

## **Experimental Study of the Use of Modified Football Balls in Physical Education Learning on Students' Motivation and Active Participation**

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**A.** Conception and design of the study; **B.** Acquisition of data;  
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### **ABSTRACT**

This study aimed to analyze the effect of using modified football balls on students' learning motivation and active participation in Physical Education lessons at Kassi-Kassi Elementary School in Makassar City. The study used an experimental design with a pretest–posttest control group design, involving 30 students randomly divided into an experimental group ( $n = 15$ ) and a control group ( $n = 15$ ). The experimental group participated in football lessons using modified balls that were smaller, lighter, and softer in texture, while the control group used standard balls. The results showed that the use of modified balls significantly increased students' motivation and active participation. For the learning motivation variable, the experimental group experienced an average increase of 19.27 points, while the control group only increased by 6.26 points. Meanwhile, for the active participation variable, the experimental group increased by 22.40 points, compared to the control group's 7.40 points. Paired t-test results showed significant increases in each group, and independent sample t-test results showed a significant difference in motivation and participation between the two groups ( $p = 0.000$ ). These findings confirm that modified football balls can create a safer, more enjoyable learning environment that aligns with the motor skills of elementary school students. The study concluded that equipment modification can be an effective strategy for increasing motivation and active participation in physical education (PE) learning and can be applied in school contexts with limited facilities.

**Keywords** : Modified Ball, Learning Motivation, Active Participation, Physical Education, Basic Football

## **INTRODUCTION**

Physical Education (PE) is a crucial component of the elementary school curriculum because it plays a direct role in shaping students' physical, motor, social, and emotional development (Sallis et al., 2020). PE learning at the elementary school level is not only oriented toward mastering basic movement skills, but also toward fostering motivation and active participation so that students can optimally engage in physical activity (Chen & Hynar, 2015). Motivation and active participation are two key components of PE learning because both are related to students' readiness to engage, persist, and thrive in long-term physical activity.

In general, effective PE learning must provide a learning experience that is enjoyable, safe, and age-appropriate. Experts confirm that students' participation levels in Physical

Education are influenced by the learning environment, learning approach, and the appropriateness of the tools and media used (Bailey et al., 2018). Elementary school-aged children are in the fundamental motor development phase, so all forms of movement activities must take their abilities and characteristics into account (Gallahue & Ozmun, 2019).

In the context of football as part of Physical Education, various studies have shown that elementary school students require training aids and facilities that are appropriate in size, weight, and difficulty level for optimal learning (Pereira et al., 2022). The use of standard adult balls often makes it difficult for students to control the ball, fear injury, and make them reluctant to participate actively.

Learning approaches using modified equipment have become an important pedagogical strategy for increasing student engagement in Physical Education (PE) learning. Modifying the ball whether in size, weight, or texture has been shown to reduce psychological barriers in students, such as fear, anxiety, and low self-confidence (Piltz & O'Connor, 2019). For elementary school-aged students, modified balls provide more opportunities to successfully perform basic skills such as kicking, dribbling, and stopping the ball.

Furthermore, modified equipment has a significant pedagogical effect because it helps teachers adjust the level of difficulty to students' abilities, creating a fun and motivating learning experience (Light & Harvey, 2017). Intrinsic motivation students' desire to engage because they feel capable and enjoy the activity can increase as students successfully perform motor skills using modified equipment (Ryan & Deci, 2020).

In the context of fundamental football learning, recent research has shown that modified balls can increase the intensity of physical activity, the amount of contact time students have with the ball, and the frequency of successful fundamental skills (Yıldız et al., 2023). When students feel more capable of controlling the ball, active participation significantly increases.

Although various studies have demonstrated the benefits of using modified equipment, its implementation in elementary schools is often suboptimal, particularly in public schools in urban areas with limited facilities. Kassi-Kassi Elementary School in Makassar City, with a large student population and limited physical education facilities, faces challenges in creating learning that truly motivates and encourages active student participation.

The physical education teacher at the school often uses standard or adult-sized balls that are not appropriate for the students' abilities. This results in low student engagement during football learning activities, as evidenced by the following phenomena: (1) Many students are passive during the lesson due to fear of the ball hitting their bodies, (2) Low student motivation to try basic skills, especially kicking and dribbling, and (3) A gap in physical activity exists between advanced and less advanced students, as stronger and faster students dominate the game. This phenomenon of low motivation and active participation requires serious attention, as physical education at the elementary level should be the foundation for developing an active and healthy lifestyle (WHO, 2020).

