein, Baker *et al.* [13] conducted a study to examine how playful learning can enhance children's agency. This article is underpinned by a developmental psychology framework that charts how play can facilitate the development of critical skills and dispositions for lifelong learning. Playing is found to have a positive impact on self-regulation and motivation, both of which contribute to children's ownership of their learning. It offered a culturally relevant view of agency that departs from autonomy, which is the focus of many current early childhood pedagogies. The work closes with actionable implications for educators on how to promote learning through play and children's authorship of their education. In the same vein, Alexander *et al.* [14] investigated the effects of vacuum and flow on medical school, specifically the input-output nature of recreation among first-year students. The data used were retrospective administrative data from four cohorts of first-year medical students at the University of Illinois at Urbana-Champaign from 2006-2010, totaling 408 students. Regressive models were used to investigate the pattern of recreational activities with respect to academic performance and vice versa before the examinations. Results showed that freshman medical students' use of recreational facilities was highly concentrated. Indeed, changes in recreational activity prior to taking an examination were positively associated with examination performance, but the opposite was also true. Those students who had radically cut back their leisure time were more likely to see decreases in their grades, not increases. The finding suggests that students who reduce their leisure involvement are expected to perform worse on tests. It implies that wellness interventions may lead to academic success for medical students, even during stressful examination periods. The study found no merit in the assumption that a decrease in wellness activities would improve exam performance. Additionally, Tapia-Paredes *et al.* [15] evaluate an intervention program of motor recreational activities aimed at promoting general basic motor skills among students with different disabilities. The purpose of this research is to determine the effectiveness of modified game activities on the performance of motor skills of students with different disabilities, using a pre-experimental design with five special needs students from the Special

Educational Unit of Shushufindi, Ecuador. The improvements were highly significant, and recreational pursuits contributed to bringing movement skills from largely "Fair" toward a more evenly "Very High" profile. Significant gains were observed, particularly in balance, manipulation, and locomotion skills among students with DS. These results support the use of modified play as a method for developing fundamental motor skills in disabled students and underscore the need for such interventions in inclusive learning environments.

Another study by Akin and Alp [16] examined the impact of a long-term adapted game-aided physical education intervention program on an individual diagnosed with Autism Spectrum Disorder and skill retention. The child was 14 years old at assessment and 15 years old when the study was completed. The study lasted 15 months, including a 12-month implementation period, a 3-month gap, and finally a retention test. The Short Form of the 2nd edition Bruininks-Oseretsky Motor Proficiency Test (BOT-2 SF) was used for assessment. Data were graphically inspected and demonstrated improvement in eight sub-dimensions of fine and gross motor skills. All skills, except the power subfactor, were maintained in the permanency test conducted after the 3-month period, with a slight decrease observed in the power sub-dimension. In general, the modified intervention programs had a beneficial effect on the motor skills of subjects with ASD and will likely improve their quality of life and educational experience. Moreover, Fathi-Azar *et al.* [17] conducted a systematic review of the efficacy of perceptual-motor exercises and physical activity in improving cognitive, motor, and academic performance in children with learning disabilities. The review followed the guidelines of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and included articles published between January 2000 and June 2022 from scientific research databases such as PubMed, MEDLINE, Scopus, Web of Science, Cochrane Library, ScienceDirect, and Google Scholar. A PICOS model was used to determine the eligibility criteria. The quality of methodology of the selected studies was determined utilizing the PEDro scale, and risk of bias (ROB) was determined by the Cochrane Collaboration tool (i.e., ROB2). The first search identified 2,160 studies, of which 10 were included in the systematic review, involving 483 children (251 in the intervention group and 232 in the control group). Results showed clear gains in cognitive measures ( $n = 7/8$ ), which included

working memory, attention, and information processing speed. Additionally, results indicated that perceptual-motor and physical activity programs may improve academic achievement ( $n = 4/5$ ) and motor skills ( $n = 5/5$ ) in children with LD. The results describing perceived mental health effects of perceptual-motor exercises ( $n = 1/3$ ) were weak and inconsistent.

