Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.15, No.11, 2024

Unveiling the Impact of Teaching Mathematics through Motor Games on Self-Esteem and Motivation among Iranian Preadolescent Students

Narges Ahmadi (Corresponding author)
MA in Educational Leadership, Islamic Azad University, Damavand, Iran
Tel: +989359576511 E-mail: Nargesahmadi1979@gmail.com

Solmaz Asem
MA in TEFL (Teaching English as a Foreign Language), Islamic Azad University, Urmia, Iran
Tel: +989143418183 E-mail: Solmaz_asem@hotmail.com

Abstract

Recent studies in the field of education have indicated that childhood is an important era of one's life and it is imperative that meticulous scrutiny is applied to children's development. The consensus of studies is that performing motion activities can be one technique to boost children's intellect and cognition. Therefore, the current study was an attempt to explore if the integration of motor games into the learning process of children can contribute to their self-esteem and motivation with respect to the mathematics course. To this end, a total of 60 nine-year-old third-year elementary school students educating at Matin Elementary School were chosen as the sample size using the convenience sampling method. The participants were divided by experimental and control groups, and treatments were provided pertaining to each group. With the goal of procuring data from the study participants, Self-esteem Inventory developed by Coopersmith (1990) and HEMS questionnaire developed by Harter (1981) were utilized as instruments for pretest and posttest procedures. Based on the statistical findings derived from independent samples t-test and ANOVA, it was established that motor games have a significant positive effect on the self-esteem of Iranian Elementary School students concerning their mathematics course learning. Likewise, it was found that motor games have a significant positive impact on the motivation of Iranian Elementary School students concerning their mathematics course learning.

Keywords: Motor Games, Self-esteem, Motivation

DOI: 10.7176/JEP/15-11-10
Publication date: October 30th 2024

1. Introduction

Childhood is increasingly recognized as an important component of one's life as it maintains ties with different cognitive, behavioral, and emotional psychological fields. Children have been thought to benefit from getting acquainted with a variety of concepts and pathways based on which they can experience development. Thereafter, they frequently engage in contexts in which they need to be curious, egocentric, and active. Accordingly, there should be opportunities for children which evoke levels of incentive so that they can actively seek, make choices, express opinions, and experience themselves. One way is to assign physical activities which are mainly designed and presented to assist children get a positive impact, learn how to interact with the environment and peers, and prepare for their future lives (Radmiri & Yaswinda, 2020).

The use of movement-physical activities of children has been emphasized by Carson, Hesketh, Rhodes, Rinaldi, Rodgers, and Spence (2017) stating that when children acknowledge the integration of these types of activities, they are more prone to benefit from physical, social, emotional, and cognitive development, and are also less likely to experience chronic diseases when they become adults. Henceforth, Prapajit (2014) posits that when it comes to bringing excitement to the learning environment, using game-related activities becomes an essential component of successful learning. These activities also pave the way for children and teachers to interact in a fun atmosphere, yielding positive effects on children's prolonged development (Ashari, Kosnin, & Jiar, 2013). Following this, studies have buttressed the substantial significance of the physical activities as regards the academic achievement (Diamond & Ling, 2016; Donnelly, Hillman, Castelli, Etnier, Lee, Tomporowski, &

Szabo-Reed, 2016; Hillman, Erickson, & Kramer, 2008; Tomporowski, McCullick, Pendleton, & Pesce, 2015). A comprehensive review of literature also represents that the notion of physical activities can escalate children's motor skills through its qualitative characteristics (Diamnod, 2015; Pesce, 2012). Such a development will in effect ameliorate the cognition and academic measures (Lopes, Santos, Pereira, & Lopes, 2013).

