# The Effect of Game-Based PJOK Learning Model in Lower Grade Elementary School to Improve Gross Motor Skills

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## Abstract

Gross motor skills of lower grade primary school students often do not reach an optimal level of development. This study aims to: (1) determine the profile of students' gross motor skills before the intervention, and (2) analyse the effect of a game-based PJOK learning model on improving these skills. This study used a true-experiment method with a pretest-posttest design on 84 lower grade elementary school students (50 boys, 34 girls). The measurement instrument refers to the Test of Gross Motor Development-2 (TGMD-2). Intervention was conducted for 8 weeks through structured games (obstacle course, target games) that train locomotor and manipulative movements. The results showed that (1) The pretest results showed an average GMQ score of 83 (below average category), with 76% of students at that level and 24% in the low category, in the posttest results there was a significant increase with the average posttest GMQ score reaching 110, including in the average to above average category. An increase of 27 points, comparative analysis shows that manipulative skills have increased higher (35%) than locomotor (28%) (2) game-based learning models have a significant effect on improving gross motor skills of lower grade elementary school students with a p-value of 0.000 <0.05. The manipulative aspect experienced a higher increase than the locomotor aspect. All students experienced an increase in GMQ scores. These results show that game-based physical education learning is not only fun but also supports children's basic movement development significantly. This success is supported by developmentally appropriate game design and the active role of teachers in providing feedback. Teachers are advised to integrate games in PJOK learning, and schools provide adequate supporting facilities.

*Keywords:* Gross Motor; Physical Education; Game-Based Learning; TGMD-2; Elementary School

## Introduction

Physical Education, Sports and Health (PJOK) has an important role in supporting the physical, mental and social development of primary school students. Through PJOK, students can develop motor skills, improve physical fitness, and instil values such as sportsmanship and cooperation (Atiq et al., 2021). At the elementary school level, especially the lower grades, learning PJOK is an important foundation in shaping gross motor skills which are a basic component in children's daily activities.

Gross motor is an ability that involves large muscle movements, such as running, jumping, and balancing the body. This ability plays an important role in children's physical activities, including speed, agility, eye-hand coordination, and balance (Mardiansyah et al., 2024). Gross motor development in primary

school-age children is highly dependent on the movement experience provided through directed and enjoyable learning. Therefore, appropriate learning methods are key to optimising this development (Safudin, 2022).

However, in the field, it is often found that learning PJOK in lower grade elementary schools tends to be monotonous and less orientated to the needs of children. Learning methods that are too theoretical and the lack of game-based activities make students less motivated to actively move (Nurwiyanto et al., 2021). As a result, gross motor skills such as speed, agility, eye-hand coordination, and balance are not optimally developed. This requires attention, because good gross motor skills at an early age are the basis for the development of sports skills in the future (Muhammad & Alexander, 2024).

The game-based learning model offers a solution to this problem. This approach can create a fun, interactive and contextualised learning atmosphere for children. Games can increase student motivation while providing stimulation to various aspects of gross motor (Fitrianto et al., 2023). In addition, games also involve competitive elements and cooperation that can enrich students' learning experience. Previous research shows that game-based learning can significantly improve various gross motor components, including speed, agility, coordination and balance.

This type of research uses the experimental method. According to (Fitrianto et al., 2023), the experimental method is a systematic approach to establishing relationships that contain causal-effect relationships. In this study, the design used was One Groups Pretest-Posttest Design, which is an experimental design that involves an initial measurement (pretest) before treatment and measurement after treatment (posttest).

This study aims to examine the effect of a game-based physical education learning model on gross motor skills of lower grade elementary school students. The focus is on the development of speed, agility, eye-hand coordination, and balance as the main indicators of gross motor. The results of the study are expected to contribute to improving the effectiveness of PJOK learning and provide recommendations for educators in developing innovative learning models and according to student needs.

By identifying examining the effect of game-based physical education learning models on gross motor skills of lower grade elementary school students, this research is expected to make a meaningful contribution to the development of curriculum and sports learning methods at the elementary school level and this research is expected to be useful as a reference for choosing learning models in the world of education. The implications of the findings of this study can be the basis for improving the quality of sports learning that is more relevant to the needs of students in this modern era.

