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Exploring The Effectiveness of Braindance on Enhancing Mathematics Performance in Kindergarten Learners: A Quasi-Experimental Study in a Private School Setting in North Caloocan

Marites D. Ebuenga, LPT, Cherry Amor Dizon, EDD, Crisanto A. Daing, PhD

The Graduate School, Master of Early Childhood Education, Our Lady of Fatima University

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ABSTRACT

This study explored the feasibility and potential effectiveness of Braindance, a movement-based activity and teaching strategy, in enhancing the mathematics performance of kindergarten learners in a private school in North Caloocan. It aimed to determine whether Braindance activities may improve the mathematics performance of kindergarten learners.

A quasi-experimental design was employed, involving 20 kindergarten learners from a private school in North Caloocan. Pre-test and post-test assessments measured improvements in Mathematics performance in number recognition, counting, basic operations, and problem-solving. The assessments consisted of a validated and pilot-tested 14-item multiple-choice test aligned with the MATATAG Curriculum.

Statistical analysis using mean, standard deviation, paired-sample t-test, independent-sample t-test, Kruskal-Wallis H-test, and Cohen's d revealed significant improvement after the intervention, suggesting that Braindance positively influences Mathematical readiness and performance. Most learners improved from the Beginning level in the pre-test to the Proficient level in the post-test, particularly in number recognition, counting, and basic operations. The paired-sample t-test revealed a significant difference between the pre-test and post-test scores at the 0.05 level of significance, ($t = -8.81$, $p < .001$), leading to the rejection of the null hypothesis. The computed Cohen's d value of 1.97 indicated a very large practical effect of the intervention.

The findings further showed that learners' age, gender, previous early childhood education, and family income did not significantly affect Mathematics performance after the intervention. Learners also showed less frustration, greater resilience and perseverance, and increased engagement and focus during Mathematics activities.

This study recommends the integration of Braindance activities and other movement-based learning strategies into early childhood Mathematics instruction to enhance learner engagement, cognitive readiness, and foundational Mathematical skills.

Keywords: Braindance, Mathematics performance, kindergarten learners, quasi-experimental design, early childhood education, movement-based learning,

INTRODUCTION

Mathematics is often a challenge for students. How could learning it become more enjoyable and engaging? Braindance, officially developed by Anne Green Gilbert in 2000, offers an approach that integrates movement and learning. It works by activating and organizing the central nervous system through structured movement patterns rooted in natural reflexes. It also contributes to learners' overall developmental health.

In Mathematics, Braindance develops core competencies-including spatial reasoning, numerical literacy, and critical thinking-by linking bodily movement to conceptual understanding, deepening students' comprehension of abstract mathematical principles. Research supports innovative methods like Braindance, through bodily movements, as they not only support physical development but also boost academic performance and engagement (Malvidi et al., 2021).

Braindance promotes cognitive skills such as problem-solving and spatial thinking while strengthening Mathematics fundamentals by incorporating movement into conventional instruction. Specific Braindance movement patterns may help mathematics learning in different ways. Breath movements may enhance self-regulation, focus, and readiness to learn, which are crucial for sustained engagement in mathematical tasks. Tactile movements may promote sensory awareness and bodily perception, facilitating the development of core cognitive processes involved in learning. Core-Distal movements enhance spatial awareness and body positioning, which are important for early numeracy and spatial reasoning. Head-Tail movements improve balance, coordination, and comprehension of directional relationships. Upper-Lower and Body-Side movements support coordination and awareness of body control and laterality. Cross-Lateral movements may strengthen attention, sequencing, and problem-solving skills. Vestibular movements enhance spatial awareness and body positioning, which are important for early numeracy and spatial reasoning. Together, these movement patterns provide a theoretical basis for how Braindance may assist early Mathematics learning beyond the benefits of general physical activity.

For example, learners can illustrate the equation "3 + 2 = 5", by taking three forward sliding steps and then two kicking steps. In total, the learners perform five lower body movements: three sliding steps and two kicking steps, which together demonstrate the addition of 3 + 2 = 5.

By engaging in these physical movements, learners not only demonstrate their understanding of addition but also physically embody the process, making the concept of adding numbers more intuitive and engaging. A scholarly investigation conducted by McCluskey et al. (2023) emphasizes the significance of physical movement in child education and developmental processes. Embodied learning perspectives highlight how early childhood Mathematics instruction uses movement and sensory engagement to build knowledge.

Mathematics is an essential life skill that strengthens critical thinking, decision-making, spatial reasoning, and practical abilities such as budgeting (Crowe, 2022). Beyond these, it fosters creativity, collaboration, and analytical problem-solving, which are important for disciplines including science, education, and economics (Uyen et al., 2021; Creswell et al., 2020). Brief physical activity, such as dancing, can further improve focus and self-control, supporting the understanding and application of mathematical concepts (Chatzopoulos et al., 2024).

The evidence shows that a child's foundational education has a major impact on their future learning trajectory, with early Mathematics proficiency acting as a key indicator of future academic success (UNICEF, 2023). Even though Mathematics skills are important, many countries, especially the Philippines, face a growing problem. Global tests, like the Program for International Student Assessment (PISA) and reports from the Organization for Economic Co-operation and Development (OECD, 2022), show a concerning decline in math skills. In contrast to the OECD average of 69%, only 16% of students in the Philippines attain at least Level 2 proficiency in mathematical competencies. Basic math, engagement, and concentration remain issues for Filipino learners (Aguahayon et al., 2023; Servallos, 2023). This highlights the urgent need for innovative solutions (Gray Group International, 2024).

This study aimed to explore how Braindance could enhance math proficiency and engagement in kindergarten students by incorporating physical movement into lessons, ultimately improving math performance and fostering greater student engagement. In the North Caloocan area, where a variety of private schools serve young learners, the need for effective teaching strategies is crucial, especially for kindergarten students.

The research has two main benefits: First, it shows how movement-based learning can improve math skills, focus, and student engagement. This could provide an alternative to traditional teaching methods. Second, it helps create a more complete approach to education. This does not only improve academic skills but also supports emotional and social development, helping learners grow in all areas.

This research followed a quasi-experimental design, assessing kindergarten students before and after using Braindance to determine its effects on their math skills. The study used pre-tests at the beginning and post-tests at the end to measure math performance and tracked student progress through an observation checklist. This helped measure focus, participation, and understanding of math. Using both test scores and observations provided a complete picture of how Braindance affected students. The findings could inform strategies for integrating Braindance into the curriculum, offering a holistic solution to the growing issue of math underachievement and supporting the development of essential life skills in young learners.

LITERATURE REVIEW

Braindance

Recent educational research emphasizes the significance of innovative teaching methods in early childhood education, particularly in foundational subjects such as Mathematics. Movement-centered pedagogies, including Braindance, have gained attention for their positive effects on cognitive abilities, socio-emotional development, and overall well-being (Chalkey, et al., 2023). This study examines the theory behind Braindance and how it could be used in early Mathematics instruction to understand the benefits of movement-based learning.

Braindance, is a movement-based teaching strategy designed to engage the entire brain, thereby promoting mental, physical and emotional development (Gilbert, 2019). It focuses on rhythmic movement, using both sides of the body, and awareness of space to support brain development. Research has shown that kinesthetic methods like Braindance enhance cognitive development. A study by Yetti et al. (2022) found that combining Braindance movements with Minang Dance and musical accompaniment enhanced motor skills, creativity, and coordination.

Incorporating movement into learning supports physical development while also helping learners build cognitive and emotional skills. Braindance helps learners explore their bodies and surroundings, building confidence and motor control. Learners who feel physically capable are more likely to participate in learning tasks. Neuroscientific research suggests that physical activity increases neural plasticity (Latino & Tafuri, 2024), stimulating cognitive functions essential for subjects such as mathematics. These insights highlight the need to integrate movement-based interventions like Braindance into early childhood curricula to enhance cognitive engagement.

Previous studies show that Braindance helps develop bodily-kinesthetic intelligence, as described in Howard Gardner's Theory of Multiple Intelligences. By involving the body in learning, Braindance supports learners' understanding of abstract concepts, particularly in mathematics. With its focus on brain integration through movement, Braindance offers a promising framework for combining physical and academic learning (Way & Ginns, 2024).

Mathematics Performance and Instruction

Early childhood education plays a pivotal role in shaping children's attitudes toward learning and academic success. During this

period, children develop vital cognitive and socio-emotional skills that affect their future academic performance (Anglia, 2024). There is growing support among educators for teaching methods that combine intellectual and physical engagement. Implementing movement-focused strategies makes learning more enjoyable and participatory (Aloizou et al., 2024; McGowan et al., 2023). Studies on Braindance suggest that it fosters both physical development and cognitive engagement in foundational subjects. As many countries have struggled with notable achievement gaps-particularly in low-income communities-there is a pressing need for effective mathematics instruction in early childhood. For example, in the United States, poor teaching strategies and negative attitudes toward Mathematics have contributed to persistent achievement gaps (Bradley, 2022). The Programme for International Student Assessment (PISA) ratings in the Philippines have slightly improved, although children still experience difficulties with fundamental math concepts (PhilStar, 2024). These challenges highlight the necessity for creative teaching strategies.

Based on the NCTM (2022), early experiences with Mathematics provide a foundation for future academic achievement. Conventional instruction, which frequently prioritizes memorization and procedural drills, may fail to engage young students and can lead to a dislike of the subject.