Another privilege offered by performing the physical/ motor activities has been addressed by Ramdiri and Yaswinda (2021) who argued that adhering to the practices of physical activities aids students not only with learning new items but also with their physical health quality, including the heart, lungs, circulation system, growth of hormone, immune system, and alike. As physical activities are intimately associated to motor skills, it is believed that teachers are responsible for developing the skills in this regard so that children are enthusiast to perform physical activities and be prepared for balance and agility (Sujiono, 2015). The study of Manzilatur and Astini (2015) also revealed that children's motoric development is strongly tied to the environmental factors. It establishes the understanding that if there is sufficient exposure of stimuli in the environment, one can expect the development of motor skills, and in case the environment and its factors do not fulfill children's need, it is implausible that children demonstrate degrees of active movements, thus slowing down the motor development. Therefore, the extent to which children are enthusiast or reluctant to resort to the afore-mentioned activities can be ascertained through their motivation.

Motivation serves as a determining factor toward establishing abundant rooms to attain the goals, particularly in the field of education. The concept of motivation has been grounded on Maslow's theory, which demonstrates that there are different levels by which a person's works or behaviors can be expected. Putting into simpler terms, as the needs of one level is fulfilled, the other needs pertaining to upper levels will subsequently emerge up to the saturation of satisfaction in all needs levels. What is known about the needs involved in these categories is largely based upon empirical the study that represented physical needs, sense of belonging, respect from others, and on the top, the notion of motivation as aspects to be given the highest attention (Radmiri & Yaswinda, 2020). Motivation has been increasingly recognized as an element that encourages justification of one's steps toward the desired path. Motivation has been thought as the energy level, and when accompanied by effective encouragement, it can double the probability of reaching goals. Forthwith, it is safe to claim that motivation is a response to a stimuli and emerges as a reaction to an action. There is a broad consensus of opinion regarding the notion of motivation which states that when learning context is well furnished with elements that provoke motivation, children find it easier to engage themselves in vivid tasks given to them and better cope with the learning context in which motor games are presented. In effect, children are more willing to express themselves practically (Radmini & Yaswinda, 2020).

Researchers have also found out that children attempt to make evaluations about the self and capabilities when being exposed to new learning situations, explicitly the ones managed by game-based instructions. As an illustration, when students have high levels of self-esteem, they feel more confident to perform the assignments and become the member of groups since they identify that they can achieve their targets and thrive in learning. To demonstrate, since the concept of self-esteem has roots in social cognitive theory, it can be asserted that in the context of learning where there are methods of instruction such as the motor-based activities, students need to be assured of their skills and potentials in a way that they fully understand the activities and accomplish them flawlessly. Henceforth, mastering the physical activities can trigger both child's self-esteem and his/her future success. In this regard, Fox (2000) establishes that it is somehow ambiguous how self-esteem can influence child's developmental status due to the fact that the components of physical self-concept follow a changing trend and are in a transformative process throughout the child and adolescent phases. When children feel independent and potent, it fosters their cognitive and affective behavior, leading to increased self-esteem. This implies that students who possess levels of self-esteem are more prone to reach their determined goals (Valentini, Troiano, & Balzano, 2012).

With respect to what discussed earlier in this context, one can argue that children encounter challenges when dealing with educational context. They need to stipulate about their incentives to learn, consider their own skills and potentials, establish relationship with their peers, cope with learning new items, and present themselves in the learning context in a way to be well acknowledged by their teachers and peers. One of the areas of education that is still challenging for children is learning mathematics. It is a science encompassing the logic and quantitative estimations, the development of which shapes the basis for technology expansion and is essential for the current life. Learning the concepts of mathematics familiarizes students with the concepts and associations existed among them (Metikasari Mardiyana, & Triyanto 2019). Studies have represented that students gradually become reluctant when being exposed to the mathematics course. They need to be motivated, hard-working, self-confident, and persistent so as to be successful in learning mathematics (Atashrooz, Naderi, Pasha, Eftekhar, & Asgari, 2017). The problem is that students hold negative attitudes toward the understanding of mathematics concepts, which results in slower rate of learning (Colomeischi & Colomeischi, 2015).

