

The Effectiveness of Manipulative Motion Skills Development through Game Activities in Elementary School Students Aged 10-12 Years

La eficacia del desarrollo de habilidades de movimiento manipulativo a través de actividades de juego en estudiantes de escuela primaria de 10 a 12 años

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Abstract. The study purpose was to determine the effectiveness of using games in developing students' manipulative motion skills for elementary school students aged 10-12 years. Materials and methods. The study used a quasi-experimental design, consisting of 48 upper-class students divided into a control group and an experimental group. This research was conducted in Koroulon and Jaten elementary schools (Indonesia). Manipulative motion skills tests are given as pre-test and post-test. To analyze the data, MANOVA were used at a significance level of 0.05. The results showed that the experimental group students had higher scores on both dependent variables than the control group. This suggests that manipulative play significantly improved the experimental group of manipulative motion skills compared to the students in the control group. The conclusions in this study, show that the use of games is very effectively used in developing manipulative motion skills of elementary school students aged 10-12 years.

Keywords: Manipulative motion skills, games, elementary school students

Resumen. El propósito del estudio fue determinar la efectividad del uso de juegos en el desarrollo de habilidades de movimiento manipulativo en estudiantes de escuela primaria de 10 a 12 años. Materiales y métodos. El estudio utilizó un diseño cuasiexperimental, compuesto por 48 estudiantes de clase alta divididos en un grupo de control y un grupo experimental. Esta investigación se llevó a cabo en las escuelas primarias de Koroulon y Jaten (Indonesia). Las pruebas de habilidades de movimiento manipulativo se realizan como prueba previa y posterior. Para analizar los datos, se utilizó MANOVA con un nivel de significancia de 0,05. Los resultados mostraron que los estudiantes del grupo experimental obtuvieron puntuaciones más altas en ambas variables dependientes que el grupo de control. Esto sugiere que el juego manipulativo mejoró significativamente las habilidades de movimiento manipulativo del grupo experimental en comparación con los estudiantes del grupo de control. Las conclusiones de este estudio muestran que el uso de juegos se utiliza de manera muy efectiva en el desarrollo de habilidades de movimiento manipulativo en estudiantes de escuela primaria de 10 a 12 años.

Palabras clave: Habilidades de movimiento manipulativo, juegos, estudiantes de escuela primaria

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Introduction

Looking at our Law Number 20 of 2003 related to the National Education System, it is emphasized that the education level is a stage of education that is determined based on the level of student development and the abilities it develops. The law above states that the level of formal education consist of basic education, secondary education and higher education which is organized, systematic, structured and carried out in accordance with a set of rules and norms, taking into account the fulfillment of a series of objectives, based on curriculum and methodology (Herġanu et al., 2023; Norqvist & Leffler, 2017). Primary education is one of the general education that lasts twelve years, organized for six years in elementary school. Students at primary school age are students who are undergoing developmental processes both intellectually, socially emotionally as well as physical (Samsudin et al., 2022), linguistic and moral development (Gordon & Williams-Browne, 2004). This means that each student has a different speed of development in each aspect depending on the maturity function and learning function (Leasa et al., 2017). Therefore, there are individual differences in elementary school students even though they are relatively the same age (Sun et al., 2018).

At the age of elementary school, students' daily activities

are dominated by activities that involve physical movements so that kinesthetics begins to develop (Nélo & Nélo, 2012). At this time a lot of growth hormone is secreted so that with enough activity it will greatly help its growth, because it is happy with physical movements, then elementary school students really enjoy dynamic forms of play (Bukowsky et al., 2014). Motion experience is needed by students (Mujriah et al., 2022), so it is necessary to design motion to become a patterned form of motion. Motion is a basic element in human life, without human movement becoming less than perfect and can cause abnormalities in the body and organs, therefore motion becomes a basic need in meeting one's needs and survival, including elementary school students. Basic movement skills lay the foundation for students to participate in various physical activities (Jumareng, Setiawan & Németh, 2022), and sports (Chen et al., 2017; Burhanuddin et al., 2023; Isnaini et al., 2023; Muzakki ett al., 2023). One of the motions is manipulative motion.