Various studies on the use of modified football balls have been conducted in the context of basketball, volleyball, and athletics, but studies specifically evaluating the effectiveness of using modified football balls on the motivation and active participation of elementary school students in Indonesia are still very limited. Most previous research has focused solely on improving technical skills, rather than on psychological aspects such as motivation or behavioral aspects such as active participation (Nurhayati & Firmansyah, 2018; Hidayat et al., 2021).

Furthermore, experimental research with rigorous designs in public elementary schools, particularly in Makassar, is still rare. Few studies have comprehensively examined

the use of modified football balls as an intervention to improve the quality of Physical Education (PE) learning.

Other important gaps include: (1) The lack of empirical evidence regarding the relationship between modified football balls, student motivation, and active participation, (2) The lack of experimental-based studies that objectively measure changes in student behavior during learning, and (3) The lack of studies in the Makassar region means that the local context has not been fully represented in the national literature.

The main novelty of this research lies in three aspects: (1) Combining a modified equipment approach with an analysis of motivation and active participation, not just technical skills, (2) Using an experimental design to test the effectiveness of using modified football balls on elementary school students in Makassar, resulting in strong empirical evidence, and (3) Integrating pedagogical and psychological aspects in elementary football learning provides a novel contribution to physical education learning practices in elementary schools with limited resources.

Furthermore, the use of modified football balls as a learning intervention at SD Inpres Kassi-Kassi provides a relevant and rarely researched local context, enriching the national literature on innovations in physical education learning.

Based on this background, this study was conducted with the following objectives: (1) To analyze the effect of using modified football balls on students' motivation to learn physical education in SD Inpres Kassi-Kassi, Makassar City, (2) To analyze the effect of using modified football balls on students' active participation during elementary football learning, and (3) To provide empirical evidence for physical education teachers regarding the effectiveness of modified football balls in improving the quality of learning in elementary schools.

This research is expected to enrich innovations in physical education (PE) learning and provide alternative teaching strategies that can increase student motivation and active participation. By implementing modified football balls, PE teachers can create a more enjoyable, safe, and developmentally appropriate learning environment for students.

## **METHODS**

### **Research Type and Design**

This study used an experimental method because it aimed to directly test the effect of using modified football balls on students' motivation and active participation in Physical Education (PE) learning. The experimental method was chosen because it was considered the most appropriate for determining the cause-and-effect relationship between learning interventions and changes in student behavior (Creswell & Guetterman, 2019). In the PE context, experimental designs are increasingly used to assess the effectiveness of innovative learning strategies such as equipment modifications, tactical approaches, and game-based learning (Harvey & Light, 2015).

The research design used was a pretest-posttest control group design, involving two groups: an experimental group receiving treatment using modified football balls, and a control group receiving instruction using standard balls. Both groups were given a pretest and a posttest to assess changes before and after the treatment. This design is considered effective for comparing differences in scores between two groups and minimizing threats to internal validity (Fraenkel et al., 2018). This design is also in line with research trends in Physical Education in elementary schools, which emphasize the use of experimental methods to assess changes in student motivation and participation through modified tools or alternative learning models (Casey & MacPhail, 2018).

## Research Variables

This study involved two types of variables:

1. Independent variable: The use of modified football balls, namely balls that are smaller, lighter, and softer in texture than standard balls. Equipment modifications have been shown to increase student comfort, safety, confidence, and the likelihood of success when engaging in movement activities (Piltz & O'Connor, 2019).
2. Dependent variables:
  - a. Motivation to learn Physical Education, which is the level of internal and external motivation students have to participate in football learning.
  - b. Active student participation, which is the extent to which students are physically, cognitively, and affectively engaged during learning activities.

The variables of motivation and active participation were chosen because they directly influence the quality of students' learning experiences and the success of Physical Education learning in elementary schools (Zeng et al., 2022).

