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# Effect of a Proposed Educational Program for Popular Games on the Development of Cognitive-Motor Abilities and Deductive Thinking Among Primary School Students in Nineveh Governorate

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**ABSTRACT**
This study aimed to investigate the impact of an educational program based on traditional popular games on the development of cognitive-motor skills and deductive reasoning among primary school students in Nineveh Governorate. The research population consisted of fourth-grade students at Al-Hadhara School for Boys during the 2024–2025 academic year. A random sample of 80 students was selected, with Class C as the experimental group and Class D as the control group. Both groups were statistically equivalent and homogeneous across key variables to ensure experimental validity. The study employed an experimental method using an equivalent-groups design with pre- and post-testing over an eight-week intervention. The educational program included various traditional games, exercises, and activities derived from local popular games. The findings indicated that the program significantly enhanced the cognitive-motor skills and deductive reasoning of students in the experimental group, while the control group following the traditional curriculum showed no significant improvement. These results suggest that structured programs incorporating culturally relevant popular games can effectively promote both motor and cognitive development in primary school children.

**Keywords:** Effect, Educational Program, Popular Games, Abilities, School Students



## INTRODUCTION

Popular games represent an integral part of a nation's historical and cultural heritage, drawing the interest of both governmental and non-governmental organizations committed to their preservation and development due to their deep connection with cultural identity. These games reflect the values, customs, and way of life of the communities that practice them, as seen through the types of games played, the tools involved, the manner of play, the gender of participants, and the environments where the games take place. Often considered one of the earliest forms of human activity in childhood, traditional games serve as a mirror of early life experiences and embody elements of everyday living that are present across all societies. They illustrate the characteristics of their cultural environment, including local traditions, natural surroundings, and social systems, while maintaining a simplicity that resonates with children's imagination and joy (Alves, 2011).

In her 2013 study, Linaza explored how traditional folk games could be integrated with digital technology to promote physical activity and play, using well-known sports figures as inspirational role models for children (Linaza et al., 2013). This approach bridges the past and present, helping to preserve cultural heritage while adapting to modern contexts. Popular games can be categorized based on several factors, including gender specificity (games for boys, girls, or both), the age group of the participants, and the preferred playing environment (Homer et al., 2012). These aspects reflect the importance of privacy, cultural values, and social norms within the community. In many cases, traditional games are characterized by clear organization, child-led management, and a system of self-regulation among the participants. The initiation of play often begins with simple selection methods such as drawing lots, tossing stones or coins (either local or foreign), or other informal approaches like foot placement (Smith, 2009). Furthermore, popular traditional games play an important role in improving sensorimotor development and are sometimes considered more effective than conventional sports activities in supporting children’s motor and cognitive growth (Saefullah et al., 2024; Tomporowski et al., 2015).

In recent years, the demand for innovative teaching methods has grown in modern societies, as traditional customs and outdated educational practices are no longer adequate to meet current needs. The advent of the communication revolution has effectively transformed the world into a global village, underscoring the importance of teaching critical and creative thinking as an essential skill for individual success and adaptation (Jefferson & Anderson, 2017). This study gains significance from its alignment with the increasing focus on the concept of thinking its types, processes, development strategies, and its influence on learners' lives. Thinking distinguishes human beings from other creatures, serving as a hallmark of rational response in challenging situations.

Although various studies have explored human cognition and thinking, several aspects still require further examination and reflection. Accurate perception is crucial for understanding scientific phenomena and uncovering their underlying principles, playing a vital role in both practical and academic aspects of life. It also contributes to numerous educational and psychological processes. Experts in child development have long acknowledged the significance of motor perception in the healthy development of primary school children. Motor perception is a psychological process that enables the individual to interpret and prepare responses to environmental stimuli such as speed, strength, and movement whether in a static or dynamic setting through sensory input (Warren, 2006).

Motor perception is fundamental to a child’s normal development and has attracted considerable attention from educators, psychologists, and physical education specialists because of its important role in enhancing mental functions through motor activity. Educational programs designed to develop motor perception have been shown to significantly improve children’s abilities, particularly at the preparatory education level, as evidenced by comparisons between pre- and post-intervention measurements (Goodwin, 2015). Furthermore, scholars in education, psychology, and child development widely acknowledge that physical activity plays a crucial role in supporting cognitive development by helping children understand relationships and patterns within their surrounding environment (Bidzan-Bluma & Lipowska, 2018; Tomporowski et al., 2015).

