

Modification of Handball Learning Using Plastic Balls at Pakusari State High School Enhancing Learning Outcomes

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Abstract

This study aims to determine the effectiveness of hand ball learning modifications using plastic balls in improving student learning outcomes in the subjects of Physical Education, Sports, and Health (PJOK). The action hypothesis in this study is that the use of plastic balls as a learning modification medium can improve the learning outcomes of students' handball skills. The main premise of the study is because handball learning in schools often faces the constraints of limited means, low media variation and a lack of courage for students to perform basic game techniques. Plastic balls were chosen because they are lighter, safer, easy to obtain and suitable for learning needs of basic skills such as passing, dribbling, catching, and shooting. This study uses the design of Class Action Research (PTK) which is carried out through the pre-cycle, cycle I, and cycle II stages. The subjects of the study were 36 students in grades XII-1 of SMA Negeri Pakusari. Data was collected through observation and handball skill tests, then analyzed descriptively based on average scores, number of students completed, and percentage of learning completion. The results of the study showed a gradual increase in learning outcomes. In the pre-cycle, the students who achieved completeness amounted to 19 students or 52.78% with an average class of 75.94. After the action in the first cycle, the completeness increased to 27 students or 75.00% with an average class of 80.28. In cycle II, the completeness reached 33 students or 91.67% with an average class of 88.78. Improvements also occur in all aspects of skills, namely passing, dribbling, catching, and shooting. Thus, the hypothesis of action is accepted. Modification of handball learning using plastic balls has proven to be effective as a safe, adaptive, and practical learning strategy to improve student learning outcomes in PJOK.

Keywords: handball; plastic balls; learning outcomes; learning modifications; Physical Education.

INTRODUCTION

Physical, Sports, and Health Education (PJOK) is an integral part of school education because it not only develops physical abilities, but also shapes the cognitive, affective, social, and psychomotor aspects of students. Through planned physical activities, students gain learning experiences that encourage the mastery of movement skills, cooperation, discipline, decision-making, and active living habits. In the context of modern learning, PJOK is no longer understood as a mere sports activity, but as a pedagogical process that places students as active subjects in learning. Therefore, PJOK teachers are required to be able to design learning that is adaptive, fun, safe, and in accordance with the characteristics of students and the condition of the facilities available at school.

One of the relevant big ball game materials developed in PJOK is handball. Handball games have a high educational value because they involve basic skills of throwing, catching, dribbling, moving without the ball, teamwork, communication, and game strategy. Various studies show that handball learning interventions in schools contribute to improved fitness, movement performance, coordination, social skills, and student involvement in physical activities (Akinci & Ateş, 2023; Tafuri & Gravino, 2026; Broto & Kristiyanto, 2026). In addition, handball learning can also be developed through a game-based pedagogical approach, small-sided games, Teaching Games for Understanding (TGfU), sport education, and digital feedback strategies to improve students' basic

skills, motivation, and attitudes towards learning (Mahmoud Sha'lan, 2022; Mazzardo & Ribas, 2022; de Lucca & Impolcetto, 2022; Rakha, 2026).

Despite having great pedagogical potential, handball learning in schools often faces practical obstacles. Based on the research manuscript at SMA Negeri Pakusari, the main problems found were the low learning outcomes of students in handball materials, limited facilities and infrastructure, and lack of variety of learning methods used by teachers. Initial conditions showed that of the 36 students in grade XII-1, only 19 students or 52.78% had achieved complete learning, while 17 students or 47.22% had not completed their studies. This percentage has not met the set learning success indicators, which is at least 75% of students achieve the Minimum Completeness Criteria.

These problems can occur because learning handball requires mastery of relatively complex basic techniques, such as passing, catching, dribbling, and shooting. If the learning process is carried out with inappropriate media, too hard a ball, limited facilities, or a monotonous learning strategy, students tend to be less confident, passive, and afraid of making mistakes. In sports learning studies, the skills of invasive games such as handball are influenced by motor skills, coordination, spatial perception, decision-making, and adequate play experience (Bajrami & Ibri, 2022; Feu et al., 2023; Farias & Segovia, 2022). Therefore, limited facilities are not only technical issues but can also affect the quality of students' learning experience.

