The Integration of Games and Physical Activities to Stimulate Cognitive Abilities of Elementary School Students

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Article Info

Abstract

This study aimed to examine the learning process by combining physical activities and games to stimulate the cognitive ability of elementary school students. The experiment was carried out using the One-Group Post-test Design. The trials involved letters games, guessing pictures, guessing names, counting kangaroos, snakes and ladders, and number adventure. The trial was carried out four times for each game for 60 minutes. The study involved 154 elementary school students, 86 boys and 66 girls. The sampling technique used the saturated sampling technique. The data collection process employed observation techniques with an assessment rubric instrument analyzed by different mean tests. The results showed that there had been an increase in the mean between the first meeting and the fourth meeting. Furthermore, the result of the t-count was greater than the t-table, and the increase was significant. In conclusion, integrative learning of physical activity combined with various forms of games effectively stimulates the cognitive aspect of elementary school students.

INTRODUCTION

Physical activity can be defined as anybody movement produced by skeletal muscle contraction that can increase energy expenditure above a certain level (Mavilidi et al., 2017). Physical activity is vital for students because it is built at a young age (Taylor et al., 2013) and becomes a part of obesity prevention (Williams et al., 2008). For this reason, physical activity becomes an essential activity and should be a priority for students, especially elementary school students.

Physical activity is crucial because it requires a learning process for mastery (Robinson et al., 2015). For this reason, it is necessary to implement a program to optimize student mastery in carrying out physical activities (Logan et al., 2011; Aryamanesh & Sayyah, 2014). In addition, the physical activity carried out by students has benefits, including building the cognitive skill (Kirk & Rhodes, 2011; Haga, 2008; Payne & Isaacs, 2017; Haapala, 2013; Fedewa & Ahn, 2011) and providing psychological benefits through the personal and social responsibility development and appropriate social behavior (Liu et al., 2010).

Currently, there is a general concern in schools that time spent on physical activity is associated with lost academic time and success in school (Mavilidi et al., 2016). Students also have fewer and fewer opportunities to do physical activity, 30-60 minutes a day (Grunbaum et al., 2004). It, of course, has an impact on the lack of opportunities for students to carry out physical activities. Schools also put more emphasis on academic achievement in the learning process.

Related to this problem, several studies have been conducted to find forms of learning to stimulate student cognitive skills by combining physical activity. For example, active learning by doing physical activities can significantly improve elementary school students' math and spelling performance (Mullender-Wijnsma et al., 2016) and incorporate active body movement in a meaningful way into learning by integrating physical activity with academic content (Webster et al., 2015). Based on the two studies, it is confirmed that physical activity can be integrated into learning and stimulate student academic achievement. However, physical activity is performed mainly by imitating movements instructed by the teacher, not in a game form. Therefore, it would have an impact on the lack of student understanding. Meanwhile, understanding is an important skill in carrying out physical activities (Stodden et al., 2008).

Based on these problems, this study aimed to examine the implementation of learning combined with traditional activities and games to stimulate the cognitive skill of elementary school students. This concern is crucial because the game is the main activity carried out by students (Goodway et al., 2019). Moreover, attracting students to make decisions by focusing on the game situation could stimulate their cognitive skills, such as tactics, decision making, and problem-solving (Butler & Griffin, 2010). Furthermore, learning through games creates a sense of pleasure, so students will be severe in doing it (Gustian, 2021). Therefore, the learning activities used student-centered games with practical methods and assignments.

METHODS

Participants

The study involved 154 students consisting of 86 boys and 66 girls. The age range of participants was 6 to 7 years, with a mean age of 6.8 years. Participants were first-grade elementary school students. This selection was based on the fact that first graders are students experiencing a transition from kindergarten. In addition, the dominant way of learning is playing, and the cognitive skill level needs optimal stimulation.

Sampling Procedures

The study was begun by observing the targeted primary school (field conditions and the willingness of teachers and schools to be involved as test subjects). As a result, four primary schools and six classes were established. Determination of the sample employed a saturated sampling technique so that students from the six classes were all included as test subjects.