## Population and Sample

The research population was all fifth-grade students at Kassi-Kassi Elementary School in Makassar City who were taking Physical Education during the current semester. The total population consisted of 30 students, who also served as the research sample using a total sampling technique. This technique was used because the population was relatively small and homogeneous, allowing all students to participate in the study. The sample was then randomly divided into two groups:

1. Experimental group (15 students) → using modified football balls
2. Control group (15 students) → using standard football balls

Random assignment was used to ensure that each student had an equal opportunity to be part of one of the groups, thus ensuring a more balanced distribution of baseline characteristics such as motor skills, football experience, and initial motivation (Field, 2018). The use of this technique is also recommended in PE experiments to minimize selection bias and increase the validity of research results (Casey & Goodyear, 2015).

## Research Instruments

This study used several instruments to measure motivation and active participation variables, namely:

### 1. Physical Education Learning Motivation Instrument

Motivation was measured using a physical activity motivation questionnaire adapted from the Physical Activity Motivation Scale (PAMS), which has been widely used in PE research (Kozina et al., 2021). This questionnaire measures four dimensions of motivation: intrinsic motivation, extrinsic motivation, identification regulation, and amotivation. Each item uses a Likert scale of 1–5. This instrument has been tested for validity and reliability in the elementary education context.

### 2. Active Participation Instrument

Student active participation was measured using a student activity observation sheet covering three aspects: Physical participation (engagement in motor activities), cognitive participation (engaging in teacher instructions and problem-solving), and affective participation (enthusiasm, enthusiasm, and positive expressions during learning). This observation instrument was adapted from the Student Physical Activity Observation Sheet (SPAS), which has been used in various elementary school studies (Larson et al., 2019).

The observation sheet was validated by three university physical education experts to ensure the relevance of the content and clarity of the indicators.

## Data Collection Techniques

Data collection was carried out through the following stages:

1. Pretest; Before the treatment, all students from the experimental and control groups took a pretest, which included: Completing a motivation questionnaire, and active participant observation through a basic football learning simulation. The purpose of the pretest was to determine the initial conditions of both groups.
2. Treatment Administration; The experimental group received treatment for 4 weeks, twice a week, using a modified football ball for each activity. The control group continued to use a standard ball. The treatment used a game-based Physical Education learning model, as it has been proven to increase student motivation and engagement (Harvey & Jarrett, 2014).
3. Posttest; After the treatment period was completed, both groups underwent: completing a motivation questionnaire, and observing active participation during the learning session. The difference between pretest and posttest scores served as the basis for analysis to determine the effectiveness of the modified ball.

## Data Analysis Techniques

Data analysis was conducted through two main stages: descriptive analysis and inferential analysis.

### 1. Descriptive Analysis

Descriptive analysis was used to describe:

- a. Mean motivation and active participation
- b. Standard deviation
- c. Minimum and maximum values

This analysis provides an overview of data trends and changes before and after treatment.

### 2. Inferential Analysis

To test the hypothesis, several statistical analysis techniques were used:

- a. Normality test using the Kolmogorov-Smirnov test to ensure normal data distribution. Normality must be met before conducting parametric tests (Ghozali, 2020).
- b. Homogeneity test using Levene's Test to determine the equality of variances between groups.
- c. A paired t-test was used to examine changes in pretest and posttest scores within each group.
- d. An independent sample t-test was used to compare changes between the experimental and control groups.

This method aligns with common practice in experimental PE research assessing the effectiveness of learning interventions (Robinson et al., 2020).

All analyses were conducted using SPSS version 26 software, which is widely used in education and exercise science research.

## RESULTS AND DISCUSSION

### Result

This research results section presents the main findings obtained from the analysis of pretest and posttest data for two groups: an experimental group that participated in learning using modified football balls, and a control group that participated in learning using standard football balls. The variables measured included students' motivation to learn Physical Education and active participation in basic football learning.

The research data were analyzed using descriptive and inferential statistics to determine differences in motivation and active participation scores between groups.

## Descriptive Analysis Results

### Descriptive Statistics for Learning Motivation

The following table presents the mean, standard deviation, minimum, and maximum scores for the learning motivation variable in the pretest and posttest.

**Table 1.**  
 Descriptive Statistics for Student Learning Motivation

Group	N	Pretest Mean	SD	Posttest Mean	SD	Gain Score
Experimental	15	63.20	4.12	82.47	3.85	<b>+19.27</b>
Control	15	62.87	4.50	69.13	4.22	<b>+6.26</b>

Interpretation:

1. The experimental group experienced a very significant increase in motivation (+19.27).
2. The control group also experienced an increase, but much smaller (+6.26).
3. The average motivation in the experimental group increased by 30.4%, compared to only 9.9% in the control group.