In this context, movement-based learning strategies offer significant benefits. Making mathematics lessons more hands-on and interactive has been shown to boost learner engagement and retention of material (Canto et al., 2022). Educational systems in Finland and other countries have effectively included movement-based activities, which have strengthened learning outcomes and increased learner participation (Niemi, 2020).

Challenges

Braindance has great potential to improve Mathematics performance, but introducing it into the classroom comes with challenges. A major challenge is student engagement, especially for learners who find movement activities difficult. Effective implementation requires teachers to understand the method and its goals, which makes teacher preparation vital (Payne & Costas, 2021). Braindance exercises may become less common and less effective because of practical constraints, such as time limitations, limited classroom space, and competing curriculum requirements. Evaluating its effectiveness can be difficult for teachers, since conventional assessment may overlook some of its benefits.

Socioeconomic conditions may influence learners' engagement and responsiveness to the program. Children from lower-income families may

have less access to resources or experience with structured physical activities that support movement-based learning, which could reduce the effectiveness of Braindance.

Purpose Statement

This study sought to ascertain whether Braindance, a movement-based learning approach, might improve kindergarten students' performance in Mathematics at a private school in North Caloocan. The study's specific objectives were to ascertain the kindergarten students' math performance level both before and after using Braindance, and investigate whether there were any notable variations in the learners'. Mathematics performance when categorized based on their profile variables, pinpoint the difficulties encountered during Braindance's implementation, and create an action plan to enhance its use in Mathematical instruction. The purpose of this study was to investigate the potential of movement-based learning as a innovative instructional approach that could improve learners focus, engagement, and comprehension of Mathematical ideas. The results may help enhance instructional strategies and offer factual proof of Braindance's efficacy in teaching Mathematics to young children.

Hypotheses

There is no significant difference in the Mathematics performance level of kindergarten learners before the utilization of Braindance when considering the learners' profiles.

There is no significant difference in the Mathematics performance level of kindergarten learners after the utilization of Braindance when considering the learners' profiles.

There is no significant difference in the Mathematics performance level of kindergarten learners before and after the utilization of Braindance.

Theoretical Framework

This study is grounded in Howard Gardner's (1983) Multiple Intelligences Theory, which posits that individuals possess multiple intelligences. Keates and Pearson (2024) further cite Gardner, stating that intelligence is composed of multiple distinct capacities that influence how learners engage with tasks. The theory carries important educational implications by advocating differentiated instruction and recognizing that students

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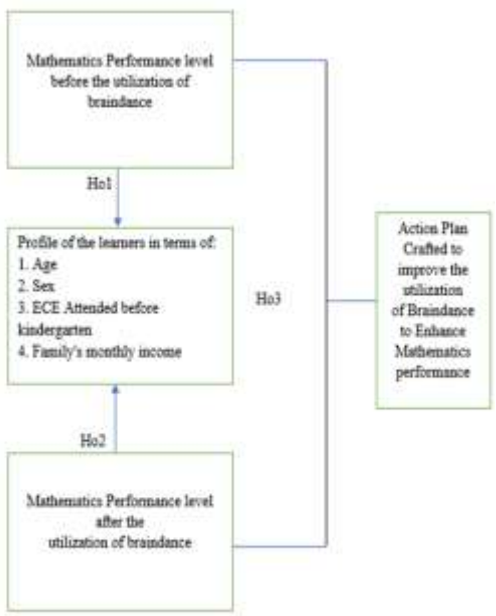
perform better when instructional methods are aligned with their primary intelligences. One of these intelligences is bodily-kinesthetic, which refers to the ability to use the body for learning and problem-solving, especially through movement. Therefore, integrating this theory into the classroom requires a fundamental change in teaching methods (Walela, 2024).

Braindance is a movement-based strategy that aligns with bodily-kinesthetic intelligence. It is a structured sequence of movements designed to activate different parts of the brain and support learning readiness. It helps learners process information through bodily engagement by integrating physical movement with cognitive tasks. Gardner (1983) proposes that physical activities involving movement can more effectively develop learners' cognitive skills. Learners can memorize information by associating it with movements, taking frequent breaks in class to play, engaging in physical exercises, and using role-playing in learning (Keates and Pearson, 2024). Smith and Walkington (2020) pointed out that body-based learning is valuable in mathematics education, strengthening this approach. They believe that using movement, such as in Braindance, helps students understand mathematical ideas and stay engaged. In early education, where a dynamic learning environment promotes deeper mathematical knowledge and the development of abilities like solving addition problems, this method, which links the body with cognitive processes, is particularly effective.

Strong evidence from Prakash et al. (2015) showed that physical activity promotes brain health and enhances cognitive vitality through neuroplasticity. BrainDance movement improves brain function, especially in areas such as the prefrontal cortex and hippocampus, which help us remember, pay attention, and solve problems. These areas are essential for the development of mathematical skills. The findings may also be interpreted through Embodied Cognition and Gardner's Multiple Intelligences Theory, which highlight the relevance of movement in learning. Braindance includes Breath (rhythmic breathing for focus and relaxation), Tactile (gentle touching and tapping to develop sensory awareness), Core-Distal (stretching and reaching to enhance spatial awareness), Head-Tail (coordinating head and tailbone movement to support flexibility and balance), Upper-Lower (separating upper and lower body movements for coordination), Body-Side (asymmetrical movements engaging both sides of the body), Cross-Lateral (opposite limb movements that may enhance brain connectivity), and Vestibular (side-to-side movements improving balance and motor control). These movement patterns may help explain gains in learners' mathematics engagement and performance; however, the study did not directly test cognitive mediators such as attention, executive functioning, or movement quality.

Simulacrum



This study examines how the learners' childhood education profile, the Braindance intervention, and their math performance are connected. The learners' profile includes age, gender, early childhood education and family's monthly income. These factors may affect how well the Braindance intervention works and how it influences their math skills and may serve as a moderating variable in the relationship between the intervention and learners' performance.

The Braindance intervention consists of eight movement patterns designed to improve brain activity, coordination, and focus. This study aims to explore the effect of the Braindance intervention on young learners' mathematics performance. The intervention involves a series of physical movements that enhance cognitive skills like memory, attention, and problem-solving, key abilities for performing mathematical tasks. It is believed that engaging in Braindance activities helps develop the brain and improves mathematical skills in kindergarten learners.

The learners' Mathematics performance is measured before and after the Braindance intervention using pre-tests and post-tests. Comparing these results shows whether Braindance improves their

Mathematics understanding and performance. In this study, performance level refers to the level of Mathematics knowledge and skills demonstrated by kindergarten learners as reflected in their pre-test and post-test scores, categorized as Beginning, Developing, Approaching Proficiency, Proficient, and Advanced.

Finally, an action plan is developed based on the study's results. This plan addresses any problems that arose during the Braindance sessions and suggests ways to improve the program. The goal is to enhance the use of Braindance and to help kindergarten learners perform better in Mathematics.

RESEARCH METHOD

The study used a quasi-experimental design, incorporating pre-test and post-test assessments to measure the effect of Braindance on the Mathematics performance of kindergarten students. Thomas (2020) noted that a quasi-experimental design is similar to a true experimental design. However, it differs in that it does not utilize random assignment, as group allocation is based on non-random criteria. This method enabled evaluation of changes in mathematical skills before and after the Braindance intervention. Initial Mathematics proficiency was assessed through the pre-test, and any progress made following the four-week program was measured through the post-test.

The Mathematics assessment used in the study was a validated early assessment tool aligned with the kindergarten Mathematics curriculum, consisting of a 14-item multiple-choice test. The assessments were administered by independent assessors who were not directly involved in implementing the Braindance intervention to reduce potential bias. However, it may not fully capture young learners' Mathematical understanding, which is generally better measured through performance-based tasks, manipulatives, interviews, and observations. Despite this limitation, it provided a standardized and efficient measure of learners' performance before and after the intervention.

Each class began with a warm-up exercise using the eight fundamental movements of Braindance: Breath, Tactile, Core-Distal, Head-Tail, Upper-Lower, Body-Side, Cross-Lateral, and Vestibular.

These movements served as the foundation of the session. As the lessons progressed, these eight movement patterns were expanded upon, incorporating both locomotor and non-locomotor movements into mathematics instruction. This approach aimed to combine physical movement with cognitive learning to enhance performance in Mathematics.

The descriptive component documented individual students' Mathematics performance before and after the intervention, highlighting any changes in skills or engagement. The comparative component analyzed differences between pre-test and post-test scores to assess the intervention's impact, identifying significant improvements or changes in performance. This helped determine Braindance's effectiveness in enhancing Mathematical skills.

This study employed a quasi-experimental one-group pretest-posttest design complemented by descriptive analysis of learner profiles and observational data on learner engagement and challenges encountered during the Braindance intervention.

Site and Sampling

The research was conducted at a private educational institution in a major metropolitan area, serving kindergarten students from diverse religious backgrounds.

The school aimed to provide an environment where young learners could explore the skills, attitudes, and moral issues that shape everyday life. These were nurtured in a way that fostered independence and the ability to make informed decisions.

The objective of the study, that is, exploring how innovative teaching methods such as Braindance could enhance academic performance, particularly in Mathematics, aligned with this vision.

The school had a history of consistently innovating its teaching strategies. It was open to adopting creative educational practices and was dedicated to students' academic excellence and personal development. Therefore, it provided an ideal setting for examining the impact of developmental techniques in early childhood education and evaluating their effectiveness in a real-world educational setting.

The participants in this study were kindergarten students from a private school in North Caloocan, enrolled for the 2025-2026 school year. The group included both male and female students from varied individual and familial circumstances, with different socioeconomic statuses, early childhood education experiences, and family situations.