The literature shows that game modification, media, rules, field size, number of players, and the form of movement tasks are important strategies in PJOK learning. This approach aims to adjust the level of difficulty of activities to students' abilities so that learning becomes safer, participatory, and meaningful. In the context of handball, the use of small-sided games has been proven to increase the intensity of student involvement, the number of touches of the ball, decision-making opportunities, and mastery of basic skills (Mahmoud Sha'lan, 2022; Sahli et al., 2023; Feu et al., 2023). The TGfU approach has also been reported to have a positive impact on motor coordination, tactical understanding, and technique skills in handball learning in schools (Mazzardo & Ribas, 2022; Papagiannopoulos & Digelidis, 2023).

In addition to a game-based approach, recent research emphasizes the importance of learning designs that make room for intrinsic motivation, fun, peer support, and success experiences. Varied game structures can increase children's motivation and enjoyment in handball-based activities (Fasold & Lukac, 2025). Verbal support from peers also affects performance indicators in small-scale handball games (Sahli et al., 2023), while pairing training in PJOK classes can regulate intrinsic motivation and perception of learning partners (Beik & Zare, 2026). The findings suggest that handball learning needs to be designed not only to practice technique, but also to build students' sense of security, confidence, cooperation, and emotional engagement.

One form of solution that is relevant to the condition of Pakusari State High School is the modification of handball learning using plastic balls. Plastic balls are easier to obtain, relatively cheap, lightweight, safe for students to use, and can reduce fear when passing, catching, or shooting. With more adaptive media, students gain more opportunities to try, repeat, improve movements, and actively engage in games. This modification is in line with the principle of the constraint-led approach, namely movement learning can be developed through adjustments to task constraints, environments, and tools so that students find movement patterns that suit their abilities (Ribeiro et al., 2021; Espoz-Lazo et al., 2025).

However, literature reviews also show research gaps. Most studies on handball have focused more on athlete performance, fitness, throwing techniques, injuries, or exercise interventions in sports

players and students (Rameshkannan & Chittibabu, 2024; Maeda et al., 2025; Gruić et al., 2025; Nyhus Hagum et al., 2023; Drôle et al., 2025). Research that specifically places plastic balls as a simple modification medium in handball learning in high school, especially within the framework of Classroom Action Research, is still relatively limited. In addition, studies on handball learning in schools generally emphasize pedagogical models such as TGfU, sport education, or small-sided games, but have not examined much of how simple and accessible media can be a practical solution for schools with limited facilities.

Thus, this research is important because it presents contextual solutions to the real problems of PJOK learning. Modifications using plastic balls are not only intended as a substitute for tools, but as a pedagogical strategy to lower learning barriers, increase participation, increase practical experience, and improve student learning outcomes. In this research paper, the application of actions showed an increase in learning completeness from the pre-cycle by 52.78%, increased to 75.00% in cycle I, and reached 91.67% in cycle II. The improvement shows that modification of learning media has the potential to be an effective approach in improving the quality of handball learning.

Based on the background, problems, and gaps of the research, the purpose of this study is to determine the effectiveness of the modification of handball learning using plastic balls in improving the learning outcomes of grade XII-1 students of SMA Negeri Pakusari in PJOK subjects. The novelty of this research lies in the use of plastic balls as a simple, safe, cheap, and contextual modification medium in handball learning based on Classroom Action Research. This study not only tests the improvement of learning outcomes but also places tool modification as a pedagogical strategy to overcome the limitations of means and increase student involvement in learning.

The scope of the research was limited to learning handball in grades XII-1 of SMA Negeri Pakusari with a total of 36 students. The action is carried out through the pre-cycle, cycle I, and cycle II stages, with a focus on improving learning outcomes through passing, catching, dribbling, shooting, exercise variations, and simple games using plastic balls. With this scope, the results of the research are expected to make a practical contribution for PJOK teachers in developing learning that is creative, adaptive, and in accordance with school conditions, as well as making an academic contribution to the development of studies on the modification of large ball games in the school physical education environment.