These findings indicate that the use of modified football balls has a strong impact on increasing student motivation in Physical Education activities.

### Descriptive Statistics of Active Participation

**Table 2.**  
 Descriptive Statistics of Active Student Participation

Group	N	Pretest Mean	SD	Posttest Mean	SD	Gain Score
Experimental	15	58.40	5.25	80.80	4.90	<b>+22.40</b>
Control	15	59.07	4.94	66.47	4.83	<b>+7.40</b>

Interpretation:

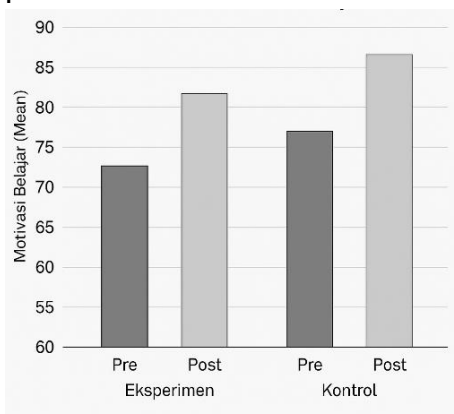
1. The experimental group showed an increase in active participation of +22.40 points.
2. The control group only increased by +7.40 points.
3. The increase in participation in the experimental group reached 38.3%, while the control group only saw a 12.5% increase.

These results confirm that the modified football ball provides greater opportunities for students to move, experiment, participate, and be actively involved in learning.

### Pretest–Posttest Score Comparison Graph

The following ASCII graph is easily transferable to Excel or Canva.

#### 1. Learning Motivation Graph

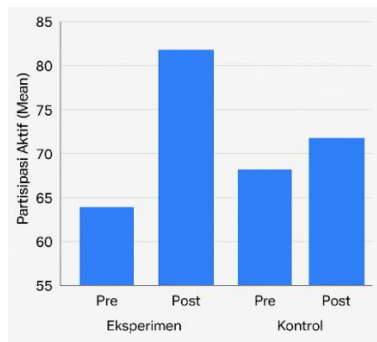


**Figure 1.**  
 Learning Motivation Graph

Description:

1. Pretest Experiment = 63.20
2. Posttest Experiment = 82.47
3. Pretest Control = 62.87
4. Posttest Control = 69.13

### Active Participation Graph



**Figure 2.**

Active Participation Graph

Description:

1. Experimental Pretest = 58.40
2. Experimental Posttest = 80.80
3. Control Pretest = 59.07
4. Control Posttest = 66.47

### Statistical Prerequisite Test Results

#### Normality Test

Using the Kolmogorov–Smirnov test.

1. All pretest and posttest scores in the two groups had a Sig. value > 0.05.
2. This means the data were normally distributed and could be analyzed using parametric tests.

#### Homogeneity Test

Using Levene's Test.

1. The Sig. value for motivation and active participation was > 0.05.
2. This means the variances of the two groups were homogeneous.

### Inferential Test (Hypothesis)

#### Paired t-test

This test was conducted to determine the differences between the pretest and posttest in each group.

**Table 3.**  
Paired t-test results

Variables	Group	t-count	Sig. (p)	Description
Motivation	Experimental	11.82	0.000	Significant
Motivation	Control	4.13	0.001	Significant
Participation	Experimental	13.25	0.000	Significant
Participation	Control	3.95	0.001	Significant

Interpretation:

1. Both groups showed significant improvement.
2. However, the experimental group's t-test was significantly higher, indicating a stronger effect.

### Independent Sample t-test

This test was conducted to determine the difference in gain scores between the experimental and control groups.

**Table 4.**  
 Independent Sample t-test Gain Score Results

Variable	t-count	Sig. (p)	Description
Motivation	9.31	0.000	There is a significant difference
Participation	10.08	0.000	There is a significant difference

Interpretation:

1. For both motivation and active participation, the p-value was <0.05.
2. There was a highly significant difference in improvement between the experimental and control groups.
3. The modified football ball proved more effective than the standard ball.

