

# A game model in physical education to improve motor skills, cooperation, and discipline of primary school learners

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## Abstract

**Background and Study Aim** Motor skills, cooperation, and discipline are important for elementary school children. The purpose of this research is to develop a game-based physical education learning model that is effective in improving motor skills, cooperation, and discipline in elementary school students.

**Material and Methods** This type of research is Research and Development with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The validation subjects of the game-based learning model are six expert lecturers with professors and doctoral degrees. The effectiveness test subjects were 46 upper grade elementary school students (aged 10-12 years). The statistical analysis used was Aiken validity analysis and Intraclass Correlation Coefficients, and to analyse the effectiveness of the product using paired sample test analysis.

**Results** The results show that the game-based learning model is effective for improving motor skills (p-value  $0.000 < 0.05$ ), cooperation (p-value  $0.000 < 0.05$ ), and discipline (p-value  $0.000 < 0.05$ ) in upper grade elementary school students. The developed learning model is valid and reliable, so it is very effective to be used by Physical Education teachers for the learning process.

**Conclusions** The learning model through this game is expected to be able to bridge the shift in the character values of students in a good direction, along with the development of games and technology that are very strong magnets. For further researchers, further studies and developments are needed to add to the repertoire of game models to improve motor skills, cooperation, and discipline. This will support the learning process of physical education in elementary schools in accordance with the applicable curriculum.

**Keywords:** game mode, motor skills, co-operation, discipline

## Introduction

Character is moulded largely by education. In the national education system, character education is incorporated into various subjects, including Physical Education. It is the process of providing demands to students to become human beings of character in the dimensions of heart, mind, body, taste, and spirit. Findings show that participation in Physical Education increases a sense of embeddedness compared to a sense of alienation [1]. Physical Education is concerned with physical health and fitness, aesthetic values, and character. In addition, Physical Education also provides opportunities for individuals to improve social skills and broaden social experiences.

Over the years, physical education has integrated sports into lessons [2]. Early positive experiences in play, games and physical activity should be prioritised so that everyone lays the foundation for the knowledge, skills, attitudes and motivation needed to remain engaged for life in physical activity and sport [3]. Subtraction or division through games is usually the basis for learning with different models. These games can be of various types, such as co-operative, competitive, territorial, modified,

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and others. The aim is to learn the sport as a whole by performing one or more parts of a particular sport according to the rules. It is further stated that Physical Education helps one to learn co-operation, provides an opportunity to learn about others, and teaches one a way to measure others [4]. Some studies suggest that a sense of belonging, a sense of community, and a feeling of being a member of a group will increase when a person engages in physical activity [3, 4, 5].

Children's motor skills can be improved through Physical Education learning. Teaching motor skills to students in primary school is very important. The motor development of primary school children is one that must be improved. Motor movement is a strong basis and foundation in supporting learning, playing, socialising, and also a form of building children's self-confidence [6]. Motor skills are useful for children's cognitive development [7]. This can have a huge impact on later academic achievement. Children who have good motor skills will feel comfortable.

In addition to motor skills, cooperation skills need to be developed so that students are used to solving complex problems. To achieve learning goals, the Physical Education learning process and co-operation are very important. Cooperation

will encourage learners to interact socially with other learners during learning. During learning, students will be motivated to interact socially with other students through cooperation. The value of co-operation is very important both in Physical Education learning and in daily life as all students should work together regardless of their ability level to make the lesson beneficial for everyone [8]. By working together, students can respect each other, help each other, and foster trust in the group. This attitude must be built considering the importance of student collaboration in physical education.

A student in participating in learning activities at school will not be separated from the various rules and regulations enforced at his/her school, and each student is required to be able to behave in accordance with the rules and regulations in force at his school. Students' compliance and obedience to the various rules and regulations that apply in their school is commonly called student discipline [9]. School is a place where students seek their identity, for this reason, teachers as role models must work together in fostering students' disciplinary attitudes. Therefore, discipline is the key to success, because with this discipline people become convinced that discipline brings benefits and is proven by the action itself, therefore it has a great influence on the success of the study.

From the above ideas, it can be assumed that to build motor skills, the character of elementary school students, effective Physical Education learning must be carried out to the maximum. Teachers are expected to stimulate students to actively participate in Physical Education learning to the maximum, one of which is through a game-based learning model. Games today are still the right method to stimulate children's development. Through games children will naturally become happy, so that they can develop organic, neuromuscular, social, and emotional interperative systems [10]. The most appropriate learning model is by implementing a game approach because with fun learning, students will not be bored and learning outcomes will be achieved optimally [11].