To overcome the challenges of learning mathematics, researchers have suggested the implementation of new strategies, such as integrating the motor-based activities, games, and physical activities into the learning process. It is believed that teaching mathematics through playing games can help children retain the knowledge and get motivated (Yarmohamadi & Bahrami, R. 2013). Also, it has been proved that one of the best methods for fostering mathematics learning is to address the games which fulfill the interest of children. Optimal use of games can be a safe way for transferring the instructional messages directly or indirectly, can deepen the understanding of responsibility-taking, and develop the motor-based skills (Hamidian, Rezaeian, & Hagigat, 2011). However, executing motor-based activities concerning its effectiveness on children's motivation has remained contentious and not fully covered in previous studies. Also, far too little attention has been paid to the role of motor games on students' self-esteem, particularly when they are in their early ages. In addition, previous studies suffer from making analysis on the integration of motor-based activities into the course of mathematics, which persists as a major problem among the children. Consequently, the current study was developed to identify the impact of teaching mathematics through motor games on self-esteem and academic motivation, which to the best knowledge of the researcher, has not been addressed in previous studies. Thus, the current paper sought to answer the following research questions:

RQ_1: Does performing motor games have any significant effect on motivation among Iranian elementary school students with respect to motor games?

RQ_2: Does performing motor games have any significant effect on self-esteem among Iranian elementary school students with respect to motor games?

2. Materials and Methods

2.1 Design

This study utilized a quasi-experimental design to investigate the effect of implementing motor games on motivation and self-esteem among Iranian elementary students concerning their mathematics course. The study employed a pretest posttest procedure for data collection. The participants were randomly assigned into two groups, namely an experimental group and a control group. The experimental group received intervention in the form of motor games, while the control group did not receive any intervention during the study period. Prior to implementing motor games, both groups completed pretests to measure their baseline levels of motivation and self-esteem using validated questionnaires related to their mathematics course. After five weeks of intervention, both groups completed posttests using the same questionnaires.

2.2 Participants

Subjects of the study who enrolled in the study and took part in the treatment sessions were categorized by 60 nine-year-old third-year elementary school students who educated at Matin Elementary School and were chosen using the convenience sampling method. Based on the purpose of the study, respondents were divided by experimental group and control group. The experimental group received the motor game performing while the control group received the conventional method of instruction.

2.3 Instruments

Since the objective of the current study was to unleash the feasible effect of teaching mathematics through motor games on motivation and self-esteem among Iranian third year elementary school students, the researcher relied on the execution of treatment sessions and administration of standard questionnaires to collect the data from participants. Accordingly, Harter's (1981) HEMS questionnaire, which includes 33 items and follows Likert five-scale design (1=never, 2= often, 3= sometimes, 4= usually, 5= always), was used to collect the data to gauge students' motivation. The reliability of this questionnaire was estimated as 0.82 using Cronbach alpha coefficient and the validity was obtained through the face validity. In addition, Coopersmith's (1990)'s Self-esteem Inventory was integrated in the data collection process, which involves 58 items, and to accommodate the purpose and participants of the current study, eight items of this questionnaire were extracted and distributed as the main questionnaire to measure the self-esteem variable. Participants chose "like me" or "not like me" to represent their viewpoints. Referring to Cronbach alpha coefficient, the reliability of the questionnaire was measured as 0.77. What is more, the validity was obtained through the face validity. After running ten sessions of treatment, the same questionnaires were distributed among the participants in order to elicit their responses

and considered as the posttest. Table 1 represents the reliability values for the instruments used in the current research work.

2.4 Procedure

Having assigned the participants to experimental group (performing the motor games) plus one control group (the conventional method of teaching), the researcher initiated the treatment sessions for five weeks. Aiming to initiate the game which was based on working with the multiplying chart, participants were positioned in three groups of 10 people, and care was given to the synergic-interplay considerations. To begin, 30 plastic wares were put on the floor, and on the other side students who were in queue were asked to count the number of their group to which they belonged. In so doing, they could their group members from 1 to 10. Then, each student was asked to pick up three wares up to the last student in the same group. Having ensured that the ten members of the group picked up their wares, then they were asked to put their wares on the floor one after another so that all wares were put on the floor on top of each other. In so doing, they understood the generalities of "add" and "multiplying".