The absence of motor perception experiences during early childhood can delay the development of motor skills and limit children's ability to understand themselves and their environment, which may ultimately hinder cognitive development (Thelen & Smith, 1994). The interaction between perception and movement plays an essential role in developing motor perception, a process that can be effectively supported through well-designed educational programs (Robinson et al., 2012). Traditional popular games represent one of the earliest forms of children's activities and reflect the cultural heritage and social life of communities. These games are deeply rooted in the history of societies and portray their customs, traditions, and environmental values in a form that is engaging and meaningful for children (Marsh, 2008).

Thinking is a cognitive activity that operates through the use of symbols, allowing individuals to represent objects, people, situations, and events indirectly. It involves a wide range of mental processes such as perception, memory, imagination, and daydreaming, as well as more complex processes including judgment, comprehension, inference, reasoning, generalization, planning, and critical evaluation (Abraham, 2016). Through these processes, thinking can appear in many forms, ranging from scientific problem-solving to imaginative exploration and creative visualization.

Among the different forms of thinking, deductive reasoning has historically received significant attention from philosophers and logicians because it represents a systematic and organized method of reasoning. Deductive reasoning is often considered a refined cognitive process that helps individuals reach logical conclusions and avoid reasoning errors. The emphasis placed on deductive reasoning does not diminish the importance of other forms of thinking; rather, it highlights the critical role that deduction plays in discovering truth and advancing knowledge (Evans & Over, 2013).

Deductive reasoning typically consists of three main components: premises, a conclusion derived from those premises, and a logical relationship that connects them. Although deductive reasoning was once believed to be primarily innate, research shows that it develops through the interaction of biological maturation and accumulated experiences. During early childhood, deductive thinking begins with simple sensory experiences and gradually evolves into more complex reasoning abilities as children grow and gain knowledge (Goswami, 2010). This developmental perspective is supported by research demonstrating that structured educational programs can significantly improve reasoning abilities among fourth-grade students, as shown by the higher performance of the experimental group compared to the control group(Sternberg et al., 2006).

This research is significant as it provides empirical evidence on the educational value of integrating local popular games into formal learning environments. By targeting primary school students in Nineveh Governorate, the study addresses a critical stage of cognitive and motor development. The use of an experimental design with pre- and post-testing ensures the reliability of its findings.

According to Lowther, one of the most effective ways to enhance perception involves increasing perceptual speed and utilizing shortcut techniques. He categorizes the components of motor perception into several key activities, including balance, agility, locomotor movements, hand-eye coordination, shape recognition, visual tracking of moving objects, and foundational experiences that help children gain control over their bodies. These experiences also involve recognizing body positions, understanding the relationship between different body parts, and forming logical associations between the body and external objects (Johnson, 2008).

Recognizing that popular games reflect the essence of childhood and mirror the cultural and social fabric of every community, researchers have been motivated to explore the use of these games in developing motor and cognitive skills among primary school children. These games, being both enjoyable and engaging for children, serve as an ideal medium for enhancing such abilities. The aim was also to assess the impact of a specially designed program incorporating these games on the development of deductive thinking. Since deductive thinking evolves through the interaction of maturation and experience, and relies heavily on sensory processing especially in this developmental stage popular games were seen as a natural and effective tool for fostering this cognitive growth.

The objectives of this research are to examine the effectiveness of the proposed program in developing the cognitive and motor skills of primary school children and to assess its impact on the development of deductive thinking. The research hypothesizes that there are significant differences between the pre-test and post-test results in cognitive and motor skills assessments, with improved performance in the post-test, and significant differences in the deductive reasoning scale favoring the post-test results. The research fields include the human field, consisting of students from Al-Hadara Boys' School; the spatial field, conducted at Al-Hadara Boys' Primary School in Mosul; and the temporal field, which took place during the first semester of the 2024–2025 academic year.

## METHODS

This study employed an experimental research method to examine the effectiveness of a proposed popular-games program in improving perceptual-motor abilities and deductive reasoning among primary school students. The experimental design used two groups, namely an experimental group and a control group, with a pre-test and post-test design. The experimental group received the learning program using traditional popular games, while the control group followed the conventional learning approach. The structure of the experimental design used in this study is presented in Table 1.

The research sample consisted of 80 fourth-grade students randomly selected from Al-Hadhara Boys' Primary School in Mosul during the 2024–2025 academic year. The participants were divided into two groups: 42 students in the experimental group and 38 students in the control group. To ensure the validity of the experiment, both groups were tested for equivalence based on several demographic variables, including age (months), height (cm), and weight (kg). The equivalence test results indicated that there were no statistically significant differences between the two groups. The comparison of these demographic variables is presented in Table 1.