The target population for this study was the total number of kindergarten enrollees, as provided by the school. Given that the number of enrollees for the 2025-2026 school year was relatively small, typically 20 students, no sampling was conducted. Instead, total enumeration was employed, meaning that all enrolled students were included in the study. Since the population size was small, no formal sample size calculation was necessary. This full-population approach ensured comprehensive data collection, avoided sampling bias and guaranteed that all students were represented in the findings. This was crucial for evaluating the effects of the Braindance intervention across varied individual and familial circumstances.

Since the study was exploratory in nature, it primarily aimed to assess the feasibility and effect of Braindance on Mathematics performance. The use of total enumeration enabled the collection of rich, detailed data without the need for sample size estimation. This approach aligned with the study's goal of providing foundational insights and exploring the intervention's potential, making it the most appropriate choice for this research.

Students who were unable to fully participate in the Braindance intervention in the study due to significant or special needs were excluded from the data analysis to maintain accurate results. Teachers facilitated the Braindance sessions but were not considered participants

in the study. While their involvement was essential to implementing the intervention, the research focused entirely on the students' experiences. Therefore, teachers were not observed, and no Teacher's Observational Checklist was used.

Research Instrument

The researcher designed the pre- and post-tests in line with the MATATAG Curriculum ("MAke the curriculum relevant to produce job-ready, active, and responsible citizens; TAke steps to accelerate the delivery of basic education services and provision of facilities; TAke good care of learners by promoting learner well-being, inclusive learning, and positive learning environment; and Give support for teachers to teach better.")

The main instrument was the pre-test and post-test, which consisted of a 14-item multiple-choice test. This test was validated and pilot-tested with another group of kindergarten learners before it was conducted among the respondents of this study. The Table of Specifications for the Pre-test (Appendix F), the Pre-Test (Appendix G), and the Author's Approval (Appendix I) provided context for the assessment tools used in the study. Additionally, the Student Observation Checklist (Appendix L) and the Certification from Content Validators (Appendix H) were referenced to discuss the validation process of the instruments.

The study gathered data on Mathematics abilities and resources using pre-test and post-test methods. An observation guide was also used to assess the implementation of Braindance activities and their impact on classroom dynamics. The Learner Observational Checklist utilized a four-point Likert scale to measure learners' participation, engagement, behavior, and responses during Braindance sessions. The scale was interpreted as follows: 3.50–4.00 = Strongly Agree, 2.50–3.49 = Agree, 1.50–2.49 = Disagree, and 1.00–1.49 = Strongly Disagree. The weighted mean was used to analyze and interpret the responses gathered from the observation checklist.

A comprehensive report summarized the findings of the investigation, explaining the objectives of the research, the methodologies employed, the analytical processes applied to the data, and the recommendations for the application of the findings.

The mathematical proficiency levels of the kindergarten learners were determined through a 14-item assessment and were categorized according to percentage scores. Learners classified at the Beginning level scored 74% and below, corresponding to 0-9 correct responses. Those identified at the Developing level scored between 75% and 79% which equated to 10 correct responses. Individuals at the Approaching Proficiency level scored between 80% and 84% representing 11 correct responses, Learners categorized as Proficient scored between 85% and 89%, which translated to 12 correct responses, while those at the Advanced level scored 90% and above, corresponding to 13-14 correct responses.

Data Collection

The study collected data in three phases: participant selection, implementation of the Braindance Intervention, and measurement of results through pre- and post-tests. Strict adherence to ethical standards was maintained to preserve the privacy of all participants during the process.

In the first phase, all kindergarten students currently enrolled in a private school in North Caloocan for the 2025-2026 school year were included in the study. The study involved children aged 4 to 6 in the kindergarten program. Parents provided informed consent after being informed about the aims, methods, and possible risks. A questionnaire was used at this stage to record children's age, gender, early schooling, and family income. To ensure fairness and minimize bias, only students who met the age and enrollment criteria were included.

Learners with severe learning disabilities or motor impairments, or cognitive/psychological conditions that could affect their ability to participate in the Braindance exercises or influence their scores were excluded from the study. This ensured the consistency and validity of the data collected.

The researcher was responsible for implementing the Braindance intervention and facilitating all classroom activities during the sessions. To ensure objectivity in data collection, three classroom teachers served as independent observers who were not involved in the implementation of the intervention. The teachers completed the Learner Observation Checklist during each session to record learners' participation, engagement, coordination, and responses using a four-point Likert scale.

The intervention consisted of the Braindance program, conducted over four weeks with one-hour sessions on Monday, Wednesday, and Friday. In each session, teachers guided learners through the eight pattern movements of Braindance. These movement patterns were designed to stimulate cognitive development through physical movement. These eight movements were as follows:

Breath: Rhythmic breathing exercises to promote focus and relaxation.

Tactile: Gentle touching and tapping activities to develop sensory awareness and body connection.

Core-Distal: Stretching and reaching movements to develop spatial awareness.

Head-Tail: Moving the head and tailbone together to help the body stay flexible and balanced.

Upper-Lower: Moving the arms/upper body and legs/lower body separately to improve coordination.

Body-Side: Asymmetrical movements to engage both sides of the brain.

Cross-Lateral: Opposite limb movements to strengthen brain connectivity.

Vestibular: Moving by gently turning the body from side to side to stimulate the inner ear and improve motor skills

During each Braindance session, teachers completed the Learner Observation Checklist to monitor the learners' participation, engagement, coordination and responses to the activities using a four- point Likert scale. The observations served as supporting data in evaluating the effectiveness of the intervention.

Challenges encountered during the implementation of Braindance were identified through teacher observations recorded in the Learner Observation Checklist and field notes.

To ensure the safety of all participants, trained staff supervised every session closely. Basic first aid supplies were available at all times for minor injuries. In case of a serious emergency, the school's emergency procedures were followed, with immediate access to medical services. Parents gave informed consent, recognizing the potential risks and agreeing to any necessary medical treatment if required. These precautions were in place to ensure the safety and well-being of every participant.

Pre– and post-tests were administered to assess the effectiveness of the Braindance intervention in improving learners' math skills. Students took a pre-test before the intervention and a post-test after four weeks to measure improvement. Both tests contained similar content to allow for a direct comparison of student progress. The focus was basic skills and number recognition, with scoring based on a predetermined rubric to ensure consistency and fairness. Statistical significance was assessed using paired t-tests.

Confidentiality was strictly maintained throughout the study. Pseudonyms were used for all participants, and data were securely stored. Digital files were saved with passwords, and paper records were locked up. All personal data was kept in password-protected folders and was only shown to the researcher and authorized persons. After the study concluded, all data were deleted or shredded to protect participants' privacy.

The study followed ethical guidelines. Parents were fully informed of the purpose, their children's voluntary participation, and their right to withdraw at any time without consequences. Results were reported only in a summarized form

Data Analysis

The following statistical tools were used to analyze and interpret the data gathered in the study. Frequency Distribution and Percentage were used to show and summarize the learners' demographic information, including their age, gender, previous early childhood education, and family income. These measures showed the distribution of the respondents across different categories.

The mean and Standard Deviation were used to describe learners' performance on the pre-test and post-test, indicating the average scores and the variability of learners' scores before and after the Braindance sessions.

Weighted Mean and Standard Deviation were used to analyze difficulties observed during the Braindance sessions, based on teachers' observations, and to assess the overall learning experiences of the learners. The responses in the Learner Observation Checklist were interpreted using a four-point Likert scale with the following verbal interpretations: 3.50–4.00 = Strongly Agree, 2.50–3.49 = Agree, 1.50–2.49 = Disagree, and 1.00–1.49 = Strongly Disagree. These interpretations were used to describe the learners' participation, engagement, and responses during the Braindance intervention.

Performance level was used to interpret learners' mastery based on their test scores. In this study, scores were categorized into five levels in accordance with the Department of Education Order No. 31, s. 2012. A score of 90–100% was interpreted as Advanced, indicating outstanding or near-complete mastery of the competencies. Scores ranging from 85 –89% are classified as Proficient, indicating full mastery of competencies. Scores of 80-84% fall under Approaching Proficiency, indicating partial mastery of the competencies. Scores 75 –79% are categorized as Developing, indicating limited understanding that still requires guidance. Lastly, scores below 75% are classified as Beginning, which indicates very limited understanding and a need for significant improvement. These performance levels were used to interpret the learners' mathematical mastery before and after the Braindance intervention Paired-Sample t-Test was applied to examine differences between the learners' pre-test and post-test scores.

Data Management Plan

Strict confidentiality was maintained for all information gathered from the participants. To protect participants' identities, each student was assigned a numerical code instead of using names. Microsoft Excel was utilized to organize and analyze demographic data, pre-test and post-test scores, and responses from the observation checklist. Electronic files were securely stored on a password-protected computer and were accessible only to the researcher and authorized personnel. Hard-copy research documents were likewise stored in a secure location.

In accordance with university research regulations, all data were retained for five years following the completion of the study and were subsequently permanently deleted or shredded. Microsoft Excel was also used for statistical analysis, and all results were reported in aggregate form to ensure the privacy and confidentiality of the participants.