### Recreational Activities and Mathematics Self-Efficacy

Bekomson *et al.* [18] investigated the effect of interest in extracurricular activities on a range of self-efficacy dimensions (i.e., social self-efficacy, academic self-efficacy, language self-efficacy, commitment to learning, and ethical/moral efficacy). The researchers used an ex-post facto design and randomly selected 1,586 students from public secondary schools in Cross River State. Data was collected using the Interest on Extra-Curricular Activity and Self-Efficacy Questionnaire (IECASEQ). Face validity of the instrument was determined by two experts in test and measurement and two in educational psychology, whereas the reliability estimate was computed using the Cronbach's Alpha method. The results were analyzed based on descriptive statistics. Results showed that interest in extracurricular activities significantly affected social, academic, language, moral, and total self-efficacy. According to these findings, the study suggested that teachers and school administrators foster an environment in which students participate in excursions and that such attendance is promoted rather than disregarded. Furthermore, Alanazi [19] examines the effects of ARMG on first-grade male students' math anxiety and performance. Participants in the experiment were two classes of students: an experimental class ( $N=28$ ) that learned math lessons with ARMG and traditional instruction, and a control class ( $N=30$ ) that was taught using only traditional methods. The ARMG program involved 24 sessions delivered over two months for students, with three sessions per week, each lasting 45 min. A significant negative correlation ( $r = -0.482$ ;  $p < 0.05$ ) between math self-efficacy and academic performance was observed. In addition, a statistically significant difference ( $\alpha = 0.05$ ) in math anxiety and performance was observed between the two groups, with lower math anxiety and higher performance scores reported by the experimental group. Based on these results, the study suggests instructional implications to enhance math instruction via ARMG.

Another study by Xu and Jang [20] examined the association between math self-efficacy and extracurricular TRAs on 6th-grade Canadian students' math achievement. It explored the underlying psychometric structure of the relationships among TRAs (including video gaming, internet use, and TV viewing) and math achievement using a large student survey on students' test performance ( $N = 26,767$ ), with students' self-efficacy as a mediator. Results of structural equation modeling fit the hypotheses; TRAs had negative direct effects on math achievement, and math self-efficacy played a mediating role in the video-gameplay/math-achievement relation. Moreover, it revealed indirect negative effects of TV watching and internet use on math achievement, mediated by math self-efficacy. This research highlights the critical relationship between students' psychological features and their digital habitats in assessing student academic achievement. In the same vein, Sapico [21] conducted a study to examine the influence of content-based recreation activities on students' development of comprehension skills in a specific set of skill algorithms, properties, principles, and uses. A descriptive, pre-experimental study design with 82 seventh-grade students was used to compute pretest and posttest scores. Pretest and posttest questionnaires with validated internal structure were based on polynomial operations items with rubric scoring. As covariates, student surveys also collected data on the extent to which students perceived that games/puzzles were used for idle time. Accuracy of spacing was expressed as a function of time, and the statistical analysis included frequency distributions, percentage distributions, independent t-tests, and paired t-tests. Results showed that there were statistically significant differences in post-tests among the groups tested using the skills algorithm, properties, principles, and application skills ( $p < 0.05$ ). On the other hand, the results demonstrated that students' perceived content-based leisure activities were not significantly associated with their comprehension skills. The study concludes that a recreational activity plan should be implemented, particularly a content-based strategy, to enhance students' understanding of mathematics.

Another study by Tian *et al.* [22] examined the relationship between recreation specialization and self-efficacy in life satisfaction, with a specific focus on flow experience as a mediator. The research developed a theoretical model examining the interrelationships among recreation specialization, self-efficacy, flow

experience, and life satisfaction. A Web-based survey was sent to Chinese long-distance runners, and 404 completed responses were analyzed. The results indicated that recreation specialization and self-efficacy positively influenced runners' flow experience. Similarly, recreation specialization, self-efficacy, and flow experience were positively related to life satisfaction. Flow experience partially mediated the relationship between self-efficacy and life satisfaction, and fully mediated the relationship between recreation specialization and life satisfaction. The finding revealed a positive correlation between recreational activities and learning. Moreover, Sawangmek [23] investigated the effects of a recreation program on science students' motivation to learn science and attitudes towards participating in activities. Thirty students (grades 4-9) in a small school in Uttaradit Province, Thailand, participated in the study through multiple activities: Warm Up, Cell Game, Fun with Ball, Genetics Game, and Team Work Game. These were intended to promote pleasure, cooperation, and the improvement of learning science. Data collection The data were collected using two instruments: (1) an observation form in which student behavior while participating was observed and rated, and (2) a questionnaire that consisted of four parts: personal information including age, sex, etc., science learning motivation on a adapted 5-point Likert scale from the Students Motivation Toward Science Learning created by Tuan *et al.* (2005), attitudes toward participating in recreational activities on a 5-point Likert scale version of attitude towards foregoing recreations prepared by Rui-Hsin Kao & Shih-Chung Tsai (2010), and suggestions after the activities. Quantitative and qualitative data were analyzed. Findings suggested that our participants' science learning motivation and attitude toward the recreational activities were achieved at the highest levels after the program. This indicates that the developed leisure activities would be useful as extracurricular science-related activities to trigger enjoyment and promote motivation and self-efficacy in science learning among students.