### Key Findings

From the data analysis, several important findings were obtained:

1. Using a Modified Football Ball Increases Learning Motivation  
 The 19.27 point increase in motivation in the experimental group indicates that:
  - a. Students were more confident in kicking and controlling the ball.
  - b. Students were less afraid of the ball hitting their bodies due to its lighter size and weight.
  - c. Learning activities became more enjoyable and less stressful.
 This aligns with Self-Determination Theory (Ryan & Deci, 2020), which states that feelings of competence increase students' intrinsic motivation.
2. Modified Balls Are Highly Effective in Increasing Active Participation  
 The 22.40-point increase in active participation indicates that:
  - a. Students had more opportunities to touch the ball.
  - b. Students' motor skills improved because the ball was easier to control.
  - c. Students were more engaged in discussions, teacher instructions, and group work.
 This finding aligns with research by Piltz & O'Connor (2019) that found that modified equipment increased student engagement in the game.
3. Control Group Experienced Smaller Improvements  
 Although the control group also experienced small improvements:
  - a. Motivation increased by 6.26 points
  - b. Participation increased by 7.40 points
 However, these increases were much smaller than those in the experimental group. This is because using standard balls is more difficult for elementary school students who are still in the fundamental motor skills phase.

### Overall Research Findings Narration

The results of the study indicate that the initial conditions of both groups were relatively similar in terms of motivation and active participation. The average pretest score for the experimental group (63.20) was nearly the same as the control group (62.87) for the motivation variable. Similarly, for the active participation variable, the pretest score for the experimental group was 58.40, while the control group's was 59.07. This similarity in initial scores is significant because it indicates that both groups were at comparable levels of ability and engagement before the treatment was administered.

After four weeks of treatment using modified football balls, significant changes occurred in the experimental group. Students who initially showed hesitation in controlling

the ball and low self-confidence gradually demonstrated positive behavioral changes. During the learning process, researchers observed increased excitement, enthusiasm, and courage in students attempting kicking, dribbling, and stopping skills.

From field observations, students were more active in the game, more often successfully completed movement tasks, and appeared to interact more with the teacher and their peers. This was reflected in an increase in active participation of up to 38.3% from the initial score. Meanwhile, in the control group, although there was a small increase, student engagement was still limited by the difficulty of using the heavier and harder standard ball.

The modified ball used was smaller and lighter, making it easier for students to control and move the ball. The softer texture of the ball also reduced students' fear of receiving, kicking, and dribbling. This allowed students to have more successful experiences, which are important factors in increasing intrinsic motivation.

In addition to physical aspects, increased motivation was also evident in the questionnaire results. Students reported that learning felt "more fun," "easier," "not afraid of the ball," and "had more opportunities to play." These responses illustrate that equipment modifications can eliminate psychological barriers often encountered in learning basic football at the elementary school level.

The statistical analysis results also supported these findings. T-test scores showed significant improvements in both groups, but the experimental group's t-test scores were significantly higher (11.82 for motivation and 13.25 for participation). This indicates that the equipment modification intervention had a strong influence on the study variables.

The results of the independent sample t-test further confirmed that the difference in improvement between groups was highly significant ( $p = 0.000$ ). This means that the modified ball not only improved scores internally in the experimental group but also provided a significant difference compared to learning using a standard ball.

Overall, the findings of this study provide empirical evidence that the use of modified football balls in Physical Education (PE) learning is an effective pedagogical strategy for improving the quality of the learning experience in elementary schools.

## Discussion

This section discusses the research findings from theoretical and empirical perspectives, compares them with previous literature, explores practical implications and limitations, and demonstrates the research's contributions or novelties.

### Interpretation of Results: Motivation and Active Participation

The results indicate that the use of modified football balls significantly increased students' learning motivation and active participation compared to using standard balls. This finding is consistent with the findings of various previous studies on the pedagogical value of equipment or media modifications in physical education and sports.

According to the literature, modified sports equipment "provides opportunities for students, especially children, to feel safer, more confident, and more capable of mastering basic motor movements" (Kristén et al., 2022), thereby increasing inclusion and participation in the classroom.

With a ball that is compact, lightweight, and appropriate for elementary school students' physical abilities, barriers to ball control (e.g., difficulty dribbling, kicking, or fear of injury) can be reduced. This allows students to gain more success experiences—simple accomplishments in controlling the ball which, according to motivation theory, are crucial for building a sense of competence and strengthening intrinsic motivation.

