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Investigating the impact of the cooperative teaching approach (collaborative teacher) through integrating the art and math curriculum on improving the quality of learning outcomes (cognitive, emotional, and psychomotor) among elementary students in the city of Karbala.

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Abstract

The present study aimed to investigate the impact of the cooperative teaching approach (collaborative teacher) through integrating the art and math curriculum on improving the quality of learning outcomes (cognitive, emotional, and psychomotor) among elementary school students in the city of Karbala. This research employed a quasi-experimental design with a pretest-posttest control group. The statistical population consisted of 3,600 elementary students in Karbala, from which a sample of 30 students was randomly selected and divided into an experimental group and a control group (15 students in each group). The research instrument was the Learning Outcomes Levels Questionnaire by Namest (2014). The cooperative teaching method through the integration of art and math curricula was applied to the experimental group. Data were analyzed using multivariate covariance analysis (MANCOVA). The findings revealed that the cooperative teaching approach (collaborative teacher) through the integration of art and math curricula improved mathematics learning among elementary school students in Karbala in the post-test stage. Additionally, it enhanced the cognitive and emotional domains of the students in the post-test stage. However, the cooperative teaching approach (collaborative teacher) through the integration of art and math curricula did not improve the psychomotor domain of the students in the post-test stage. Therefore, it is recommended that teachers design lesson plans combining art and mathematics in a way that allows students to explore both subjects simultaneously.

Keywords: Cooperative teaching, cognitive, emotional, psychomotor, curriculum.

Introduction

Student learning is crucial because it equips individuals with the knowledge, skills, and competencies necessary for personal growth, career advancement, and social progress. It empowers learners to think critically, solve problems, adapt to a constantly changing world, and fosters innovation and resilience. Furthermore, quality education increases social mobility, reduces inequality, and promotes economic prosperity by preparing individuals for meaningful participation in their communities and the global workforce (Vohono et al., 2020). The quality of students' learning outcomes includes the depth of understanding, skill acquisition, and application of knowledge demonstrated by students as a result of their

educational experiences. It goes beyond mere memorization and encompasses critical thinking, problem-solving abilities, creativity, and adaptability. High-quality learning outcomes indicate that students have not only mastered content but have also developed the capacity to analyze information, make connections, and apply concepts across different contexts (Romavatin, 2023).

In addition, the quality of learning outcomes is often assessed through various criteria, including standardized tests, performance assessments, and portfolio evaluations. These assessments measure students' abilities to achieve specific educational goals and standards set by educational institutions or governing bodies. Furthermore, alignment between learning outcomes, curriculum objectives, teaching methods, and assessment strategies impacts the overall quality of education. Effective teaching practices, supportive learning environments, and opportunities for reflection and feedback also contribute to enhancing the quality of students' learning outcomes, promoting continuous improvement and lifelong learning. The quality of learning outcomes includes cognitive, emotional, and psychomotor dimensions, which together reflect the holistic development of learners (Harifa, 2023). In the cognitive domain, high-quality learning outcomes not only indicate the acquisition of real knowledge but also mastery of critical thinking, problem-solving, and analytical skills. This includes the ability to analyze information, evaluate evidence, and synthesize ideas to create new insights and perspectives. Additionally, cognitive learning outcomes include higher-order thinking skills such as creativity, innovation, and complex reasoning, enabling learners to apply their knowledge effectively in real-world contexts. Emotional learning outcomes are equally important as they relate to the development of social-emotional skills, self-awareness, empathy, and resilience. High-quality emotional learning outcomes foster a positive learning environment where students feel supported, engaged, and motivated to learn. This includes nurturing emotional intelligence, self-regulation, and interpersonal communication skills that empower learners to navigate social interactions, manage stress, and cope effectively with challenges. Furthermore, emotional learning outcomes enhance a sense of belonging, well-being, and self-confidence, contributing to personal growth and holistic mental health (Morsid et al., 2022). In the psychomotor domain, high-quality learning outcomes are related to the development of physical skills, coordination, and related abilities. This includes hands-on activities, practical demonstrations, and experiential learning opportunities that enable learners to acquire and refine motor skills specific to their academic disciplines or professional aspirations. High-quality psychomotor learning outcomes not only involve mastery of technical skills but also the application of procedural knowledge, precision, and adaptability in performing tasks or activities. Additionally, psychomotor learning outcomes support the development of muscle memory, fine motor control, and spatial awareness, enhancing learners' ability to effectively engage in various manual or physical tasks (Shi et al., 2020).Various methods are used to enhance the quality of learning, one of which is the cooperative teaching approach (collaborative teacher) through the integration of art and math curricula. Cooperative teaching, also known as co-teaching, involves collaboration between two or more educators to deliver instruction to a diverse group of students (Skor et al., 2015). In this approach, teachers work together to plan, deliver, and evaluate lessons, drawing on each other’s expertise and perspectives to meet the individual learning needs of all students. Cooperative teaching can take different forms, such as team teaching, where educators share responsibility for instruction; parallel teaching, where the class is divided into smaller groups taught simultaneously by different teachers; or station teaching, where students rotate between learning stations guided by various teachers (Lipponen, 2023). This collaborative teaching method has also gained popularity among Iraqi educators (Al-Kurashi et al., 2023).