Ethical Consideration

The Institutional Ethics Review Committee (IERC) of Our Lady of Fatima University granted ethical approval prior to the conduct of the study. Additionally, permission to conduct the study was obtained from the participating institutions' school administration. The purpose, procedures, possible hazards, and anticipated advantages of the study were fully disclosed to parents or legal guardians. Parents or guardians provided written informed consent prior to the students; involvement. Additionally, age-appropriate explanations of the study were used to obtain the kindergarten student's consent. Participants were made aware that participation in the study was completely voluntary and that they might leave at any moment without facing any penalties or repercussions. Throughout the whole research procedure, privacy and confidentiality were scrupulously upheld. Instead of using names, each learner was given a numerical code to secure their identity. Microsoft Excel was used to encode and analyze demographic data, pre-test and post-test scores, and replies to the observation checklist. Printed records were maintained in a safe place, while electronic files were kept on a password-protected computer that only the researcher and authorized staff could access. All research data will be kept for five years following the study's conclusion before being completely erased or shredded in compliance with university research rules. Considering the researcher's affiliation with a religious community, measures were implemented to minimize potential bias and ensure objectivity. These measures included supervision by a neutral third party and observation by a non-Catholic monitor during the conduct of the study. Although the Braindance activities involved minimal risk, appropriate safety measures were observed during all sessions. A first-aid kit was readily available, and learners who sustained minor injuries were referred to the school clinic. In the event of an emergency, school procedures were followed, and parents or guardians were immediately notified. The researcher made sure that every source used in the investigation was correctly attributed and acknowledged. In compliance with recognized principles of research integrity, data were analyzed and reported truthfully, correctly, and objectively.

RESULTS

Profile of Kindergarten Learners

The 20 kindergarten learners were described by age, gender, type of early childhood education (ECCE) attended, and monthly family income.

Table 2 presents the demographic profile of respondents by age for Phase 1 (Pre-Intervention). The study involved 20 kindergarten learners whose ages ranged from 4 to 5 years old, this is consistent with the typical age level for kindergarten learners as guided by the Department of Education (DepEd Order No. 015, s. 2025).

The age distribution showed that most of the kindergarten learners were within the usual age for the level, with an average of around five years old. As they were close in age, the learners likely approached thinking and social interaction in similar ways. Because learners at Similar developmental stages were more likely to engage effectively and benefit effectively from structured activities, such as homogeneity, which was especially significant for interventions like Braindance, which combine cognitive learning with physical movement.

Notably, as the learners started the academic year within the typical age range for the cohort, the inclusion of a single learner who turned six soon after the start of the school year did not introduce significant developmental variability. The concentration of participants around the ages of four and five ensured that the intervention outcomes were interpretable and could be attributed to the instructional approach rather than differences in developmental readiness.

From a teaching standpoint, learners in this age group aligned with recommended practices in early childhood education. McGowan et al. (2023) emphasized that movement-integrated learning is most effective when aligned with the learners' cognitive and motor characteristics, supporting the use of age-appropriate movement-based interventions like Braindance. According to the National Council of Teachers of Mathematics (2022), early math teaching should be appropriate for the developmental stage of the learners.

In summary, the age distribution supported both the feasibility and the potential effectiveness of the intervention, confirming that the cohort was given the similarity in age among the participants. The group provided an appropriate setting for assessing the impact of the

Braindance intervention, allowing performance changes to be attributed to the intervention rather than to differences in age.

Table 2: Distribution of Learners According to Age in Phase 1Profile of Kindergarten Learners

Age (in years)	Frequency	Percentage
4	8	40%
5	11	55%
6	1	5%
Total	**20**	**100%**

Table 3 shows the distribution of learners by sex. Male learners made up a slightly larger percentage of the sample (n = 12, 60%) than female learners (n = 8, 40%), as shown in Table 3. Both categories were properly represented, as seen by the slight difference between male and female learners. This balance made equal participation in the intervention possible.

Given that sex may influence early childhood learning preferences (Mavilidi et al., 2021), having a balanced sample minimized bias and strengthened the study's internal validity. Movement-based instructional approaches like Braindance, which incorporate social interaction, cognitive processing, and physical movement, engage learners of all sexes, ensuring equal learning opportunities for all. They also reduce the possibility of sex-based differences in performance outcomes or engagement (Gilbert, 2019). The slight difference between male and female learners showed that both groups were represented, supporting equal participation in all study activities. Any observed improvements in mathematics performance may be more confidently attributed to the intervention's effects rather than to differences between the sexes.

Table 3: Distribution of Learners According to Sex

Sex	Frequency	Percentage
Male	12	60%
Female	8	40%
Total	**20**	**100%**

Table 4 presents the learners' early childhood experiences prior to entering kindergarten. The distribution of early childhood education experiences showed that there were two equally represented groups: first, those learners who were able to attend daycare and second, those who did not have any structured education prior to kindergarten, which may have been shaped by a combination of family circumstances, educational access, and purpose of care, rather than a uniform progression through formal early childhood programs.

Participation in early childhood education programs plays a critical role in developing cognitive, social, and emotional competencies that support later academic achievement, particularly in mathematics (Anglia, 2024; UNICEF, 2023). The presence of these two groups suggests that there may have been differences among learners in terms of school readiness, especially in areas such as attention regulation, familiarity with classroom routines, social interaction, and foundational numeracy skills.

Variations in early education exposure among learners may help explain the differences in results observed during the initial engagement with the Braindance intervention. Learners who attended daycare were more likely to be familiar with structured activities, group participation, and introductory numerical concepts, which may have contributed to their adjustment to the intervention tasks. On the other hand, learners who did not go to daycare may have encountered challenges in adjusting to classroom expectations and instructional routines. Despite these differences, the Braindance intervention supports equitable participation among all learners because of its movement-based and inclusive design. Mavilidi et al. (2021) stated that incorporating rhythm, body movement, and multisensory engagement minimizes reliance on prior academic exposure, allowing learners to develop foundational skills despite their varying educational backgrounds. Therefore, it may be said that the differences in early childhood experiences between the two groups may have had no association with the results of this study.

Table 4: Distribution of Learners in Terms of Early-Childhood Education Attended

Prior Education Before Kindergarten	Frequency	Percentage
Daycare	7	35%
Preschool	6	30
None	7	35
Total	**20**	**100**

Table 5 presents the socioeconomic status of the learners in terms of average monthly family income. The results showed that 35% of the learners came from families with a monthly income of ₱10,000–₱20,000, 20% from ₱21,000–₱30,000, 15% from ₱31,000–₱40,000, and 30% from families earning above ₱40,000 per month. Using the NEDA-based household income classifications (Philippine Institute for Development Studies [PIDS], 2020), this distribution indicated that the participants came from low- to middle- income households. This suggests that the sample, which included learners from varying socioeconomic backgrounds, may also have differed in terms of access to learning resources, school readiness, and foundational academic skills such as mathematics (Bradley, 2022).

Considering Braindance as a movement-based and inclusive approach to learning, Braindance may provide an opportunity for learners to actively engage in developing foundational numeracy skills without relying on external resources (Chalkey et al., 2023), including family household income. Taken together with other demographic characteristics such as age, gender, and prior early childhood education, the participants represented a balanced and heterogeneous cohort. The diversity of the participants provided a suitable context for examining the implementation of Braindance among learners from different socioeconomic backgrounds.

Table 5: Distribution of Learners in Terms of Average Monthly Family Income

Monthly Income Range	**Frequency**	**Percentage**
₱10,000 – ₱20,000	7	35%
₱21,000 – ₱30,000	4	20%
₱31,000 – ₱40,000	3	15%
Above ₱40,000	6	30%
Total	**20**	**100%**

Steps in Using Braindance

Table 6 shows the Steps in Braindance utilized in the intervention program. During the four-week program at a private school in North Caloocan, the Braindance-integrated mathematics intervention was conducted three times a week for one hour per session. Braindance was utilized in each lesson as a warm-up and as an integrated instructional tool for the entire math class. This strategy used movement to support math understanding and student readiness not only physically but also cognitively.

Each lesson began with the eight fundamental movement patterns outlined in Anne Gilbert's Braindance framework (Gilbert, 2019): Breath, Core-Distal, Head-Tail, Upper-Lower, Body-Side, Cross-Lateral, and Vestibular. By regulating energy levels, enhancing attentional readiness, and strengthening the brain-body connection, these activities helped learners perform at their best on subsequent mathematical problems. Beyond the warm-up, Braindance was intentionally integrated into Mathematics instruction to promote concept understanding and skill acquisition. Specific mathematical goals, such as basic addition (sums up to 10) and two-digit addition without regrouping, as well as simple addition by using counting-forward methods, were linked to each movement pattern. Learners were engaged in math through structured, hands-on activities.

This section presents the specific movements, activity descriptions, examples of mathematical integration, related lesson topics, and the instructional purposes for each activity.

Students remained more attentive and engaged in their learning when Braindance was used as a warm-up and during Mathematics lessons. Students were able to physically demonstrate numbers and operations through movement activities, which made arithmetic topics easier to learn. For example, when working on a simple addition problem like 1+1=2, two students came to the front of the class and stretched their arms upward (Upper-Lower). As a way to help them connect the physical activity to the Mathematics problem, the class then counted how many pupils were doing the movement. Learners were encouraged to participate and maintain their interest throughout the lesson by this method.

Also, braindance contributed to the development of motor abilities, including balance and coordination. For example, in 2 + 2 = 4, learners performed cross-lateral movement by crossing the midline (right hand to left knee). Movement-based learning has been shown to improve early childhood academic achievement and cognitive functioning, based on research (McCluskey, Mavilidi, & Chatzopoulos, 2023), which supports these findings.

In summary, using Braindance enhanced the enjoyment of arithmetic classes while promoting kindergarten students' overall growth.

