



Effect of Modified Bow Learning on Archery Accuracy in Elementary School Extracurricular

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Keywords

archery learning;
modified bow; accuracy;
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Abstract

This study analyzed the effect of archery learning using modified bows on students' accuracy in extracurricular activities at Public Elementary School 02 Pakintelan. Elementary school archery often faces obstacles such as limited facilities, low motivation, and standard equipment unsuited to students' physical characteristics. Modified bows were used as an innovative approach to improve accuracy and engagement. This study used a quantitative quasi experimental one group pretest posttest design with 22 students selected through total sampling. Data were collected using an archery accuracy test at 10 meters with 20 shots (maximum score 200). The treatment comprised 16 meetings using modified bows. Data were analyzed using descriptive statistics, normality and homogeneity tests, and a paired-samples t-test ($\alpha = 0.05$). Results showed significant improvement in archery accuracy after treatment. The mean score increased from 63.95 to 120.86. The paired-samples t-test yielded $p = 0.000$ ($p < 0.05$), indicating a significant effect of modified bow learning on accuracy. In conclusion, modified bows can be recommended as an innovative and effective strategy to improve archery accuracy and student participation in elementary school extracurricular activities.

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INTRODUCTION

Sport is an integral part of the education system, playing a vital role in improving the overall quality of human resources (Hasan et al., 2025). Through sporting activities, individuals not only gain physical benefits, such as increased fitness, but also experience development in mental, emotional, and social aspects (Riyanto & Mudian, 2019; Wakitayanti & Hartono, 2021). Educational sports are systematically designed to support student development at each developmental stage. Physical education focuses not only on physical activity but also on the development of motor and critical thinking skills and the formation of character values such as discipline, cooperation, and sportsmanship (Hasan, 2024; Salahudin et al., 2024). The learning process in physical education must be designed to be interesting, enjoyable, and appropriate to student characteristics, especially at the elementary school level. At this stage, students tend to learn more easily through direct experience and practical activities. Therefore, innovation in learning methods and media is needed to achieve learning objectives effectively.

A sport that can be developed in physical education is Archery. Archery is a sport that requires precision, concentration and coordination as well fine motor control (Yudho et al., 2025). In this sport, an archer shoots at a target with arrows and bows. Archery may appear simple, but it takes a strong foundation and repetitive drillwork to shoot well. The target sport category in which archery falls under, is a dynamic activity whose measurement of success depends on the accuracy to hit the target at high precision (Faqiha et al., 2023; Yudho et al., 2022). Archery Accuracy is also pretty straight forward, since it affects actual scoring directly. Good accuracy demands the interplay of muscle strength and body stability, with some delineation in vision directed toward another object, as well as a control over emotions.

Archery instruction many times faces challenges in Elementary Schools. Limited facilities and infrastructure will have an impact on learning effectiveness is one of them. There's far too many bows and arrows compared to the size of each class, or even for students joining all these clubs on their own time. This means students have to wait a long time before it is their turn, if at all, to practice. This leads to less effective practice time and restricts the number of times students can practice. Consequently, archery skills develop at a much slower rate in this scenario. Another problem found is when students are given the same archery equipment as used in standard, which does not match with characteristics of an elementary school student. (Prasetyo, 2015), stated that for relatively high draw weights, students had difficulty controlling the movement of the body at a stable posture or in an aiming state. This has made it nearly impossible for students to learn the skills essential for good archery causing inexperienced shooting and a drastic loss in accuracy. Moreover, it affects students' mental health and makes learning less fun and more predictable. When students struggle to operate the equipment, they become frustrated and lose both interest and motivation to practice. (Zepeda et al., 2020). Motivation is similar in that it plays an important role in both successful learning when kids are motivated to learn —particularly the optional sort of extracurricular activities. Thus, there is a need for appropriate learning strategy to increase engagement and interest of the students

One alternative is the use of modified bows in archery lessons. Modified bows are designed with safety, comfort, and suitability to students' physical abilities in mind. With a lighter weight and simpler design, these bows allow students to more easily control movements and improve shooting accuracy (Prasetyo, 2015). Furthermore, the use of modified bows can also increase the frequency of practice because they are easier to use interchangeably. The use of modified learning media is a form of innovation in physical education that adapts the learning process to students' needs. Modified bows not only serve as alternative tools but also as a pedagogical approach that can help students gradually understand basic techniques. Observations at Pakintelan 02 Public Elementary School indicate that students' archery accuracy is still relatively low. This is evident in the small number of students who achieve high scores in each archery trial. This condition indicates that the ongoing learning process has not fully optimized students' abilities.