METHODS

Research Design

This study uses a Class Action Research (PTK) design with a quantitative-qualitative descriptive approach. The PTK design was chosen because the research aims to improve the learning process directly through actions that are systematically designed, implemented, observed, and reflected. The action model refers to a cyclical pattern consisting of the stages of planning, implementing actions, observation, and reflection. This approach is relevant for physical education learning because it allows teachers and researchers to refine learning strategies based on real classroom conditions, student responses, and evaluation results of each cycle. In the context of handball learning, the action approach is also in accordance with the characteristics of movement skill learning which requires repetition, feedback, assignment modification, and media adjustment so that students have an optimal learning experience. Several handball learning studies have shown that changes in assignment design, small games, and adaptive pedagogical approaches can improve students' engagement, coordination, and engineering skills (Mazzardo et al., 2022; Mahmoud Sha'lan,

2022; Feu et al., 2023).

Location, Time and Research Subject

The research was carried out at Pakusari State High School, Jember Regency, in the even semester of the 2025/2026 school year. The subject of the study was 36 students in class XII-1. All students in the class were used as research subjects because this research was in the form of class actions that focused on improving the learning process and outcomes in one study group. The selection of subjects was based on the results of initial observations which showed that students' learning outcomes in handball material had not reached the classical completeness indicator. In addition, the limited learning facilities and low variety of media are the reasons for the need for learning actions through the modification of tools using plastic balls.

Variables and Action Focus

The focus of action in this study is the modification of handball learning using plastic balls. Modifications are made by replacing or adjusting the ball media to make it lighter, safer, easier to control, and in accordance with the student's abilities. The observed outcome variables were the results of learning handball skills, which included four main aspects, namely passing, dribbling, catching, and shooting. These four aspects were chosen because they are basic skills that support students' success in the game of handball. The adjustment of tools and the form of movement tasks in this study is in line with the principle of task constraint manipulation, which is the change of tools, rules, spaces, or tasks to help students develop movement patterns gradually according to their abilities (Ribeiro et al., 2021; Espoz-Lazo et al., 2025).

Research Procedure

The research was carried out through three main stages, namely pre-cycle, cycle I, and cycle II. In the pre-cycle stage, the researcher made initial observations of the handball learning process and measured students' initial abilities in the aspects of passing, dribbling, catching, and shooting. The pre-cycle results are used as the basis for designing actions in cycle I. In cycle I, actions are carried out by applying handball learning using plastic balls. Learning is directed at the introduction and practice of basic skills through simple passing, catching, dribbling, and shooting activities. Teachers provide demonstrations, instruction, and repetitive practice opportunities to get students used to using plastic balls in learning situations. During the action process, the researcher made observations on student engagement, ability to perform basic techniques, and obstacles that arise during learning. At the end of the first cycle, an evaluation of learning outcomes was carried out to determine the increase in completeness.

Based on the reflection of the first cycle, there are still students who have not reached the KKM, so the action is continued to cycle II. In cycle II, learning is improved by adding a variety of exercises, such as passing in a stationary position, walking, and running, training to receive the ball in pairs, and small games that give students the opportunity to touch the ball more often. This strategy is based on the idea that small-sided games and variations in game situations can increase the frequency of engagement, decision-making, and skill mastery in handball learning (Mahmoud Sha'lan, 2022; Sahli et al., 2023; Feu et al., 2023). At the end of cycle II, a re-evaluation was carried out to determine the success of the action.

Research Instruments

The instruments used in this study are observation sheets and handball skill assessment rubrics. Observation sheets are used to record the learning process, student participation, response to the use of plastic balls, and obstacles that arise during the action. The assessment rubric is used to

assess four aspects of skills, namely passing, dribbling, catching, and shooting. Each aspect is scored based on the quality of movement execution, technique accuracy, ball control, and success in the context of practice or play. The use of skill observation is in accordance with the characteristics of PJOK learning because learning outcomes are not only measured through knowledge, but also through movement performance that is seen during learning activities. The study of handball learning emphasizes the importance of assessing technical skills in the context of games so that learning outcomes are more in line with the characteristics of sports activities (Mazzardo et al., 2022; Rakha, 2026).

Table 1. Assesment Indicator

Assessed Aspect	Assessment Indicator
Passing	Accuracy in passing the ball to a teammate
Catching	Ability to catch the ball correctly
Dribbling	Ability to dribble the ball with good control
Shooting	Accuracy and power in shooting the ball toward the goal

Data Collection Techniques

Data were collected through observation of the learning process and handball skills tests at each stage of the study. Observations were made during the action process to obtain information about student activities and the effectiveness of the use of plastic balls in learning. Skill tests are carried out in the pre-cycle, cycle I, and cycle II to determine the development of student learning outcomes. The main data collected included the scores of each skill aspect, the number of students who reached the KKM, the number of students who have not completed, the percentage of completion, and the average class.

