



## Integration of Traditional Games in Educational Technology-Based Physical Education Learning to Improve the Physical Fitness of Female Students

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### Abstract

This study aims to analyze the effectiveness of integrating traditional games into physical education learning based on educational technology to improve the physical fitness of female students. The study used a quantitative approach with a quasi-experimental method and a  $2 \times 2$  factorial design involving 168 female students of PPMI Assalaam Surakarta aged 13–18 years. The sample was selected using a proportionate stratified random sampling technique and divided into treatment and control groups. The treatment group participated in physical education learning that integrated traditional games, while the control group received conventional learning. The research instrument used the Nusantara Student Fitness Test (TKPN) which includes measurements of body mass index, flexibility, muscle strength and endurance, and cardiorespiratory endurance. Data were analyzed descriptively and inferentially using the Wilcoxon Signed Rank Test and the Mann–Whitney U Test. The results showed that the treatment group experienced a higher increase in physical fitness than the control group with a gain score of 0.389 and 0.170. This increase was significant in both age groups, namely 13–15 years and 16–18 years ( $p < 0.05$ ). These findings demonstrate that integrating traditional games into educational technology-based learning designs can create active, contextual, and meaningful learning experiences, making them more effective in improving the physical fitness of female students than conventional learning. This research confirms that utilizing local culture-based learning resources is an educational technology innovation that can support improvements in the quality of physical education learning.

### Keywords:

educational technology, traditional games, physical education, physical fitness, female students

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## INTRODUCTION

The development of educational technology has changed the learning paradigm from merely delivering material to a process that emphasizes the design of effective, efficient, and student-centered learning experiences.(Adhi, Pujiyanto, Mahardiyanti, & Afiatunisa, 2024)In the context of physical education, educational technology is not only defined as the use of digital devices, but also as a systematic approach in designing, developing, utilizing, managing, and evaluating the learning process so that learning objectives can be achieved optimally.(Alfani, 2022)This approach provides opportunities for teachers to integrate various learning resources, learning strategies, and media that are appropriate to the characteristics of students so that learning becomes more meaningful.(Ansharudin et.al., 2022)One form of implementation of educational



technology is optimizing local culture-based learning resources through learning designs that can increase student involvement in physical activities.(Ardha, 2022).

Physical education has a strategic role in shaping students' physical fitness as an important indicator of health and quality of life.(Arfanda, 2023)Physical fitness is not only related to the ability to carry out daily activities without experiencing excessive fatigue, but also serves as the foundation for the physical, mental, social, and academic development of adolescents.(Bapor & Semarayasa, 2022). Good fitness contributes to increased learning concentration, thinking skills, mental health, and student productivity.(Da'i & Apriyanto, 2025)Therefore, physical education learning needs to be designed through learning experiences that can encourage physical activity in an active, structured, and enjoyable way.(Haetami et.al, 2024).

The phenomenon of declining levels of physical fitness among adolescents is a challenge faced by various educational institutions in Indonesia.(Hasan, 2023). Lifestyle changes towards sedentary behavior, increased use of digital devices, and reduced physical activity cause many students to have low levels of fitness.(Hidayat et.al, 2025)This condition was also found in female students at PPMI Assalaam, who have busy academic activities and dormitory life, which limits their opportunities for physical activity.(Juhanis et.al, 2025). Initial diagnostic data shows that most female students are in the category of low physical fitness, so learning innovations are needed that can increase physical activity without disrupting the rhythm of Islamic boarding school activities.(Kardi, Ansar, & Nopiyanto, 2025).

One relevant approach to answer this problem is to integrate traditional games into physical education learning.(Kurniawan, 2022)Traditional games such as betengan, gobak sodor, and jump rope contain elements of movement that can train cardiorespiratory endurance, muscle strength, agility, coordination, balance, and flexibility in an integrated manner. In addition to providing physiological benefits, traditional games also foster cooperation, communication, sportsmanship, problem-solving skills, and a love of local culture.(Lufthansa, Artanty, Rohmah, & ..., 2025)These characteristics make traditional games a learning resource rich in educational value and in line with the principles of active learning.

