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Effectiveness of Modification Aids in High Jump Learning

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ABSTRACT

This study aimed to determine the effectiveness of modified learning aids in improving the high jump ability using the Fosbury Flop technique among twelfth-grade students at SMA Negeri 11 Makassar. A quantitative approach with a quasi-experimental method and pretest-posttest control group design was employed. The population consisted of 120 twelfth-grade students, with a sample of 30 students selected through purposive sampling and divided into two groups 15 students in the experimental group receiving instruction with modified learning aids and 15 students in the control group receiving conventional instruction. The intervention was conducted over eight weeks with two sessions per week. The research instrument was a high jump performance test with three jump attempts, and data were analyzed using Paired Samples t-Test, Independent Samples t-Test, and N-Gain Score calculation. The results revealed that the experimental group improved by an average of 15.3 cm from 105.3 cm to 120.6 cm which was statistically significant ($t = 21.161$; $p = 0.000$), while the control group improved by only 8.7 cm from 104.8 cm to 113.5 cm ($t = 14.653$; $p = 0.000$). The between-group comparison via Independent Samples t-Test yielded $t = 2.387$ with a significance value of 0.024 ($p < 0.05$), confirming a significant difference between the two groups. N-Gain Score calculations indicated that the experimental group achieved a score of 0.68 (moderate category) while the control group obtained only 0.19 (low category). This study concludes that the use of modified learning aids is significantly more effective in improving students' high jump performance than conventional instruction, and successfully brought the average student achievement above the minimum competency standard set by the curriculum. These findings recommend that physical education teachers adopt modification-based learning approaches as a primary strategy in athletics instruction, particularly in schools with limited standard sports facilities.

Keywords: Modified Learning Aids; High Jump; Fosbury Flop; Physical Education.

ABSTRAK

Penelitian ini bertujuan untuk mengetahui efektivitas penggunaan alat bantu modifikasi dalam meningkatkan kemampuan lompat tinggi gaya Fosbury Flop pada siswa kelas XII SMA Negeri 11 Makassar. Penelitian menggunakan pendekatan kuantitatif dengan

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metode eksperimen semu (quasi-experimental) dan desain pretest-posttest control group design. Populasi penelitian berjumlah 120 siswa kelas XII, dengan sampel sebanyak 30 siswa yang dipilih melalui teknik purposive sampling dan dibagi menjadi dua kelompok 15 siswa kelompok eksperimen yang mendapatkan pembelajaran menggunakan alat bantu modifikasi dan 15 siswa kelompok kontrol yang mengikuti pembelajaran konvensional. Perlakuan dilaksanakan selama delapan minggu dengan frekuensi dua kali pertemuan per minggu. Instrumen penelitian berupa tes kemampuan lompat tinggi dengan tiga kali kesempatan lompatan, dan analisis data dilakukan menggunakan Paired Samples t-Test, Independent Samples t-Test, serta perhitungan N-Gain Score. Hasil penelitian menunjukkan bahwa kelompok eksperimen mengalami peningkatan rata-rata sebesar 15,3 cm dari 105,3 cm menjadi 120,6 cm yang secara statistik signifikan ($t = 21,161$; $p = 0,000$), sementara kelompok kontrol hanya meningkat 8,7 cm dari 104,8 cm menjadi 113,5 cm ($t = 14,653$; $p = 0,000$). Perbandingan posttest antar kelompok melalui Independent Samples t-Test menghasilkan nilai $t = 2,387$ dengan signifikansi 0,024 ($p < 0,05$), yang membuktikan adanya perbedaan yang signifikan antara kedua kelompok. Perhitungan N-Gain Score menunjukkan kelompok eksperimen memperoleh nilai 0,68 (kategori sedang) sedangkan kelompok kontrol hanya 0,19 (kategori rendah). Penelitian ini menyimpulkan bahwa penggunaan alat bantu modifikasi terbukti lebih efektif dalam meningkatkan kemampuan lompat tinggi siswa dibandingkan pembelajaran konvensional, sekaligus mampu membawa rata-rata capaian siswa melampaui standar minimal kompetensi yang ditetapkan kurikulum. Temuan ini merekomendasikan agar guru pendidikan jasmani mengadopsi pendekatan pembelajaran berbasis modifikasi sebagai strategi utama dalam pembelajaran atletik, khususnya di sekolah yang menghadapi keterbatasan sarana dan prasarana standar.

Kata Kunci: Alat Bantu Modifikasi; Lompat Tinggi; Fosbury Flop; Pendidikan Jasmani.