In particular, manipulative basic motion is a complex basic motion because a person involves all parts of his body to manipulate objects such as kicking, catching, throwing and hitting (Chen et al., 2016). Manipulative movement skills will develop with age and will be even faster when accompanied by a series of exercises (Iivonen & Sääkslahti, 2014). Furthermore, the movement skills learned by students make it easier to carry out daily activities and can

provide opportunities to participate in various play activities, physical recreational activities, sports (Sukur et al., 2023; Samsudin et al., 2023), dancing, gymnastics (Resita et al., 2023), outdoor education and games (Gonçalves-Junior et al., 2018; Rodríguez Fernández et al., 2019; Rosa et al., 2022).

Doing games is an activity that is joyous, fun and causes enjoyment. According to Harvey et al. (2014), games characterized by physical activities that contain philosophical values in every movement. Reinforced by Stolz & Pill, (2014) states that games are human symptoms that are culturalized human dynamic activities. For elementary school students, doing games is a means to transform the potential strengths that exist in children into various abilities and skills in life later. At this time of activity in elementary school developed the trend of "learning while playing" (Casey & MacPhail, 2018). According to Bailey et al. (2009), with the activity of the game all students with various levels of motor abilities are limited to basic movements. This study aims to see the effectiveness of developing manipulative motion skills through game activities in elementary school students aged 10-12 years.

Methods

Participants

The experimental subjects in this study were upper grade elementary school students aged 10-12 years who came from Indonesia, namely Koroulon (n=50) and Jaten elementary schools (n=50). They were selected based on inclusion criteria, namely: (i) not sick or injured, (ii) not participating in other activities outside the program. Out of 100 only 96 students were selected based on inclusion criteria. Then they were allocated into the experimental group (n=48) and the control group (n=48). Division into experimental and control groups used random analysis (<https://www.randomizer.org/>). The CONSORT diagram is presented in Figure 1.

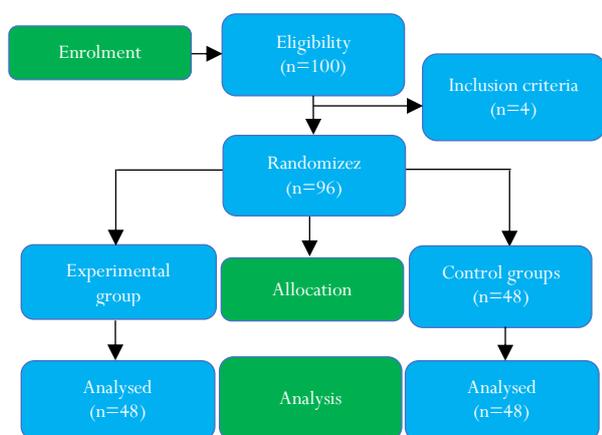


Figure 1. CONSORT diagram

Study Design

This research is an experimental study of the results of

the game development model. This study used an unequal comparison group design method. This design is one of the powerful quasi-experimental research designs (Eddy et al., 2020). In this study, the researchers gave pre-test and post-test to students in the experimental and control groups. After treatment, the researchers compared the conditions before and after treatment in two groups. The dependent variables of manipulative skills are thrown, caught and kicked. The control group was given lessons as usual by the teacher according to the school curriculum program, while the experimental group was given a game developed by the researcher. The program for the experimental and control groups was carried out for 12 weeks, 3 times a week, namely Monday, Wednesday and Friday from 08.00-09.00 in the morning.

Research instrument

The instrument adopted in this research is the manipulative skills test, namely throw, caught and kicked (Juliantine et al., 2022; Lestari et al., 2023). Assessment is carried out by means of movements that comply with the criteria given a value of 4. In this study this instrument had a Cronbach value of 0.86.