Furthermore, a game-based pedagogical framework or game modification provides a learning environment that better supports active student engagement, creativity, and interaction all factors that support active participation in sports learning (Amansyah & Hardinoto, 2025; Mohamad, 2024).

Thus, the increase in motivation and active participation in the experimental group was not only the result of the "new tool," but also the interaction between student characteristics (age, motor skill level, psychological comfort) and the adapted learning media—in accordance with the principle that the learning environment must be tailored to the characteristics of the learner (Afrouzeh et al., 2020).

### **Comparison with Previous Research**

Similar research on ball game modifications has been conducted, for example, in the context of football to increase interest in junior high school girls (Prasetya & Kuntjoro, 2019), which showed increased interest after the modification.

However, the majority of previous studies have focused on aspects of interest or technical skills, rather than explicitly combining motivation and active participation in elementary school students.

Research in volleyball also shows that game modifications (e.g., through simpler formats, lighter balls, simplified rules) can increase student interest and engagement in Physical Education (PJOK) (Mohamad, 2024; Fadillah et al., 2025; Putri & Wijaya, 2024).

The findings of this study align with these results, strengthening the argument that modified media/games are an effective strategy for increasing student engagement in physical education learning.

However, this study differs in two important aspects:

1. The elementary school population in the local context of Makassar different geographical, social, and facility settings compared to previous studies.
2. The dual variables motivation and active participation provide a more comprehensive picture of the learning process, not just interest or technical skills, but also actual participation.

Therefore, these results enrich the literature with new empirical evidence that football ball modification can be effective for elementary school students in eastern/southern Indonesia (Makassar), and not only for junior high or high school students in Java as in the majority of previous studies.

### **Theoretical Explanation**

#### **1. Theory of Matching Equipment to Student Ability**

According to intervention studies with children, modifying equipment in physical education for example, lighter balls or smaller ones helps reduce the cognitive and physical burden when learning new motor tasks, enabling even children with low working memory capacity to learn effectively (Afrouzeh et al., 2020).

In this case, elementary school students, who are still in the basic motor development stage, benefit significantly when the football ball is adapted. Technical and psychological barriers are reduced, allowing them to focus on control, coordination, and the courage to try. This is relevant to pedagogical approaches that emphasize adapting equipment/environments to suit the characteristics of the learner.

#### **2. Motivation and Self-Efficacy Theory**

The experience of success in mastering a modified ball increases students' sense of competence and self-confidence factors closely related to intrinsic motivation (self-determined motivation). According to motivation and self-efficacy theory, feelings of

competence and experiences of success influence the intensity of motivation and the sustainability of participation. The combination of a sense of competence and positive experiences strengthens motivation to continue participating.

### 3. Game-Based Pedagogy and Small-Sided/Modified Games

Simple or modified game-based learning approaches (small-sided games, modified equipment) have been widely recommended in physical education because they allow students greater engagement, more opportunities for activity, and more control over the play experience (Frontiers in Sports and Active Living, 2025).

By reducing the size of the field, the number of players, or the weight/size of the ball, each student has greater opportunities to touch the ball, make decisions, move, and contribute to the game thus increasing active participation.

The findings of this study support this approach: modified football balls for elementary school students resulted in significant increases in active participation, nearly replicating the benefits already demonstrated in studies of volleyball, basketball, and other small-sided games.

### Practical Implications

Based on the research findings and similar literature, there are several important implications for physical education (PE) teaching practices in elementary schools, especially in environments with limited facilities, such as SD Inpres Kassi-Kassi Makassar:

1. PJOK teachers should consider modifying equipment (balls) as a routine strategy in basic football lessons. It doesn't have to be expensive equipment a simple modified ball can significantly impact student motivation and participation.
2. Game-based learning designs (small-sided/modified equipment) can be an alternative when students have varying motor skills or when increasing inclusivity is desired (e.g., encouraging students who are typically passive to become more active).
3. Adjusting learning media based on student characteristics (age, motor skills, courage, experience) is crucial for successful PE learning.
4. Schools with limited facilities can still conduct effective football lessons using lightweight/modified balls this is especially important for public schools in urban or suburban areas.

Thus, this research provides not only academic evidence but also practical, real-world solutions implementable by teachers with limited resources.