Table 1. Comparison arithmetic mean, standard deviation, and t-test value of demographic variables between the experimental and control groups.

| Variables | Experimental Group | Control Group | Calculated t-value | Significance Level |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| Age (months) | 122 ± 1.61 | 121 ± 1.72 | 1.48 | 0.05 |
| Height (cm) | 134 ± 1.81 | 133 ± 1.67 | | |
| Weight (kg) | 32.5 ± 2.04 | 34 ± 1.92 | | |

* The tabular t-value is 1.99 at a significance level of 0.05 with 78 degrees of freedom.

In addition, the equivalence of the two groups was also examined in terms of motor perception ability using the Nelson Perceptual-Motor Test during the pre-test stage. The results indicated that there were no statistically significant differences between the experimental and control groups, confirming that both groups had similar initial abilities before the intervention. The results of this comparison are presented in Table 2.

Table 2. Comparison of students' scores on the Nelson perceptual-motor test for the pretest between the experimental and control groups.

| Variable | Experimental Group (Mean ± SD) | Control Group (Mean ± SD) | Calculated t-value | Significance Level |
|---|---|---|---|---|
| Motor Perception (sec) | 39.6 ± 3.71 | 37.8 ± 4.16 | 1.82 | 0.05 |

* The tabular t-value is 1.99 at a significance level of 0.05 with 78 degrees of freedom.

Several instruments were used in this study to collect data related to perceptual-motor skills and deductive reasoning. The first instrument was Nelson's Perceptual-Motor Test, which measures various components such as eye-foot coordination, spatial perception, shape recognition, eye-hand coordination, balance, agility, and transitional movements. The second instrument used in this study was the Deductive Reasoning Scale designed to measure deductive thinking abilities among primary school students (Józsa et al., 2024). Both instruments were reviewed by experts to ensure content validity, while reliability testing was conducted using a test-retest method on a pilot sample of students, producing reliability coefficients of 0.81 for the perceptual-motor test and 0.84 for the deductive reasoning scale.

Data collection was conducted through several stages. First, an exploratory study was carried out on 10 students outside the main research sample to ensure the feasibility of the research procedures and the clarity of the program activities. Afterward, pre-tests were administered to both the experimental and control groups to measure baseline levels of perceptual-motor ability and deductive reasoning. The experimental group then participated in the popular-games program for eight weeks, consisting of 16 sessions (two sessions per week), with each session lasting 40 minutes. Meanwhile, the control group followed the traditional teaching method. After the intervention period was completed, post-tests were conducted under the same conditions as the pre-tests to measure changes in students' abilities.

Table 3. Structure of the instructional session for experimental and control groups

| **Group** | **Pretest** | **Intervention** | **Posttest** | **Measurement** |
|---|---|---|---|---|
| Experimental Group | Nelson Perceptual -Motor Test Inductive Thinking Test | Proposed Program Using Traditional Popular Games | Nelson Perceptual-Motor Test Inductive Thinking Test | Difference between pre- and post-test scores (for each) |
| Control Group | Nelson Perceptual -Motor Test Inductive Thinking Test | Traditional Method | Nelson Perceptual-Motor Test Inductive Thinking Test | Difference between pre- and post-test scores (for each) |

The collected data were analyzed using several statistical techniques. These included descriptive statistics, such as the arithmetic mean and standard deviation, to describe the data distribution. To examine the differences between pre-test and post-test results within groups, the paired sample t-test was used. Meanwhile, the independent sample t-test was applied to compare the differences between the experimental and control groups. In addition, percentage analysis was used to support the interpretation of results. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS).

## RESULTS AND DISCUSSION

The results related to motor perception are presented in Tables 4, 5, and 6. These tables describe the statistical analysis of the pre-test and post-test scores for both the experimental and control groups using the Nelson Perceptual-Motor Test.

The analysis of the experimental group indicates a clear improvement in motor perception scores between the pre-test and post-test. The mean score increased from 39.6 ± 3.71 in the pre-test to 43.2 ± 2.17 in the post-test. The calculated t-value was 2.94, which is greater than the tabular t-value of 2.02 at the 0.05 significance level with 40 degrees of freedom, indicating that the improvement is statistically significant.

Table 4. Statistical indicators for the pre-test and post-test of motor perception for students in the experimental group.

| Statistical Indicators / Variable | Pre-Test | Post-Test | Calculated t-Value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| Motor Perception | 39.6 ± 3.71 | 43.2 ± 2.17 | 2.94* |

* The tabular t-value is 2.02 at a significance level of 0.05 with 40 degrees of freedom.