Based on the background description, it can be identified that there is a research gap, namely the suboptimal application of media or learning tools that are appropriate to the characteristics of elementary school students in archery activities, where most of the learning

still uses standard tools that are less adaptive to the physical abilities and motor development stages of students, as well as the lack of empirical studies that specifically test the effectiveness of using modified bows to improve archery accuracy in extracurricular contexts at the elementary school level, therefore, this research is urgent to be carried out considering the low level of student accuracy, limited infrastructure, and decreased learning motivation that have an impact on less than optimal learning outcomes, so that innovative solutions are needed that not only improve technical skills but also student involvement in the learning process. The novelty of this research lies in the use of a modified bow as a learning tool tailored to the characteristics of elementary school students. Modifications were made to the material, size, and draw weight of the bow, using lighter and safer materials, such as PVC pipe, and the bow size was adjusted to the students' physical abilities. Furthermore, the draw weight was made lighter, making it easier for beginners to control. The use of this modified bow is expected to help students perform archery techniques with greater stability, increase comfort during practice, and improve shooting accuracy. The purpose of this study is to empirically analyze the effect of archery learning using modified bows on improving students' archery accuracy and to identify the magnitude of the increase that occurs after being given treatment in archery extracurricular activities in elementary schools.

METHODS

The present study is quantitative research with quasi-experimental (one group pretest-posttest design). The purpose of this research design was to figure out the influence of archery learning on students' archery degree of accuracy with a modified bow. This study was conducted at Sirombo Field, Pakintelan, Semarang City with all students who carry out extracurricular activities in Archery at Public Elementary School 02 Pakintelan as the subject of the research. This study applied total sampling, the entire population of about 22 students is brought to be a research sample. The independent variable in this study is learning archery using a modified bow. Whereas the depended variable is students archery shooting accuracy based on a practical evaluation of 20 bows shoot at an exact range (10 meters) with maximum scores being 200 points. The resulting score is transformed to the following **table 1**.

Table 1. Archery Accuracy Assessment Norms

Interval	Information
161-200	Very well
121-160	Good
81-120	Currently
40-80	Not enough
<40	Very less

Data collection through tests. The test consisted of a pretest, taken before the start of treatment, and a posttest in order to gauge how much students have improved. Sessions (n = 16) involved basic archery practice of stance, grip, draw, aim, release and follow through performed twice per week using a modified bow. The obtained data were analyzed using SPSS in terms of descriptive statistics, prerequisite tests (normality and homogeneity), and a t-test at the level of 0.05. The findings from this analysis would be applied to assess whether a modified bow significantly improved students' shooting accuracy .

RESULTS AND DISCUSSION

Table 2. Statistical Descriptive Analysis

Variables	N	Total Score	Min	Max	Mean $\pm$ Stdev
Pretest	22	1407	35	110	63.95 $\pm$ 19.55
Posttest	22	2659	80	156	120.86 $\pm$ 19.95

Based on the results of descriptive statistical analysis, the sample for each variable (pretest and posttest) consisted of 22 participants. In the pretest, the total score obtained was 1407, with a minimum value of 35 and a maximum of 110, and an average of 63.95 with a standard deviation of 19.55. On the other hand, in the posttest, the total score obtained was 2659, with a minimum value of 80 and a maximum of 156, and an average of 120.86 with a standard deviation of 19.95. These data indicate a significant increase between the pretest and posttest.

Table 3. Pre-test Post-test Data on Archery Accuracy

Interval	Information	Pre-test	Post-test
161-200	Very well	0	0
121-160	Good	0	11
81-120	Currently	3	10
40-80	Not enough	16	1
<40	Very less	3	0

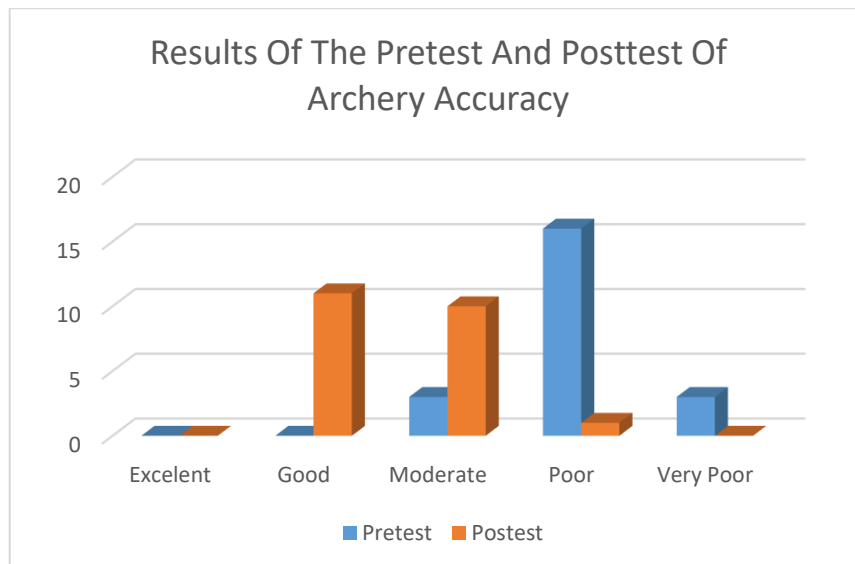


Figure 1. Results of the pre-test and post-test of archery accuracy

The results of the pretest and posttest on archery accuracy demonstrated a clear improvement in students' performance after the treatment was implemented. During the pretest, no students achieved the "very good" or "good" categories. Most participants, totaling 16 students, were classified in the "poor" category, while three students were categorized as "average" and another three as "very poor." However, the posttest results revealed substantial progress. A total of 11 students reached the "good" category, 10 students were classified as "average," and only one student remained in the "poor" category, with no students falling into the "very poor" category. This shift in score distribution reflects a considerable enhancement in students' archery accuracy, marked by movement from lower performance categories toward higher achievement levels following the intervention.