3. Results and Discussion

To answer the research questions, the first step was to determine if the variables followed a normal or non-normal distribution. Therefore, Kolmogorov-Smirnov test was conducted to assess the normality of data distribution, which is illustrated in Table 2.

As Table 2 suggests, the significance levels of the K-S test (P-value > 0.05), which manifests that variables studied in the current research work are normally distributed. In order to make further analysis on the research questions, independent sample t-test was taken into consideration. Following is a representation of the analyses pertaining to the two research hypothesis. It is safe to state that the hypotheses were formulated on the basis of null and alternative, where the rejection of null hypothesis meant the acceptance of the alternative hypothesis, thus confirming the claim.

First Hypothesis)

Null Hypothesis: Performing motor games does not have any significant effect on motivation among Iranian elementary school students with respect to motor games.

Alternative Hypothesis: Performing motor games has a significant effect on motivation among Iranian elementary school students with respect to motor games.

As indicated earlier, independent samples T-test was performed to examine the first research hypothesis, the results of which are shown in Table 3.

As Table 3 represents, for both the pretest and posttest, there are two groups, namely Control and Experimental, each with 30 students. In the pretest, the mean motivation score for the Control group is 3.804 and for the Experimental group is 3.891. In the posttest, the mean motivation score for the Control group drops to 3.640, while the Experimental group increases notably to 4.155. However, meticulous examination is required to represent the differences statistically.

As shown in Table 4, initially, prior to the introduction of motor games, the motivation scores showed a minor difference between the groups. The Control group had a mean score of 3.804 (SD = 0.327), while the Experimental group recorded a mean of 3.891 (SD = 0.380).

Levene's test for equality of variances was not significant ($F = 0.678$, $p > 0.05$), indicating that the assumption of homogeneity of variances was met. Consequently, the t-test result for equal variances assumed was considered. This test revealed that the difference in scores between the two groups was not statistically significant ($t(30) = -0.595$, $p = 0.557$), suggesting comparable motivation levels for both groups at the beginning of the study.

After performing the motor games, the motivation scores diverged between the groups. The Control group's score decreased to a mean of 3.640 (SD = 0.381). In contrast, the Experimental group, having experienced motor games, displayed a notable increase in motivation with a mean score of 4.155 (SD = 0.213).

Levene's test for the post-intervention scores was significant ($F = 9.925$, $p = 0.005$), indicating a violation of the homogeneity of variances. Given this violation, we relied on the t-test result for unequal variances (or the result

labeled "equal variances not assumed"). This test confirmed a statistically significant difference between the groups ($t(17.260) = -4.085$, $p < 0.001$) with a confidence interval for the mean difference ranging from -0.780 to -0.249.

Our investigation offers compelling evidence for the beneficial impact of motor games on the motivation of Iranian elementary school students. Beginning with similar motivation levels, the post-intervention data vividly highlighted a pronounced increase in motivation for students who engaged with motor games. This underscores the potential value of motor games as an innovative educational strategy, particularly in the context of Iranian elementary education.

The one-way ANOVA for the pretest data revealed that the group difference was not statistically significant. The obtained $F(1, 28)$ value was 0.459. When compared to the critical F-value of 4.19597171 at $\alpha=0.05$, this result is not significant, suggesting that the p-value is greater than 0.05. Therefore, the pretest scores between the groups did not show a statistically significant difference. This means that both groups were relatively similar in their pretest scores, and any subsequent differences in the posttest could potentially be attributed to the performing motor games.

For the posttest data, the one-way ANOVA indicated a statistically significant group difference with an $F(1, 28)$ value of 21.5. This value is notably larger than the critical F-value of 4.19597171 at $\alpha=0.05$. Thus, the result is statistically significant at the 0.05 level, suggesting that the p-value is less than 0.05. Therefore, there was a significant difference in posttest scores between the groups. This finding suggests that the performing motor games have had an effect on the students' scores, as the scores were not significantly different before performing motor games.