In contrast, the results of the control group show only a slight improvement between the pre-test and post-test scores. The mean score increased from 37.8 ± 4.16 to 39.4 ± 3.23, with a calculated t-value of 1.98, which is close to but does not exceed the tabular t-value of 2.02 at the 0.05 significance level with 36 degrees of freedom. This indicates that the improvement in the control group was not statistically significant.

Table 5. Statistical indicators for the pre-test and post-test of motor perception for students in the control group.

| Statistical Indicators / Variable | Pre-Test | Post-Test | Calculated t-Value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| Motor Perception | 37.8 ± 4.16 | 39.4 ± 3.23 | 1.98* |

* The tabular t-value is 2.02 at a significance level of 0.05 with 36 degrees of freedom.

Furthermore, when comparing the post-test scores of the experimental group with those of the control group, the results demonstrate that the experimental group achieved higher performance in motor perception. The experimental group obtained a mean score of 43.2 ± 2.17, while the control group achieved 39.4 ± 3.23. The calculated t-value indicates that the difference between the two groups is statistically significant at the 0.05 significance level, confirming that the intervention had a measurable effect on students' motor perception abilities.

Table 6. Significance of differences between the post-test scores of motor perception for the experimental and control groups.

| Statistical Indicators | Experimental Group | Control Group | Calculated t-Value |
|---|---|---|---|

| Variable | Mean ± SD | Mean ± SD | |
|---|---|---|---|
| Motor Perception | 43.2 ± 2.17 | 39.4 ± 3.23 | 1.98* |

* The tabular t-value is 1.99 at a significance level of 0.05 with 78 degrees of freedom

The results related to deductive reasoning are presented in Tables 7, 8, and 9. These results were obtained using the Deductive Reasoning Scale applied during both the pre-test and post-test stages.

The analysis of the experimental group shows a substantial improvement in deductive reasoning ability after the implementation of the popular-games program. The mean score increased from 29.31 ± 1.32 in the pre-test to 34.06 ± 1.16 in the post-test. The calculated t-value was 2.53, which exceeds the tabular value of 2.03 at the 0.05 significance level with 36 degrees of freedom, indicating a statistically significant difference.

Table 7. Statistical indicators for the pre-test and post-test of deductive reasoning for students in the experimental group.

| Statistical Indicators / Variable | Pre-Test | Post-Test | Calculated t-Value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| Deductive Reasoning | 29.31 ± 1.32 | 34.06 ± 1.16 | 2.53* |

* The tabular t-value is 2.03 at a significance level of 0.05 with 36 degrees of freedom.

For the control group, the results reveal only minor improvements between the pre-test and post-test. The mean score increased from 27.20 ± 1.61 to 29.41 ± 1.23, with a calculated t-value of 1.81, which is lower than the tabular t-value of 2.02 at the 0.05 significance level with 40 degrees of freedom. This suggests that the traditional teaching approach had limited influence on the development of students' deductive reasoning abilities.

Table 8. Statistical indicators for the pre-test and post-test of deductive reasoning for students in the control group.

| Statistical Indicators / Variable | Pre-Test | Post-Test | Calculated t-Value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| Deductive Reasoning | 27.20 ± 1.61 | 29.41 ± 1.23 | 1.81* |

* The tabular t-value is 2.02 at a significance level of 0.05 with 40 degrees of freedom

A comparison of the post-test scores between the experimental and control groups further confirms the effectiveness of the intervention. The experimental group achieved a mean score of 34.06 ± 1.16, while the control group obtained 29.41 ± 1.23. The calculated t-value of 2.73 is greater than the tabular value of 1.99 at the 0.05 significance level with 78 degrees of freedom, indicating a statistically significant difference between the two groups.

Table 9. Significance of differences between the post-test scores of deductive reasoning for the experimental and control groups.

| Statistical Indicators / Variable | Experimental Group | Control Group | Calculated t-Value |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | |
| Deductive Reasoning | 29.41 ± 1.23 | 34.06 ± 1.16 | 2.73* |

* The tabular t-value is 1.99 at a significance level of 0.05 with 78 degrees of freedom.

The results presented in Tables 4 and 6 demonstrate that the experimental group experienced significant improvements in motor perception compared to both their pre-test scores and the post-test results of the control group. These findings indicate that the proposed popular-games program was effective in improving the perceptual-motor abilities of primary school students as measured by the Nelson Perceptual-Motor Test.

