

Flashcard-based physical education: Enhancing students' physical fitness through visual-motor learning cues

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Abstract

Physical education (PE) plays a pivotal role in fostering children's motor skills and physical fitness, especially at the primary school level. However, declining levels of physical activity and student engagement have prompted educators to seek more interactive and effective teaching strategies. This study aimed to examine the effectiveness of flashcard-based instruction in improving the physical fitness of elementary school students during PE lessons. Unlike previous studies that mainly applied flashcards for cognitive learning or basic motor instruction, this study examines their direct impact on physical fitness outcomes. This approach positions flashcards not only as conceptual aids but as visual-motor triggers designed to enhance exercise intensity and movement quality during PE lessons. A quasi-experimental design with a pre-test–post-test control group format was employed. A total of 84 fifth and six-grade students from two public elementary schools in West Java, Indonesia, participated in the study. The experimental group (n=42) received PE instruction integrated with flashcard media, while the control group (n=42) followed conventional PE lessons without media aids. Physical fitness was measured using the Indonesian Student Physical Fitness Test (TKSI) Phase C, comprising five test items. Data were analyzed using paired sample t-tests and independent sample t-tests. Both groups showed significant improvement in post-test scores ($p < 0.05$). However, the experimental group exhibited a significantly higher gain score ($M = 5.12$) compared to the control group ($M = 2.34$), indicating greater effectiveness of flashcard-based instruction. Flashcards enhance student engagement, comprehension, and movement execution in PE lessons. As a practical and low-cost instructional tool, flashcards hold promise for improving physical fitness outcomes among elementary school students, particularly in resource-limited educational settings.

Keywords: Bullying, Social-Emotional Development, Early Childhood

INTRODUCTION

Physical education at the elementary school level plays a crucial role in forming the foundation

of physical fitness and motor development of children (Siedentop and van der Mars, 2023). Through structured physical activity, students not only increase their physical capacity, but also develop social skills, discipline, and self-confidence (Bessa and Hastie, 2021; Dai et al., 2022; Mulyana et al., 2023). In other words, physical education that is designed effectively becomes a long-term investment in the quality of life of children in the future (Pate et al., 2011). One of the main objectives is that students have good physical fitness quality (Hambali et al., 2021), because physical fitness is one of the main indicators of student physical health and has a close relationship with learning achievement, emotional regulation, and sleep quality (Donnelly et al., 2016; Tomporowski et al., 2015). Various international studies show that children with high levels of physical fitness tend to have better attention capacity, superior academic performance, and lower risk of obesity and metabolic disorders (Álvarez-Bueno et al., 2017).

However, ironically, the physical fitness conditions of elementary school students today actually show a significant decline trend in many countries, including Indonesia. The results of the national and local survey say that most elementary students are in the category of low to very low physical fitness (Mutohir et al., 2023) with the prevalence of inadequate daily physical activity, which is a minimum of 60 minutes of moderate to severe physical activity per day (World Health Organization (WHO), 2020). The problem was allegedly caused by lifestyle changes towards Sedentari (Dumuid et al., 2017), Domination of Digital Technology in the Life of Children (Apriyanti et al., 2024), as well as the lack of variations and attractiveness in the learning method of physical education (Lesmawan et al., 2024; Rahayu et al., 2023).

In addition, the challenges in the implementation of effective physical education in elementary schools are still a concern, especially related to the less varied teaching methods and the lack of innovative learning media. In schools, the implementation of physical education is often only a complement to the curriculum, which is carried out routinely but is not always designed with the principle of effective pedagogy (Setiawan, 2024). As a result, students take passive physical education lessons and are less motivated to be actively involved. On the other hand, physical education teachers also face various obstacles, such as limited facilities and infrastructure, limited time, and lack of training in developing innovative learning media (Ilahi et al., 2025; Oktaviani et al., 2025).

In this context, efforts to increase the effectiveness of physical education learning are very important. One promising approach is the use of visual and interactive-based learning media, such as flashcard. Flashcard is known as a simple learning aid but has great potential in increasing focus, memory, and understanding of student concepts (Bikalawan et al., 2024). In general, flashcards have been widely used in language learning, science, and mathematics, and are proven effective in increasing learning motivation and material retention (Iffah et al., 2024; Joseph et al., 2012; Kanca et al., 2021). Flashcard is a simple but effective learning aid, which can be used to strengthen the understanding of concepts through repetition and visualization (Herlina and Dewi, 2017; Kasih et al., 2022; Ni Nyoman et al., 2022). In physical education, flashcards can be modified to present movement instructions, the introduction of fitness concepts, game rules to small games that integrate cognitive and motor aspects simultaneously.