### Gap in Research

Current research on the instructional interventions for individuals with mild intellectual disabilities (MID) has been limited to classical teaching methods, individualized educational plans, and adapted teaching procedures. Despite this, research on the effects of a specific recreational activity (RA) on students with MID's mathematics achievement and self-efficacy is lacking, particularly in inclusive classrooms. Though

recreational activities have been identified as potentially beneficial for social, emotional, and physical development, there is insufficient evidence-based research on whether and how they relate to academic performance in a formal mathematics context. The majority of those have focused on cognitive and behavioral interventions without considering the possibility that engaging in recreational activities may enhance academic performance and students' self-efficacy with MID. The knowledge gap regarding the impact of recreational activities on mathematics achievement and self-efficacy among students with mild intellectual disabilities in inclusive classrooms in Calabar Metropolis is a challenge that warrants a focused empirical investigation. The search for this gap can be tackled by researchers who will, in turn, add immeasurable value to the educational system and student learning experience in Nigeria, and promote inclusive education. Addressing these gaps will help ensure that students with MID receive the academic and social support needed to reach their potential.

### Statement of the Problem

The low achievement in mathematics among students, including those with mild intellectual disabilities (MID), in both the West African Examination Council (WAEC) and Senior School Certificate Examinations (SSCE) has drawn attention from educators, the government, and stakeholders in both the commercial and public sectors in recent years. Despite the critical importance of mathematics in secondary education, most students with MID continue to experience difficulties in learning this subject and also have low self-confidence. The coexistence of the lack of academic aggression and self-efficacy in students with MID had deep social-emotional consequences. Students with MID are prone to high levels of anxiety and low motivation, accompanied by poor self-esteem, which impedes their learning and social integration. Many mathematical problems require a series of steps to arrive at a solution. Students with Mild Intellectual Disabilities (MID) often struggle to keep track of these steps, which can lead to incomplete or incorrect answers. For instance, a multi-step word problem might confuse them, causing them to miss critical information. As a result, many may develop a low sense of self-efficacy in math due to repeated failures, further hindering their motivation and willingness to engage with mathematical tasks. This cycle can ultimately result in poor academic achievement and diminished self-efficacy. Given this context, it is important to know how involvement in

recreational activities affects students' math achievement and self-efficacy.

### Objective of the Study

The main aim of the study is to examine the effects of recreational activities on students' Mathematics achievement and self-efficacy with mild learning disabilities. In particular, the study attempted.

1. To examine the effect of the recreational activities on achievement in Mathematics of students with mild intellectual disabilities
2. To examine the effect of the recreational activities on achievement self-efficacy in Mathematics of students with mild intellectual disabilities

### Research Questions

The following research questions were posed to guide the study.

- I. What are the differences between the mean achievement score in Mathematics of students with mild intellectual disabilities when taught with recreational activities and those taught with lecture methods?
- II. What are the differences between the mean self-efficacy score of students with mild intellectual disabilities in Mathematics when taught with recreational activities and those taught with lecture methods?

### Statement of Hypotheses

The following hypotheses guided the study;

1. There is no significant difference between the mean achievement score in Mathematics of students with mild intellectual disabilities when taught with recreational activities and those taught with the lecture method.
2. There is no significant difference between the mean self-efficacy score in Mathematics of students with mild intellectual disabilities when taught with recreational activities and those taught with the lecture method.

### METHODOLOGY

This study uses a 2x2 factorial design. The study was quasi-experimental and non-randomized. The

group design was a pretest-posttest control. Since it included a control and allowed the independent variable to be manipulated to establish causal relationships, this was a design preferred by the researcher. This allows comparisons across groups, accounting for the logistical constraints of education. In educational environments, random assignment to treatment and control groups might not be practical given the existing classroom layout. A control group was inculcated, and an intervention was provided as treatment. Teachers' assessment was used to diagnose MID. This design allows for comparisons between participants and nonparticipants in recreational activities to control for the effects of these activities on mathematics achievement and self-efficacy.

The structural model of the design is as follows:

O1 x O2 (E)

O1 x O2 (C)

where O1 represents the pretest results of the experimental and control groups. O2 is the final result of the experimental and control groups.

### Participants/Sample

The following diagnostic criteria were utilized for two days to identify students with Mild intellectual disabilities and determine appropriate treatment:

### Standardized Intelligence Tests

Stanford-Binet Intelligence Scales: This test was used to assess intelligence in individuals with Mild Intellectual Disability (MID) and provides a Full-Scale IQ score, along with subtest scores reflecting different cognitive abilities.

### Adaptive Behavior Assessments

Adaptive Behavior Assessment System (ABAS-3): The ABAS-3 measures adaptive behavior and provides scores across domains to identify strengths and weaknesses in adaptive functioning.