Statistical analysis

Analysis of the data from the trial results aimed to describe the average score (M) and test the similarity of students' manipulative motion average scores between the experimental and control groups. The data of this trial consists of preliminary observation data and final observation data from manipulative movements of elementary school students aged 10-12 years. Students' manipulative motion data is used to estimate the level of effectiveness. The experimental group uses a game model and the control group uses the model conventionally. The average score similarity test uses the MANOVA statistical test at a signification level of 0.05.

Results

The results of the description of the scores of the average manipulative motion of students in the experimental group and the control group during the two observations are presented in Table 1.

Table 1.
Results of Manipulative Motion Observations

Type	Manipulative Motion	
	O1	O2
Experiment	44,36% (very lacking)	78,46% (good)
Control	50,67% (less)	69,73% (enough)

Table 1 shows that in general the average score of manipulative motion in the category control group is sufficient, while in the experimental group it tends to be well categorized.

Further data analysis used the MANOVA statistical test

to see: 1) there were differences in students' manipulative motions together with students who used the game and conventionally and 2) there was a difference in manipulative motion between students who used the game and conventionally. As a parametric statistical test, MANOVA bases itself on assumptions 1) the distribution of data is normal, 2) the matrices of bound covariances are the same, and the variance between groups is homogeneous. Therefore, before the MANOVA test is carried out, a test is first carried out on these assumptions statistically. The results of successive assumption tests are presented in Table 2.

Table 2.
Experimental Group Data Distribution Normality Test

Source	Type	Kolmogorove-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Manipulative Motion	Pre-test	0.057	48	0.200	0.979	48	0.554
	Post-test	0.081	48	0.200	0.962	48	0.126

Table 2 Presents the results of the normality test of the distribution of manipulative motion variable data in the experimental group. Table 2 indicates that the statistical values of Kolmogorove-Smirnov and Shapiro-Wilk on manipulative motion, both in the experimental group each had a signification number greater than 0.05. This shows that the manipulative motion skills data in the experimental group are normally distributed.

Table 3.
Normality Test of Control Group Data Distribution

Source	Type	Kolmogorove-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Manipulative Motion	Pre-test	0.080	48	0.200	0.964	48	0.151
	Post-test	0.100	48	0.200	0.976	48	0.437

Table 3 Presents the results of the normality test of the distribution of manipulative motion variable data in the control group. Table 3 indicates that the statistical values of Kolmogorove-Smirnov and Shapiro-Wilk on manipulative motion, both in the experimental group each had a signification number of less than 0.05. This suggests that the manipulative motion skills data in the control group are abnormally distributed.

Table 4.
Test Box Similarity of Covariance Matrices

Bound variables	N	Box'M	F	df1	df2	Sig.
Manipulative Motion	96	13.893	4.524	3	590480.000	0.004

Table 5.
Levene Test of Similarity of Variance of Faults Between Groups

Bound variables	N	F	df1	df2	Sig.
Manipulative Motion	96	4.174	1	94	0.044

In Table 4 presents the results of the BOX test the similarity of the matrices of the covariance of the manipulative motion variables of students between the experimental and control groups.

Based on Table 4 it appears that the Box statistical values in all groups have signification numbers of .004 This

signification number is greater than 0.05. Thus the covariance matrices of bound variables are the same.

Table 5 Presents the Levene test the similarity of error variances of student manipulative motion variables between experimental and control groups.

Table 5 Shows that levene statistical values in all group variance pairs have signification numbers of .004 and 000 The signification numbers are greater than 0.05%. Therefore, the variance of each group pair is homogeneous. In other words, the variance of each pair of groups is no different.

The results of the above assumption test show that they have met the requirements for the MANOVA test to be applied. Based on data analysis, the following are presented the results of multivariate tests as shown in Table 6.