Various methods are used to improve the quality of learning. One of these methods is the collaborative teaching approach (co-teaching) through the integration of the arts and mathematics curriculum. The collaborative teaching approach, also known as co-teaching, involves cooperation between two or more educators to deliver instruction to a diverse group of students (Scor et al., 2015). In this approach, teachers work together to plan, deliver, and assess lessons, utilizing each other's expertise and perspectives to meet the individual learning needs of all students. Co-teaching can take various forms, such as team teaching, where instructors share responsibility for teaching, parallel teaching, where the class is divided into smaller groups and taught simultaneously by different teachers, or station teaching, where students rotate

through learning stations led by different teachers (Lipopen, 2023). Collaborative learning among teachers has also gained popularity among Iraqi educators (Al-Kershi et al., 2023).

One of the key aspects of collaborative teaching is its emphasis on learning and diversity. Educators can create a more inclusive learning environment by integrating their resources, skills, and knowledge to address the diverse needs, interests, and learning styles of all students. Co-teaching allows for differentiated instruction, where teachers can adapt their approaches to address the varying abilities, backgrounds, and preferences of students, ensuring that each learner has access to high-quality instruction and support. Additionally, collaborative teaching fosters collaboration, communication, and teamwork among educators, modeling positive social skills and promoting a culture of shared responsibility for student success (Supna et al., 2021). The collaborative teaching approach integrates the arts and mathematics curriculum by combining the creative elements of art with the analytical aspects of mathematics to enhance students' understanding and engagement. Through this approach, educators collaborate to design interdisciplinary lessons that incorporate visual arts such as design, painting, or sculpture to illustrate mathematical concepts and principles. For example, students may create geometric patterns or designs inspired by mathematical concepts such as symmetry and transformation. By integrating art and mathematics, collaborative teaching encourages students to explore connections between these seemingly different subjects, enhancing critical thinking, creativity, and problem-solving skills, while also promoting a comprehensive understanding of both disciplines (Zinali et al., 2023).

The lack of improvement in learning outcomes, including cognitive, emotional, and psychomotor dimensions, among elementary school students in Karbala highlights the need for innovative approaches such as cooperative teaching. Collaborative teaching methods, particularly through the integration of art and math curricula, offer a promising solution. By merging artistic creativity with mathematical concepts, cooperative teaching engages students in interdisciplinary learning experiences that stimulate cognitive development, emotional intelligence, and psychomotor skills. This approach allows educators to address diverse learning styles and needs, fostering deeper understanding, motivation, and knowledge retention among students. Furthermore, integrating art and mathematics not only enriches the learning process but also cultivates creativity, critical thinking, and problem-solving abilities essential for success in both academic and real-world contexts. This approach addresses the challenges of enhancing learning outcomes in Karbala. Investigating the impact of cooperative teaching, especially through the integration of art and math curricula, is essential for improving the quality of learning outcomes among elementary school students in Karbala for several reasons. First, such an approach strengthens interdisciplinary connections, enabling students to perceive the practical applications of mathematical concepts through artistic expression, thereby enhancing cognitive comprehension and retention. Second, cooperative teaching promotes social interaction and teamwork, positively influencing emotional growth by fostering a sense of belonging and mutual support among students. Finally, integrating art and mathematics encourages the development of psychomotor skills by engaging students in creative, hands-on activities requiring problem-solving and fine motor coordination, leading to a more holistic educational experience. Given these considerations, this study seeks to address the fundamental question: Does the cooperative teaching approach (collaborative teacher) through the integration of art and math curricula improve the quality of learning outcomes (cognitive, emotional, and psychomotor) among elementary school students in Karbala?