Data Analysis Techniques

Data analysis was carried out descriptively, quantitatively, and qualitatively. Quantitative data was analyzed by calculating the average value of skills, the number of completed students, the number of students who had not completed the course, and the percentage of classical completeness in each cycle. The percentage of completeness is calculated by comparing the number of students who reach the KKM with the number of all students, then multiplied by 100%. Qualitative data from observation results were analyzed through data reduction, data presentation, and conclusion drawing to explain changes in learning behavior, participation, and student responses to learning actions. The indicator of research success is determined if at least 75% of students achieve a KKM score of 75. If the results in one cycle have not reached these indicators, then the action is corrected in the next cycle. With this analysis technique, the success of the action is not only seen from the increase in completeness rate, but also from changes in the learning process, increased student involvement, and improved mastery of basic handball skills.

Table 2. Assesment criteria

Score	Assessment Criteria
60	The student is not yet able to perform the basic handball techniques correctly, is less active during learning activities, and requires full guidance from the teacher.
65	The student is less active and has not yet mastered the basic techniques using the plastic ball; movement coordination is still inaccurate.
70	The student begins to understand the basic handball techniques but still frequently makes errors in performing the movements.
75	The student can perform the basic techniques well but still requires teacher guidance during movement execution.
80	The student can perform the basic techniques; the movements are correct but not yet consistent in the accuracy of passing, dribbling, or shooting.
85	The student can perform the basic handball techniques using the plastic ball well, although there are still minor errors in movement coordination.
90	The student is very active and able to perform all basic techniques well, with only a few minor errors.
95	The student is very active and able to perform passing, catching, dribbling, and shooting using the plastic ball very well; the movements are accurate, confident, and performed without errors.

RESULTS

This class action research was carried out on students in grades XII-1 of Pakusari State High School with a total of 36 students. The data on learning outcomes was obtained through the assessment of basic skills of the handball game which included passing, dribbling, catching, and shooting. The assessment was carried out in three stages, namely pre-cycle, cycle I, and cycle II. The Minimum Completeness Criterion (KKM) used is 75, so that students are declared complete if they obtain a minimum score of 75 on the learning results of handball skills. The presentation of the results of the research focused on increasing learning completeness, changes in the percentage of students who have not completed, and the development of the average score of each aspect of basic handball skills.

Table 3. Recapitulation of handball learning outcomes

Completeness	Number of Students	Percentage
Completed	19	52,78 %
Not yet finished	17	47,22 %
Total	36	100 %

Based on Table 2, the results of handball learning at the pre-cycle stage show that out of 36 students, only 19 students or 52.78% have achieved KKM, while 17 students or 47.22% have not reached completeness. These findings show that students' initial ability in handball learning still does not meet the set classical success indicators, which is at least 75% of students achieve KKM. This condition indicates that previous learning has not been able to fully facilitate the mastery of basic handball skills optimally. The low completeness in the early stages can be influenced by the limitations of the media, the low variety of learning, the fear of students towards the ball, and the uneven mastery of passing, dribbling, catching, and shooting techniques. This is in line with the study of invasion game learning which confirms that students' success in games such as handball is influenced by practical experience, movement coordination, decision-making, and the suitability of movement tasks with students' abilities (Bajrami et al., 2022; Feu et al., 2023; Silva et al., 2020).