## The Nature of Children's Motor Skills

Motor skills are movements of the body or body parts that are deliberate, automatic, fast and accurate. The movements performed by children are the coordination of hundreds of complex muscles (Lopes et al., 2013). In every basic movement made by children involves coordination between the body and muscles that produce some basic behaviours such as movements that are intentional or not, for example children falling during play (Tuasikal et al., 2024) states that motor development is a process of maturity or movement that directly involves the muscles to move and the innervation process that becomes a person able to move his body. Motor development used to be considered as having a very natural and predictable developmental path. Now, opportunities for movement, training and encouragement of new movements, and changes in a young child's physique are considered factors that influence a young child's motor abilities. There are differences in motor skills between individuals. A child's motor skills will also heal the child's creativity and imagination which is part of the child's mental development. As such, experts often emphasise that physical activity and physical skills can enhance a child's intellectual abilities. The left hemisphere governs logical and rational thinking, analysing, speaking and being time- and detail-oriented, while the right hemisphere governs intuitiveness, music, dance and creativity.

(Maulana et al., 2023) classify three motor skills of children, namely: (a) Locomotor skills: walking, running, jumping, sliding; (b) Non-locomotor skills (moving body parts with the child staying in place): lifting, pushing, sticking, swinging, pulling; and, (c) Skills of projecting and receiving/catching objects: catching, throwing. To stimulate gross motor according to the child can be done by training the child to jump, climb, squeeze, whistle, make happy, sad, happy facial expressions, run, tiptoe, stand on one foot, walk on a footbridge, and so on. Gross motor movements involve the activity of the muscles of the child's hands, feet and whole body. These movements rely on maturity in coordination. To train children's gross motor skills, you can, for example, train children to stand on one foot.

In its development, gross motor develops before fine motor. This can be seen when the child is able to use his leg muscles to walk before the child can control his hands and fingers to cut and glue.

The characteristics of four-year-olds in general are abundant energy, an overabundance of ideas, endless chatter and activity. Quarrels caused by stubbornness and differences of opinion between children and adults are common. Children often test boundaries, are full of confidence and assert a growing need for independence. Meanwhile, they also have many pleasant traits. According to (Yusroni, 2024), factors that influence children's motor development include:

(a) Development of the nervous system; (b) Physical condition; (c) Strong motivation; (d) Psychological aspects; and (e) Age.

**The Nature of the Co-operative Learning Model Inside Outside Circle Technique**

According to (Festiawan, 2020), cooperative learning involves students who are divided into small groups and directed to learn the specified learning material. This means that cooperative learning involves small groups that are guided to learn and participate in predetermined activities. Actively participating in learning with small groups that have been determined is the main basis in this cooperative learning because of the learning objectives to be achieved together.

One of the co-operative learning models is the Inside-outside Circle (IOC) Learning Model which is a learning model with a small circle and large circle system where students share information and move actively at the same time with different partners briefly and regularly.

It was developed by Spencer Kagan to provide opportunities for students to share information and actively move at the same time. Therefore, children will be stimulated to learn and be active both individually and in groups (Faruk et al., 2025). Cooperative learning type inside outside circle is packaged in a varied way, students will interact with each other and various information in an unusual way, so that students will be more enthusiastic and active in participating in the teaching and learning activities that are being carried out.

The learning objective of the inside outside circle technique is to allow students to share information with each other at the same time. In addition, the inside outside circle learning technique can develop children's activeness to learn, namely by sharing information with each other, children have the opportunity to process information and improve communication skills. With skills, the characteristics of cooperative learning are learning with friends, face-to-face between friends, productive and active and learning in small groups (Sgro et al., 2019). These characteristics prove that cooperative learning does prioritise cooperation and interaction between friends with others, actively participating and being productive in learning and activities so that each group that has been formed will contribute to each other and share to be able to achieve learning goals in each group. communicating directly can activate children.

According to (Sunanto et al., 2024) there are five main steps in implementing this IOC model, namely:

1. In the first step, half the class stands in a small circle and faces outwards.

2. Step two, the other half of the class form a circle outside the first circle and face inwards.

3. Step three, then two children in pairs from the small and large circles share information. This information exchange can be done by all pairs at the same time with varied movements.

4. Step four, the child in the small circle stays in place, while the child in the large circle moves one or two steps clockwise.

5. In the last step, it is the turn of the child in the large circle to share information, and so on.

In its application, there are several advantages of the Co-operative learning technique Inside Outside Circle technique (Fu & Burns, 2018) including the following:

1. There is a clear structure that allows children to share information together in a concise and organised manner.

2. In addition, children have many opportunities to process information and improve their communication skills.

3. It can be applied to any grade level and is very popular with children.

4. Easy to break into pairs. students will be formed into a small group into a pair to interact well with each other.

5. More ideas emerge. The application of this technique will make it easier for educators to find concepts in teaching and learning activities.