INTRODUCTION

Athletics is one of the most important sports in physical education in schools (Putra et al., 2017). One of the athletic numbers taught is the high jump. High jump is a form of jumping movement by lifting your legs up by lifting your body as much as possible to reach a certain height. High-jump learning in schools often encounters obstacles, especially related to the limitations of adequate facilities and infrastructure, as well as the lack of learning modifications that are attractive to students (Efendi et al., 2024; Yardi Sulaeman et al., 2025).

The problem in high jump learning is not just a technical problem, but touches on a more fundamental aspect: the low quality of students' learning experience which has a direct impact on the achievement of their movement competence. When students do not get adequate learning experience in athletics, their potential to develop physically, motorically, and mentally becomes hampered. This condition is a serious problem that needs to be addressed immediately through a more adaptive and contextual learning approach (Bastian & Akhmad Syarif, 2023; Mukrimin et al., 2023).

Based on initial observations made at SMA Negeri 11 Makassar, it was found that students' high jump abilities are still relatively low. This can be seen from the results of the high jump of students which on average only reached 100-110 cm, even though the expected standard for high school students is a minimum of 120 cm. The low ability of

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students to jump high jump is caused by several factors, including: (1) lack of motivation for students to participate in high jump learning, (2) limited adequate facilities and infrastructure, (3) monotonous and uninteresting learning methods, and (4) students' fear of jumping because they are afraid of injury.

The urgency of this research is even stronger considering that high jump is one of the mandatory competencies in the physical education curriculum at the high school level listed in the Learning Outcomes of the Independent Curriculum. This means that students' failure to achieve high jump competency standards is not only a matter of sports achievement, but also has implications for the achievement of overall curriculum goals. Rationalization of interventions through modification tools is very relevant because this approach allows teachers to adjust the level of difficulty and risk of learning to the real conditions of students in the field, without having to sacrifice the substance of the competencies they want to achieve (Bastian & Akhmad Syarif, 2023; Mukrimin et al., 2023).

To overcome these problems, innovation in high jump learning is needed. One alternative that can be done is to use modification tools. Modification aids are tools that are specifically designed to make it easier for students to learn basic high jump techniques while still paying attention to the safety and comfort aspects of students. Some previous research has shown that the use of modified aids can improve student learning outcomes in various sports (Basri, 2019; Muhammad Alfian Lucky Jauharies, 2025).

A number of previous studies have confirmed the effectiveness of modifying learning tools and approaches in improving sports learning outcomes. Found that modification of assistive devices significantly lowered students' anxiety levels while also increasing active participation in athletic learning. In line with that, the modification-based learning approach is able to accelerate the mastery of basic movement techniques in students who previously experienced psychological obstacles in exercising. These two findings reinforce the theoretical foundation that modification is not just a simplification, but a planned pedagogical strategy to optimize the learning process of students' movements (Arga & Riskal Fitri, 2025; Fadlan, 2019; Rifai, 2017; Sugiarto, 2021).

The problem-solving plan in this study is to design and implement a modified tool in the form of a high jump bar made of elastic material that can be adjusted in height gradually, as well as a thicker landing mat as a replacement for standard facilities that are not yet available. This approach allows students to practice at a progressive level of height—starting at a lower than standard height and then gradually increasing it—so that fear can be minimized and student confidence is organically formed. These modifications will be integrated into a structured learning scenario over eight meetings with teacher guidance as facilitator (Raswin & Aulia, 2015).

This study aims to determine the effectiveness of modified aids in high jump learning in grade XII students of SMA Negeri 11 Makassar. With this research, it is hoped that it can contribute to the development of athletic learning, especially high jump numbers in schools.

This study hypothesizes that the use of modified aids significantly increases the high jump ability of grade XII students of SMA Negeri 11 Makassar compared to conventional learning without modifications. The novelty of this study lies in an approach that not only measures the increase in physical jump results, but also examines changes

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in students' levels of confidence and learning motivation as supporting variables—a dimension that has not been touched much by similar studies before. Thus, this research is expected to fill the existing literature gap and become a practical reference for physical education teachers in designing more inclusive and effective athletic learning.

METHOD

This type of research is a quasi-experimental experiment with a pretest-posttest control group design. This design was chosen because the researcher could not fully control the external variables that could affect the results of the study (Arga, 2025). In this study, there were two groups, namely the experimental group that received treatment using modified aids and the control group that received conventional learning.