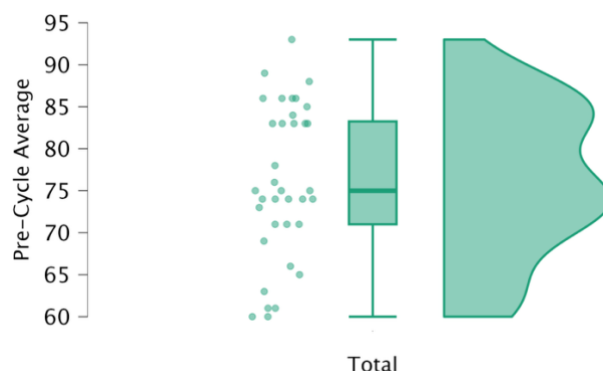


Figure 2. Pre-cycle handball learning outcomes

Figure 2 clarifies the initial condition that the proportion of students who have not completed is still quite large. This visualization shows that there is a need for more adaptive learning actions so that learning barriers can be reduced. In the context of physical education, students will be more easily involved in learning if the tasks of movement, tools, and learning environment are adjusted to their ability level. Therefore, the use of plastic balls as a modification medium becomes relevant because it can lower the initial difficulty level, increase a sense of security, and give students more opportunities to try out basic handball movements. This principle is in accordance with the constraint-led approach and nonlinear pedagogy that emphasizes the importance of modifying tools, rules, spaces, and tasks so that learners can find movement patterns that suit their capacity (Ribeiro et al., 2021; Espoz-Lazo et al., 2025).

Tabel 4. Handball learning outcomes cycle 1 result

Completeness	Number of Students	Percentage
Completed	27	75,00 %
Not yet finished	9	25,00 %
Total	36	100 %

Based on Table 3, after the implementation of handball learning using plastic balls in cycle I, the number of students who achieved completeness increased to 27 students or 75.00%, while students who did not complete decreased to 9 students or 25.00%. This improvement shows that the actions in cycle I have reached the minimum limit of classical success indicators. Pedagogically, the use of plastic balls provides a safer, lighter, and easier to control learning experience, so that students are more courageous to repeat movements. The increased completeness also shows that media modification not only serves as a substitute for standard balls but becomes a learning strategy that helps students understand and practice basic skills gradually. These findings support the results of research showing that handball learning through small games, TGfU, and task modification can improve engagement, ball-touching opportunities, decision-making, and mastery of students' basic skills (Mahmoud Sha'lan, 2022; Mazzardo et al., 2022; Murillo et al., 2020).

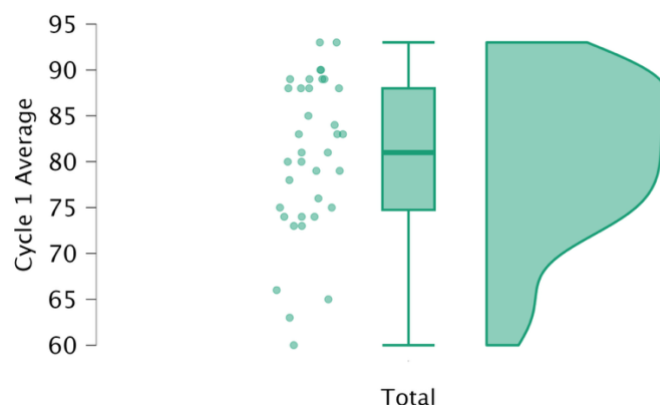


Figure 3. Cycle 1 handball learning outcome

Figure 3 shows a clear visual change compared to the pre-cycle stage, namely the increase in the proportion of students who complete and the proportion of students who have not completed it. This change indicates that students are beginning to adapt to learning using plastic balls. In learning practice, lighter media can reduce anxiety when catching or receiving the ball, so students are more active in paired exercises, group exercises, and simple games. In addition, learning that provides a space for repeated practice allows students to improve hand-eye coordination, ball control, and movement accuracy. This is in line with the findings that fun game structures, peer support, and game-based activities can increase student motivation, fun, and performance in handball learning (Sahli et al., 2023; Fasold et al., 2025; Beik & Zare, 2026).

Tabel 5. Handball learning outcomes cycle 2 result

Completeness	Number of Students	Percentage
Completed	27	91,67 %
Not yet finished	9	8,33 %
Total	36	100 %

Based on Table 4, the learning outcomes in cycle II showed a stronger improvement. The number of students who achieved completeness increased to 33 students or 91.67%, while students who did not complete decreased to 3 students or 8.33%. These results show that the improvement of actions in cycle II successfully increases the effectiveness of learning. The improvement can be explained by the addition of a variety of exercises, such as passing, walking, and running exercises, receiving the ball in pairs, and simple games that give students more opportunities to interact with the ball. The variety of activities makes learning more contextual and closer to actual game situations. In handball learning, the more opportunities students have to touch the ball, move, make decisions, and work together, the greater the chance of improving game skills (Feu et al., 2023; Mahmoud Sha'lan, 2022; Sahli et al., 2023).