6. More tasks can be done. Students will be more active and enthusiastic.

## *Methods*

This type of research is experimental. The experimental method is defined as a systematic method to establish relationships that contain causal phenomena. The design used in this research is 'One Groups Pretest-Posttest Design', which is a research design that has a pretest before being treated and a posttest after being treated, thus it can be known more accurately, because it can compare with being held before being treated. The design can be described as follows

Figure 1. True-experiment design
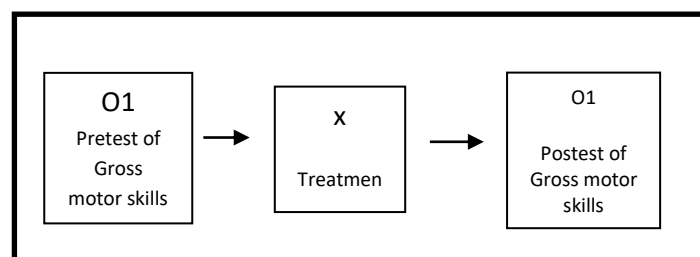


Description:

O1 : Pretest of Gross motor skills

X : Treatment

O4 : Postest test of Gross motor skills

The population in this study were third grade students of SD Muhammadiyah Sagan in the 2024/2025 school year consisting of 3 classes. The sample in this study were third grade students of SD Muhammadiyah Sagan in the 2024/2025 school year consisting of 3 classes totalling 84 lower grade elementary school students (50 boys, 34 girls).

## *Results and Discussion*

In this study, the data was analysed using descriptive statistics, namely statistics used to analyse data by describing and describing the data that has been collected as it is without intending to make generalised conclusions.

Tabel 1. Descriptive statistics

| Descriptive Statistics | | | | | |
|---|---|---|---|---|---|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| PreTest | 84 | 53 | 64 | 59.18 | 2.791 |
| PosTest | 84 | 70 | 80 | 75.01 | 2.709 |
| Valid N | 84 | | | | |

Based on the analysis results in Table 1 above, it can be seen that the gross motor skills data of lower grade elementary school students (pretest; min 53, max 64, Mean 59.18, SD 2.791 and posttest min 70, max 80, mean 75.01, SD 2.709).

**Normality Test**

The data normality test in this study was carried out using the Kolmogorov Smirnov normality test, if the significant value $<0.05$, then the sample data comes from an abnormally distributed population, while if the significance$> 0.05$ then the sample comes from a normally distributed population. Furthermore, the normality test results obtained can be seen in the following table:

Table 2. Normality Test Results

| Kelompok | Sig. | Keterangan |
|---|---|---|
| Gross Motor skills Pretest | 0,38 | Normal |
| Gross Motor skills Posttest | 0,09 | Normal |

Based on the results of table 2, it can be seen that all data have a p (sig) value$> 0.05$, it can be concluded that all data are normally distributed. So, from the results of these data all data are declared normally distributed and can be continued using parametric statistics.

**Homogeneity Test**

The homogeneity test aims to ensure that the variants of each group are the same or similar, so that comparisons can be made fairly. The homogeneity test rule is if $p> 0.05$. Then the data is declared homogeneous, and likewise if $p < 0.05$ then the data is declared inhomogeneous. The results of the homogeneity test in this study can be seen in table 3 below.

Table 3.  Homogeneity Test Results

| Data | Sig | Keterangan |
|---|---|---|
| Pretest-posttest Gross Motor Skills | 0,931 | Homogen |

Based on table 3 above, it can be concluded that the p value (sig) $> 0.05$ so that the data is declared homogeneous. Based on the tests that have been carried out, namely the homogeneity test and obtained all data are homogeneous, the test can be continued using parametric statistics.

*Hypothesis Test*

**The Effect of Game-Based Physical Education Learning Model on Improving Gross Motor Skills of Lower Grade Elementary School Students**

The hypothesis in this study is that 'There is a significant effect of the Game-Based Physical Education Learning Model on Increasing Gross Motor Skills of Lower Grade Elementary School Students'. The conclusion in this study can be declared significant if the value of t count> t table and the sig value is smaller than 0.05 (sig <0.05). Based on the results of the analysis, the results of data processing are as follows:

Table 4. T-test of Pretest and Posttest Results of Game-Based Physical Education Learning Model towards Improving Gross Motor Skills of Lower Grade Elementary School Students

| Data | p-value | Keterangan |
|---|---|---|
| Pretest-posttest Gross Motor Skills | 0,00 | Sig<0,05 |

From the t-test results in the table above, it can be seen that the significance value (sig) is 0.000 <0.05, so these results can be concluded and show that there is a significant difference. Thus the hypothesis that reads 'There is a significant effect of the Game-Based PJOK Learning Model on Increasing Gross Motor Skills of Lower Grade Elementary School Students' is accepted.