Review of Literature and Theoretical Foundations

Collaborative Teaching through the Integration of Art and Math Curricula

Collaborative teaching is a dynamic and engaging approach that emphasizes teamwork and shared responsibility between teachers and students. In this model, teachers work together to plan, deliver, and evaluate learning experiences, while students are grouped into small teams that encourage active participation. This instructional method fosters teamwork, interaction, and mutual support, creating a classroom environment that promotes deeper understanding and active engagement. By collaborating with one another, students not only acquire knowledge but also develop critical thinking,

communication, and social skills essential for success both within and beyond the classroom (Luo et al., 2022). The structure of collaborative teaching defines specific roles for both teachers and students. Teachers collaborate in lesson design, often co-teaching to ensure that students receive comprehensive and diverse perspectives on the subject matter. In the classroom, students are assigned to small, heterogeneous groups, with each member holding specific tasks or roles that contribute to a shared learning objective. This division of responsibilities encourages students to take ownership of their learning while holding them accountable for their contributions to the group. Through this collective effort, students develop a stronger sense of responsibility and independence (Kudo et al., 2022).

One essential aspect of collaborative teaching is positive interdependence, where students rely on each other to achieve success. Each group member is assigned a role to ensure that everyone contributes uniquely to the group's success. This fosters a sense of unity and shared purpose, as students recognize that their individual achievements are intertwined with the success of their peers. Positive interdependence also helps students build strong interpersonal relationships and promotes an inclusive classroom culture, where students support one another and celebrate collective success (Davoust, 2019). In addition to positive interdependence, collaborative teaching emphasizes individual responsibility. Although students work together in groups, each member is responsible for completing their portion of the work. This prevents situations where only a few students carry the workload, while others contribute less. Teachers play a crucial role in monitoring both individual and group performance, ensuring that all students meaningfully contribute to the group's progress. This approach not only promotes fairness but also enhances students' sense of responsibility and work ethic (Bilok et al., 2024).

Collaborative teaching also fosters the development of important social and interpersonal skills. When students engage in group discussions, share resources, and collaborate on problem-solving tasks, they learn how to communicate effectively, listen to different perspectives, and resolve conflicts in a constructive manner. These skills are essential for success in both academic and professional environments, as they equip students with the ability to work effectively with others, manage social dynamics, and develop emotional intelligence. Additionally, collaborative teaching provides opportunities for students to practice leadership, teamwork, and decision-making (Finalason, 2024).

Ultimately, collaborative teaching creates an inclusive and supportive learning environment that helps students with different abilities and learning styles. Through teamwork, students can leverage each other's strengths and provide support to peers in areas where they might face challenges. Teachers can also differentiate instruction to meet the diverse needs of learners, ensuring that all students have the opportunity for success. This inclusive approach not only improves academic outcomes but also enhances a sense of belonging and community in the classroom, making learning a more enjoyable and rewarding experience for everyone (Gust, 2024).

Collaborative teaching is a powerful approach to education that promotes active learning, social interaction, and the development of essential life skills. By working in groups, students can learn from each other, deepen their understanding of the material, and develop critical social and communication skills. However, for collaborative teaching to be successful, teachers must carefully plan and manage group activities, monitor student participation, and provide guidance and support when necessary. Despite the challenges, the benefits of collaborative teaching make it a valuable strategy for fostering engagement and promoting a collaborative teaching environment (Wang et al., 2015).

Cognitive learning

Cognitive learning provides a comprehensive framework for understanding how individuals acquire, process, and retain knowledge. Unlike behaviorist theories that focus on observable behaviors and external stimuli, cognitive learning delves into the internal mental processes that underpin the learning process. It seeks to understand how the mind interprets and organizes information from experiences, thoughts, and sensory inputs to facilitate learning. This approach emphasizes the importance of understanding the mental activities involved in acquiring and applying knowledge rather than merely observing changes in behavior.

Cognitive learning centers around processes such as thinking, knowing, remembering, and problem-solving. These activities are essential to how we perceive and interact with the world. For instance, thinking involves cognitive operations like analyzing, synthesizing, and evaluating information. Knowing and remembering pertain to how information is stored and retrieved from memory, while problem-solving involves applying knowledge in new and complex situations. The goal of cognitive learning theories is to explain how these processes work together to enhance the ability to learn and adapt (Prophilit Leva & Hill, 2018).