This research was carried out at SMA Negeri 11 Makassar in the even semester of the 2024/2025 school year, namely from January to October 2025. The implementation of the research was carried out for 8 weeks with a frequency of meetings 2 times a week, so that there were a total of 16 meetings.

The population in this study is all grade XII students of SMA Negeri 11 Makassar which totals 120 students. The research sample was selected using a purposive sampling technique with the following criteria: (1) grade XII students who actively participate in physical education learning, (2) in physical and spiritual health, (3) willing to be a research sample. Based on these criteria, a sample of 30 students was obtained which was divided into two groups, namely 15 students in the experimental group and 15 students in the control group.

The main instrument used in this study is the Fosbury Flop style high jump ability test, which measures the maximum height that students successfully pass in three jump opportunities. The score taken is the result of the highest jump that was successfully passed without dropping the bar. This instrument was developed based on the high jump assessment standard in the high school PJOK curriculum and has been widely used in previous studies so that its content validity can be accounted for. Before use, the instrument was tested for reliability through the test-retest method in small groups outside the study sample to ensure consistency of measurement results. In addition to the high jump test, structured observation sheets were also used to record the quality of students' movement techniques during the learning process, including aspects of beginning, repulsion, attitude on the bar, and landing.

Data collection is carried out through the following stages: (1) Pretest, carried out before treatment is given to determine the initial ability of the high jump of students in both groups. (2) Treatment, the experimental group received high jump learning using modified aids for 8 weeks (16 meetings), while the control group received conventional learning. (3) Posttest, carried out after the treatment is completed to determine the final ability of the high jump of students in both groups.

The data analysis techniques used include a Prerequisite Test carried out before the main analysis, including a data normality test using the Shapiro-Wilk test (due to the number of samples ≤ 30) and a variance homogeneity test using the Levene test. Both tests aim to ensure the fulfillment of parametric statistical assumptions. The Hypothesis Test was conducted using the Independent Samples t-Test to compare the average post-test scores between the experimental group and the control group. In addition, the Paired Samples t-Test was used to measure the significance of the score increase in

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each group (pre-test to post-test). The significance level used is $\alpha = 0.05$. The Effectiveness Test was conducted using the calculation of the N-Gain Score to measure the proportional increase in high jump ability.

N-Gain interpretation categories: high (> 0.7), medium ($0.3-0.7$), and low (< 0.3) (Hake, 1999). The entire analysis process is carried out with the help of SPSS software version 25.

RESEARCH RESULTS

The results of the descriptive analysis The High Jump Ability of Both Groups

Table 1. Descriptive Statistics of High Jump Ability of Both Groups

Groups	Statistics	Pretest (cm)	Posttest (cm)	Increment (cm)
Eksperimen	Mean	105,3	120,6	15,3
	SD	8,4	9,2	2,8
	Min	90	105	10
	Max	120	138	22
Control	Mean	104,8	113,5	8,7
	SD	7,9	8,5	2,3
	Min	92	100	5
	Max	118	128	14

Based on Table 1 Descriptive Statistics of High Jump Ability of the Two Groups, the experimental group obtained a pretest score with a mean of 105.3, a standard deviation of 8.4, a minimum score of 90, and a maximum of 120. In the posttest, the mean was 120.6 with a standard deviation of 9.2, a minimum value of 105, and a maximum of 138. The increase in the experimental group had a mean of 15.3, a standard deviation of 2.8, a minimum value of 10, and a maximum of 22.

In the control group, the pretest score had a mean of 104.8, a standard deviation of 7.9, a minimum score of 92, and a maximum of 118. The posttest score showed a mean of 113.5 with a standard deviation of 8.5, a minimum value of 100, and a maximum of 128. The increase in the control group had a mean of 8.7, a standard deviation of 2.3, a minimum value of 5, and a maximum of 14.

The normality test was carried out using the Shapiro-Wilk test considering that the number of samples for each group was 15 people ($n \leq 30$). The test results showed that all data—both pretest and posttest in both groups—were normally distributed, with the significance value of each being above $\alpha = 0.05$. Full results are presented in Table 2.

Table 2. Shapiro-Wilk Normality Test Results

Groups	Data	Statistics	Say.	Remarks
Eksperimen	Pretest	0,951	0,537	Normal
	Posttest	0,947	0,483	Normal
Control	Pretest	0,958	0,641	Normal
	Posttest	0,953	0,573	Normal

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Based on the table of normality test results, in the experimental group, the significance value of the pretest was 0.537 and the posttest was 0.483 with normal distribution information. In the control group, the significance value of the pretest was 0.641 and the posttest was 0.573, which also showed normal distributed data.