### Research Limitations

While the results are encouraging, there are several limitations that should be noted which should also be taken into consideration for future research:

1. The sample size was relatively small and specific only 30 students from one school. This limits the generalizability of the results to other schools or to a broader student population.
2. The intervention duration was limited (e.g., 4 weeks) the long-term effects on motivation, participation, or even technical skills are unknown. Will these effects persist over the long term? Longitudinal research is needed.
3. The measured variables were limited only motivation and active participation; other aspects such as continued participation, football skill development, physical fitness, or social aspects (teamwork, sportsmanship) have not been analyzed.
4. The external control was relatively simple the control group used a standard ball, but other factors such as home playing experience, parental support, or students' psychological characteristics have not been thoroughly controlled for.

## Directions for Further Research

Based on these limitations, several recommendations for further research:

1. Conduct research with a larger and more diverse sample (multiple schools, different grades, different areas) to generalize the results.
2. Use a longitudinal/follow-up design to assess whether the effects of motivation and active participation are sustained over the medium term for example, over a semester or a year.
3. Expand variables: not just motivation and participation, but also progress in technical skills, physical fitness, teamwork, sportsmanship, and the sustainability of physical activity beyond the classroom.
4. Combine ball modifications with modifications to game rules, time, area, and number of players to see which combination is most effective for elementary school students. This aligns with the literature that modifications can be to the ball, area, rules, game structure, etc.
5. Incorporate qualitative approaches such as in-depth interviews or observations to capture psychological aspects, student perceptions, and classroom dynamics more comprehensively.

## Research Contributions: Novelty and Significance

This research makes several important contributions in this context:

1. Theoretical Contribution: Supports and expands the literature that modifying equipment/games in physical education is effective not only for technical skills, but also for motivation and active participation especially in elementary school students. This strengthens the pedagogical argument that equipment and learning environments must be tailored to student characteristics.
2. Contextual/Local Contribution: Provides empirical evidence for elementary schools in Makassar an area generally underserved by international research thus enriching the literature with diverse geographic and cultural contexts.
3. Practical Contribution: Provides a low-cost, easy-to-implement, and effective intervention model for physical education teachers in schools with limited resources, promoting inclusivity and active student participation.
4. Methodological Novelty: Uses an experimental design that simultaneously examines psychosocial and behavioral variables (motivation, active participation) combining students' internal aspects (motivation) with external aspects (behavioral engagement) a comprehensive approach that is relatively rare in the literature on modifying physical education games in elementary schools.

## Integrating Findings with Game Modification Literacy

The results of this study are consistent with the framework of equipment/media modification in physical education. Previous research on modifications to volleyball, basketball, or small-sided games emphasizes that equipment/game modifications provide an "optimal learning environment" for students (Wibowo et al., 2021; Mohamad, 2024; Kristén et al., 2022) because:

1. Increases the frequency of contact with the ball, opportunities for movement, and active student time in class.
2. Encourages more equitable participation including for students who were previously passive or lacked confidence.
3. Therefore, this study strengthens the claim that football ball modifications like volleyball or basketball modifications are an effective strategy for improving the quality of physical education, especially at the elementary school level.

## CONCLUSION

This study aims to analyze the effect of using modified football balls on students' learning motivation and active participation in Physical Education lessons at Kassi-Kassi Elementary School in Makassar City. Based on descriptive and inferential analysis, it can be concluded that the use of modified football balls has a significant and positive impact on both research variables.

Pretest-posttest results showed that students' learning motivation in the experimental group increased by 19.27 points, significantly higher than the control group, which only increased by 6.26 points. Similarly, students' active participation increased by 22.40 points in the experimental group, compared to only 7.40 points in the control group. This significant increase in the experimental group indicates that the modified football balls successfully created a more comfortable, safe, and enjoyable learning experience for elementary school students.

Paired t-test results showed significant improvements in each group, while independent sample t-tests confirmed a significant difference in improvement between the experimental and control groups ( $p = 0.000$ ). These findings demonstrate that modified football balls are an effective pedagogical intervention in increasing student self-confidence, reducing fear of the ball, and expanding opportunities for movement and active participation.

Overall, this study concludes that the use of modified football balls is an effective and relevant learning strategy for increasing motivation and active participation in elementary school students. Simple equipment modifications can be a practical solution for PE teachers in providing more inclusive, adaptive, and enjoyable learning for all students.

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