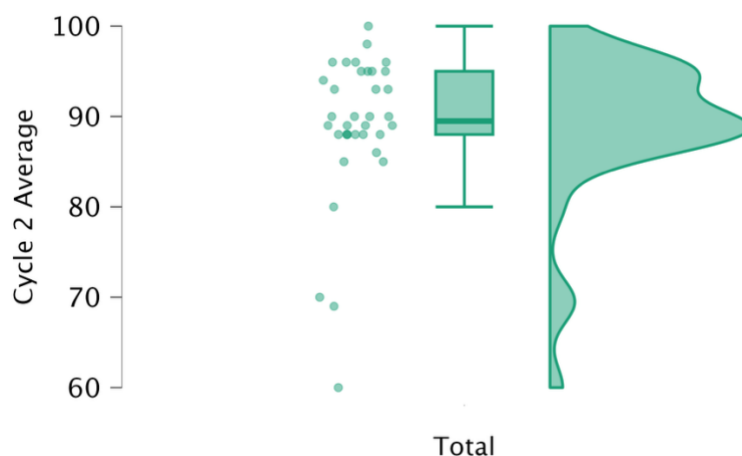


Figure 4. Cycle 2 handball learning outcome

Figure 4 shows that most students have achieved completeness in cycle II. Interpretively, this visualization shows that learning modifications using plastic balls are more effective when combined with a variety of exercises and small games. At this stage, students are not only helped by the lightweight and safe characteristics of the ball, but also by the learning design that gives the playing experience more meaningful. Game-based learning allows students to understand when to pass, catch, dribble and shoot in a more realistic context. This is in line with the Teaching Games for Understanding and Sport Education approach which places game understanding, decision-making, cooperation, and technical skills as interconnected parts of physical education learning (Mazzardo et al., 2022; de Lucca et al., 2022; Sánchez-Gómez et al., 2021; Papagiannopoulos et al., 2023).

Table 6. Mean scores of students' handball skill aspects across research cycles

Aspect	Pre-Cycle	Cycle I	Cycle II
Passing	74.58	80.42	87.64
Dribbling	75.69	81.11	88.06
Catching	78.06	80.69	90.56
Shooting	75.42	78.89	88.89

Based on Table 5, all aspects of handball skills improved from pre-cycle to cycle I and from cycle I to cycle II. The passing aspect increases gradually, which indicates that students are increasingly able to direct the ball to friends with better control. The dribbling aspect has also improved, indicating that students are increasingly able to control the ball when moving. The improvement in the catching aspect shows that students are more confident in receiving the ball, while the improvement in the shooting aspect shows progress in directing the ball to the goal. These four aspects improve shows that modifications using plastic balls have a comprehensive impact on basic handball skills, not just one aspect of engineering. These results reinforce the view that the development of invasion game skills requires a combination of technique practice, decision-making, play experience, and task modification that matches the student's characteristics (Mazzardo et al., 2022; Murillo et al., 2020; Farias et al., 2022; Nora & Nurcahyo, 2023).