Previous research has shown that the use of flashcards in learning can increase student involvement and understanding of concepts. For example, studying by Pamolarco, 2023 found that the use of digital flashcards in learning mathematics increases the involvement and acquisition of student vocabulary with special needs. Nevertheless, research on the effectiveness of the use of flashcards in the context of physical education, especially to improve the physical fitness of elementary school students, is still limited. One of the relevant studies is a study by Kanca et al., 2021 which evaluates the effectiveness of learning physical fitness learning in elementary schools. The results showed that the use of effective motion cards in improving student physical fitness learning outcomes, with an average formative class evaluation score of 2.82 from a maximum of 3.00. However, this research is more focused on cognitive and affective aspects, while direct influence on increasing physical

fitness of students has not been studied in depth. In addition, a study by Bikalawan et al., 2024 shows that flashcard learning media in physical education can improve student locomotor motion skills, such as running, jumping, and sliding. However, this research does not specifically measure the overall improvement of physical fitness. Thus, there is a need for more comprehensive research that examines the effectiveness of the use of flashcards in improving the physical fitness of elementary school students.

The urgency of this study is increasing given the importance of physical fitness for the health and development of children. According to the Society of Health and Physical Educators, school-age children need at least 60 minutes of moderate to high intensity physical activity every day to maintain their fitness and health Centers for Disease Control and Prevention, 2013. However, many elementary schools have not provided sufficient time for physical education and other physical activity. Therefore, an effective and efficient learning strategy is needed to maximize the available time and increase students' physical fitness.

The purpose of this study is to examine the effectiveness of the use of flashcard media in physical education learning at the elementary school level, especially in improving student physical fitness. This study will use an experimental design with a quasi-experimental approach, where the experimental group will receive learning using flashcard, while the control group will receive conventional learning. Measurement of physical fitness will be carried out before and after intervention to assess the changes that occur. This research is expected to make a new contribution in the field of physical education by introducing innovative and effective learning methods. In addition, the results of this study can be a reference for physical education teachers in designing interesting learning strategies and have a positive impact on students' physical fitness. Thus, this research has the potential to improve the quality of physical education in elementary schools and support the overall health development of children.

Although several studies have explored flashcards to support conceptual understanding or locomotor skills, no research has specifically examined how flashcard-based instruction influences comprehensive physical fitness components measured through standardized fitness tests. Thus, the potential of flashcards as visual-motor prompts that can elevate movement execution, exercise intensity, and overall fitness remains underexplored. This study addresses this gap by introducing a structured flashcard-assisted PE model designed not only to guide movement cues visually but to improve students' physical fitness performance. Such an approach represents an innovative pedagogical shift, especially in resource-limited schools.

Thus, this study aims to fill the gap in the literature regarding the use of flashcard media in physical education and provide practical solutions to improve the physical fitness of elementary school students, as well as concrete steps in encouraging students to actively move, learn visually, and build healthy living habits, flashcard media has the potential to become relevant pedagogical innovations that are relevant, applicative, and sustainable.

METHOD

Materials

This study uses the Quasi-experimental design with the Pre-Test-Post-Test Control Group Design format. The experimental group is given physical education learning that integrates flashcard media as a tool for physical activity, while the control group receives conventional learning according to the curriculum without the use of flashcard media. This design allows the analysis of the comparison of the effectiveness of the use of flashcard media to improve students' physical fitness. The subject of this study was 84 elementary school students (class V and VI) from two public schools in West Java Province, Indonesia. The selection of samples is carried out purposively by considering the physical health conditions of students and the availability of school facilities. A total of 42 students were designated as experimental groups, and 42 other students as control groups. All participants obtained written permission from parents and schools. This study has obtained ethical approval from

the institutional research ethics committee. In the experimental group, the main media used is a flashcard of physical activity developed specifically for physical education learning in elementary schools. For example, the display of flashcard in learning physical fitness can be seen in the following picture:

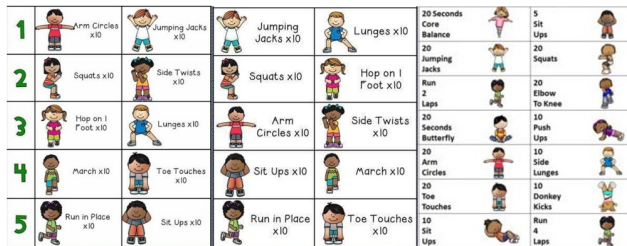


Figure 1. Flashcard Physical Fitness Exercise

Data collection procedures

The research instrument here uses the type of Indonesian Student Fitness Test (TKSI) Phase C, which consists of five test items: 1) Child Ball, has a validity value of 0.511 and the reliability value of 0.494; 2) Tok Ball has a validity value of 0.376 and the reliability value is 0.524; 3) Shuttle Run 4x10 m get ball has a validity value of 0.645 and the reliability value of 0.473; 4) Move the ball has a validity value of 0.472 and the reliability value is 0.508; 5) Running 600 m has a validity value of 0.545 and the reliability value is 0.490. Each test item has a score of 1–5, so the total total score is 5 and a maximum of 25. The study was conducted for 4 weeks, with a frequency of twice per week during regular physical education hours (a total of 8 sessions). Data collection procedures are as follows:

Implementation of pre-tests

In the first week, all participants underwent physical fitness tests using the instruments that had been explained. The test was carried out by PJOK teachers and research assistants who had been trained.

Implementation of intervention

The experimental group receives learning with the integration of flashcard media at the heating, core, and cooling stages. Flashcard is used as an individual or small group activity guide. The control group follows conventional PJOK learning according to the national curriculum without additional auxiliary media.

Implementation of post-test

After the 4-week learning program is completed, students from both groups returned to undergoing the same physical fitness test as in pre-test. The test results data are recorded for further analysis.

Data analysis procedures

Descriptive statistics

Calculation of average and standard deviation of physical fitness test results in both pre-test and post-test for each group.

Test for normality and homogeneity

The normality test was carried out using the Shapiro-Wilk, while the variance homogeneity test was carried out with the Levene's Test to ensure the data meets the parametric analysis assumptions.

Inferential statistics

o Paired sample t-test is used to compare pre-test and post-test scores in each group. o Independent t-test (independent sample t-test) is used to compare differences in the gain score between the experimental and control group.

RESULT AND DISCUSSION

The results of the study are based on research objectives, namely to determine the effectiveness of the use of flashcard media in physical education learning to improve the physical fitness of elementary school students. Measurements are made using the TKSI Phase C instrument, with five test items that have good validity and reliability. Analysis includes a comparison of pre-test and post-test scores in each group, as well as differences in the increase between experimental and control groups. The following is the data on the results of the physical fitness test and the results of the analysis using the help of the SPSS program version 27.

Descriptive statistics

The results of pre-test and post-test measurements of physical fitness in each group are presented in the following table 1:

Table 1. Average and standard deviation of physical fitness scores

Group	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Difference (Gain Score)
Experiment (n=42)	15.12 ± 2.11	20.24 ± 1.96	5.12
Control (n=42)	14.97 ± 2.08	17.31 ± 2.17	2.34

From this table, it appears that both the experimental group and the control group experienced an increase in physical fitness scores after intervention. However, an increase in the experimental group (5.12 points) is absolutely higher than the control group (2.34 points). Besides that, testing the normality and homogeneity of the research data, shows the value of GIS. P-value is good by using the Shapiro-Wilk approach for the normality and levene's test for the homogeneity test showing $P > 0.5$, which means that all data is normally distributed and has the same variance. More details can be seen in the following table:

Table 2. Normality Test Results (Shapiro-Wilk)

Group	Stage	Statistic W	Sig. (p-value)	Distribution
Experiment	Pre-test	0.976	0.382	Normal
Experiment	Post-test	0.972	0.265	Normal
Control	Pre-test	0.968	0.197	Normal
Control	Post-test	0.963	0.134	Normal

Description: Because all p value > 0.05, the data is declared normally distributed.