Table 6: Steps in Using Braindance

STEP	Braindance Movement	Activity Description	Math Integration Example	Related Topics	Purpose
1	Breath	Students took slow, deep breaths in rhythm.	Students counted breaths aloud (1 + 1 = 2).	Sums up to 5, Sums of 6 to 8	Promote calmness, focus, and basic counting.
2	Tactile	Students tapped or brushed different body parts	"Tap your right leg 8 times and tap left arm 2 times" (8 + 2 = 10).	Sums of 6 to 8, Sums of 9 to 10	Develop sensory awareness and reinforce counting.
3	Core– Distal	Students stretched arms/legs outward, then curled inward.	"4 stretches + 5 curl = 9" (4+5=9)	Sums of 9 to 10 – Part 2, 2-Digit Addition	Support understanding of magnitude and grouping.
4	Head– Tail	Spine-based movements: wiggling forward, arching back.	"5 forward bend wiggles + 5 backward = 10" (5+5=10)	Sums of 9 to 10 – Review, Problem Solving in Addition	Support sequencing and number manipulation.
5	Upper–Lower	Moved upper (arms) and lower (legs) body parts separately.	Place value: "2 upper movements for tens + 3 lower for ones = 23."	2-Digit Addition	Reinforce understanding of tens and ones.
6	Body-Side	Moved side to side (left then right).	Balanced equations: "2 steps left + 2 steps right = 4." (2+2=4)	Problem Solving in Addition, Sums of 6 to 10	Practice moving both sides of the body and understanding equality

7	Cross-Lateral	Movements crossing the midline (right hand to left knee).	Skip counting: "4 cross-touches + 3 twists = 7." (4+3=7)	Counting Forward	Activate both side of the brain and notice patterns
8	Vestibular	Students spun gently in place, alternating directions.	Directional counting: "5 spins right + 5 left = 10." (5+5=10)	Addition Using Counting Forward – Application	Improve balance, focus, and counting skills.

Integration Activity: At the end of each session, students joined together in a group dance to the song "Beautiful Sunday". They used all eight Braindance patterns, reviewing counting, sequencing, and patterning while having fun moving to the music

1-Hour Session Structure

Activity	**Time**	**Purpose**
Braindance Warm-Up	10 minutes	Activate brain and body through math-based movement
Lesson Proper: Math Movement Activities and Written Exercises	40 minutes	Engage with mathematical concepts using kinesthetic learning
Ending Routine- "Beautiful Sunday" Dance	10 minutes	Reinforce all Braindance patterns through music and review math skills

Source. Gilbert, A. G. (2000). BrainDance: A full-body/brain warm-up based on developmental movement patterns.

Mathematics Performance Level of Kindergarten Learners before the Utilization of Braindance

Table 7 presents the results of the pre-test. The pre-test results showed that the kindergarten learners' overall Mathematics performance before the use of Braindance was at the Beginning level. Out of 20 learners, only one was on the Advanced level with 92.9%. The lowest percentage score was 21.4%, which is classified under the Beginning level. Some learners showed a higher understanding of the Mathematics concepts assessed, with percentage scores of 85.7% and 92.9%, corresponding to the Proficient and Advanced levels, respectively. The majority of learners scored between 5 and 9, which placed them within the Beginning level, indicating that most learners had not yet mastered the foundational numeracy skills. This is also reflected in the mean percentage score of 55.36%, showing that, on average, the learners were still in the early stages of learning mathematics. The findings of Aguahayon, Tingson, & Pentang (2023), showed that early Mathematics learners often exhibit varied performance levels and that learning gaps are common at this stage if appropriate instructional strategies are not implemented.

Furthermore, Aloizou et al., (2024) stated that pre-test results underscore the need for an instructional intervention such as Braindance, as literature suggests that movement-based and brain- integrated learning approaches can help address learning gaps, improve engagement, and support cognitive development in early childhood classrooms.

Table 7: Distribution of the Learners According to Their Performance Level in the Pre-Test

Learner	Score	% Score	Performance Level
1	7	50.0%	Beginning

2	8	57.1%	Beginning
3	3	21.4%	Beginning
4	13	92.9%	Advanced
5	11	78.6%	Developing
6	7	50.0%	Beginning
7	4	28.6%	Beginning
8	6	42.9%	Beginning
9	7	50.0%	Beginning
10	9	64.3%	Beginning
11	9	64.3%	Beginning
12	9	64.3%	Beginning
13	6	42.9%	Beginning
14	6	42.9%	Beginning
15	7	50.0%	Beginning
16	11	78.6%	Developing
17	8	57.1%	Beginning
18	12	85.7%	Proficient
19	6	42.9%	Beginning
20	6	42.9%	Beginning

Total Students: 20 Mean Percentage: 55.36%

Mean Score: 7.75 Overall Performance: Beginning

Legend: Advanced (90% and above) | Proficient (85%–89%) | Approaching Proficiency (80%–84%) | Developing (75%–79%) | Beginning (74% and below)

Source. DepEd Order No. 31, s. 2012. Policy Guidelines on Assessment for K to 12 Basic Education Program.

Mathematics Performance Level of Kindergarten Learners after the Utilization of Braindance

Table 8 presents the results of the post-test after the utilization of Braindance. The findings revealed that the learners obtained a mean score of 11.9 and a mean percentage score of 85.0%, interpreted as Proficient. Of the 20 learners, seven (35%) achieved the Advanced level, seven (35%) were at the Proficient level, five (25%) were at the Developing level, and two (10%) were at the Beginning level. No learner fell under the Approaching Proficiency level.

The results indicate that most learners performed at the Proficient to Advanced levels in the post-test. These findings were consistent with studies showing that movement-based and brain-integrated learning strategies enhanced cognitive engagement, focus, and academic performance in early childhood classrooms (Aloizou et al., 2024). Similarly, research on Braindance and physically active learning emphasized its positive impact on children's cognitive development and academic outcomes, particularly in Mathematics, by promoting neural

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integration and readiness to learn (Yetti & Syarah, 2022). In general, the results of the post-test indicate that using Braindance is associated with significant in kindergarten learners' performance in Mathematics.

Table 8: Distribution of the Learners According to Their Performance Level in the Post-Test

Learner	Score	% Score	Performance Level
1	11	78.6%	Developing
2	12	85.7%	Proficient
3	10	71.4%	Beginning
4	14	100%	Advanced
5	12	85.7%	Proficient
6	12	85.7%	Proficient
7	11	78.6%	Developing
8	14	100%	Advanced
9	11	78.6%	Developing
10	13	92.9%	Advanced
11	13	92.9%	Advanced
12	14	100%	Advanced
13	11	78.6%	Developing
14	14	100%	Advanced
15	10	71.4%	Beginning
16	12	85.7%	Proficient
17	12	85.7%	Proficient
18	13	92.9%	Advanced
19	11	78.6%	Developing
20	12	85.7%	Proficient

Total Learners: 20

Mean Score: 11.9
Mean Percentage: 85.0%
Overall Performance: Proficient

Legend.
A – Advanced (90% and above)
P – Proficient (85% – 89%)
AP – Approaching Proficiency (80% – 84%)
D – Developing (75% – 79%)
B – Beginning (74% and below)

Source**.** DepEd Order No. 31, s. 2012. Policy Guidelines on Assessment for K to 12 Basic Education Program.

Significant Difference in the Pre-Test Mathematics Performance between Age Groups

Table 9 presents the Mathematics performance of kindergarten learners grouped according to age. An independent samples t-test was employed to determine whether a significant difference exists between the two age groups. The results show a t-statistic of -1.05 and a p-value of 0.31.

At the 0.05 level of significance, the computed t-statistic of -1.05 falls within the non-rejection region of the critical values of ±2.14, and the p-value of 0.31 is greater than 0.05 ($p = 0.31 > 0.05$). Therefore, the null hypothesis is not rejected. This means that there is no significant difference in the pre-test math performance of learners aged 4 and those aged 5-6.

Although the older group (5-6 years old) obtained a slightly higher mean score, the difference was not statistically significant. This implies that age did not significantly influence Mathematics performance prior to the implementation of the Braindance strategy.

With a total of 20 learners, the results suggest that small age differences among kindergarten learners do not substantially affect early Mathematics performance. This finding establishes a comparable baseline among participants and supports the assumption that any significant improvement in post-test performance may be attributed to the Braindance intervention rather than age-related differences.

These findings are consistent with the position of the National Council of Teachers of Mathematics (2022), which emphasizes that early mathematics learning is primarily influenced by instructional quality and meaningful learning experiences rather than small age differences within the kindergarten level. They also support Aguahayon et al. (2023), who found that age has less influence on math performance compared to teaching strategies and learning opportunities. When learners receive similar instruction, age-related differences are minimal.

Overall, the results indicate that learners began the study with relatively comparable levels of mathematical ability.

Table 9: Significant Difference in the Pre-Test Mathematics Performance between Age Groups

Age Group	No. of Learners	P-Value	t-Critical	t-Stat	Decision	Interpretation
4	8	0.31	+2.14	-1.05	Do not reject H_0	Not Significant
5–6	12					

The Mathematics Performance and Sex of the Learners

Table 10 presents the difference in the Mathematics performance level of learners when grouped according to sex. An independent sample t-test was employed to determine whether a significant difference exists between male and female learners.

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At the 0.05 level of significance, the computed t-value for the pre-test falls within the non-rejection region of the critical value (t = 0.00, t-critical = ±2.12), and the two-tailed p-value is 1.00, which is greater than 0.05 ($p = 1.0 > 0.05$). This indicates that there is no statistically significant difference in pre-test mathematics performance between male and female learners. Thus, sex is not a significant factor associated with baseline mathematics performance in this sample.