These results are consistent with previous studies indicating that physical education programs designed with cognitive and educational objectives can contribute significantly to the development of children’s perceptual-motor abilities. Physical education activities that integrate movement and cognitive processes provide opportunities for children to enhance coordination, balance, and spatial awareness through active participation in structured learning environments (Bao, 2024; Tomporowski et al., 2015).

Furthermore, activities involving eye–hand coordination, agility, balance, and transitional movements such as walking, running, jumping, crawling, and sprinting play an essential role in improving sensorimotor awareness. These types of movements stimulate both physical and cognitive engagement, which supports the development of perceptual-motor skills in children. The popular games program implemented in this study included many of these movement patterns, which likely contributed to the improvement observed in students’ perceptual-motor performance (Wuang et al., 2021).

In addition, the findings are consistent with several previous studies that highlight the importance of effective teaching strategies in promoting student engagement and active participation in learning activities. Teaching approaches that encourage students to participate actively and stimulate their interest in physical activities are more likely to achieve educational objectives and improve motor and cognitive outcomes among learners (Ennis, 2011).

The researchers attribute the positive outcomes observed in the experimental group to the design of the popular-games program. The program included a variety of natural motor activities such as running, relay races, jumping, crawling, and dribbling, all of which promote transitional motor skills. These activities also required students to maintain balance, control body movements, and respond quickly to environmental stimuli.

Furthermore, the program incorporated ball games that stimulated eye hand and eye foot coordination, which are fundamental components of perceptual-motor development. These activities required students to track moving objects, adjust their movements accordingly, and maintain spatial awareness, thereby supporting the development of coordination and motor control. Previous studies have similarly confirmed that structured physical activity programs can effectively enhance perceptual-motor abilities among primary school students (Azar et al., 2023; Johnstone & Ramon, 2011)

In contrast, the control group did not show significant improvement in motor perception, as indicated in Table 5. This finding suggests that the traditional instructional method used in the control group lacked sufficient motor rich activities and interactive experiences necessary for improving perceptual-motor skills.

Overall, the results confirm the research hypothesis that the popular games-based program has a positive effect on the perceptual-motor abilities of fourth-grade students.

The results presented in Tables 7 and 9 indicate that the experimental group demonstrated significant improvements in deductive reasoning ability compared to both their pre-test scores and the post-test scores of the control group. These findings suggest that the proposed popular-games program not only improved motor skills but also contributed to the development of students' cognitive abilities, particularly deductive reasoning.

One factor that may explain this improvement is the incorporation of diverse group games in the experimental program. Many of these activities required students to analyze situations, make quick decisions, and apply logical thinking while performing physical movements. In contrast, the control group followed a traditional teaching method that provided fewer opportunities for cognitive engagement during physical activities.

According to Tudge & Rogoff (2014), cognitive development is influenced by four main factors: maturation, experience, social interaction, and equilibrium. Since both groups in the present study were similar in age and physical characteristics, the differences in deductive reasoning development can likely be attributed to the learning experiences and social interactions provided through the popular-games program.

Another important factor is the relationship between movement and cognitive processing. During the implementation of the games, students in the experimental group were required to identify patterns, predict outcomes, and apply logical reasoning while performing various physical activities. This process encouraged the development of deductive reasoning skills, as students learned to connect cognitive understanding with motor actions and experiential learning. When learners actively discover relationships and patterns through direct experience, they tend to develop deeper understanding and stronger memory retention, which ultimately supports the improvement of reasoning abilities (Jensen & Nickelsen, 2008).

The findings of the present study therefore suggest that integrating educational games and movement-based activities into physical education programs can contribute to both cognitive and motor development. The combination of physical engagement, problem-solving, and social interaction creates a learning environment that supports the development of higher-order thinking skills among primary school students.

Overall, the results confirm that the popular-games educational program had a significant positive effect on the development of deductive reasoning skills among fourth-grade students.

## CONCLUSIONS

The findings of this study indicate that the proposed folk games program was effective in improving both cognitive-motor abilities and deductive reasoning skills among fourth-grade primary school students. The experimental group demonstrated significant improvements in motor perception and deductive reasoning in the post-test compared to the pre-test results and the control group. These results suggest that integrating structured folk games into physical education can enhance students' coordination, balance, spatial awareness, and cognitive processing through active and engaging learning experiences. In contrast, the traditional instructional program implemented in the control group did not produce significant improvements in either cognitive-motor abilities or deductive reasoning skills among students.

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