Information processing is a key concept in cognitive learning that compares the human mind to a computer. This model divides the learning process into stages: sensory memory, short-term memory, and long-term memory. Sensory memory briefly holds sensory information, short-term memory temporarily processes this information, and long-term memory stores it for extended periods. Understanding these stages helps in recognizing how information is encoded, maintained, and retrieved, which is crucial for effective learning (Wankstern et al., 2015).

Schemas, or cognitive frameworks, are another essential aspect of cognitive learning, as they help organize and interpret information. Schemas assist individuals in understanding new information by linking it to what they already know. They act as mental shortcuts that facilitate comprehension and recall. As individuals encounter new experiences, their schemas are either reinforced or adjusted to incorporate new knowledge. This process of developing and refining schemas is crucial for cognitive growth and learning (Koppel & Bernstein, 2024).

Constructivism, a theory associated with Jean Piaget and Lev Vygotsky, posits that learners actively construct their understanding of the world through experiences. According to constructivism, learning is not a passive absorption of information but an active process in which learners build on their existing knowledge. This perspective emphasizes that cognitive growth is an ongoing process of adaptation and development, where learners integrate new information into their pre-existing cognitive structures.

Metacognition, or the awareness and regulation of one's cognitive processes, is also an integral part of cognitive learning. It involves monitoring and controlling one's learning strategies, such as planning, tracking progress, and evaluating outcomes. Metacognitive skills enable learners to be more effective by helping them assess their understanding and adjust their learning approaches. By strengthening metacognition, educators can enhance learners' abilities to manage their learning processes, leading to more effective and personalized learning experiences (Lambo et al., 2024).

Emotional learning

Emotional learning, often referred to as Social-Emotional Learning (SEL), is a process through which individuals recognize and manage their emotions, develop empathy for others, and build positive relationships. This learning involves identifying and labeling one's emotional states, understanding how these emotions influence behavior and decision-making, and developing strategies to regulate emotions effectively. SEL also includes learning to guide social interactions with empathy and respect, which involves understanding and responding to the emotions of others. By nurturing these skills, emotional learning contributes to emotional intelligence, which is crucial for personal well-being, effective communication, and successful interpersonal relationships.

In educational settings, emotional learning is integrated into curricula to enhance students' overall development and academic performance. The goal of SEL programs is to create supportive environments where students can develop self-awareness, self-management, social awareness, communication skills, and responsible decision-making. These competencies help students manage stress, resolve conflicts, collaborate with peers, and ultimately support their academic success and personal growth. Emotional learning, by addressing both the emotional and cognitive aspects of learning, promotes a holistic approach that prepares individuals to navigate complex social landscapes and build resilience in the face of challenges (Baskel, 2022).

Psychomotor learning

Psychomotor learning refers to the development of physical skills through the integration of motor and cognitive processes. This type of learning focuses on how physical abilities are acquired, refined, and executed, ranging from basic motor functions like walking or grasping objects to more complex actions such as playing a musical instrument or mastering a sport. Psychomotor learning is not just about physical movement; it involves a combination of cognitive processes, including perception, attention, and decision-making, that guide and optimize motor performance. Psychomotor learning plays a significant role in various areas, from sports and performing arts to professional skills and everyday activities (Baskal et al., 2022).

The initial stage of psychomotor learning involves understanding the task or movement at a conceptual level. In this cognitive stage, learners form a mental representation of the skill they are trying to acquire. For example, in sports, an athlete might begin by learning the rules and techniques of a specific movement, such as how to swing a tennis racket. At this stage, the focus is primarily on learning the fundamentals and mechanics of the skill. Learners often rely heavily on external instructions, observations, and mental practice to understand what needs to be done before they can effectively perform the movement.

As learners progress from the cognitive stage to the associative stage, they begin to practice the skill more frequently, refining their movements and making fewer errors. This stage involves significant internal and external feedback as learners start adjusting their actions based on the results of their practice. The associative stage is marked by improvements in accuracy, coordination, and movement consistency. For example, a pianist practicing scales gradually improves their technique by adjusting finger placement, speed, and dynamics through repetition and feedback from a teacher or self-assessment.