This is consistent with the National Council of Teachers of Mathematics (2022), which notes that sex-based differences in early mathematics are usually minimal when learners receive equal and developmentally appropriate instruction. Since learners began with comparable scores, any improvement observed after the intervention is less likely to be attributed to sex differences and instead be associated with the Braindance strategy.

Table 10: Significant Difference in the Mathematics Performance in the Pre-test between Male and Female Learners

Sex	No. of Learners	P-Value	t-Critical	t-Stat	Decision	Interpretation
Male	12	1.0	±2.12	0.0	Do not reject H_0	Not Significant
Female	8					

The Mathematics Performance and School Attended before Kindergarten

Table 11 presents Mathematics performance on the pre-test by the school attended prior to kindergarten. To determine whether a significant difference exists in the Mathematics performance of learners by the school they attended before kindergarten, a Kruskal-Wallis H test was used, as the comparison involved several independent groups.

The p-value of the H-test was 0.19, which was greater than the 0.05 level of significance. This indicates that the difference among the groups was not statistically significant. Thus, the null hypothesis of no significant difference in pre-test mathematics performance across the groups is not rejected.

These findings suggest that learners possessed relatively similar foundational numeracy skills upon entering kindergarten, despite differences in their preschool backgrounds. This result is consistent with UNICEF (2023), which emphasizes that while early childhood education experiences may vary, equitable and developmentally appropriate instruction at school entry can minimize differences in early academic performance.

Overall, the absence of a significant difference according to the prior school attended strengthens the baseline comparability of the learners and supports the attribution of any post-intervention gains to the Braindance strategy rather than to differences in prior educational exposure.

Table 11: Summary Result of the H-test on the Mathematics Performance in the Pretest According to the School Attended before Kindergarten

School Attended before K	No. of Learners	P-Value	H-Critical	H-Stat	Decision	Interpretation
None	7	0.19	5.99	3.27	Do not reject H_0	Not Significant
Daycare	7					
Pre-school	6					

Mathematics Performance and Family Income

Table 12 presents the summary results of the H-test on Mathematics Performance in the Pre-test by average monthly Income. To determine differences in the Mathematics performance of learners by family income, the Kruskal-Wallis H test was used.

The result of the H-test showed that the p-value (0.46) was greater than the 0.05 level of significance, which implies that there was no statistically significant difference in the Mathematics pre-test performance of kindergarten learners across different average monthly income groups. In addition, the effect size analysis indicated that the differences in performance between the income groups were negligible. Thus, the null hypothesis stating that there was no significant difference in Mathematics performance among learners from varying income levels was not rejected.

These findings imply that, before the utilization of the Braindance strategy, household income did not significantly influence learners' baseline Mathematics performance. Learners from diverse socioeconomic backgrounds can still develop essential early numeracy skills through common classroom experiences and structured early learning opportunities.

Studies indicate that the effect of family income on early numeracy is often indirect, operating through verbal and cognitive development (James-Brabham et al., 2023). Movement-integrated learning is an inclusive and learner-centered teaching strategy that can help close the gaps brought on by socioeconomic disparities (Way & Ginns, 2024). These approaches establish equitable environments for learners to work with numbers and mathematical reasoning, which supports the Conclusion that learners' pre-test scores were not significantly influenced by their socioeconomic status.

In general, the lack of significant differences in pre-test Mathematics ability by income indicates comparable baseline mathematics performance across learners from different socioeconomic backgrounds. Therefore, any observed post-intervention gains in mathematics performance are less likely to be influenced by differences in learners' socioeconomic background, lending support to the interpretation that the results were associated with the Braindance strategy and strengthening the internal validity of the study.

Table 12: Summary Result of the H-test on the Mathematics Performance in the Pre-test According to the Average Monthly Income

Monthly Income	No. of Learners	P-Value	H-Critical	H-Stat	Decision	Interpretation
₱10,000–₱20,000	7	0.46	7.81	2.60	Do not reject H_0	Not Significant
₱21,000–₱30,000	4					
₱31,000–₱40,000	3					
More than ₱40,000	6					

Significant Difference in the Post-Test Mathematics Performance between Age Groups

Table 13 presents the significant difference in the post-test results of the learners using the t-test for independent means and the result is given below.

The t-test result for the post-test mathematics performance of the age groups (4- and 5–6-year-olds) indicated no significant difference between them. With a p-value 0f 0.79, which is higher than 0.05 level significance, the t-computed value was less than the t-critical value at the 0.05 level of significance ((t = -0.28 < t-critical = ±2.13), so the null hypothesis was not rejected.

As in the pre-test, these findings suggest that chronological age within this narrow range does not significantly influence mathematics performance after the implementation of the Braindance strategy.

This result suggests that the instructional strategy could have contributed to learners' mathematics performance. Studies on movement-based learning support this view, showing that physically engaging, embodied instructional approaches can enhance mathematical understanding across early childhood age groups by promoting cognitive and motor integration (Chatzopoulos et al., 2024). In this context, the uniform post-test performance suggests that learners, regardless of being four or five years old, respond similarly to the Braindance activities, which demonstrated the effectiveness of age-inclusive, movement-centered pedagogy.

Table 13: Significant Difference in the Mathematics Performance in the Post-test between Age Groups

Age Group	No. of Learners	P-Value	t-Critical	t-Stat	Decision	Interpretation
4	8	0.79	±2.13	-0.28	Do not reject H_0	Not Significant
5–6	12					

The Mathematics Performance and Sex of the Learners

Table 14 presents the result of the post-test, where the significant difference in the performance level in Mathematics of male and female learners was determined using the independent samples t-test with unequal variances.

At the 0.05 level of significance, post-test Mathematics performance was not significantly affected by sex. As shown in Table 14, the statistical analysis revealed that there was no significant difference in the post-test mathematics performance of male and female learners. With a two-tailed p-value of 1.00, which is higher than the 0.05 level of significance, and a calculated t-value of 0.00, which is lower than the critical value of 2.12, the null hypothesis of no difference in pre-test performance between sexes was not rejected. This indicates that sex was not a significant factor affecting Mathematics performance in the post-test results.

The findings indicate that male and female kindergarten learners demonstrated comparable performance in Mathematics after the implementation of the Braindance instructional strategy. This is consistent with the movement-centered pedagogy approach discussed by Chalkey et al., (2023), which highlights how physically active learning environments foster academic success and cognitive development in a variety of learner groups.

Overall, the absence of a significant difference in post-test performance indicates that both male and female learners started at a similar level, thereby strengthening the conclusion that improvements in mathematics achievement can be attributed to the Braindance instructional strategy rather than to sex-related differences among learners.

Table 14: Result of the T-test of Difference Between the Mathematics Performance in the Post Test of Male and Female

Sex	No. of Learners	P-Value	t-Critical	t-Stat	Decision	Interpretation
Male	12	1.0	2.12	0.0	Do not reject H_0	Not Significant
Female	8					

The Mathematics Performance and School Attended before Kindergarten

Table 15 presents the results showing whether the school attended before kindergarten significantly affected learners' performance in the post -test.

The results of the H-test showed no significant difference in post-test Mathematics achievement among kindergarten learners according to the school they had attended before kindergarten (H = 3.50, p = 0.17, α = 0.05; H-critical= 5.99). Because the null hypothesis was not rejected, prior preschool attendance did not significantly affect performance after the Braindance intervention. This is consistent with the pre-test outcomes, suggesting that early educational background did not influence learners' mathematical abilities. Overall, the instruction benefited all students equally, with structured, developmentally appropriate teaching helping build foundational skills in kindergarten.

According to the findings presented in Table 15, learners who had no prior schooling, attended daycare, or attended preschool demonstrated comparable Mathematics performance in the post-test, as reflected by the non-significant p-value of 0.17, which is greater than the 0.05 level of significance. Gray Group International (2024); emphasized that early childhood education programs were designed to provide equitable learning opportunities and that structured, engaging, and inclusive strategies like Braindance helped reduce the effects of differences in prior schooling on later academic performance. The absence of a significant difference in post-test results suggested that gains in Mathematics performance could be attributed to the Braindance strategy rather than to learners' previous educational experiences.

Table 15: Summary Result of the H-test on the Mathematics Performance in the Post-test According to the School Attended before Kindergarten

School Attended before K	No. of Learners	P-Value	H-Critical	H-Stat	Decision	Interpretation
None	7	0.17	5.99	3.50	Do not reject H_0	Not Significant
Daycare	7					
Pre-school	6					

The Mathematics Performance and the Family Income

Table 16 presents whether the average monthly income was a factor in the learners' performance in the post-test. The Kruskal-Wallis H-test was conducted, and the result is shown in the table.

At the 0.05 significance level, the results showed no meaningful differences between the income groups. As a result, the null hypothesis was not rejected. This implies that learners' performance in Mathematics during the intervention was unrelated to family income. Furthermore, there is no statistically significant difference in Mathematics ability between the various income groups, since the resulting p-value (0.58) was higher than 0.05 level of significance.

This indicates that the intervention was the key factor supporting improvement in Mathematics achievement. The fact that there were no discernible variations between socioeconomic groups further suggested that the Braindance method was inclusive. The learners from various socioeconomic backgrounds who were able to successfully participate in the math exercises demonstrate that movement-based instruction can produce equitable and easily accessible learning opportunities. These findings support Payne and Costas (2021), who found that experiential and movement-based learning strategies enhance cognitive development and engagement among learners from different socioeconomic backgrounds. The current findings also imply that the Braindance intervention might reduce learner profile-related performance gaps, giving every child the chance to acquire the fundamentals of Mathematics in early childhood education.