### Developmental and Educational History

Interviews and Questionnaires: Information from parents, teachers, and other caregivers about the student's developmental milestones, academic performance, self-efficacy, and social interactions can support diagnosis.

## **Sampling Techniques**

The participants are 4031 mild intellectual disabled Senior Secondary (SSI) students in Calabar Metropolis of Cross River State, Nigeria.

Respondents (students) were purposively selected for participation through proportionate stratified random sampling and simple random sampling within the population.

Stage 1 employs stratified sampling, focusing on the two Local Government Areas (Calabar South and Calabar Municipality) that make up Calabar Metropolis. Stages 2: Two schools (one from Calabar South and the other from Calabar municipality) were purposively selected using a simple random sampling method (one for the experimental group (Calabar South) and one control (Calabar Municipality)). Finally, in step 3, the intact class of students in SS1 with MID in both the two chosen schools was used. The Problem Monitor-Teacher Form for Age 6-18 was used as a screener to assess students' emotional and behavioral problems using 3 scales (internalizing, externalizing, and attention). The researchers also used school records, teacher mathematics assessment scores, and a teacher nomination checklist. A sample of 120 senior secondary school students with mild intellectual disability was drawn from schools (60 in each group). Girls in the experimental group were 33, and boys 27; in the control group, 39 girls to 21 boys among a total of 60 students.

## **Instrumentation**

The "Mathematics Achievement Test" (MAT) and the Mathematics Self-Efficacy Rating Scale Questionnaire (MSERSQ) were constructed by the researcher to collect pre- and post-test data. With the exception of the serial arrangement, this MAT was identical in both testing, for the purpose of evaluating students' academic achievement in Mathematics, also an MSESQ composed of 20 items was developed using a five point Likert scale as: Strongly agreed (SA), Agreed (A), Undecided (UD), Disagreed(D), and Strongly disagreed SD.

The fifty (50) multiple-choice objective test items that were chosen from the previous WAEC examination, based on the SS1 scheme of work, limited to geometry concepts, which were scored dichotomously (Correct options -1 Mark each, Incorrect option -0 Mark each), were used to measure students'

academic achievement in Mathematics. Before instruction started, the students in the schools took the MAT and MSERSQ pre-tests.

The experimental group was taught with recreational activities, while the control group was taught without recreational activities (lecture method).

The recreational activities utilized in the current study are Building Projects Using Geometric Shapes, Board Games, and Puzzles.

The educator guides students as they use materials such as LEGO, blocks, or cardboard to build structures composed of different geometric shapes, such as cubes, pyramids, and prisms. For example, students can build models of houses, bridges, or other structures that involve various geometric ideas. Construction projects offer a tactile, visual learning experience that is vital for students with Mild Intellectual Disabilities (MID). Practical support allows students to touch and feel materials, thus providing an opportunity to learn geometric concepts through physical manipulation.

Games and puzzles that introduce geometric concepts, such as tangrams, shape bingo, and geometry-themed board games, are also used by teachers. These games are characterized by requiring players to identify, create, or manipulate geometric shapes while playing. This will encourage cognitive skills involving geometry (problem-solving, critical thinking).

Mild Intellectual Disabilities (MID) students can engage in building projects, board games, puzzles, etc. Teachers can offer varying levels of difficulty to accommodate different skill levels, so that everyone in the room can contribute meaningfully.

The instruction was four weeks. Subsequently, the same students took the MSERSQ and MAT posttests to measure what was learned. The face validity of the questions was determined by four College of Education academics (two test and measurement experts and two mathematics educators) who judged whether the items were commensurate with the cognitive levels they were intended to measure. Content validity was used to ensure that more content at the sub-topic level led to an increased number of questions. Appropriate products were used for analysis after excluding unsuitable items. To assess the instrument's reliability, 40 SSI Mathematics students in a class at a school

approximately 8 km from the experimental school and 6 km from the control were given the MAT and MSERSQ. This particular school was selected because it was deemed similar in all respects to the students in the main study. Reliability coefficients are high (Kuder-Richardson Formula 20 (KR-20) = 0.86, Cronbach's Alpha = 0.88) for the MAT and MSERSQ scales, indicating good reliability.

### Procedure for Data Collection

It took place in the first semester of the 2025-26 school year. This was repeated for a total of four weeks for both the lecture method group and the recreational activities (RA) group. Inside that 28-day period, maturation [which might compromise internal authenticity] was not allowed to happen. Before initiating the study, informed consent of all participants' involved education professionals and institutions was obtained. All ethical principles regarding the research study were adhered. The experimental class was taught with experimental instructional activities for 80 minutes every week. On the other hand, the control group was taught for about 80 minutes in a lecture format. They were administered a pretest before any instruction was provided to determine what they knew prior to treatment. After the instruction was completed, a posttest was administered to participants in both the experimental and control groups. The post-test numbers were changed to give the impression that the test items were different from those of the pretest, to prevent pupils from being test-wise, and to prevent students from being trained for the test. The data for the research question were analyzed by descriptive statistics, and two hypotheses were tested. Data were subjected to analysis of covariance (ANCOVA).