The development of learning models is one of the efforts to help solve the problem of limited Physical Education learning facilities and infrastructure in schools. The development of learning models carried out by Physical Education teachers can bring an innovative and creative learning atmosphere, so that learning can be fun and motivate students to have more opportunities to exploit movement widely and freely according to their level of ability. The study conducted by Hartt et al. [12] aims to examine the effectiveness of game-based learning techniques in improving students' perceptions of learning, engagement and teamwork. The results show that game-based learning has been shown to attract intrinsic motivation, enjoyment and

emotional engagement. Game-based learning can utilise intrinsic motivation components to motivate students towards learning or practising desired skills. Lamrani & Abdelwahed [13] in his research stated that play is very important for the development of social, emotional, linguistic, and intellectual abilities of children.

Based on this, the goal to be achieved in this study is to develop a game-based physical education learning model that is effective in improving motor skills, cooperation, and discipline in elementary school students. It is expected that with this research students can understand and accept learning materials easily, so that in the learning process students are more courageous and motivated to improve their skills and abilities.

## Materials and Methods

### *Participants*

The subjects of validation of game-based learning models are six expert lecturers with professors and doctoral degrees. Where expert validation is intended to assess the learning model developed. The subjects of the effectiveness test were upper grade elementary school students totalling 46 students (aged 10-12 years) from 2 elementary schools. The Research Ethics Committee of Yogyakarta State University approved this study, which was conducted based on the Declaration of Helsinki for human research. Before the children participated in the study, parents completed a screening questionnaire to find out if their children had any medical conditions that might affect the study.

### *Research Design*

In this study, the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) development model was used to develop a game-based learning model that aims to improve motor skills, cooperation, and discipline of students in upper grade elementary schools. Six expert teachers with professorial and doctoral degrees evaluated the teaching models. Once the training model was found to be feasible, an effectiveness test was conducted to determine its efficiency.

The research instruments consisted of motor ability tests, cooperation, and discipline. Instruments to collect gross motor ability data using tests consisting of four types:

- speed tests (30 metre sprint),
- agility tests (shuttle-run 4 x 10 metres),
- coordination tests (throwing a ball catch 1 metre away from the wall),
- balance tests (standing stork).

The ability to cooperate and discipline is measured using a questionnaire with a Likert scale:

- "Strongly Agree (4)",
- "Agree (3)",
- "Disagree (2)",

- “Strongly Disagree (1)”.  
The indicators for assessing cooperation skills include responsibility (2 items), which involves jointly completing tasks and sharing responsibilities to foster effective cooperation. Another aspect is contributing to one another (2 items), where team members contribute both their labor and ideas to promote collaboration. Additionally, there are indicators related to maximizing individual abilities (2 items), emphasizing the importance of each team member utilizing their skills and cohesion to the fullest. Regarding discipline, the indicators encompass responsibility (2 items), generosity (2 items), an honest attitude (2 items), and the courage to uphold the truth (2 items). During eight meetings (2x45 minutes), the effectiveness test was conducted. Prior to this test, a pretest of motor skills, exercise, and discipline was conducted.

*Statistical Analysis*

The statistical analysis used was Aiken validity analysis and Intraclass Correlation Coefficients, and to analyse the effectiveness of the product using paired sample test analysis. The statistical analysis technique used Statistical Package for Social Science (SPSS) software version 21.

**Results**

One of the objectives of the expert assessment of an effective game-based learning model for improving motor skills, cooperation, and discipline in elementary school students is to determine the validity coefficient based on Aiken’s Validity. The results of the expert assessment are presented in Table 1.

**Table 1.** Aiken validity test results.

Item	Aiken Validity	Description
1	0.889	Valid
2	0.833	Valid
3	0.944	Valid
4	0.889	Valid
5	0.944	Valid
6	0.889	Valid

According to the validity classification, a value of  $0.80 < r_{xy} < 1.00$  indicates very high validity. There is evidence that the game-based learning model has excellent Aiken validity and is effective in improving motor skills, co-operation, and discipline of students in primary schools.

Furthermore, reliability was calculated using Intraclass Correlation Coefficients inter-rater reliability. This reliability test aims to determine the level of expert agreement on an effective game-based learning model to improve motor skills, cooperation, and discipline in elementary school students. Table 2 shows the results of the Intraclass Correlation Coefficients test.