Materials and Apparatus

The cognitive skills referred to in this study were language and mathematical skills. Language skill is the ability of students to recognize letters and object names. Mathematical skills include the ability of students to recognize, add, and subtract numbers (Mullender-Wijnsma et al., 2016). The data collection technique used was observation. The instrument used was an assessment rubric using a Likert Scale of one to four ac-

cording to the aspects contained in language and math skills. The scale criteria used one for needs improvement, two for fair, three for good, and four for very good. Data collection was carried out by observing students when participating in learning at the first and fourth meetings. It was carried out to determine the changes in the student's language and mathematical skills when participating in physical activity-based integrative learning integrated into games.

Procedures

The experiment was carried out using the One-Group Pretest-Posttest Design. The study involved only one treatment group without a control group. The games were the modified games of playing letters, guessing pictures, guessing names, counting kangaroo, snakes, ladders, and number adventure. The games have been proven to improve knowledge, motor skills, and attitudes (Gustian & Tomoliyus, 2015).

The treatment was carried out four times for each game and class with a sixty-minute duration so that the total meeting was twenty-four meetings and the overall duration was 1440 minutes. The details are described in Table 1. The implementation of the game was adjusted to the theme being studied. In this study, the theme used was my passion. The treatment was carried out by dividing students into several groups of four. Each group would compete to complete the tasks or obstacles in each game.

Table 1. Distribution of Meetings and Duration of Game Implementation

Name of Game	Number of Meeting	Duration (Minutes)
Playing Letters	4	60
Guessing Pictures	4	60
Guessing Names	4	60
Counting Kangaroos	4	60
Snake and Ladders	4	60
Number Adventures	4	60
Total	24	1440

Data Analysis

The collected data were analyzed using qualitative descriptive analysis. The method used was to recap the results achieved by students according to the observed aspects and add up each score achieved by students in

each assessed aspect. Furthermore, the score obtained by students was converted into a maximum score of 100 and stored in a frequency distribution table to make it easier to determine the student's cognitive skills. The normality test results in Table 2 show that the obtained data were normally distributed. Therefore, to test the mean differences in the pre-test and post-test and their significance, a paired sample test was used using SPSS 2.0.

Table 2. Result of Normality Test

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pre-test	.132	154	.000
Post-test	.119	154	.000

RESULT

Based on the research results presented in Table 3, the mean score of the student's ability to recognize letters increased by 0.27 or 27 points from the first meeting to the fourth meeting and remained in a good category. The increase also occurred in the student's ability to name objects. The mean value and score increased by 1.09 and 36, respectively. The increase of the mean value in the student's ability to name objects reached a quite large size because it could exceed one point from needs improvement to good category. Overall, the student's language skills also increased. However, the increase was not large, namely 0.07 for the mean value and 23 for the score, and was still in the good category.

Table 3. Language Skills

Assessed Aspect	Meeting I		Meeting IV	
	Mean	Skor	Mean	Skor
Recognizing Letters	3	462	3,17	489
Mentioning Object Names	2.09	448	3.14	484
Total Score	3.09	950	3.16	973

The research results on the student mathematical skills in Table 4 show that the mean of the ability to recognize numbers had increased by 0.16 and 25 for the score. The mean of subtracting and adding aspects also increased. The mean values were 0.47 and 0.85, respectively. The mean value increase of the adding aspect was quite large because students could achieve the very good category, which was previously in the good cate-

gory. For the subtracting aspect, it was still in the good category.

Table 4. Mathematics Skills

Assessed Aspects	Meeting I		Meeting IV	
	Mean	Score	Mean	Score
Recognizing Numbers	3	463	3.16	487
Subtracting	2.64	407	3.11	480
Adding	2.66	411	3.51	542
Total Score	2.77	1280	3.26	1510

The value recapitulation of the first meeting in Table 5 shows that most student cognitive skills were in a good category. It included 78 students, or equivalent to 50% of the total number of students. Furthermore, several students' cognitive skills were in the fair category, including 42 students or equivalent to 42%. On the other hand, only nine students, or 6% of students who had very good cognitive skills and three students (2%) were in the needs improvement category. These results indicated that student cognitive skills tend to be dominated by the good category.