### Ethical Information

Respondents provided data with their consent, made out to the heads/principals of schools, as well as support from class teachers. All information obtained was confidentially treated, and for this research, the same was reported.

**Table 1: Mean Of Pre-Test and Post-Test Scores of the Difference between the Mean Achievement Score in Mathematics of Students with Learning Disabilities When Taught with Recreational Activities and Those Taught with Lecture Methods (N=120)**

Strategy	N	Pre-test Mean SD	Post- test Mean SD	Mean difference score
Recreational activities	60	19.18 3.16	37.00 4.23	17.82
Lecture method	60	18.23 2.78	28.32 3.51	10.09

Sources: Field work, 2025.

## RESULTS

### Answer to Research Questions

#### Research Question One

What are the differences between the mean achievement score in Mathematics of students with learning disabilities when taught with recreational activities and those taught with lecture methods? Table 1 shows the answer to this research question using descriptive statistics.

The results shown in Table 1 reveal that the mean achievement difference score in Mathematics concepts for students with learning disabilities using recreational activities (17.82) was higher than that for their counterparts taught by the lecture method (10.09). By implication, students who were taught mathematical concepts using recreational methods outperformed those taught through the lecture method.

#### Research Question Two

What is the difference between the mean self-efficacy score in Mathematics of students with learning disabilities when taught with recreational activities and those taught with lecture methods? Table 2 shows the answer to this research question using descriptive statistics.

The results presented in Table 1 reveal that the mean self-efficacy difference score for Mathematics concepts for students with learning disabilities taught with recreational activities (25.42) was higher than that for students taught by the lecture method (11.35). By implication, students who were taught mathematical concepts through recreational activities had higher self-efficacy than those taught using the lecture method.

### Testing Research Hypotheses

Ho1: The mean achievement of students with MID in mathematics instruction using recreational activities is not significantly different from their counterparts when instructed using a lecture method. The

**Table 2: Mean of Pre-Test and Post-Test Scores of the Difference between the Mean Self-Efficacy Score in Mathematics of Students with Learning Disabilities When Taught with 7Es Learning Strategy and those Taught with Lecture Methods (N=200)**

Strategy	N	Pre-test Mean SD	Post- test Mean SD	Mean difference score
Recreational activities	60	30.25 2.91	55.67 6.77	25.42
Lecture method	60	28.47 2.78	39.82 3.25	11.35

Sources: Field work, 2025.

independent variable is the use of recreational activities, while the dependent variable is the mean mathematics achievement score of students.

The descriptive results presented in Table 1 indicate that 120 students with MID participated in the study, with 60 assigned to the experimental group (utilizing recreational activities) and 60 to the control group (no intervention). Posttest scores on recreational activities revealed that students in the experimental group ( $n = 60$ ) achieved a higher mean score ( $M = 37.00$ ,  $SD = 4.23$ ) than those in the control group ( $n = 60$ ;  $M = 28.32$ ,  $SD = 3.51$ ). This difference of approximately 8.68 points suggests that students taught through recreational activities outperformed their counterparts in the control group. The findings in Table 3 indicate that the mean achievement score in Mathematics for students taught with recreational activities was significantly higher than that of their counterparts taught using the lecture method ( $F=165.140$ ;  $p=0.000$ ).

Thus, at the 0.05 level, the null hypothesis was rejected. The result also provides a partial Eta squared estimate of .585, which scales with the impact intensity. This implies that the nature of recreational activities accounted for moderate variance (58.5%) in students' post-test scores in mathematics achievement. And the adjusted R-squared is .579, which implies that the independent variable (recreational activities use) explains the variation in the dependent variable.

Ho2; The mean self-efficacy score in Mathematics of students with MID taught with recreational activities does not differ significantly from their counterparts taught through the lecture method. The independent variable is the utilization of recreational activities, and the dependent variable is self-efficacy in Mathematics.