Table 3. Homogeneity Test Results (Levene's Test)

Variable	Levene Statistic	df1	df2	Sig. (p-value)
Pre-test	0.438	1	82	0.510
Post-test	0.632	1	82	0.429
Gain Score	1.241	1	82	0.268

Description: Because the value of $P > 0.05$ in all variables, the variance of the two groups is homogeneous.

Testing effectiveness

Testing efficiency is carried out in two ways, namely using paired sample t-test analysis to determine the average difference between pretest and posttest values in each group, and also independent sample

t-test analysis to determine the difference in gain scores between experimental and control groups. For more details about the results of the analysis, can be seen in the following table:

Table 4. The results of the paired sample t-test for each group

Group	t (df=41)	p-value	Information
Experiment	-13.94	0.000*	Significant
Control	-7.81	0.000*	Significant
(* $p < 0.05$)			

The results show that both the experimental group and the control group experienced a statistically significant increase after intervention.

Table 5. Independent Sample T-test Gain Score

Group	Mean Gain	t (df=82)	p-value	Keterangan
Experiment	5.12	6.24	0.000*	Significantly different
Control	2.34			
(* $p < 0.05$)				

There is a significant difference between the experimental group and the control group in terms of increasing physical fitness. This shows that intervention using flashcard media is significantly more effective than conventional methods.

Discussion

The results showed that there was a significant increase in physical fitness in the experimental group that received physical education –based physical education learning compared to the control group that gained conventional learning. The average gain score of the experimental group is 5.12, much higher than the control group which is only 2.34. This result is also strengthened by the inferential statistical test (independent sample t-test) which shows significant differences between groups. This finding indicates that the use of flashcard media in physical education learning has a higher effectiveness in increasing the physical fitness of elementary school students.

These research findings are further reinforced by evidence that task cards or visual cues in physical education can improve the quality of movement execution, consistency of exercise intensity, and students' motor engagement. Recent studies by Di et al., 2025 in the instructional scaffolding model found that visual task direction makes students understand task demands more quickly, thus significantly reducing transition time and increasing the proportion of physical activity during lesson units. Other research by Chen et al., 2018 shows that the use of visual task cards in PE classes improves movement accuracy and has a positive effect on MVPA levels because students can correct movements independently without having to wait for teacher instructions. These findings are relevant to the flashcard design in this study, which not only functions as a cognitive aid but also as a motor prompt that directly guides the intensity and quality of movement.

In addition, visual pedagogy-based PE research in the last 5 years shows that visual representation has a strong influence on motor competence and effortful engagement. The documented visual cues improve self-regulated movement, which is a prerequisite for increasing aerobic and anaerobic fitness in elementary school-aged children (Möding et al., 2022). Meanwhile, a meta-analysis found that movement interventions guided by visual stimuli resulted in significant improvements in cardiorespiratory fitness, as children tended to perform repetitions of movements more stably, rhythmically, and with higher volume (Kay et al., 2025). Thus, these theoretical and empirical mechanisms provide a strong basis for why flashcards in this study are pedagogically able to improve students' physical fitness more effectively than conventional learning.

One of the main reasons for the success of using flashcard is the nature of this media that is visual, simple, and interactive (Paldy et al., 2025). Flashcard allows students to understand physical activity instructions quickly through clear visualization of images and text (Rubleva et al., 2024). This media facilitates the dominant visual-keineesthetic learning style in elementary school age children (Isnaeni, 2025). In addition, research on Bikalawan et al., 2024 states that flashcard media in physical education can increase student motivation and involvement in basic motor learning, including running, jumping, and throwing activities. This is in line with the theory of multimodal learning which states that the integration of visual information and physical movements strengthen the understanding and retention of material (Marquez et al., 2019). In addition, flashcard has the advantage in providing structures in the learning process, especially in the heating, core, and cooling stages. When used systematically, flashcard helps the teacher provide consistent and clear instructions, and encourage the active participation of students individually or small groups (Paldy et al., 2025). Visually structured activities can reduce students' confusion in understanding movements, increasing focus, and accelerating the implementation of instructions, so that the learning time becomes more effective (Iffah et al., 2024).