All things considered, the lack of notable variations by family income highlights how movement-based education can foster an inclusive learning environment that promotes fair results. This suggests that educators can ensure balanced learning outcomes for every learner and highlight the significance of engaging teaching approaches by addressing the socioeconomic factors that affect Mathematics performance.

Table 16: Summary Result of the H-test on the Mathematics Performance in the Post-test According to the Average Monthly Income

Monthly Income	No. of Learners	P-Value	H-Critical	H-Stat	Decision	Interpretation
₱10,000–₱20,000	7	0.58	7.81	1.90	Do not reject H_0	Not Significant
₱21,000–₱30,000	4					
₱31,000–₱40,000	3					
More than ₱40,000	6					

Significant Difference in the Mathematics Performance Level of the Learners before and after the Utilization of Braindance

Table 17 determines the significant difference between the learners' pre-test and post-test scores. A paired t-test for dependent means was used in the analysis. This test is appropriate for small sample sizes (n=20).

There was a significant difference between the pre-test and post-test scores at the 0.05 significance level because the obtained t-value ($|t| = 8.81$) exceeded the two-tailed critical value (t-critical = 2.09). Further evidence that the difference between the pre-test and post-test scores was statistically significant and due to chance is supported by the obtained p-value ($p < .001$) which was less than the 0.05 level of significance. As a result, the null hypothesis, which states that there is no significant difference in the learners' Mathematics performance before and after the utilization of Braindance, is rejected. This implies that the learners' performance in Mathematics showed significant improvement following the utilization of Braindance.

Furthermore, the large effect size (Cohen's d=1.971) indicates that the difference reflected a substantial improvement in learners' mathematics performance after the intervention was implemented. This means that the improvement was not only statistically significant but also practically meaningful in terms of learning gains.

Given that the differences in learners' profiles were not statistically associated with their Mathematics performance during the study, the results suggested that Braindance as a movement-based strategy effectively engaged young learners and was associated with improved Mathematics performance. This interpretation is consistent with the embodied cognition perspective discussed by Festa et al. (2023), which posits that physical movement plays a critical role in supporting brain development and learning by strengthening neural connections essential for higher-order thinking and concept formation. This supports prior research demonstrating that physical activity and creative movement in early childhood education contribute to improved academic outcomes and inclusive learning environments that accommodate different learning styles (Gilbert, 2019).

The analysis of the results of this study, integrated with data from other research studies, suggests that, overall, Braindance may have contributed to improvements in Mathematics performance among kindergarten learners, as it supported both foundational numeracy skills and cognitive development.

Table 17Result of the T-Test: Paired Two Sample Means

Performance	No. of Learners	P-Value	t-Critical	t-Stat	Decision	Interpretation
Pre-test (Performance before the intervention)	20	3.85748 E-08	2.09	-8.81	reject H_0	Significant

Post-test (Performance after the intervention)	20					
Cohen's D = 1.97						

Challenges Encountered by the Learners in Using Braindance in Enhancing Mathematics Performance

This section discusses the challenges experienced by kindergarten learners during the use of Braindance to support Mathematics learning, based on an observation checklist accomplished by the teachers across the three phases of the intervention.

Table 18 shows several challenges that kindergarten learners experienced during the implementation of the intervention, particularly during the beginning phase when some learners appeared frustrated or overwhelmed during the activity (M = 2.67) and needed frequent prompts or assistance to keep up with Braindance (M = 2.67), both interpreted as Agree. Despite these challenges, learners generally demonstrated active participation, were able to follow sequence of movements, and showed enjoyment and engagement in the activity. indicating a positive response to the intervention.

As learners were consistently exposed to the intervention, the challenges gradually diminished. Difficulties with body movements or coordination remained low, resistance to participation was minimal, and the need for prompts and assistance decreased from the beginning phase (M = 2.67) to the final phase (M = 2.00). Observable improvements emerged, including enhanced engagement, adaptability to movement sequences, and confidence in participating activities related to Mathematics.

The results also revealed positive developments in Mathematics performance. Learners showed a better comprehension of Mathematical skills, became more confident in answering mathematical problems, and improved attention during Mathematical tasks. Likewise, learners showed fewer struggles in focusing and engaging in mathematics activities following Braindance. Similarly, learners exhibited positive responses to Braindance and Mathematics tasks. Learners showed less indicators of frustration, more resilience and perseverance, and were more engaged and focused during mathematical activities.

This is considered normal as such developmental patterns are expected in children aged 4 to 6 years, where repetition, modeling, and structured guidance are required when they are introduced to embodied learning approaches, such as Braindance (Yetti & Syarah, 2022; McGowan et al., 2023). The findings also align with research showing that physically active learning can support executive functioning, attention control, and cognitive integration when implemented consistently (Mavilidi et al., 2021; Chatzopoulos et al., 2024). Way and Ginns (2024), likewise, emphasized that scaffolding, visual cues, andintentional movement design is critical in helping young learners successfully connect bodily movement with mathematical reasoning. Overall, the grand mean increased from 2.84 during the beginning phase to 3.20 during the middle phase and 3.32 during the final phase, indicating increasingly positive learner responses to Braindance and mathematics activities throughout the intervention.

In summary, the reduction of challenges and the increase in learners' engagement provide additional support that Braindance, as a developmentally appropriate instructional strategy, can promote cognitive and emotional development in early childhood education.

Table 18: Learners' Challenges During Braindance Sessions Based on the Observation Checklist

Braindance Activity Participation and Reactions

Items/Indicators	**Beginning Phase**	**Interpretation**	**Middle Phase**	**Interpretation**	**Final Phase**	**Interpreta-tion**
1. The student actively participates	3.00	Agree – with active participation	3.33	Agree – with active participation	3.67	Strongly Agree – highly

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in Braindance exercises.						active participation
2. The student follows the sequence of movements with ease.	3.00	Agree – can follow the sequence	3.67	Strongly Agree – highly able to follow the sequence	3.67	Strongly Agree – highly able to follow the sequence
3. The student demonstrates enjoyment or engagement in the activity.	3.33	Agree – enjoyed and engaged in the activity	3.33	Agree – enjoyed and engaged in the activity	3.67	Strongly Agree – highly engaged in the activity
4. The student struggles with body movements or coordination.	2.33	Disagree – no struggle with body movements	1.67	Disagree – no struggle with body movements	1.67	Disagree – no struggle with body movements
5. The student appears frustrated or overwhelmed during the activity.	2.67	Agree – with frustration over the activity	1.67	Disagree – with no frustration over the activity	1.67	Disagree – with no frustration over the activity
6. The student needs frequent prompts or assistance to keep up with Braindance.	2.67	Agree – needs prompts	2.33	Disagree – does not need prompts	2.00	Disagree – does not need prompts
7. The student adapts to changes in the rhythm or sequence quickly.	2.67	Agree – can adapt to changes	2.33	Disagree – cannot adapt to changes	3.67	Strongly Agree – can highly adapt to changes
8. The student avoids or resists participation in Braindance activities.	2.00	Disagree – no resistance in participation	1.67	Disagree – no resistance in participation	1.67	Disagree-no resistance in participation

Over-all Mean

Phase	Weighted Mean	Interpretation
Beginning Phase	2.79	Agree – with positive reaction and active participation in Braindance
Middle Phase	3.20	Agree – with positive reaction and active participation in Braindance
Final Phase	3.46	Agree – with positive reaction and active participation in Braindance

Mathematics Performance in Relation to Braindance

Items/Indicators	Beginning Phase	Interpretation	Middle Phase	Interpretation	Final Phase	Interpreta-tion
1. The student demonstrates improved attention during math tasks after Braindance.	3.33	Agree – with improved attention	2.67	Agree – with improved attention	3.33	Agree – with im-

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						proved attention
2. The student shows increased confidence in solving math problems after participating in Braindance.	3.33	Agree – with increased confidence	3.33	Agree – with increased confidence	3.67	Strongly Agree – with highly increased confidence
3. The student struggles to focus or engage in math activities following Braindance.	2.33	Disagree – no struggle	2.00	Disagree – no struggle	1.67	Disagree – no struggle
4. The student's understanding of mathematical concepts (e.g., counting, shapes) improves after Braindance.	3.00	Agree – with improved attention	3.33	Agree – with improved attention	3.67	Strongly Agree – with highly improved under-standing
5. The student's performance in math tasks is inconsistent or significantly impacted by difficulties with Braindance.	3.00	Agree – with performance inconsistencies	2.00	Disagree – without performance inconsistencies	2.00	Disagree – without Performance inconsis-tencies

Over-all Mean

Phase	Weighted Mean	Interpretation
Beginning Phase	2.86	Agree – Braindance demonstrates a positive effect on math performance
Middle Phase	3.07	Agree – Braindance demonstrates a positive effect on math performance
Final Phase	3.40	Agree – Braindance demonstrates a positive effect on math performance

Student's Response to Braindance and Mathematics Tasks

Items/Indicators	Beginning Phase	Interpretation	Middle Phase	Interpretation	Final Phase	Interpreta-tion
1. The student shows resilience and persistence despite difficulties in Braindance.	3.00	Agree – with resilience and persistence	4.00	Strongly Agree – with high resilience and persistence	3.67	Strongly Agree – with high resilience and persistence
2. The student displays signs of frustration that may impact both Braindance and math activities.	3.00	Agree – with signs of frustration	2.00	Disagree – without signs of frustration	2.00	Disagree – without signs of frustration