One can conclude that while there was no significant difference between the groups in their pretest scores, a significant difference emerged in the posttest scores. This suggests that the performing motor games had a statistically significant effect on the scores of the groups.

Second Hypothesis)

Null Hypothesis: Performing motor games does not have any significant effect on self-esteem among Iranian elementary school students with respect to motor games.

Alternative Hypothesis: Performing motor games has a significant effect on self-esteem among Iranian elementary school students with respect to motor games.

Based on Table 6 and Table 7, the mean scores for self-esteem in the control group was 3.894 (SD = 0.339) and for the experimental group was 3.913 (SD = 0.392). An independent samples t-test was conducted to compare self-esteem scores for students in both groups.

Levene's Test for Equality of Variances indicated that the assumption of equal variances was met ($F = 0.789$, $p = 0.399$). Thus, the results from the "Equal variances assumed" row were used for interpretation. There was no statistically significant difference in self-esteem scores between students in the control and experimental groups at the pre-test stage ($t(30) = -0.203$, $p = 0.142$, two-tailed). The mean difference was -0.019 with a 95% confidence interval ranging from -0.161 to 0.123.

The mean self-esteem score for the control group was 3.710 (SD = 0.357) and for the experimental group was 4.206 (SD = 0.224). Another independent samples t-test was conducted to compare self-esteem scores in the post-test phase between the two groups.

The Levene's Test for Equality of Variances showed a significance of 0.002, indicating that the variances were not equal. Consequently, the results from the "Equal variances not assumed" row were utilized. There was a statistically significant difference in self-esteem scores between the control and experimental groups at the post-test stage ($t(24.890) = -6.595$, $p < 0.001$, two-tailed). The mean difference was -0.496 with a 95% confidence interval ranging from -0.645 to -0.347.

Based on the results, while there was no significant difference in self-esteem between the control and experimental groups during the pre-test, a significant difference emerged after the performing motor games in the post-test phase. This suggests that performing motor games have had a significant effect on increasing self-esteem among Iranian elementary school students in the experimental group compared to those in the control group.

As illustrated in Table 8, the one-way ANOVA conducted for the pretest data showed that there was no statistically significant difference between the groups. The calculated $F(1, 28)$ was 0.626. The associated p-value

was greater than 0.05, indicating that the difference in the means of the two groups was not statistically significant. Therefore, the pretest scores between the two groups were not statistically different. This confirms that both groups started on a similar baseline prior to the performing motor games, ensuring that any observed post- performing motor games differences are not due to pre-existing disparities.

The one-way ANOVA for the posttest data demonstrated a significant difference between the groups. The F(1, 28) value was 23.936. Given the associated p-value was less than 0.05, this result is statistically significant, pointing to a significant difference in the means of the posttest scores between the two groups. Therefore, the posttest scores exhibited a significant difference between the groups. Given that the groups were statistically similar in their pretest scores, this posttest difference is attributable to the performing motor games. The use of motor games seems to have positively influenced self-esteem among Iranian elementary school students.

In conclusion, the second hypothesis posited that motor games have a significant impact on self-esteem among Iranian elementary school students. The pretest scores did not differ between the groups, ensuring a comparable starting point. The posttest results, however, highlighted a significant effect of motor games on the self-esteem of the students. This aligns with the alternative hypothesis and suggests the potential benefits of incorporating motor games in educational settings, particularly for bolstering self-esteem.