The variance homogeneity test was performed using the Levene test to ensure that the variance of the two groups did not differ significantly. The test results on the pretest data showed a value of $F = 0.412$ with a significance of 0.526 ($p > 0.05$), which means that the variance of the two groups was homogeneous. The fulfillment of these assumptions of normality and homogeneity confirms the use of parametric statistical tests at a later stage.

Table 3. Uji Paired Samples t-Test

Groups	Mean Pretest	Mean Posttest	Improvement	t	Sig. (2-tailed)	Remarks
Eksperimen	105,3	120,6	15,3	21,161	0,000	Signifikan
Control	104,8	113,5	8,7	14,653	0,000	Signifikan

Based on Table 3 of the Paired Samples t-Test results, the experimental group obtained a mean pretest of 105.3 and a mean posttest of 120.6 with an increase of 15.3. The t-value was calculated as 21.161 with a significance (2-tailed) of 0.000 indicating significant results.

In the control group, the mean pretest was 104.8 and the mean posttest was 113.5 with an increase of 8.7. The t-value was calculated as 14.653 with a significance (2-tailed) of 0.000 which also showed significant results.

Table 4. Independent Samples t-Test on Posttest Scores

Variabel	Mean Eksperimen	Mean Control	Differences	t	df	Sig. (2-tailed)
Posttest	120,6	113,5	7,1	2,387	28	0,024

Based on Table 4, the mean posttest value of the experimental group was 120.6 and the control group was 113.5 with a difference of 7.1. The test results showed a t-value of 2.387 with a degree of freedom (df) of 28 and a significance value (2-tailed) of 0.024.

Effectiveness Test (N-Gain Score)

To measure the proportional effectiveness of treatment, the N-Gain Score was calculated for each group. The maximum score used in the calculation is determined based on the realistic highest achievement for high school students, which is 150 cm. The results of the calculation are presented in Table 5.

Table 5. Effectiveness Test (N-Gain Score)

Groups	Mean Pretest	Mean Posttest	Max Score	N-Gain	Category
Eksperimen	105,3	120,6	150	0,68	Medium
Control	104,8	113,5	150	0,19	Low

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Based on Table 5, the experimental group had a mean pretest of 105.3 and a mean posttest of 120.6 with a maximum score of 150, so that an N-Gain value of 0.68 was obtained which was in the medium category. The control group had a mean pretest of 104.8 and a mean posttest of 113.5 with a maximum score of 150, so that an N-Gain value of 0.19 was obtained which was in the low category.

DISCUSSION

Before the intervention was implemented, the results of the descriptive analysis showed that the initial ability of the high jump between the experimental group and the control group was at an equal condition. The experimental group recorded an average pretest of 105.3 cm (SD = 8.4), while the control group obtained an average of 104.8 cm (SD = 7.9). This difference of only 0.5 cm is statistically meaningless, and is reinforced by the results of the Levene homogeneity test which showed a value of $F = 0.412$ with a significance of 0.526 ($p > 0.05$), which confirmed that the variance of the two groups was homogeneous before the treatment was administered. This equality of early ability is an important prerequisite in experimental research, as it ensures that the differences in outcomes that arise after treatment are really the impact of the intervention given, not the result of differences in initial ability between groups (Sugiyono, 2019). This condition also confirms that the purposive sampling process carried out succeeded in producing two statistically comparable groups.

The average pretest of the two groups which ranged from 105 cm was also in line with the findings of initial observations which showed that students' high jump abilities were still below the minimum standard of 120 cm set by the high school PJOK curriculum. This condition indicates a real need for more innovative and structured learning interventions. Widiastuti (2015) emphasized that the low achievement of students in athletic numbers such as the high jump is generally not solely caused by physical limitations, but is more influenced by learning methods that are less adaptive to the characteristics and needs of students.

The results of the Paired Samples t-Test in the experimental group showed an average increase of 15.3 cm—from 105.3 cm to 120.6 cm—with a value of $t = 21.161$ and a significance of 0.000 ($p < 0.05$). This increase is not only statistically significant, but also practically meaningful because the average posttest of the experimental group (120.6 cm) has exceeded the minimum standard of high jump competency of high school students by 120 cm. This means that the modification aid-based learning intervention successfully took students from substandard conditions to those that met the demands of the curriculum within eight weeks. This finding is in line with the results of Suherman's (2018) research which proves that modification of aids in athletic learning significantly improves student learning outcomes while reducing psychological barriers that have been the main barrier to achieving movement competence.