Table 6.
Summary of Multivariate Test Results

Type	Influence	Value	F	Sig.
Type	Pillai's trace	.997	17484.51	0.000
	Wilks' lambda	.003	17484.51	0.000
	Hotelling's trace	376.011	17484.51	0.000
	Roy's largest root	376.011	17484.51	0.000

In Table 6 it appears that the statistical values of Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root for both the covariate variable and the model variable, each having signification numbers smaller than 0.05%. These results show that there are manipulative basic movements of elementary school students together. The results of the analysis of the influences between the subjects of this game model variable on each of the manipulative motion variables are presented in Table 7.

Table 7.
Summary of Inter-Subject Influence Test Results

Group	Bound Variables	M	SD	F	Sig.
Experiment	Manipulative motion	78.46	11.97	138.095	0.000
	Control	69.73	10.24		

Table 7 shows that based on the source of influence of the game model on manipulative motion variables, it was found that the statistic $F = 138.095$ with the signification number 0.000. The signification figure is smaller than the admission limit of 0.05. Table 6 in the column of mean values (M) and standard deviation (SD) indicates that the average values (M) and standard deviation (SD) of manipulative motion ($M = 78.46$ and $SD = 11.97$) in the experimental group were greater than in the control group ($M = 69.73$ and $SD = 10.24$). This suggests that the game model used in the experimental group had a greater influence compared to the control group in the achievement of manipulative motions of elementary school students aged 10-12 years.

Discussion

The study purpose was to determine the effectiveness of using games in developing students' manipulative motion

skills for elementary school students aged 10-12 years.

One effective strategy in developing manipulative motion skills of elementary school students aged 10-12 years is through interactive games. The game is designed with due regard to material aspects, construction and language. The activity of motion through games provides an opportunity to develop the manipulative motion of the student without having to sacrifice his main goal (Jones, 2005).

The use of games in the effectiveness of developing manipulative motion is much different when done conventionally (Dimiyati et al., 2022). This is supported by previous research, by Casey & MacPhail, (2018) emphasizes that developing the manipulative motion of the student through the game approach must be more selective in structuring his activities. Although it has a good purpose, this kind of approach requires special abilities in optimizing it so that there are no mistakes in the process. Strengthened by research conducted by Beni et al. (2017), the importance of play as an approach in creating student learning experiences, including elements of: social interaction, fun, challenges and motor skills. Singleton (2009), asserts that students are more interested in learning motion using games in their activities than conventionally. Thus the game is an effective strategy in developing manipulative movement skills of elementary school students aged 10-12 years.

After using the game, the manipulative motion skills of the students of the experimental group increased significantly, because in the game they taught about manipulative skills. Chen et al. (2016), emphasizes that interesting games can attract students' attention, motivate students to move as well as be actively involved in the game. In addition, the world of elementary school students is played and often played in daily activities. This makes students more excited to do activities. MacPhail et al. (2013), asserts there is a relationship between the implementation of pleasant movement activities and the participation of students. This kind of condition must be designed so that students are interested in moving and can develop their manipulative motion skills. Strengthened on the research conducted by Trinkūnienė & Kardelienė (2013), asserts that difficulties in learning to move during this time include: low physical activity status, limited equipment, lack of time, number of students, loss of motivation and excess daily workload. Robinson (2011), asserts students who have low skills usually lack confidence and are often unprepared to learn. The need for a well-planned method in order to effectively develop students' manipulative motion skills.

The results in this study are supported by the research conducted Fisher et al. (2005) asserts that there is a significant relationship between basic movement skills and vigorous student activity in schools both independently and in groups. Further strengthened by Kalaja et al. (2012) provides a more complete understanding of the meaning of fundamental movement skills and their relationship with the student's level of physical activity and the student's rate of physical growth, since basic skills and physical activity are

closely related.

Conclusions

The conclusions in this study show that the use of games is very effectively used to develop manipulative motion skills of elementary school students aged 10-12 years. Students are more active in movement, enthusiastic, not afraid to try and unconsciously through the game have an impact on improving their manipulative motion skills. Thus this study has shown that games are an effective strategy for developing the manipulative skills of primary school students aged 10-12 years.

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