From a cognitive perspective, the use of flashcard media in physical learning is able to strengthen the process of encoding and retrieval of motor information (Mardiani et al., 2024), the information presented verbally and visually will simultaneously be more easily processed and remembered by students (Vanichvasin, 2020). In the context of physical education, flashcard acts as a bridge between understanding the concept of fitness and concrete physical practice. As research conducted by (Bikalawan et al., 2024) shows that flashcard is effective in increasing the understanding of basic motion concepts and increasing students' enthusiasm for physical activity.

Another advantage of flashcard media is its ability to increase the intensity and quality of students' physical movements. In this study, five physical fitness tests used (Child Ball, Tok Ball, Move The Ball, Shuttle Run, and 600 meters) showed a more significant increase in the experimental group. This increase is thought to be caused by a combination of cognitive and motor elements implanted through flashcard. When students understand the purpose of activity visually, they are better able to control the quality of movement and involve the muscles of the body optimally, thus supporting increased fitness (Kanca et al., 2021). In addition, other factors such as motivation also play an important role in the effectiveness of media -based learning. Flashcard that is designed in an interesting, colorful, and interactive manner can increase the enthusiasm and emotional involvement of students in learning (Nuernberger et al., 2023; Utami et al., 2025h states that intrinsic involvement in physical activity is influenced by competent and autonomous feelings (Kokkonen et al., 2020). With the help of visual media such as flashcard, students feel more confident because the instructions given are easily understood and enable the success of individuals in completing the task of motion. The findings of this research are also in line with studies conducted by Rosfaniarti et al., 2025 who said that the use of flashcards succeeded in actively increasing student participation, involvement in group discussions, and better understanding of concepts.

Furthermore, an increase in physical fitness learning outcomes through flashcard media is also supported by effective monitoring and repetition systems. In learning using a flashcard, students are indirectly exposed to repetition of consistent motion instructions, thus strengthening the habituation of physical activity (Nurputeri et al., 2024). In terms of implementation, the practicality of the use of flashcards also provides benefits for physical education teachers. This media is easy to carry, flexible in large class arrangements, and does not require high technology infrastructure. This is important in the context of elementary schools in Indonesia which often faces the limitations of learning facilities (Juita et al., 2024; Zulfa et al., 2023).

Therefore, overall the results of this study confirm that the use of flashcard media is not only effective in cognitive and affective aspects, but also has a direct impact on increasing the physical fitness of elementary school students. The use of this media can be an applicative pedagogical solution,

especially in facing the challenges of low physical participation and decreased levels of children's fitness in the current digital era (Hambali et al., 2024).

CONCLUSION

This study concluded that the use of flashcard media in physical education learning was significantly more effective than conventional methods in increasing physical fitness of elementary school students. The results of the analysis showed a greater increase in the experimental group than the control group. Flashcard media is proven to be able to increase student involvement, facilitate understanding of motion instructions, and create a more pleasant and structured learning atmosphere. This visual media integration contributes to the intensity and quality of physical activity carried out by students during the learning process, so that it has a direct impact on increasing physical fitness abilities. This finding indicates that flashcard is one of the applicative and efficient pedagogical solutions, especially in the elementary school environment that has limited facilities and time. Therefore, it is advisable to physical education teachers to adopt visual learning media such as flashcard in designing attractive and effective physical activity. Specifically for researchers, this research can be used as a basis for conducting further research, of course with a broader area coverage, longer duration of intervention, and quantitative and qualitative combination approaches are needed to strengthen and broaden understanding of the effectiveness of flashcard media in various contexts of physical learning.

AUTHOR CONTRIBUTION STATEMENT

The authors contributed substantially to the completion of this research. Sumbara Hambali (SH) who also served as the corresponding author, was responsible for conceptualization, development of the framework, the preparation of the original manuscript and make revisions to the manuscript, and project administration. Veny Juniarni Hardi (VJH) contributed to methodology design and preparation of research instruments. Papat Yunisal (PY) contributed to coordination of data collection and supervision during field implementation. Asep Akbaruddin (AA) contributed to responsible for data analysis, including statistical processing and interpretation of findings. All authors have read and agreed to the published version of the manuscript.

DECLARATION

The author declares that this research was conducted independently and that the manuscript is an original work which has not been published or submitted elsewhere. The author states that there is no conflict of interest related to the research, authorship, or publication of this article. This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. All ethical considerations in data collection and analysis were followed to ensure the validity and integrity of the research.

DATA AVAILABILITY

The dataset generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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