From the perspective of educational technology, traditional games are not positioned solely as play activities, but as media and learning strategies that are systematically designed to achieve learning objectives.(Maidar, 2024). Teachers act as instructional designers who develop learning experiences through the selection of learning models, activity management, assessment preparation, and planned evaluation of learning outcomes.(Ula, Anjani, Ulva, Sahputra, & ..., 2022). Thus, the integration of traditional games becomes part of the educational technology-based learning design that utilizes authentic learning resources according to the characteristics of the learner's environment.(Twiningsih, Gunarhadi, & Musadad, 2024).

This approach is increasingly relevant in Islamic boarding school environments which have limited space and time for implementing physical education learning.(Zuhdi, 2021). Educational technology-based learning design allows teachers to develop effective, contextual, and measurable physical activities without having to rely on complex sports facilities.(Wicahyani et al., 2025)Through

systematic learning management, traditional games can become an alternative learning method that can increase the participation of female students while maintaining local cultural values as part of a holistic educational process.(Wibowo et.al, 2023).

Although various studies have shown that traditional games contribute to improved physical fitness, most research still focuses solely on the effectiveness of physical activity or aspects of physical education. Research examining traditional games as part of technology-based learning designs, particularly in Islamic boarding schools, is still very limited.(Wati, Khory, & Dafun, nd). Furthermore, previous research has generally not linked the integration of traditional games with the design of systematic learning experiences in accordance with the principles of educational technology, so the opportunities for its development are still wide open.

Based on these conditions, this study aims to analyze the integration of traditional games in educational technology-based physical education learning to improve the physical fitness of female students. This research is expected to contribute to the development of educational technology science through the utilization of local culture as a systematically designed learning resource, while also becoming an alternative innovation in effective, contextual, and sustainable physical education learning to improve the physical fitness of students in Islamic boarding schools.

## METHODS

This study used a quantitative approach with a quasi-experimental method using a  $2 \times 2$  factorial design. This design was chosen to analyze the effect of integrating traditional games in physical education learning on the physical fitness of female students, while also testing differences in effects based on age groups (13–15 years and 16–18 years). The study was conducted at PPMI Assalaam Surakarta in 2026. The independent variable in this study was physical education learning that integrated traditional games (betengan, gobak sodor, and jump rope), while the attribute variable was the age group of female students. The dependent variable of the study was physical fitness which was measured after the implementation of the learning intervention.

The study population consisted of 1,086 female students of PPMI Assalaam from 27 classes. The study sample consisted of 168 female students selected using proportionate stratified random sampling technique based on age group characteristics. The sample was then divided into an experimental group and an active control group. The experimental group received physical education learning through the integration of traditional games designed based on the principles of educational technology, while the control group received conventional physical activity learning in the form of aerobics and badminton with equivalent training duration.

The learning implementation in the experimental group was designed using an educational technology approach through a needs analysis process, designing learning experiences, utilizing traditional games as learning resources, managing learning activities, and evaluating learning outcomes. The games of betengan,

gobak sodor, and jump rope were integrated into the syntax of physical education learning so that students gained active, collaborative, contextual, and meaningful learning experiences. This approach positions traditional games not only as physical activities, but also as learning media systematically designed to achieve physical fitness learning objectives.

The measurement instrument used was the Nusantara Student Fitness Test (TKPN), a national standard instrument recommended by the Ministry of Youth and Sports. The fitness components measured included body composition (Body Mass Index), flexibility (V-Sit and Reach), muscle strength and endurance (30-second Sit-Up and Squat Thrust), and cardiorespiratory endurance (PACER Test). All instruments were used to obtain data on physical fitness before and after treatment so that changes could be analyzed objectively.