The descriptive results presented in Table 2 indicate that 120 students with MID participated in the study, with 60 assigned to the experimental group (utilizing recreational activities) and 60 to the control group (no intervention). Posttest scores on recreational activities revealed that students in the experimental group ( $n =$

60) achieved a higher mean self-efficacy score ( $M = 55.67$ ,  $SD = 6.77$ ) than those in the control group ( $n = 60$ ;  $M = 39.82$ ,  $SD = 3.25$ ). This difference of approximately 15.85 points suggests that students taught through recreational activities had higher self-efficacy than their counterparts in the control group. The results in Table 4 indicate that students' self-efficacy in Mathematics when taught with the recreational method showed significant differences from their counterparts in the lecture method ( $F=724.919$ ;  $p=0.000$ ). Thus, at the 0.05 level, the null hypothesis was not accepted. Also, the result shows a partial Eta squared of 0.862. This implies that treatment (recreational activities) contributed to the high percentage value (86.2 percent) of variance in post-test scores of students' academic self-efficacy in Mathematics. Also, the value of adjusted R-squared is .866, indicating that the treatment with recreational activities together explained 86.6 percent of the variance in the dependent variable.

## DISCUSSIONS OF FINDINGS

The first hypothesis stated that the mean achievement score in Mathematics for students taught with recreational activities does not significantly differ from that for students taught with the lecture method. This hypothesis was rejected. Teaching and learning can therefore be improved through recreational activities, as seen. This may be attributed to students' active engagement in class, which is reflected in their academic success.

The results are similar to those of Abdullah *et al.* [24], who described recreational activities in lessons as being used effectively to suit individual students' needs, which would result in positive mathematics accomplishments at every level of ability. Building projects using geometric shapes may aid students in their real-world application of mathematics, thereby enhancing their understanding of various mathematical concepts. Similar findings were reported by Pan *et al.* [25], Laidley and Conley [26], Chen *et al.* [27], and

**Table 3: One-Way Analysis of Covariance (ANCOVA) of the Difference in the Mean Achievement Score in Mathematics Of Students with Learning Disabilities When Taught with Recreational Activities, Do not Significantly Differ from their Counterparts When Taught with Lecture Methods (N=120)**

Source	Type III Sum of Squares	Df	Mean Square	F-ratio	Sig.	Partial Eta Squared
Corrected Model	2369.400a	2	1184.700	82.822	.000	.586
Intercept	4362.398	1	4362.398	304.973	.000	.723
Pre-test	107.391	1	107.391	7.508	.007	.060
Treatment	2362.201	1	2362.201	165.140	.000	.585
Error	1673.592	117	14.304			
Total	132031.000	120				
Corrected Total	4042.992	119				

a. R Squared = .586 (Adjusted R Squared = .579)

**Table 4: One-Way Analysis of Covariance (ANCOVA) of the Difference in the Mean Self-Efficacy Score in Mathematics of Students with Learning Disabilities When Taught with Recreational Activities Does not Significantly Differ from their Counterparts When Taught with Lecture Methods (N=120)**

Source	Type III Sum of Squares	Df	Mean Square	F-ratio	Sig.	Partial Eta Squared
Corrected Model	20123.587a	2	10061.793	380.945	.000	.868
Intercept	4756.658	1	4756.658	180.090	.000	.608
Pre-test	227.989	1	227.989	8.632	.004	.069
Treatment	19147.091	1	19147.091	724.919	.000	.862
Error	3063.875	116	26.413			
Total	352916.000	119				
Corrected Total	23187.462	118				

a. R Squared = .868 (Adjusted R Squared = .866)

Perić *et al.* [28], who found that students engaged in recreational activities attained significantly higher levels of mathematics achievement than their counterparts who received conventional education. For instance, when games are incorporated into mathematics lessons, students with mild intellectual disabilities become highly engaged. Learning is more fun and motivating when it involves activities like games, puzzles, or hands-on tasks, which improve academic performance.

Furthermore, the results are in line with those of Sánchez *et al.* [29] and Ali [30], who found that teacher preparation is a critical factor related to the academic performance of students with MID. For example, using recreational activities such as educational games and puzzles can strengthen engagement and enhance

academic achievement. This can also make mathematics learning more relatable and enjoyable. Moreover, the results confirm the work of Sangodapo and Ola [31], who found that the emotional and physical classroom environment plays a major role in student learning. This is supported by San Miguel *et al.* [32] and Ravet and Mtika [33], who reported that the availability of recreational physical activity resources positively contributes to students' academic success. This not only helps develop social skills but also allows students to help each other learn, creating an environment that supports math achievement.

The second null hypothesis is that there is no significant difference in self-efficacy in Mathematics among students with Mild learning disabilities taught through recreation and lecture. This hypothesis was also rejected. Higher self-efficacy is important for

promoting success and positive feelings towards mathematics, as well as motivating involvement. Leisure activities offer a promising context for improving learning outcomes, as they promote engagement and self-perception. Implemented well, this model can help teachers support students in increasing their competence and confidence in mathematics.