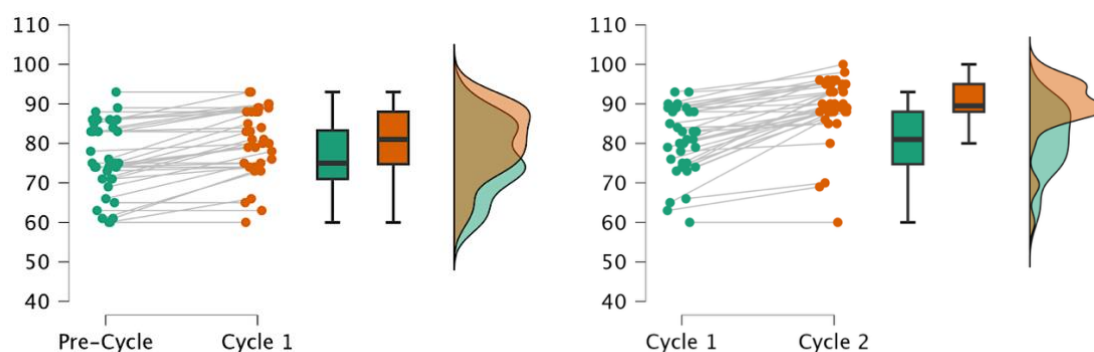


Figure 5. Comparison of pre-cycle - cycle 1 and cycle 1 - 2 results

Overall, the results of the study show that the modification of handball learning using plastic balls can gradually improve student learning outcomes from pre-cycle, cycle I, to cycle II. Learning completeness increased from the initial condition that did not meet the success indicators to exceed the indicators in the first cycle and was stronger in the second cycle. In addition, all aspects of basic handball skills, namely passing, dribbling, catching, and shooting, showed an increase in average score. Thus, the use of plastic balls can be declared effective as a medium for modifying handball learning because it is able to create safer, adaptive, participatory, and more participatory learning in accordance with student characteristics. These results strengthen the argument that limited facilities should not be the main obstacle to PJOK learning if teachers are able to innovate media and design appropriate activities.

DISCUSSION

The findings of this study show that the modification of handball learning using plastic balls makes a positive contribution to improving student learning outcomes. Rationally, the increase can be explained through the fit between the characteristics of the media, the learning needs of the students, and the complexity of handball skills. Handball is an invasion game that demands coordination between manipulative skills, mobility, spatial orientation, decision-making, and teamwork. When learning media is too difficult to control or causes fear, students tend to be passive and less daring to try. In contrast, the use of lighter and safer plastic balls allows students to explore movement, repetition techniques, and more intensive interactions with the ball.

This rationality is in line with the principle that learning sports skills needs to be adjusted to the capacity of students. In handball learning, success is not only influenced by physical ability, but also by the amount of practical experience, sense of security, motivation, and quality of student involvement in game situations (Feu et al., 2023; Mazzardo et al., 2022; Mahmoud Sha'lan, 2022). Thus, the increase in learning outcomes in this study can be understood because of reduced learning barriers and increased opportunities for students to practice actively. Media modification is not just a replacement of tools, but a pedagogical strategy that makes movement tasks more proportional to students' abilities.

The results of this study are supported by various previous studies that affirm the importance of learning modifications, small games, and game-based approaches in physical education. Mahmoud Sha'lan (2022) shows that small-sided games can improve the mastery of basic handball skills because students get more opportunities to touch the ball, make decisions, and interact in game situations. Feu et al. (2023) also emphasized that the game room and task structure are important mediators in the

learning load of handball in schools. The findings strengthen this research because the modification of plastic balls provides easier, safer, and more suitable learning conditions for students.

Mazzardo et al.'s (2022) research on Teaching Games for Understanding in handball learning also supports these findings, especially since engineering skills develop better when students learn through the context of meaningful games. Another support comes from Sahli et al. (2023), who show that social interaction and peer verbal support in small-scale handball games can affect student performance. Fasold et al. (2025) added that a fun handball-based game structure can increase children's motivation and enjoyment. Thus, the success of the actions in this study is in line with the evidence that handball learning will be more effective if students experience activities that are safe, fun, and provide opportunities for repetitive practice.

However, some previous research has had a different focus. Some Scopus studies focus more on athlete performance, physical characteristics, injuries, or specific training programs in handball players, rather than learning PJOK in schools (Akinci & Ateş, 2023; Maeda et al., 2025; Gruić & Jonjić, 2025; Rameshkannan & Chittibabu, 2024; Nyhus Hagum et al., 2023). This difference suggests that the results of the study in athletes cannot always be applied directly to school students, because the objectives, intensity, initial ability, and context of learning are different. Therefore, this research fills a space that has not been touched much, namely the application of simple media in the form of plastic balls as a contextual solution for handball learning in schools with limited facilities.

Theoretically, the findings of this study can be explained through the ecological dynamics approach and the constraint-led approach. This approach views that movement skills develop through interaction between individuals, tasks, and the environment. When the tools used are modified, students obtain more suitable task conditions so that they can find effective movement patterns. Ribeiro et al. (2021) explain that manipulation of task constraints in handball activities can affect movement patterns and skill adaptation. Espoz-Lazo et al. (2025) also affirm that non-linear pedagogy provides space for learners to adjust their movements through a variety of tasks and learning environments.

In this study, plastic balls act as a form of task constraint modification that reduces the initial complexity of learning. Students are not immediately exposed to the demands of a standard handball game, but are given a lighter, easier to control, and safer medium. This condition allows the learning process to take place gradually from mastering basic techniques to application in simple games. This interpretation is also in line with the TGfU approach, which emphasizes that game understanding and technique skills need to be developed through playing experience, not just separate technique practice (Mazzardo et al., 2022; Papagiannopoulos & Digelidis, 2023; de Lucca & Impolcetto, 2022).