The individual achievements of the experimental group also showed encouraging consistency. The range of individual increases ranged from 10 to 22 cm, with none of the students having an increase below 10 cm. This indicates that the benefits of modified aids are felt equally by all students, not just those with better physical abilities. These findings reinforce Mahendra's (2019) argument that modification-based learning approaches are inclusive—able to accommodate students' diverse abilities and provide

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meaningful learning experiences for all ability levels, including students who previously faced psychological barriers in the form of fear of injury.

The control group that followed conventional learning also showed a statistically significant improvement, with a value of $t = 14.653$ and a significance of 0.000 ($p < 0.05$). The mean posttest of the control group increased from 104.8 cm to 113.5 cm, with an average increase of 8.7 cm. However, this achievement is not enough to bring the average student beyond the minimum standard of 120 cm. The range of individual increases that only ranged from 5 to 14 cm also showed that most of the control group students were still far behind the expected standard. The increase that occurred in the control group was most likely a natural effect of the practice effect that inherently occurs in every learning process, regardless of the method used (Schmidt & Wrisberg, 2008).

These results confirm that conventional learning, while not entirely ineffective, has significant limitations in encouraging optimal improvement in high jump ability—particularly when students face psychological barriers and limited means. Lutan (2001) stated that physical education learning that is not accompanied by modification of movement tasks tends to create a widening achievement gap between students who have good physical abilities and students who face difficulties, because uniform task standards are not able to accommodate the diversity of students' abilities in the classroom.

The results of the Independent Samples t-Test on the posttest scores of the two groups resulted in a value of $t = 2.387$ with a significance of 0.024 ($p < 0.05$), which statistically proves that there is a significant difference between the average posttest of the experimental group (120.6 cm) and the control group (113.5 cm). The average difference of 7.1 cm in the posttest reflects the real advantages of modified aid-based learning over conventional methods. Thus, the research hypothesis that the use of modified aids significantly increases the high jump ability of grade XII students of SMA Negeri 11 Makassar is accepted. Bahagia and Suherman (2000) stated that modification in physical education learning is essentially the teacher's effort to adapt the learning environment to the student's abilities and characteristics, so that every student has an equal opportunity to succeed.

The significant difference in improvement between these two groups can also be understood from the perspective of motor learning theory. Fitts and Posner (in Schmidt & Wrisberg, 2008) suggest that the mastery of movement skills takes place through three phases: cognitive, associative, and autonomous. The use of modified aids that allow students to practice at a level of difficulty that matches their abilities accelerates the transition from the cognitive phase to the associative phase, as students can concentrate on improving techniques without being burdened by the fear of failure or injury. In contrast, conventional learning with a fixed standard of height tends to leave some students stuck in the cognitive phase for longer due to unaddressed psychological barriers.

The calculation of the N-Gain Score provides a more proportionate perspective on the effectiveness of the intervention by considering the student's initial abilities. The experimental group obtained an N-Gain of 0.68 which was in the medium category and was very close to the threshold of the high category (> 0.70), while the control group only obtained a low N-Gain of 0.19 (Hake, 1999). The difference in N-Gain of 0.49 between

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these two groups quantitatively reflects how far apart the effectiveness of the two learning approaches is.

The N-Gain experimental group that was close to the high category showed that the modification aids worked almost optimally in maximizing the potential for improvement of students from their initial condition. This achievement is consistent with the findings of Adang and Mudjihartono (2009) who concluded that interventions based on modification of learning tools and environments are able to produce N-Gain in the medium to high category in athletic skills learning in high school, especially when the intervention is designed progressively and continuously for a minimum of eight weeks. Meanwhile, the control group's N-Gain of only 0.19 confirmed that without planned modifications, the potential for improvement of students—especially those below standard—could not be maximized through conventional learning alone.

The results of this study have significant implications for the learning practice of physical education in high school. The proven effectiveness of modification aids in improving students' high jump skills confirms that learning innovations don't have to be expensive or complex—simple modifications such as replacing rigid bars with elastic straps and using thicker mats are enough to make a meaningful difference. This is very relevant to the real condition of many schools in Indonesia that face limitations of standard sports facilities and infrastructure (Kristiyanto, 2012).

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that the use of modified aids has been proven to be more effective in increasing students' high jump abilities compared to conventional learning, while being able to bring average student achievement beyond the minimum competency standards set by the curriculum. These findings recommend that physical education teachers adopt a modification-based learning approach as a key strategy in athletic learning, particularly in schools that face limitations of standard facilities and infrastructure.

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