The autonomous stage represents the point where the motor skill becomes automatic or habitual and requires less conscious thought or cognitive engagement. At this stage, the learner can perform the skill smoothly and with minimal error, even in complex or variable environments. For example, a dancer who has practiced a routine for months can execute the steps without consciously thinking about each movement. At this level, the skill becomes deeply integrated with the learner's cognitive and motor systems, allowing for multitasking and adaptation to external factors like changes in rhythm or space.

Feedback plays a crucial role throughout the process of psychomotor learning. External feedback, provided by coaches, instructors, or peers, helps learners correct their mistakes and refine their techniques. For example, a basketball coach might point out flaws in a player's shooting form, allowing them to make adjustments during practice. On the other hand, internal feedback comes from the learner's sensory experiences and self-monitoring. For instance, a musician may notice that the sound is off and adjust their fingers accordingly. This combination of feedback—external and internal—helps guide learners through different stages of skill acquisition and improvement, making it an essential part of the learning process.

Research Background

Zinali et al. (2023) investigated the integration of art and mathematics. Their results show that combining art and mathematics can significantly improve the learning process and understanding of mathematical concepts. Furthermore, this paper analyzes the impact of integrating art and mathematics on the development of individual skills. The effectiveness of this approach in fostering creative thinking, social participation, and problem-solving is also examined. Ultimately, the findings indicate that the integration of art and mathematics can be an effective strategy for enhancing the teaching and learning process. This integration strengthens the connections and interactions between art and mathematics and encourages students to engage in more active and creative learning.

Vasali Omid (2023) examined the relationship between the integrated art and mathematics learning style and its effect on the performance of exceptional elementary school students. The goal of this research is to explore the relationship

between the integrated art-mathematics learning style and its impact on the academic performance of elementary school students. The study investigates how combining artistic elements with mathematics education affects students' academic success and their participation in the learning process. This research aims to clarify the benefits and challenges of implementing an integrated art-mathematics approach in primary education through a comprehensive literature review.

Kargar Barzi (2023) analyzed the effects of the collaborative teaching method on the learning process of learners. Data analysis shows that the collaborative teaching method can significantly affect student motivation and academic progress. However, the success of this method strongly depends on the teacher's skills in managing classroom interactions and their ability to create a supportive and collaborative environment. Ultimately, the paper recommends that teachers should be trained in the use of collaborative teaching methods and utilize various strategies to ensure the active participation of all students. Additionally, schools should provide sufficient resources to support these methods to maximize their positive impact on the learning process.

Research Method

This research is a type of quasi-experimental and applied study. The design used in this research is a pre-test, post-test design with a control group. Quasi-experimental designs are semi-complete versions of actual experiments. These designs have the ability to control some internal validity criteria, although their efficiency is not as high as that of experimental designs, but their ability to control variables is greater than that of preliminary designs. In this study, 30 participants were selected through convenience sampling and divided into two groups of 15 participants each and will undergo a pre-test. Then, the experimental group will receive cooperative teaching (teacher collaboration) through the integration of the art and mathematics curriculum, while the control group will be placed on a waiting list. After the treatment period, both groups will undergo a post-test. The statistical population includes 3,600 elementary school students in the city of Karbala. Based on the statistical population, 30 students were randomly selected and randomly assigned to two groups of 15 students each. The sample size for each group in this study was chosen based on the minimum sample size for experimental studies. The data collection tool was the Learning Outcomes Levels Questionnaire by Nakhost (1393), and the educational and workshop protocol was used to measure the impact of the cooperative teaching approach through the integration of art and mathematics curricula. The data were analyzed using SPSS-26 software at two levels of descriptive statistics (mean and standard deviation) and inferential statistics (analysis of covariance while adhering to the statistical assumptions of Levene's test, Mauchly's test of sphericity, and Shapiro-Wilk test).

Findings

The cooperative teaching approach (co-teacher) through the integration of the art and mathematics curriculum has an impact on improving the quality of learning outcomes for elementary school students in the city of Karbala.

As shown in the results of Table (1), there is a significant difference between the groups at the 0.05 level ($p < 0.05$). Considering that the mean scores of math learning in the experimental group are higher than those of the control group in the post-test, this difference favors the experimental group. This indicates that cooperative teaching (co-teacher) through the integration of art and mathematics curriculum has successfully improved math learning in elementary school students in Karbala at the post-test stage.