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3. The student's body language reflects frustration or lack of understanding during Braindance activities (e.g., crossed arms, avoiding eye contact).	2.33	Disagree – does not reflect lack of understanding	2.00	Disagree – does not reflect lack of understanding	2.00	Disagree – does not reflect lack of understanding
4. The student seems energized and engaged after completing Braindance, showing improved focus in subsequent math tasks.	3.00	Agree – energized and engaged after Braindance	3.33	Agree – energized and engaged after Braindance	3.67	Strongly Agree – highly energized and engaged after Braindance
5. The student is able to cope with the challenges of Braindance and still shows focus in math tasks.	3.00	Agree – can cope with the challenges	3.33	Agree – can cope with the challenges	3.67	Strongly Agree – can greatly cope with the challenges

Over-all Mean

Phase	Weighted Mean	Interpretation
Beginning Phase	2.93	Agree – with positive response to math Braindance tasks
Middle Phase	3.33	Agree – with positive response to math Braindance tasks
Final Phase	3.00	Agree – with positive response to math Braindance tasks

Grand Mean (for each Phase)

Phase	Weighted Mean	Interpretation
Beginning Phase	2.84	Agree – with positive response to math Braindance tasks
Middle Phase	3.20	Agree – with positive response to math Braindance tasks
Final Phase	3.32	Agree – with positive response to math Braindance tasks

Legend. 3.50–4.00 = Strongly Agree; 2.50–3.49 = Agree; 1.50–2.49 = Disagree; 1.00–1.49 = Strongly Disagree.

Proposed Action Plan

Based on the findings, a proposed action plan has been developed to guide the sustainable implementation of Braindance in kindergarten mathematics, ensuring its continued effectiveness and positive impact on learners. The action plan focuses on key areas such as teacher training, classroom integration, supporting learners, home-school collaboration, monitoring and evaluation, developing resources, and expanding Braindance to other subjects.

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The proposed action plan provides a structured framework to maintain and enhance the use of Braindance in early childhood classrooms. By building teacher skills, using Braindance consistently in the classroom, supporting learners, and keeping track of progress, schools can continue the positive results seen in this study. The results show that using movement in learning is appropriate for young children, makes lessons more fun and engaging, and helps them improve their Mathematics performance.

Table 19:Proposed Action Plan for the Utilization of Braindance in Kindergarten Mathematics

Area of Concern	**Objectives**	**Activities / Interventions**	**Persons Involved**	**Time Frame**	**Success Indicators**
Teacher Capacity on Braindance Implementation	Enhance teachers' knowledge and skills	Conduct training/workshops, provide demonstrations, develop teacher guides	School Administration, Teachers, External Trainers	Start of school year; refresher quarterly	Teachers implement Braindance confiden-ly in lessons
Classroom Integration	Ensure consistent use during lessons	Incorporate Braindance as warm-up, align movement sequences with lesson objectives and utilize visual guides	Kindergarten Teachers	Daily	Braindance observed consistently in lessons
Learner Engagement	Support mastery and active participation	Step-by-step demonstrations, music/visual cues, individualized assistance, and give repeated guided practice when necessary	Teachers	Daily	Increased learner participation and mastery
Home–School Collaboration	Strengthen continuity of learning	Distribute home guides, encourage parental practice, conduct parent orientation	Teachers, Parents	Every grading period	Parents report increased home practice; learners show smoother execution
Monitoring & Evaluation	Assess impact on academics and behavior	Pre/post assessments, observation checklists, regular progress review	Teachers, Curriculum Coordinators, Administrators	Quarterly & end of year	Improved scores; enhanced focus, coordination, and engage-ment
Resource Development	Provide supportive mate-rials	Create posters, charts, videos; designate movement space	Administration, Teachers	As needed	Adequate materials accessible; learners follow

					sequences independently
Expansion to Other Learning Areas	Explore applica-tions beyond Mathe-matics	Pilot in literacy, science, socio-emotional lessons; document outcomes	Teachers, Curriculum Planners	Second semester / next school year	Positive outcomes and improved performance in other areas

DISCUSSION

Most of the learners were five years old, male, had previously attended day care before starting kindergarten, and came from households with monthly incomes between ₱10,000 to ₱20,000 and above ₱40,000 pesos.

The Braindance intervention featured an eight-step movement routine—Breath, Tactile, Core–Distal, Head–Tail, Upper–Lower, Body–Side, Cross–Lateral, and Vestibular—carried out as a warm-up exercise prior to Mathematics classes. These movements appeared to enhance learners' attentiveness, coordination, and cognitive readiness for learning, and indicated the feasibility of integrating Braindance into classroom instruction.

Results indicated that most learners progressed from the Beginning level to the Proficient level in Mathematics after the intervention, showing improved learning outcomes under the study conditions and supporting feasibility of the intervention. No significant differences were detected when learners were grouped according to age, gender, early childhood education, or family income. However, a significant difference was observed between the overall pre-test and post-test scores ($t(19) = -8.81$, $p < .001$), leading to the rejection of the null hypothesis and suggesting that Mathematics performance showed a positive change following the intervention under the study conditions.

Initially, learners showed moderate signs of frustration or feeling overwhelmed during the activities (weighted mean = 2.67). By the final phase, these signs had decreased (weighted mean = 2.0), suggesting improved adaptation and engagement throughout the intervention.

However, the one-group pretest–posttest design did not control for external factors such as increased teacher attention, novelty effects, learner motivation, extended engagement time, and regular classroom instruction. Therefore, the observed improvements cannot be attributed primarily to the Braindance intervention. The findings should be considered as preliminary evidence rather than definitive proof of effectiveness. The absence of a delayed post-test limits conclusions about the long-term retention of learning gains. As participants had already progressed to Grade 1, follow-up assessment was not feasible. Future research should include delayed post-tests to assess the sustainability of the intervention's effects. Future studies employing multiple schools and larger sample sizes, longer intervention periods, and controlled experimental designs are advised to strengthen causal inference.

This study is positioned as a pilot feasibility study; however, future studies including different schools and bigger sample sizes are recommended to improve the generalizability and robustness of the findings and to further evaluate the usefulness and feasibility of Braindance.

However, gains may be influenced by regression to the mean, maturity, test familiarity, and classroom instruction; consequently, results should be read cautiously, and causal claims cannot be made despite a positive association between Braindance and Mathematics performance.

CONCLUSION

The findings of the study suggest that the utilization of Braindance was feasible to implement and was associated with improved Mathematics performance among kindergarten learners.

Most of the kindergarten learners were five years old, with more males than females. The learners were equally represented in terms of having attended and not having attended daycare prior to kindergarten, and most of the learners' families had a monthly income of ₱10,000–₱20,000.

The steps in using Braindance to improve the mathematics performance of kindergarten learners were: Breath, Core-Distal, Head-Tail, Upper-Lower, Body-Side, Cross-Lateral, and Vestibular.

Mathematics performance before the use of Braindance was at the Beginning level, whereas after its use, the learners achieved the Proficient level.

In the pre-test, as well as post-test, there were no significant differences in the Mathematics performance level of kindergarten learners as to age, gender, early childhood education, and family income. Therefore, the null hypotheses stating no significant variation in kindergarten learners' Mathematics performance before and after Braindance, when considering learner profile, were accepted.

There was a significant difference in the Mathematics performance level of kindergarten learners between the pre-test and post-test in the utilization of Braindance. Therefore, the null hypothesis stating that there was no significant difference in Mathematics performance before and after the utilization of Braindance was rejected.

As to the challenges encountered by the learners in using Braindance, those observed during implementation were minor and did not appear to hinder learner participation or engagement in the activities.

An action plan was crafted to improve the utilization of Braindance in enhancing Mathematics performance of the kindergarten learners.

Overall, the findings provide preliminary evidence of the feasibility and potential of introducing Braindance into Mathematics instruction to support the development of basic arithmetic skills among kindergarten learners. However, because the one-group pretest-posttest design did not control for other factors such as increased teacher attention, the novelty of movement-based activities, learner enthusiasm, extended engagement time, and regular classroom instruction, the results cannot conclusively attribute the observed improvements to Braindance alone. Therefore, the data should be taken as preliminary evidence rather than definite proof of effectiveness. Future studies employing larger samples, longer intervention periods, and controlled experimental designs are encouraged to strengthen the evidence regarding its effectiveness.

RECOMMENDATION

Based on the findings and conclusions, the following recommendations are offered:

1. Students should adopt the habit of doing Braindance as a daily warm up activity to prepare them cognitively and physically for Mathematics lessons and other subjects.
2. Teachers should integrate Braindance as a daily warm-up activity to prepare learners cognitively and physically for Mathematics lessons.
3. Parents and Guardians should inspire their children to use Braindance as a warm up activity before studying.
4. School administrators should support professional development programs in Braindance and its integration into the kindergarten curriculum to strengthen foundational Mathematics and literacy skills.
5. Policy makers should incorporate structured movement sequences into lesson guides and develop instructional materials that combine movement, music, and Mathematics to stimulate multi-sensory learning.

6. The Community should support the use of Braindance to enhance the educational system and foster a collaborative environment for students' success.

7. Future researchers may study the use of Braindance in additional topic areas and grade levels to further enhance learners' motivation, engagement, and persistence in learning. They should also explore employing multiple schools and larger and more diverse samples, delayed post-tests, and validated assessment instruments to improve the reliability and generalizability of findings. Employing independent assessors, blinded observations, and fidelity checks may increase impartiality, while evaluating aspects such as attention, engagement, and executive functioning could provide deeper insights into how Braindance supports learning outcomes.

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