4. Discussion

The purpose of this study was to gain a better understanding of the feasible influence of teaching mathematics through the motor games on Iranian elementary school students' motivation and self-esteem. Accordingly, findings of the first research question provide supporting evidence that presenting the mathematics subjects through executing the motor games can have positive effects on students' intention to take part in classroom activities, deal with their peers, learn in fun situations, and feel comfortable when establishing communication with others. Also, it was found that students feel less anxious when they encounter the mathematics problems, gain interest in solving the problems, and feel free to negotiate with their teachers concerning the problems. This finding strongly implies that when the context of learning is set in a way that students feel relaxed through running games and physical activities, and teachers create atmospheres in which students conceive themselves as potent to engage in various tasks and situations, students will be able to add to their current knowledge of mathematics in a much more enhanced matter and show enthusiasm toward learning new items. This idea is supported by Wastiau, Keaney and Berghe (2009) and Pierce (2013) who argued that performing the physical activities can increase the motivation of preschool children and it is needed to encourage students to explore new knowledge. In addition, the results of the study undertaken by Petkov and Rogers (2011) also confirm the finding of the current study in that motivation can give rise to one's behavior when it comes to presenting oneself and do something that is beneficial. Furthermore, Mahazir, Siti Khadijah, Ismail, Ismail, and Mohd Nordin (2019) concluded that activities include some elements that can boost children's enthusiasm for learning new concepts, which is consistent with the finding of the current study.

Another key finding of the present research was that using motor games have a positive impact on the self-esteem among Iranian elementary school students. The most compelling explanation for the present finding is that movement is an essential part of learning as it considerably influences the cognitive, emotional and relational factors. Also, when it comes to the field of education, this finding can be linked to the fact that incorporation of motor games will enable the children to attain their objectives and significant learning that will sustain their growth. Simply stating, higher levels of physical activities can lead to increased self-esteem, which is in line with the findings of the study performed by Valentinil, Troiano, and Balzano (2012). Also, this pattern of result is consistent with the previous literature, emphasizing that making use of moves and physical activities can add to the positive judgments of children about themselves, particularly when dealing with the mathematics course (Ericsson & Karlsson, 2011; Fotiadou, Christodoulou, Soulis, Vasileios , & Mousouli, 2014). Also, Kakavoulis (2008) suggests that participating in physical activities such as games can be beneficial for children's self-judgement, resulting in the fact that they get involved in peer groups and feel much more confident when dealing with difficult-to-manage situations such as solving the problems of mathematics, which is in line with the finding of the present research work.

5. Conclusions

Findings of the current study proved the effectiveness of teaching mathematics through motor games with respect to two concepts, namely motivation and self-esteem. Despite the limitations concerning the instruments used, design of the study, and the population, the present research contributes to a growing body of evidence suggesting that learning through play cultivates positive self-evaluation and incentive on the part of children

when they experience difficult-to-handle courses such as mathematics. Therefore, it is recommended that teachers and syllabus designers develop functional programs such as motor games and physical activities to teach difficult courses like mathematics in order to mitigate the number of obstacles children encounter while learning new items. Also, addressing self-esteem in elementary school is crucial as it lays the foundation for future academic success, social interactions, and personal development. By utilizing motor games as a means to promote self-esteem, educators can create a positive educational atmosphere that supports the holistic growth of students.

References

Ashari, Z., Kosnin, A., & Jiar, Y. (2013). The Effectiveness of Learning Through Play Module On The Understanding Of Number Concept Among Preschool Children. *Journal of Education and Practice, 27,* 198-206.

Atashrooz, B., Naderi, F., Pasha, R., Eftekhar, Z., & Asgari, P. (2018). The effect of expectation-value motivation paradigm on intrinsic and extrinsic academic motivation, educational occupation, and performance in Mathematics. *Quarterly of Child Psychology Health, 5*(2), 83-94.

Carson, V., Hesketh, K.D., Rhodes, R.E., Rinaldi., Rodgers, W., & Spence, J.C. (2017). Psychometric properties of a parental questionnaire for assessing correlates of toddlers' physical activity and sedentary behavior. *Measurement in Physical Education and Exercise Science, 21*(4), 190–200.

Colomeischi, A. A., Colomeischi, T. (2016). The students 'emotional life and their attitude toward mathematics learning. *Procedia - Social and Behavioral Sciences, 180*, 744–750.

Coopersmith, S. (1990). *Manual of Self-esteem Inventory*. Consulting Psychologist Press.