Table (1): Multivariate Analysis of Covariance (MANCOVA) of Learning Scores in the Studied Groups

source	sum of squares	degrees of freedom	Mean Square	F	Significance Level	Eta value	Statistical power
pre-test	482.088	1	482.088	20.069	0.001	0.426	0.991

group	502.346	1	502.346	20.912	0.001	0.436	0.993
error	648.579	28	24.021				
Total	52655	30					

The results of Table (2) show the Multivariate Analysis of Covariance (MANCOVA) results for the differences between the experimental and control groups in learning dimension scores among primary school students in Karbala. Based on the data in the table, there is a significant difference between the experimental and control groups in the learning dimensions of primary school students in Karbala at the 05/0>p level. The eta value is 0.420, meaning that 42% of the difference between the two groups is explained by the learning dimension scores of the students. Additionally, the test power is 1, indicating the adequacy of the sample size.

Table (2) Results of Multivariate Analysis of Covariance (MANCOVA) for the difference between the experimental and control groups in learning dimensions among primary school students in Karbala.

source	Value	F	Significance Level	Eta value	Statistical power
گروه	0.420	5.560	0.005	0.420	0.897

Collaborative teaching (co-teacher) through the integration of the art and mathematics curriculum has an impact on the cognitive aspect of learning.

As the results in Table (3) show, there is a significant difference between the groups at the 0.05 level ($p < 0.05$). Considering that the mean cognitive scores in the experimental group are higher than those in the control group in the post-test, this difference favors the experimental group. This means that collaborative teaching (co-teacher) through the integration of the art and mathematics curriculum was able to improve the cognitive aspect of learning in primary school students in Karbala in the post-test phase.

Table (3) Multivariate Analysis of Covariance (MANCOVA) Cognitive Scores in the Studied Groups

source	sum of squares	degrees of freedom	Mean Square	F	Significance Level	Eta value	Statistical power
pre-test	16.421	1	16.421	4.483	0.044	0.152	0.530
group	47.405	1	47.405	12.942	0.001	0.341	0.933
error	91.572	25	3.663				
Total	9098	30					

Collaborative teaching (co-teaching) through the integration of the arts and mathematics curriculum has an impact on the emotional aspect of learning.

As shown in the results of Table (4), there is a significant difference between the groups at the level of 0.05 ($p > 0$). Given that the mean emotional scores in the experimental group are higher than those of the control group in the post-test, this difference is in favor of the experimental group. This means that collaborative teaching (co-teaching) through the integration of the arts and mathematics curriculum has been able to improve the emotional aspect of learning in elementary school students in Karbala at the post-test stage.

Table (4) Multivariate Analysis of Covariance (MANCOVA) Emotional Scores in the Studied Groups

source	sum of squares	degrees of freedom	Mean Square	F	Significance Level	Eta value	Statistical power

pre-test	4.102	1	4.102	0.679	0.418	0.026	0.124
group	80.810	1	80.810	13.370	0.001	0.348	0.940
error	151.097	25	6.044				
Total	4132	30					

Collaborative teaching (co-teaching) through the integration of art and mathematics curriculum has no significant effect on the psychomotor aspect of learning.

As the results of Table (5) show, there is no significant difference between the groups at the 0.05 level (P > 0.05). This means that collaborative teaching (co-teaching) through the integration of art and mathematics curriculum has not been able to improve the psychomotor aspect in elementary school students in Karbala city at the post-test stage.

Table (5) Multivariate Analysis of Covariance (MANCOVA) Psychomotor Scores in the Studied Groups

source	sum of squares	degrees of freedom	Mean Square	F	Significance Level	Eta value	Statistical power
pre-test	3.934	1	3.934	2.015	0.075	0.075	0.276
group	26.725	1	26.725	13.691	0.001	0.354	0.945
error	48.789	25	1.952				
Total	5021	30					

Discussion and Conclusion

The cooperative teaching approach (co-teaching) through the integration of art and mathematics curriculum has an impact on improving the quality of learning outcomes for elementary students in Karbala.