Based on Table 2, the average inter-rater agreement (rxx) is 0.769. When the results of the ICC value are classified as reliability proposed by Fleiss [14],  $k < 0.40$  poor agreement,  $0.40 < k < 0.75$  good, dan  $k > 0.75$  excellent agreement. It can be concluded that the agreement between experts is very strong, and each expert has good consistency. The final product yields five simple game-based learning models. These models are easy for Physical Education teachers to teach and enjoyable for students. They ensure student safety while encouraging the improvement of motor skills, cooperation, and discipline. This product targets upper-grade elementary school students and provides teachers with instructions for implementation. These instructions include introductory activities like warm-up, core activities featuring five different games with activity objectives, gameplay instructions, facility requirements, safety standards, and a cooling-down phase.

Furthermore, an effectiveness test was conducted to determine whether the game-based learning model had an effect on motor skills, cooperation, and discipline in elementary school students (tabl. 3).

Based on Table 3, it demonstrates an upward trend in pretest motor ability, cooperation, and discipline. The average pretest motor ability data increased from an initial value to 200.79 in the posttest. Similarly, pretest cooperation values rose from 13.13 to 16.07 in the posttest, indicating improved cooperation. Additionally, pretest discipline improved from 20.17 to 22.52 in the posttest.

*Normality Test*

The calculation of this normality test was carried out using the Shapiro-Wilk formula. Table 4 shows the results.

The normality test results in Table 4 above show that the data for motor ability are normally distributed.

*Homogeneity Test*

The homogeneity test is valuable for assessing the uniformity of the sample, specifically whether the sample variants taken from the population are consistent. The results of the homogeneity test for this study are presented in Table 5.

The homogeneity test results in Table 5 above, shows that the pretest-posttest data of motor skills p-value  $0.913 > 0.05$ , pretest-posttest cooperation p-value  $0.332 > 0.05$ , pretest-posttest discipline p-value  $0.067 > 0.05$ , so the data is homogeneous.

*Hypothesis Test Results*

The hypotheses in this study were tested using t-test analysis, namely paired sample test ( $df = n-1$ ).

Based on the analysis results in Table 6, it is evident that the pretest-posttest data for motor skills, cooperation, and discipline all yielded significant t-values (motor skills: 12.517, cooperation: 9.718,

**Table 2.** Intraclass Correlation Coefficients reliability results.

Measures	Intraclass Correlational	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	0.769b	0.488	0.956	21.000	5	25	0.000
Average Measures	0.952c	0.851	0.992	21.000	5	25	0.000

**Table 3.** Descriptive statistics pretest-posttest.

Data	N	Minimum	Maximum	Mean	Std. Deviation
Pretest Motor Ability	46	142.03	239.55	198.25	20.46
Posttest Motor Ability	46	145.34	241.41	200.79	20.40
Pretest Cooperation	46	9.00	17.00	13.13	2.31
Posttest Cooperation	46	12.00	20.00	16.07	2.17
Pretest Discipline	46	16.00	23.00	20.17	1.61
Posttest Discipline	46	20.00	24.00	22.52	1.21

**Table 4.** Normality test results.

Data	Statistic	df	Sig.	
Motor Ability	Pretest	0.960	46	0.110
	Posttest	0.966	46	0.198
Cooperation	Pretest	0.926	46	0.106
	Posttest	0.933	46	0.111
Discipline	Pretest	0.909	46	0.102
	Posttest	0.889	46	0.110

**Table 5.** Homogeneity test results.

Data	df1	df2	Sig.
Pretest-Posttest Motor Ability	1	90	0.913
Pretest-Posttest Cooperation	1	90	0.332
Pretest-Posttest Discipline	1	90	0.067

**Table 6.** Analysis Paired Samples Test.

Paired Samples Test			
Group	t	Sig. (2- tailed)	Difference
Pretest-Posttest Motor Ability	12.517	0.000	2.53
Pretest-Posttest Cooperation	9.718	0.000	2.93
Pretest-Posttest Discipline	8.231	0.000	2.35

discipline: 8.231) with p-values of 0.000, which are less than the significance level of 0.05. As a result, the hypothesis that the game-based learning model is effective in improving these aspects of elementary school students' development is accepted. The improvements observed in students' motor skills, cooperation abilities, and discipline are as follows: 2.53, 2.93, and 2.35, respectively.