The data were analyzed descriptively and inferentially using statistical software. Descriptive analysis was used to describe the characteristics of the data through the mean, standard deviation, minimum, and maximum values. Prior to hypothesis testing, prerequisite tests were conducted, including normality and homogeneity of variance tests. Furthermore, the research hypotheses were tested using a  $2 \times 2$  factorial Analysis of Variance (ANOVA) to determine the main effect of traditional game-based learning, the influence of age group, and the interaction between the two variables on the physical fitness of female students. The significance level used in all statistical tests was  $\alpha = 0.05$ .

## RESULTS & DISCUSSION

### RESULTS

The results of this study revealed the effect of integrating traditional games into educational technology-based physical education learning on improving the physical fitness of female students at PPMI Assalaam. A total of 168 female students participated in the study and were divided into treatment and control groups. The treatment group received physical education learning that integrated traditional games, while the control group received conventional learning. Analysis was conducted on changes in physical fitness scores based on pretest and posttest results, as well as differences in improvement based on age group.

**Table 1.** Descriptive Statistics of Physical Fitness of Female Students

| Group     | n  | Pretest (Mean $\pm$ SD) | Posttest (Mean $\pm$ SD) | Gain Score |
|-----------|----|-------------------------|--------------------------|------------|
| Treatment | 84 | 1.836 $\pm$ 0.244       | 2.225 $\pm$ 0.307        | 0.389      |
| Control   | 84 | 1.931 $\pm$ 0.247       | 2.101 $\pm$ 0.274        | 0.170      |

Table 1 shows that both groups experienced an increase in physical fitness after the learning implementation. The treatment group experienced an increase in average score from 1.836 to 2.225, while the control group increased from 1.931 to 2.101. The treatment group's gain score (0.389) was higher than the control group's (0.170). These descriptive results indicate that the integration of traditional games in physical education learning provides a greater increase in physical fitness compared to conventional learning.

**Table 2.** Hypothesis Test Results

| Hypothesis                                                   | Statistical Test          | Statistical Value | p-value | Information |
|--------------------------------------------------------------|---------------------------|-------------------|---------|-------------|
| Pretest–posttest differences between treatment groups        | Wilcoxon Signed Rank Test | = 28              | <0.001  | Significant |
| Pretest–posttest differences of the control group            | Wilcoxon Signed Rank Test | = 178             | <0.001  | Significant |
| Differences between treatment and control (ages 13–15 years) | Mann–Whitney U Test       | = 1198            | 0.005   | Significant |
| Treatment and control differences (ages 16–18 years)         | Mann–Whitney U Test       | U = 1352          | <0.001  | Significant |

The results of the hypothesis testing showed that learning in both groups resulted in significant improvements in physical fitness ( $p < 0.001$ ). However, the Mann–Whitney test results showed that the treatment group achieved statistically higher improvements than the control group, both in the 13–15 and 16–18 age groups. These findings indicate that the integration of traditional games has a positive effect on improving the physical fitness of female students.

**Table 3.** Summary of the Effectiveness of Traditional Game Integration Based on Age Group

| Group                          | Mean Gain | Effectiveness Category |
|--------------------------------|-----------|------------------------|
| Treatment for ages 13–15 years | 0.407     | Highest                |
| Treatment for ages 16–18 years | 0.371     | Tall                   |
| Age control 13–15 years        | 0.190     | Low                    |
| Age control 16–18 years        | 0.150     | Lowest                 |

Based on Table 3, the highest increase in physical fitness occurred in the treatment group aged 13–15 years with a mean gain of 0.407, followed by the treatment group aged 16–18 years with a mean gain of 0.371. In contrast, the control group showed lower increases in both age groups. Although descriptively the 13–15 age group achieved slightly higher increases, the results of the statistical analysis showed that the effectiveness of integrating traditional games was relatively consistent across both age groups. Thus, physical education learning that integrates traditional games is proven to be more effective in improving the physical fitness of female students than conventional learning.