As shown in the results of Table (1), there is a significant difference between the groups at the 0.05 significance level. Moreover, considering that the average math scores in the experimental group are higher than those of the control group in the post-test, this difference favors the experimental group. This suggests that the cooperative teaching approach (co-teaching) through the integration of the art and math curriculum has been able to improve math learning outcomes for elementary students in Karbala in the post-test stage. The results of Table (2) show the results of the Multivariate Analysis of Covariance (MANCOVA) for the difference between the experimental and control groups in the learning dimensions of elementary students in Karbala. According to the data in the table, there is a significant difference between the two groups in the learning dimensions at the 0.05 level ($p<0.05$). The eta squared value is 0.42, meaning that 42% of the difference between the two groups can be explained by the learning dimensions. Furthermore, the test power is 1, indicating the adequacy of the sample size. The results of this hypothesis are consistent with the findings of research by Vosali Omid (2023), Karagar Barzi (2023), Mohammadi (2023), Azari Maiwan and colleagues (2023), Asgari and colleagues (2023), Parghaz (2021), Al-Karshi and colleagues (2023), Sharma and colleagues (2023), Sabah (2023), Stoness and Slavin (2020). In explaining this hypothesis, it can be said that it has been proven that cooperative teaching through the integration of art and mathematics is an effective approach to enhance learning among elementary students in Karbala. By blending the creativity of art with the logical structure of mathematics, this method helps engage students at various levels and makes abstract mathematical concepts more tangible and easier to understand. For example, visual arts such as drawing geometric shapes or using patterns in design can help students understand mathematical ideas like symmetry, measurement, and spatial reasoning.

This interdisciplinary approach supports different learning styles, allowing students to explore mathematical concepts through hands-on activities, visual displays, and creative expression. Furthermore, the collaborative nature of this teaching method strengthens social interaction and teamwork, which is vital for young students' growth. Working

together on integrated art and math projects encourages communication, critical thinking, and problem-solving. When students collaborate, they not only share ideas but also develop the ability to view problems from different perspectives, thus enhancing their overall cognitive abilities.

Teachers of both subjects can work together to develop lessons that complement each other, creating a more cohesive learning experience that is both engaging and educational. This teamwork also fosters a supportive classroom environment where students feel more connected and motivated to participate. Integrating art with mathematics introduces a fresh and innovative approach to learning that meets the diverse needs of students and provides a more comprehensive educational experience that addresses cognitive, emotional, and social aspects of learning.

This method, by making learning more enjoyable and relevant, has the potential to improve academic performance and student engagement while fostering a deeper understanding of both subjects. Therefore, this integrated approach not only enriches the curriculum but also promotes a more inclusive and dynamic learning environment for elementary school students in Karbala.

Cooperative Teaching (Co-Teaching) through the Integration of Art and Mathematics Curriculum Has an Impact on the Cognitive Aspect of Learning

As the results in Table (3) show, there is a significant difference between the groups at the 0.05 significance level. Moreover, since the average cognitive scores in the experimental group are higher than those in the control group in the post-test, this difference favors the experimental group. This suggests that cooperative teaching (co-teaching) through the integration of art and mathematics curriculum has been able to improve the cognitive aspect of learning in elementary students in Karbala in the post-test stage. The results of this hypothesis are consistent with the findings of Azari Maiwan and colleagues (2023), Asgari and colleagues (2023), Parghaz (2021), Al-Karshi and colleagues (2023), Sharma and colleagues (2023), and Sabah (2023). In explaining this hypothesis, it can be said that cooperative teaching that integrates art and mathematics has a significant impact on the cognitive growth of elementary students in Karbala. This approach, by blending the logical and sequential nature of mathematics with the creative and visual aspects of art, enhances students' cognitive abilities. For example, when students create geometric patterns or solve mathematical problems through artistic projects, they engage multiple cognitive processes such as spatial reasoning, pattern recognition, and problem-solving. This interdisciplinary method helps students conceptualize mathematical ideas in a more tangible and relatable way, reinforcing their understanding and retention of mathematical concepts. Furthermore, the integration of art with mathematics encourages critical thinking and problem-solving skills. Artistic projects involving mathematical elements, such as creating symmetrical designs or calculating areas for art projects, require students to apply mathematical principles in a practical context. This hands-on approach challenges students to think critically and connect abstract mathematical concepts with real-world applications. The process of solving these integrated problems promotes higher-order thinking skills and helps students develop a deeper understanding of both subjects.

By engaging in such projects, students practice analyzing, synthesizing, and evaluating information, which enhances their overall cognitive development. In addition, the collaborative nature of this teaching method supports cognitive growth through social interaction and teamwork. When students work together on integrated art and math projects, they share ideas, discuss solutions, and negotiate procedures, stimulating cognitive processes such as communication and collaborative problem-solving. This social interaction not only supports the cognitive development of each student but also creates a supportive learning environment where students feel more engaged and motivated to participate.