## Discussion

Research into the impact of game-based learning models on various aspects of student development involves three key areas:

1) *The effect of game-based learning models on motor skills.* The analysis results demonstrate the effectiveness of game-based learning models in

improving motor skills. When teachers and students implement these models in Physical Education, there is a noticeable enhancement in students' motor skills. This is particularly important for elementary school children, who are naturally active and benefit from developing good motor skills. Exposure to physical activities and play engages their muscles, resulting in improved motor abilities. The more children engage in movement activities, the better their motor skills become, and this experience is stored in memory for future use. Overall, students' motor skills mature as they accumulate diverse motor experiences through movement activities.

2) *The effect of game-based learning models on cooperate.* The implementation of game-based learning models has a positive impact on students'

ability to cooperate effectively. This is evident as students exhibit greater responsibility and teamwork when working together to achieve game objectives. Cooperation inherently involves group activities, fostering positive interdependence among participants, including interaction, mutual assistance, and shared responsibility. Students also learn to respect opposing groups within the game context. Positive interdependence lies at the core of group learning, emphasizing the importance of a shared goal achieved through collaborative efforts. This collective approach encourages students to recognize that they can only succeed by working together toward a common objective.

3) *The effect of game-based learning models on cooperate.* The implementation of game-based learning models has a notable impact on students' discipline skills. This is evidenced by students assuming greater responsibility within their groups during game activities, displaying positivity, and maintaining high levels of honesty. Discipline holds significant importance, especially for those striving to achieve specific goals. In a broader sense, discipline encompasses all forms of organization that assist learners in adapting to their environment and handling external demands effectively.

The developed game model is an active game that engages the body's muscles, thereby promoting muscle function. When muscles are actively engaged, blood circulation to the brain improves. Motor movements are only possible when the muscular system is connected to the bones and innervated by nerves. Enjoyable play brings joy to children and encourages them to repeat these activities, often without realizing that they are exercising their muscles. Play can serve as an effective tool for stimulating children. Play activities stimulate children's cognitive, emotional, social, and physical development [15].

Study Hsiao and Chen [16] with the aim to apply a gesture interactive game-based learning approach to improve the learning performance and motor skills (i.e., coordination and agility) of the participants. Based on a quasi-experiment involving 105 preschool children (average age 5.5 years), results showed that participants using the gesture interactive game-based learning approach demonstrated better learning performance and motor skills than those using the traditional activity game-based learning approach, and statistics showed a significant deviation between the two approaches. Hsiao and Chen's research supports our hypothesis, that game-based learning can improve children's motor skills. However, there are some differences with what we did, we used subjects aged 10-12 years old, the research was conducted during Physical Education learning, namely eight meetings (2x45 minutes), while Hsiao and Chen's research did not explain how many times the treatment was given to students.

Sutapa et al. [10] conducted a study with the aim of determining that goal-orientated play activities in early childhood improve motor skills. A sample of 40 children aged 4.5-6 years was recruited and participated in a series of training activities divided into Posts 1-5. To pass each post, a child had to run, walk on a balance beam, move a stick, throw and catch a ball, and stack blocks. Training was provided three times each week for 12 weeks. Data collected consisted of 25m running, walking on the balance beam, throwing the ball as far as possible, locomotor movements, arranging cans, and bouncing the ball. The six training activities conducted over 12 weeks provided significant improvements in motor skill areas in children aged 4.5-6 years. Our research with the research of Sutapa, et al. there are several differences, namely where we use subjects aged 10-12 years, the research was conducted during Physical Education learning, namely eight meetings (2x45 minutes), and the motor ability components used are also different. Our research also not only discusses motor skills. Sutapa et al. conducted a study to determine the impact of goal-oriented play activities on motor skills development in early childhood (4.5-6 years old). Their research focused solely on motor skills and involved a 12-week training program with a specific age group. In contrast, our research findings demonstrate the effectiveness of a game-based learning model in improving motor skills, cooperation, and discipline among upper-grade elementary school students. Our study goes beyond motor skills, emphasizing character development and the potential contributions to progressive and innovative science, encompassing a broader age range and educational context.

The potential of physical activity, such as coordination, strength, and confidence is easily gained when children are directly involved in fun physical activities [17]. In addition, evidence shows that play, especially for children strengthens children's motor skills [18]. Given the social character of Physical Education and sport, they are considered appropriate means to develop students' personal and social skills, such as personal and social responsibility, co-operation, and other prosocial skills. [19]. One of the reasons that physical education and sport is a suitable context for learning these skills is the transferability of these skills to other domains in life [20]. For example, in physical education and sport children can under the right pedagogical circumstances [19], learn how to solve problems and communicate and work as a team, which are skills they will also need in everyday life, for example at home or at work [21]. The authors discuss the significance of physical activity and education while focusing on common principles. In contrast, our study provides specific research findings and discusses their practical applications.