Diamond, A. (2015). Effects of Physical Exercise on Executive Functions: Going beyond Simply Moving to Moving with Thought. *Ann Sports Med Res, 2*(1), 1011–1015.

Diamond, A., Ling, D. S. (2016). Conclusions about interventions, programs, and approaches for improving executive functions that appear justified and those that, despite much hype, do not. *Developmental Cognitive Neuroscience, 12*, 34–48.

Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., & Szabo-Reed, A. N. (2016). Physical Activity, Fitness, Cognitive Function, and Academic Achievement in Children. *Medicine & Science in Sports & Exercise, 48*(6), 1197–1222.

Ericsson, I., Karlsson, M. (2010). Effects of Increased Physical activity and Motor training on Motor Skills and Self-esteem: An Intervention Study in School Years 1 through 9. *International Journal of Sport Psychology, 14,* 1-19.

Fotiadou, E., Christodoulou, P., Mousouli, M., & Soulis, S. (2015). Motor Development and Self-Esteem of Children and Adolescents with Visual Impairment. *Journal of Education and practice, 5*(37), 97-107.

Fox, K. R. (2000). Self-esteem, self-perceptions and exercise. *International Journal of Sport Psychology, 31*, 228-240.

Gasemian, H., Sohrabi, M., & Taheri, H. (2019). The effect of chosen physical activities on static and dynamic balance of children with special learning disorders. *Motor-Sports Development and learning, 11*(1), 103-121.

Hamidian, N., Rezaeian, F., & Hagigat, Sh. (2011). The effect of local game on the visual-movement development of mentally-retarded kindergarten and primary school students in Shiraz. *Exceptional School Education, 111*, 29-38.

Harter, S. (1981). A new self-report scale of intrinsic versus extrinsic orientation in the classroom: Motivational and informational components. *Developmental Psychology, 17*(3), 300–312.

Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nat Rev Neurosci, 9*(1), 58–65.

Kakavoulis, A. (2008). *Psychology and education of the person*. Athens.

Lind, R., Beck, M., Geertsen, & Lundbye,-Jensen, J. (2016). Motor-enriched learning activities can improve mathematical performance in preadolescent children. *Frontiers in Human Neuroscience, 10*, 645.

Lopes, L., Santos, R., Pereira, B., & Lopes, V. P. (2013). Associations between gross Motor Coordination and Academic Achievement in elementary school children. *Human Movement Science, 32*(1), 9–20.

Manzilatur, R.A., Astini, S.M. (2015). Peran kegiatan tari untuk mengembangkan kemampuan motorik kasar anak kelompok B di TK Muslimat Mazraatul Ulum II Paciran Lamongan. *PAUD Teratai, 2*(1), 1-7.

Mahazir,I., Siti Khadijah, A., Ismail, M., Ismail, K , Mohd Nordin, N. (2019). Impact of Games on Motivation, Attention and Skills in Pre-school Children. *International Journal of Advanced Trends in Computer Science and Engineering, 8*(1), 156-159.

Metikasari, S., Mardiyana, & Triyanto. (2019). Mathematics learning difficulties of slow learners on a Circle. *Journal of Physics, 1227*, 1-6.

Pesce, C. (2012). Shifting the focus from quantitative to qualitative exercise characteristics in exercise and cognition research. *Journal of Sport & Exercise Psychology, 34*(6), 766–86.

Petkov, M., Rogers, G. (2011). Using Games to Motivate Today's Technology-Dependent Students. *Journal of Stem Teacher Education, 48*(1), 7-12.

Prapajit, K. (2014). *Video games and history learning*. (Master's Thesis). Middle Tennessee State University.

Radmiri, T., Yaswinda, F. (2020). Motivation and Self-Confidence in Motor Activities in Kindergarten. *Advances in Social Science, Education and Humanities Research, 538*, 192-198.

Tomporowski, P. D., McCullick, B., Pendleton, D. M., & Pesce, C. (2015). Exercise and children's cognition: The role of exercise characteristics and a place for metacognition. *Journal of Sport and Health Science, 4*(1), 47–55.