This result is consistent with Wilkerson *et al.* [34], who indicated that the level of self-efficacy in mathematics among student athletes participating in recreational sports was significantly higher. This is also supported by Koko and Okpara [35] and Hovey *et al.* [36], who demonstrated that students' self-efficacy in mathematics is boosted by involvement in entertainment-related activities. Students can track their progress and celebrate milestones while using recreational activities. These activities can help cultivate a feeling of accomplishment and bolster their self-efficacy in mathematics. These results are consistent with previous studies by [37, 38] and Chiva-Bartoll *et al.* [39], who observed that teacher training programs and support for recreational activities have a significant positive impact on learners' self-efficacy. A well-structured teacher-training program that emphasizes the use of recreational activities can significantly enhance students' self-efficacy. By equipping teachers with effective strategies and fostering a positive learning environment, students are more likely to engage with the material, build confidence, and develop a strong sense of self-efficacy in their mathematical abilities.

Also, the results are consistent with those of Kim *et al.* [40] and Wankasi [41], who found that the school environment impacts the development of self-esteem among learners. Recreational and environmental factors are important contextual factors that may influence academic self-efficacy by affecting students' well-being, cognitive processes, and motivation to learn. The beneficial effects primarily manifest as enhanced concentration, stress relief, and improved physical health, while negative environmental factors can impede learning.

These contingent results are also supported by Yoh *et al.* [42], Mustafa Issa Ali Al Ahme [43], Aksoy *et al.* [44], Sofian *et al.* [45], Reckase *et al.* [46], and Van-Putten *et al.* [47], who also documented that recreational materials can increase student self-efficacy and learning. Physical activity, such as sports and play, can increase confidence and reduce stress, develop leadership skills, and provide necessary

breaks. On the other hand, if access (to funding, facilities, or interest) is not there, then we deprive students from these benefits, and so schools must supply tools and activities to support student development in abundance."

### **Implications of Inclusive Education**

Several implications can be drawn from the study on the effects of recreational activities on the mathematics achievement and self-efficacy of students with MID in inclusive education. These implications are valuable to educators, policymakers, and practitioners for developing more conducive and efficient learning environments for students with MID.

Inclusive education is an educational philosophy and practice that ensures all children, regardless of background, ability, or disability, have equal opportunities to participate in and benefit from the educational process. It highlights that diverse learning needs should be catered to in the mainstream setting, and that a sense of belonging and support is promoted among all learners [48].

Inclusive Education is a dynamic form of education that responds and adapts through time to develop effective learning environments for all learners. Through these methods, educational institutions can more effectively foster a positive learning environment that improves all learners' experiences, advancing the goal of creating an inclusive society. Recreational mathematics should be included in the mathematics curriculum to help enthuse learners. This may include games, sports, and a wide range of creative arts that are connected to mathematical concepts, making learning more fun and meaningful. Differentiating instructional strategies for a heterogeneous group of students with MID is necessary. Activities need to be created that cater to all different levels of abilities and learning styles so that everyone feels involved [14]. By focusing on creative activities that foster success and cooperation, instructors can support students in developing self-efficacy beliefs in mathematics. Such support could motivate students to challenge themselves and persevere in the face of learning difficulties. In the ideal inclusive classroom, learning would be supported by an atmosphere where students feel safe expressing themselves, asking questions, and taking risks. "The trust and rapport can be built through recreational activities and strengthen their time in the classroom."

Teachers should be trained to incorporate recreational activities in their teaching. Professional development initiatives can prepare teachers to use these strategies in practice. Teacher education should further focus on understanding the specific problems that pupils with MID encounter, so that teachers can respond to and support them.

Education policy should also recognize and include leisure education as a major component of the program and curriculum for MID children. This includes an investment in the resources and training that enable these programs, as well as financial support for those services. Schools may want to consider putting in place structures to evaluate the effectiveness of such recreation activities on students' mathematics achievement and self-efficacy. Frequent measurement will inform the modification and development of programming. Knowing that academic progress is not independent of personal and social growth, inclusive education should emphasize a holistic view in which leisure-time activities are also seen as a necessary step towards all-around development for the individual. Educational activities should include recreational activities that develop self-efficacy and achievement, so that these students with MID continue to learn beyond the classroom.

The study's implications regarding the impact of recreation on mathematics achievement and self-efficacy emphasize the importance of developing an inclusive educational environment that accommodates the diverse learning needs of students with mild intellectual disabilities. By incorporating recreational activities into the normal educational process, encouraging positive learning environments, and ensuring collaboration between teachers, parents, and communities in delivering education, schools can create better experiences for these students. This will help to reform an educational system that truly values all learners.