From the perspective of student development, modified learning also provides space for a diversity of abilities in one class. Unskilled students can learn with lower pressure, while more capable students still gain challenges through a variety of exercises and games. This is relevant to the view that physical education learning should be adaptive, inclusive, and oriented towards meaningful movement experiences (Schembri et al., 2021; Beik & Zare, 2026; Tafuri & Gravino, 2026). Therefore, the development of handball learning through plastic balls can be positioned as a transition strategy from basic learning to more complex handball games.

Practically, the results of this study provide several implications for PJOK teachers. First, teachers can use plastic balls as an alternative medium when the school does not have a standard handball or when students are still in the early stages of mastering techniques. This medium is more economical, easy to obtain, safe, and suitable for increasing practice opportunities. Second, handball

learning should not only be carried out through conventional technical instruction but needs to be packaged in a variety of exercises, small games, and activities in pairs or groups so that students are more active and gain a more meaningful playing experience (Mahmoud Sha'lan, 2022; Sahli et al., 2023; Feu et al., 2023).

Third, teachers need to view learning modification as a pedagogical strategy, not as a form of simplification that reduces the quality of the material. Modifications can be a bridge to achieve higher game competencies because students learn gradually according to their initial abilities. Fourth, schools with limited facilities can still organize handball learning effectively through teachers' creativity in utilizing simple media. This implication is important for the context of physical education in Indonesia, especially in schools that do not have complete sports facilities. Thus, handball learning using plastic balls can be recommended as an adaptive, safe, participatory, and relevant learning alternative to improve student learning outcomes in PJOK.

CONCLUSION

Based on the results of the research, it can be concluded that the modification of handball learning using plastic balls is effective in improving the learning outcomes of grade XII-1 students of Pakusari State High School in the subjects of Physical Education, Sports, and Health. This effectiveness can be seen from the gradual increase in learning completeness in each cycle, accompanied by an increase in class average and mastery of basic handball skills, namely passing, dribbling, catching, and shooting. The use of plastic balls has proven to be an alternative learning medium that suits the needs of students and school conditions. Plastic balls that are lighter, safer, easier to control, and easier to obtain help students be more confident in following learning. This media also provides students with the opportunity to repeat movements more often, improve techniques, and actively participate in game activities. Thus, tool modification not only serves as a substitute for standard means, but also as a pedagogical strategy to create more adaptive, fun, and meaningful learning. This research shows that limited facilities are not always the main obstacle in PJOK learning if teachers are able to design learning creatively. Through media modifications and variations of activities, handball learning can still be carried out effectively according to the characteristics of students. Therefore, PJOK teachers are advised to develop other forms of learning modification that are safe, economical, and relevant to the learning objectives. Further research can test the use of modified media in other large ball game materials, involve a wider number of subjects, or compare the effectiveness of several types of modified media on student motivation, skills, and learning outcomes.

RECOMMENDATION

Based on the results of the research, PJOK teachers are recommended to use plastic balls as an alternative learning medium for handball, especially in schools that have limited facilities and infrastructure. The use of plastic balls can help students be more courageous, active, and confident in practicing basic techniques of the game of handball. Teachers also need to develop a gradual variety of exercises, ranging from simple technique exercises, paired exercises, small group exercises, to simple games that resemble actual game situations. Schools are advised to support teachers' creativity in modifying PJOK learning media. This support can be provided through the provision of simple tools, safe practice spaces, and policies that encourage teachers to innovate learning according to student needs. Media modification doesn't always have to use expensive tools or game standards but

can take advantage of tools that are easy to obtain, safe to use, and still fit the learning objectives. For students, learning using plastic balls is expected to increase active participation, cooperation, courage to try, and discipline in participating in PJOK learning. Students need to be given the opportunity to practice repeatedly so that passing, dribbling, catching, and shooting skills develop optimally. Researchers are then recommended to develop similar research on different levels of education, number of subjects, or large ball game materials. Follow-up research can also examine the influence of media modifications on other aspects, such as learning motivation, student interests, teamwork, social skills, physical fitness, or decision-making abilities in games.

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