The results showed an alarming profile of gross motor skills of lower grade primary school students at the pretest stage, with an average GMQ score of 83 which falls into the below-average category according to TGMD-2 standards (Kalantari, 2024). In-depth analysis revealed that 76% of students (64 out of 84) were in this category, while 24% (20 students) were even in the low category (GMQ ≤79). This finding is consistent with research (Mardiansyah et al., 2024) which reported that children in Southeast Asian urban environments tend to experience delayed motor development due to reduced opportunities for active play. The weakest aspects were identified in locomotor skills such as horizontal jump (65% of students did not meet the criteria) and manipulatives such as overhand throw (58% of students failed), which according to (Fauzi et al., 2023) require complex integration of eye-hand coordination and dynamic balance.

After the 8-week game-based learning intervention, there was a significant improvement with the average posttest GMQ score reaching 110, falling into the average to above average category. This increase of 27 points has an effect size of Cohen's d = 2.3, including a very large effect. These results reinforce the findings of (Sultoni et al., 2018) which showed that a structured play approach can improve motor development 2-3 times faster than conventional methods. Comparative analysis showed that manipulative skills improved more (35%) than locomotor (28%), a pattern also observed by (Adi et al., 2022) in a similar study. This may be due to the nature of target games such as mini basketball and ring toss which specifically train throwing accuracy and power (Cieśliński & Chaliburda, 2016).

This positive change is inseparable from the characteristics of the learning model applied. As stated by (Lopes et al., 2013), a game-based approach creates a low-stress but high challenge learning environment, allowing students to experiment with various movement patterns. The findings also support (Eun, 2019) theory of zone of proximal development, where social interaction during group games helps students reach higher levels of ability. However, this study recognises some limitations such as those including the relatively short duration of the intervention and variations in students' biological maturation that may have affected the results. Recommendations for future research include expanding the sample and adding a motion quality assessment component through video analysis to gain a more holistic understanding.

The t-test value between Pretest and Posttest on Gross Motor Skills of Lower Grade Elementary School Students is obtained a significance value (sig) of 0.000 <0.05 which means that the research hypothesis is accepted. The results showed that the game-based PJOK learning model significantly improved students' gross motor skills, with an average increase in GMQ scores of +27 points (from below average to

average to above average categories). This finding is in line with the theory (Samodra et al., 2023) which states that games are a natural medium for children to develop motor skills through social interaction and movement exploration. In the context of PJOK learning, game-based activities such as obstacle courses and target games provide opportunities for students to practice locomotor (running, jumping) and manipulative (throwing, catching) movements in a fun and contextualised manner (Johnson, 2018).

Physiologically, games designed with high movement intensity can stimulate the development of muscle strength, coordination, and balance. Research (Nopembri & bin Shahril, 2024) proved that students involved in traditional games such as Gobak Sodor experienced significant improvements in running speed and throwing accuracy. This was reinforced by this study's posttest data, where 100% of students showed progress on manipulative aspects, especially in kicking and catching skills. This improvement occurs because games provide immediate feedback so that students can immediately correct their movements (Haegele, 2020).

From a psychological perspective, game-based models also increase student motivation and engagement. According to (Kuen, 2018) play activities fulfil children's basic psychological needs, namely competence, autonomy, and social connectedness. Observation data during the intervention showed that students were more enthusiastic and actively participated compared to conventional PJOK learning which was drills. This finding is consistent with a study (Estero et al., 2020) which found that learning through play reduces students' anxiety towards physical activity.

## Conclusions

Based on the results of data analysis and discussion, this study concludes that the game-based physical education learning model is effective in improving gross motor skills of lower grade elementary school students.

Prior to the intervention, the majority of students (76%) had gross motor skill levels in the "Below Average" category (GMQ 80-89), while 24% were in the "Low" category (GMQ ≤79). No students reached the "Average" level at baseline. This suggests that most of the study participants require more intensive stimulation to achieve age-appropriate motor development.

The game-based learning model was shown to significantly improve gross motor skills with Lower Grade Primary School Students with a significance value (sig) of $0.000 < 0.05$.

Based on the research that has been conducted, the researcher provides several suggestions for future studies, including extending the intervention time to measure long-term effects, comparing different types of games (traditional vs. modern), involving additional measurements such as physical fitness or social skills.

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