## CONCLUSION

The findings of this study indicate that teaching methods significantly impact the achievement and self-efficacy of students with mild intellectual disabilities in Mathematics. Specifically, there is a notable difference in the mean achievement scores of students taught using recreational activities compared to those instructed through traditional lecture methods. This suggests that incorporating recreational activities into the curriculum enhances students' understanding and performance in Mathematics.

Furthermore, the study reveals a significant difference in the mean self-efficacy scores of students with mild intellectual disabilities, with those engaged in recreational activities demonstrating higher self-efficacy than those taught via lecture methods. This underscores the importance of employing interactive and engaging teaching strategies to foster not only academic success but also confidence in students' mathematical abilities. Overall, the results advocate integrating recreational activities into teaching practices to better support students with mild intellectual disabilities in Mathematics learning and self-perception.

Since the schools were fixed and the individuals were not transferred between them, a randomized quasi-experimental design was not employed. Furthermore, the roles of students' age, gender, motivation, and interest in the results were not investigated. A long-term study could provide information on the effects of recreational activities on students with MID across different curriculum areas. The study could be extended to other areas of knowledge to initiate discussion on pedagogical management and to contribute to the development of more efficient ways of inclusive teaching.

## RECOMMENDATIONS

The results of the present study could lead to the following suggestions. The aim of the recreational activities is to support students' learning in terms of achievement and self-efficacy in specific mathematical concepts. Therefore, it should be recommended.

1. Recreational activities should be a fundamental part of the mathematics curriculum for students with MID. This might involve games, manipulatives, and group projects integrated with mathematical ideas. The significant difference in achievement scores implies that leisure activities help understand and memorize mathematical concepts. Making learning fun and interactive can help students better relate to the material.
2. Teachers should develop and implement recreational activities that are specifically targeted at raising mathematics self-efficacy. The events should offer goal-setting, peer feedback, and chances for reflection on how students have evolved. Given that self-efficacy is associated with academic performance, developing students' confidence through

organized play can lead to higher levels of mathematical achievement.

3. There is a need for school management to continuously train the teachers about how they can use recreational activities in teaching. The training would focus on developing lesson plans that make learning math fun through games, movement, and collaboration. When teachers are prepared with knowledge and skills about the use of leisure processes, they can assist students with MID to reach better academic success.
4. Teachers must develop, produce, and distribute materials that specify different recreational activities for teaching math to MID students. This may take the form of activity sheets, lesson plans, and test items. Providing teachers with ready-to-use resources can enhance the utilization of recreational activities in the classroom, ensuring consistency and effectiveness in teaching.
5. The educators would adopt a framework of positive reinforcement during extracurricular activities to recognize students' extra effort and performance in the subject of mathematics. This could be something as simple as stickers, praise, or certificates for participation and progress. By acknowledging student success, this can make them gain self-confidence and motivation to become more involved in recreational pursuits as well as academic duties.
6. Periodic evaluation of students' performance and self-efficacy on mathematics prior to and post involvement in recreational activities is suggested to assess the efficacy of recreational activities. Employ instruments or scales that assess self-confidence in mathematics. Using surveys or scales that measure self-belief in mathematical abilities may provide instructors with useful information for adapting instruction to learners' needs.

#### **LIMITATIONS OF THE STUDY**

This study has several limitations. The study only included students with mild intellectual disabilities, rendering the findings less generalizable to people with severe impairments or other learning disabilities. It was not possible for the researchers to randomly assign the study's subjects to experimental and control groups

because schools were fixed. Because complete classrooms were used, they were simply classified as experimental and control based on the school attended. Second, the study examined only one branch of mathematics — geometry. However, using the recreational activities was intended to keep students engaged during instruction. Before recreational activities were introduced, factors such as motivation, attitude, family history, and even seating arrangements could influence students' self-esteem. The sample was finally limited in terms of the number of schools, and thus has external validity limitations, yet the results are still a contribution.

#### **CONFLICT OF INTEREST**

The author(s) have declared that no conflict of interest exists. The research was conducted independently of any financial, professional, or personal relationships that could have influenced the findings or interpretation.

#### **INSTITUTIONAL REVIEW BOARD STATEMENT**

On April 2, 2024, the Ethical Committee of the Research and Development Committee at the Ministry of Education in Cross River State, Nigeria, granted approval for this study (Ref. No. MOE/SEC/544/V-II/50).

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#### **CONSENT TO PARTICIPATE**

The study involved willing participants who made voluntary, thorough, informed decisions. They were told they could withdraw at any time without repercussions.

#### **DATA AVAILABILITY STATEMENT**

The protection of participant privacy prohibits the release of data supporting this study's findings. But anonymized data can be requested from the corresponding author with appropriate institutional approvals.

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