Valentini, N., Troiano, G., & Balzano, S. (2012). Motor Activity in the Development of the Individual's Divergent Thinking and Self-esteem. *Education, 2*(5), 123-129.

Sujiono B. (2015). *Metode pengembangan fisik*. Jakarta: Universitas Terbuka.

Wastiau, P., Kearney, C., &Van de Berghe, W. (2009). *How are digital games used in schools?* Complete results of the study. Final report, Brussels, Belgium.

Yarmohamadi, V., Bahrami, R. (2013). Teaching through games on improvement of mathematics point of view held by primary school female students. *Learning Disabilities, 3*(3), 122-135.

Table 1. Reliability Values of the Research Questionnaires

Questionnaire	Cronbach's Alpha
Motivation	0.82
Self-esteem	0.77
Total	0.81

Table 2. Results of the Kolmogorov-Smirnov Test

Variable	Kolmogorov-Smirnov	Level of Significance
Motivation	1.041	0.228
Self-esteem	1.049	0.225

Table 3. Results of the Independent Samples T-test for the First Research Hypothesis

Groups		N	Means	Std. Deviation	Std. Error Mean
Pre-test	Control	30	3.804	0.327	0.059
	Experimental	30	3.891	0.380	0.069
Post-test	Control	30	3.640	0.381	0.069
	Experimental	30	4.155	0.213	0.038

Table 4. Further Analysis of the Independent Samples T-test for the First Research Hypothesis

Independent Samples Test

		Levene's Test for Equality of Variances		t- test for equality of Means						
						Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	df				Lower	Upper
Pretest	Equal variances assumed	0.678	0.419	-0.595	30	0.557	-0.086	0.144	-0.386	0.213
	Equal variances not assumed			-0.595	21.524	0.557	-0.086	0.144	-0.386	0.214
Posttest	Equal variances assumed	9.925	0.005	-4.085	30	0.000	-0.515	0.126	-0.776	-0.253
	Equal variances not assumed			-4.085	17.260	0.001	-0.515	0.126	-0.780	-0.249

Table 5. ANOVA Tet

		Sum of Squares	df	Mean Squares	F	Sig.
Pretest	Between Groups	0.045	1	0.045	0.459	>0.05
	Within Groups	2.766	28	0.098		
	Total	2.811	29	0.096		
Posttest	Between Groups	1.591	1	1.591	21.5	<0.05
	Within Groups	2.098	28	0.074		
	Total	3.689	29	0.127		

Table 6. Results of the Independent Samples T-test for the Second Research Hypothesis

Groups		N	Means	Std. Deviation	Std. Error Mean
Pre-test	Control	30	3.894	0.339	0.061
	Experimental	30	3.913	0.392	0.071
Post-test	Control	30	3.710	0.357	0.065
	Experimental	30	4.206	0.224	0.040

Table7. Further Analysis of the Independent Samples T-test for the Second Research Hypothesis

Independent Samples Test

		Levene's Test for Equality of Variances		t- test for equality of Means						
						Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	df				Lower	Upper
Pretest	Equal variances assumed	0.789	0.399	-0.203	30	0.142	-0.019	0.155	-0.161	0.123
	Equal variances not assumed			-0.203	28.820	0.142	-0.019	0.155	-0.161	0.123
Posttest	Equal variances assumed	9.126	0.002	-6.595	30	0.052	-0.496	0.139	-0.601	-0.391
	Equal variances not assumed			-6.595	24.890	0.075	-0.496	0.139	-0.645	-0.347

Table 8. ANOVA Test

		Sum of Squares	df	Mean Squares	F	Sig.
Pretest	Between Groups	0.067	1	0.067	0.626	>0.05
	Within Groups	2.996	28	0.107		
	Total	3.063	29	0.105		
Posttest	Between Groups	1.891	1	1.891	23.936	<0.05
	Within Groups	2.224	28	0.079		
	Total	4.115	29	0.141		