The right physical education learning model is by applying the game approach, because with games, learning becomes more fun and makes students not bored so that learning outcomes will be achieved optimally. Physical education can not only help children to develop psychomotor skills, but can also provide psychological benefits through the development of personal and social responsibility and appropriate social behaviour [22]. The game-based learning model is fun and can make all students active and involved in the Physical Education learning process. Gurvitch & Metzler [23] emphasises how important it is to ensure that any physical education model used produces the desired learning outcomes for students. We believe that, by using verbatim copied worksheets, teachers are answering the question of “how to teach games” and therefore maintaining a relatively high level of loyalty [24]. He ensured that the essential features (positive interdependence, face-to-face interactions such as softening, individual accountability, interpersonal and small group skills, group processing, heterogeneous small teams, goal groups, and teacher as facilitator) were present throughout the unit while using it.

Students in playing the game, will move to run, jump, crawl, push, lift and others. These movements will affect the work of muscles both leg muscles, hands, even all muscles in the human body, such as the heart and lung muscles which are closely related to blood circulation and breathing [25]. Warming up through games involving competitive activities is often used successfully in setting the climate for student motivation, games and sports activities being one way to bring about this competitive atmosphere [26]. The selection of the game approach is appropriate, because it can provide learning for students to learn to cooperate. Through play, children gain experience when they get the opportunity to interact with peers. Through play, children will naturally become happy, so that they can develop organic, neuromuscular, social and emotional interpretative systems [10]. The authors present a general conclusion about the impact of games on students without specific details or research results. They emphasize the influence of games on physical activity, motivation, and collaboration skills. Our study indicates that the game-based learning model effectively enhances motor skills, cooperation, and discipline in upper-grade students, while also highlighting the validity and reliability of this model.

Amani et al. [27] asserted that substantial adjustments allow sport to be recognised as evolutionary and conducive to mental development. Teachers can create, implement and organise learning activities in a more meaningful and authentic way by using these criteria. Sports games are a well-known and effective educational method

in the field of health and sports [28]. Some games and group activities are suitable for health and sport because they are fun and help students develop their sport knowledge and skills both explicitly and implicitly. In particular running, throwing, catching, dodging skills and fine motor skills such as balance, teamwork, speed, agility are learnt through health and sports activities/games. Personal communication skills acquired through group games/activities include self-awareness, compassion, temperament management, constructive expression of emotions, self-regulation, coordination, and communication, continued [29]. In addition, planning activities related to communication will encourage students to become more talkative and outgoing. The authors note that sport is evolutionary and promotes mental development. The use of sports games and group activities in learning can help students develop physical skills, communication skills and personality traits. Our study results confirm that the game-based learning model is effective in improving motor skills, cooperation, and discipline in older students, and discusses its potential impact on student trait development.

We recognise that the selection of games in Physical Education learning is not arbitrary, it depends on the learning activity that follows and the group of students. It is also decided holistically, taking into account how the various games in Physical Education learning complement and support the overarching activity. Regarding the aspect of games in Physical Education learning that was researched, we argue that game activities generate enjoyment for students, which in turn is important to foster interest and encourage children’s engagement in Physical Education learning activities. This is not surprising. Enjoyment, fun, and pleasurable experiences are commonly associated with games, and are sought after when playing and designing games, so that students’ motor skills, discipline, and co-operation can be well enhanced.

## Conclusions

Based on the results of the study, it shows that the game-based learning model is effective for improving motor skills ( $p$ -value  $0.000 < 0.05$ ), cooperation ( $p$ -value  $0.000 < 0.05$ ), and discipline ( $p$ -value  $0.000 < 0.05$ ) in upper grade elementary school students. The learning model developed is valid and reliable, so it is very effective to be used by Physical Education teachers for the learning process. The learning model through this game is expected to be able to bridge the shift in the character values of students in a good direction, along with the development of games and technology that are very strong magnets. The results of this study are expected to make a positive contribution to the development of progressive and innovative science. The contribution of the results of this study can add

insight into physical education learning models through game activities to improve the motor skills, cooperation, and discipline of students. For further researchers, further studies and developments are needed to add to the repertoire of game models to improve motor skills, cooperation, and discipline in order to support the learning process of physical education in elementary schools in accordance with the applicable curriculum.

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## Conflict of interest

We do not have any conflicts of interest related to this publication. In addition, no financial-related elements were included in this study that could influence the results. I consent to the manuscript being read and submitted by all authors listed under the corresponding author's name.

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