The combination of individual cognitive work and group collaboration enriches the learning experience, contributing to more comprehensive cognitive development, which benefits elementary students in Karbala.

Cooperative Teaching (Co-Teaching) through the Integration of Art and Mathematics Curriculum Has an Impact on the Affective Aspect of Learning

As the results in Table (4) show, there is a significant difference between the groups at the 0.05 significance level. Additionally, since the average emotional scores in the experimental group are higher than those in the control group in

the post-test, this difference favors the experimental group. This suggests that cooperative teaching (co-teaching) through the integration of art and mathematics curriculum has been able to improve the emotional aspect of learning in elementary students in Karbala in the post-test stage. The results of this hypothesis are consistent with the findings of Vassali Omid (2023), Mohammadi (2023), Stokes and Slavin (2020). In explaining this hypothesis, it can be said that cooperative teaching through the integration of art and mathematics, by creating a more engaging and supportive learning environment, has a significant emotional impact on elementary students in Karbala. Combining art and mathematics allows students to express themselves creatively while engaging with complex mathematical concepts. This integration can make learning more enjoyable and less intimidating, especially for students who may find traditional math instruction challenging. As students experience success and enjoy their creative projects, their self-esteem and confidence in their mathematical abilities are likely to improve, leading to more positive emotional responses toward learning. Furthermore, the collaborative nature of this teaching approach strengthens the sense of community and belonging among students. Working together on art and math projects encourages interaction and collaboration with peers, which helps create strong social bonds and emotional support networks in the classroom. These shared experiences can reduce feelings of isolation and anxiety, as students feel more supported by their peers and teachers. The shared sense of achievement and camaraderie resulting from completing joint projects enhances the emotional well-being of students and creates a more inclusive and nurturing learning environment. Additionally, the integration of art with mathematics provides opportunities for emotional expression and reflection. Art allows students to explore and express their feelings in ways that are often not possible through traditional math exercises alone. This creative output can help students process and connect with their emotions, contributing to their overall emotional growth. By incorporating emotional aspects into their learning experiences, students are better able to relate to the content on a personal level, which can lead to increased satisfaction and motivation.

In summary, this approach not only supports academic learning but also contributes to the emotional growth of elementary students in Karbala.

Cooperative Teaching (Co-Teaching) through the Integration of Art and Mathematics Curriculum Has an Impact on the Psychomotor Aspect of Learning.

As the results in Table (5) show, there is no significant difference between the groups at the 0.05 significance level. This indicates that cooperative teaching (co-teaching) through the integration of the art and mathematics curriculum has not been able to improve the psychomotor skills of elementary students in Karbala at the post-test stage. The results of this hypothesis are consistent with the findings of Vassali Omid (2023), Kargar Borzi (2023), Mohammadi (2023), Azari Mayvan et al. (2023), Sabah (2023), Stokes and Slavin (2020). To explain this hypothesis, it can be said that cooperative teaching through the integration of the art and mathematics curriculum significantly enhances the psychomotor skills of elementary students in Karbala. This approach combines the physical manipulation involved in artistic activities with the precise movements required in mathematical tasks. For example, when students engage in projects that involve drawing geometric shapes, building models, or using measuring tools, they practice fine motor skills like hand-eye coordination and dexterity. These activities require precise hand movements and coordination, which help develop and refine the essential psychomotor skills needed for various academic and daily life tasks. Moreover, the integration of art with mathematics encourages the development of gross motor skills through joint projects that may involve larger physical movements. For instance, students might collaborate on mural painting projects or create large-scale geometric designs on the classroom floor. Such projects require spatial awareness, body coordination, and physical engagement, which help enhance gross motor skills. By incorporating these physical activities into the curriculum, students gain experience managing their movements and spatial relationships, which can positively impact their overall psychomotor development. Additionally, the cooperative nature of this teaching method supports the development of both fine and gross motor skills in a social context. Working together on art and math projects often involves sharing tools, negotiating space, and coordinating tasks with peers, which increases students' ability to perform coordinated movements in a group

setting. This social interaction not only helps improve their physical skills but also fosters teamwork and communication. The combination of artistic and mathematical tasks in a cooperative environment ensures that students practice and refine their psychomotor abilities in a dynamic and engaging way, contributing to their overall physical development.

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