The assessment of the last meeting in Table 6 shows that most of the student's cognitive skills were in a good category, involving 109 students or equivalent to 71%. Several student cognitive skills were also in the fair category, including 35 students or equivalent to 23%. Students owning very good cognitive skills had increased to ten people or 9%, and there was no student in the needs improvement category.

Based on these results, the student's cognitive skills were still dominantly at a good stage. However, there was an increase of 31 students from the assessment results at the first meeting. The very good category also increased to ten students. In the fair category, 27 students were reduced, and there was no student in the needs improvement category.

Based on the statistical analysis results carried out in Table 7 and Table 8, the mean value of the student's last test result was higher than the first meeting test score. These results indicated that there had been an increase in the student's cognitive skills by 1.77. The difference test results show that the standard deviation value was 1.51, meaning that the student's cognitive skills were significantly close to the mean value or in a good category. The t-count (14.61) was greater than the

t-table (1.66). In addition, the significance test results, with a level of 95%, showed significant results. These results prove that physical activity-based integrative learning combined with games can stimulate elementary school students' cognitive skills.

Table 5. First Meeting Cognitive Score Recapitulation

Range	Absolute (F)	Relative (%)	Descriptive Range
81-100	9	6	Very Good
71-80	78	50	Good
61-70	64	42	Fair
0-60	3	2	Needs Improvement
Total	154	100	

Table 6. Last Meeting Cognitive Score Recapitulation

Range	Absolute (F)	Relative (%)	Descriptive Range
81-100	10	6	Very Good
71-80	109	71	Good
61-70	35	23	Fair
0-60	0	0	Needs Improvement
Total	154	100	

Table 7. Mean Analysis

		Mean	N	STDEV	Std. Error Mean
Pair 1	First Meeting	71.40	154	5.91	.48
	Last Meeting	73.17	154	4.83	.40

Table 8. T-Test Analysis

		Paired Differences		t	df	Sig.
		95% Confidence Interval of the Difference				
		Lower	Upper			
Pair 1	First Meeting Last Meeting	2.01	1.53	14.6	153	.000

DISCUSSION

The study results prove that physical activity-based integrative learning combined with games can stimulate the cognitive aspect of elementary school students. This means that the student's cognitive skills can increase if the learning process is integrated, combining physical activities and games. These results align with

previous research stating that the student academic achievement significantly increased using an active approach to physical activity (Marques et al., 2018; Marques et al., 2018; Fedewa & Ahn, 2011).

The increase occurs because physical activity encourages students to explore their environment (Payne & Isaacs, 2017) and respond to each task quickly, efficiently, and accurately (Roebers & Kauer, 2009). In addition, students who do physical activity experience an increase in connections between nerve cells that affect their intelligence until adulthood (Kuh et al., 2006; Murray et al., 2006).

Furthermore, physically active students have good motor development to improve their reading and basic math skills (Westendorp et al., 2011). In addition, physical activity encourages cognitive processes, such as paying attention, remembering, predicting, observing, matching, and solving problems Gelisli & Yazici (2015). For this reason, physical activity should be an important part of the efforts to stimulate the student's cognitive aspect, especially elementary school students. According to the results of this study, the statement concerning the time spent doing physical activity is associated with the loss of academic time and success in school is not valid. In contrast, the reduced time for students to engage in physical activity may harm academic achievement (Have et al., 2018).

Cognitive skills emphasized in this study included math and language skills. It was based on math and language skills play a vital role in a student's educational careers and are important for their social and work functioning in everyday life (Mullender-Wijnsma et al., 2016). For this reason, physical activity must be specifically integrated when teaching mathematics and language to improve these skills optimally.

The results showed that there had been an increase of 1.77. However, the increase was still slight. Furthermore, cognitive skills in this study only emphasized language and math skills. For this reason, it is recommended that further research is carried out to investigate the appropriate learning activities to stimulate the cognitive stimulation of elementary school students by combining physical activity. In addition, it can also stimulate other cognitive skills.

CONCLUSION

Physical activity-based integrative learning combined with games has been proven effective in stimulating elementary school students' cognitive skills. It means that the cognitive skills of elementary school students can be improved through integrated learning of physical activities carried out in games. It could improve student literacy skills and become a promising way to improve student learning, enjoyment, and health.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

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