### Discussion

The results of the study indicate that the integration of traditional games in physical education learning based on educational technology can improve the physical fitness of female students more effectively than conventional learning. The increase in gain scores in the treatment group is higher than the control group

indicating that traditional games provide a more active, enjoyable, and meaningful learning experience. From an educational technology perspective, this finding reinforces that learning effectiveness is not only determined by the use of digital technology, but also by the teacher's ability to design a systematic learning experience through the use of contextual learning resources. Traditional games function as a learning medium that can optimize student interaction with the learning environment so that physical education learning objectives can be achieved more effectively. This finding is in line with the theory of educational technology proposed by Januszewski and Molenda (2008), which states that educational technology is an ethical practice in facilitating learning through the creation, use, and management of learning processes and resources.

The improvement in physical fitness achieved by the treatment group indicates that traditional game-based physical activity can stimulate various fitness components, such as cardiorespiratory endurance, muscle strength, agility, coordination, and flexibility. The characteristics of games such as gobak sodor, betengan, and jump rope require students to move dynamically, collaborate, and make quick decisions during the game. These activities produce a higher intensity of movement than conventional learning, thus having a positive impact on improving physical fitness. The results of this study support the research of Widiastuti (2020) which states that traditional games are an effective form of physical activity to improve students' motor skills and fitness because they involve diverse body movements while fostering learning motivation through enjoyable activities.

The research findings also indicate that the effectiveness of traditional game integration is relatively consistent across both the 13–15 and 16–18 age groups. Although the 13–15 age group achieved slightly higher improvement scores, the analysis results show that both age groups benefited significantly from the implementation of traditional games. This indicates that traditional game-based learning designs have the flexibility to be applied to various age characteristics of adolescents. These results align with research by Lubans et al. (2016) which explains that physical activities designed according to student characteristics can improve physical fitness without being significantly affected by age differences, as long as the intensity and frequency of exercise are carried out regularly.

From an educational technology perspective, learning success is influenced not only by the media used, but also by the learning design that systematically integrates objectives, strategies, learning resources, and assessments. In this study, traditional games were implemented as part of a learning design designed to provide authentic, collaborative, and learner-centered learning experiences. This approach aligns with the 21st-century learning paradigm that positions learners as active subjects in constructing knowledge through direct experience. The results of this study align with Branch's (2009) research, which asserts that systematically designed learning designs can increase learning effectiveness because all learning components are integrated to achieve predetermined goals.

Overall, this research contributes to the development of educational technology through the use of traditional games as an innovative learning resource in physical education learning. The integration of local culture into learning design not only impacts physical fitness, but also strengthens social skills, cooperation,

sportsmanship, communication, and the preservation of cultural values. Thus, traditional games can be positioned as a relevant learning medium to support active and meaningful learning in schools and Islamic boarding schools. These findings also strengthen the results of Bailey's (2018) research which states that physical education learning designed in an active, collaborative, and contextual manner has a positive impact on the physical, social, and affective development of students, making it worthy of being integrated into learning practices oriented towards improving the quality of learning outcomes.

## CONCLUSION

Based on the research results, it can be concluded that the integration of traditional games in physical education learning based on educational technology has proven to be more effective in improving the physical fitness of female students compared to conventional learning. Learning that utilizes traditional games as learning resources and learning media is able to create an active, contextual, and student-centered learning experience, thereby encouraging optimal increases in physical activity. The results also show that physical fitness increases occurred significantly in the treatment group, both in the 13-15 and 16-18 year age groups, so this approach can be applied to various adolescent age levels. These findings confirm that educational technology is not only oriented towards the use of digital technology, but also on designing learning systems that utilize authentic learning resources systematically to achieve learning objectives. Therefore, the integration of traditional games in physical education learning can be an alternative, effective learning innovation to improve physical fitness, preserve local culture, and support the realization of active, meaningful, and sustainable learning in schools and Islamic boarding schools.

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