Table 4. Prerequisite Test

Variable	Statistics	df	Sig.	Information
Pretest Normality	0.945	22	0.255	Normal
Posttest Normality	0.983	22	0.954	Normal
Data Homogeneity	0.102	42	0.751	Homogeneous

Based on the preliminary test results shown in **Table 4**, the normality test for the pre-test data yielded a statistical significance value of 0.255, while the normality test for the post-test data yielded a statistical significance value of 0.954, both values being greater than 0.05 ($p > 0.05$). This indicates that the pre-test and post-test data are normally distributed. Furthermore, the homogeneity test results showed a statistical significance value of 0.751 ($p > 0.05$), indicating that the data variance is homogeneous. Therefore, it can be concluded that all data met the criteria for normality and homogeneity, making them suitable for proceeding to the hypothesis analysis stage.

Table 5. Paired Sample T-Test

Pretest - Posttest	Mean	Standard Deviation	Std. Error Mean	t	df	Sig.
	-56,909	22,920	4,887	-11,646	21	.000

Based on **Table 5**, the paired sample t-test analysis revealed a mean difference of -56.909, with a standard deviation of 22.920 and a standard error value of 4.887. The obtained t-value was -11.646 with 21 degrees of freedom and a significance value of 0.000 ($p < 0.05$). These findings indicate that there was a statistically significant difference between the pretest and posttest scores. The negative mean difference shows that students achieved higher scores after the treatment, suggesting that the intervention successfully enhanced students' archery accuracy. The substantial difference between the mean score and the standard deviation demonstrates that the treatment had a strong effect, indicating that the use of modified bows was highly effective in improving students' performance and shooting skills.

The results of this study indicate that learning archery using a modified bow significantly improved students' shooting accuracy. This was evident in the increase in the average score from 63.95 in the pretest to 120.86 in the posttest. This improvement indicates that the intervention improved students' basic aiming skills at targets. Theoretically, this performance improvement aligns with the principle of motor learning, which states that repeated practice tailored to students' abilities will significantly improve motor (Jafar et al., 2023; Sutapa et al., 2021). The distribution of archery accuracy categories also changed significantly. Before treatment, most students were in the poor category; after treatment, the majority were in the moderate and good categories. This shift indicates that using equipment tailored to students' characteristics can accelerate the acquisition of basic skills. This finding aligns with research by Al-Aviv et al., (2025), which states that equipment modification in physical education can increase participation and learning effectiveness because students are more easily adapted to the given motor tasks.

The paired-samples t-test results indicated a significant difference in the pretest and the posttest ($p = 0.000$; $p < 0.05$). The results of the use of modified bows show not only descriptive changes but also statistically significant improvements in students' accuracy. Previous findings also indicated that interventions based on tool modification could lead to substantial learning progress in sports skills (Priyambada et al., 2026). The improvement in archery accuracy is also closely related to biomechanical factors. The use of a lighter, modified bow enables more stable shooting performance because students have greater control over the movements involved in drawing and releasing the bowstring.

Lighter, easier-to-use tools make for confident and motivated students ready to participate in learning. This is in accordance with the opinion of Inggritiya et al., (2024), namely that according to the theory of intrinsic motivation it can be said that a sense of competence and comfort while carrying out activities will increase student engagement which leads to good learning outcomes. However, different studies came up with conflicting findings. It has been proposed that implementing standard tools from an early age may encourage improved

technique adaptation in the future (Buszard et al., 2020; Piquer-Piquer et al., 2025). These studies argue that tool modifications can make students overly dependent on easier conditions, leading to difficulties when transitioning to standard tools. However, in the context of elementary education, a gradual approach remains more effective. These differences in results can be explained by the pedagogical approach used. In this study, tool modifications function not only as aids but also as part of a learning strategy tailored to the students' developmental stage. According to Touzard et al., (2023), children require a progressive, adaptive learning approach to develop motor skills optimally without excessive stress. Furthermore, limited facilities that previously hampered learning can also be overcome through the use of modified arcs. With simpler, easier-to-use tools, students' practice frequency increases, providing more opportunities to practice. Teachers not only act as material deliverers but also as facilitators who can create a conducive learning environment. Innovation in physical education can improve the quality of students' learning experiences and positively impact learning outcomes (Dzhurynskyi et al., 2023; Manzano-Sánchez et al., 2024).

Overall, this study's results indicate that teaching archery with modified bows is an effective strategy for improving elementary school students' shooting accuracy. While there are differing views on the use of modified bows, these findings provide evidence that an approach tailored to students' characteristics can yield optimal results. Therefore, the use of modified bows can be recommended as an innovative and applicable learning alternative for improving sports skills at the elementary school level.

CONCLUSION

Based on the research conducted, it can be concluded that learning archery with a modified bow significantly improves students' archery accuracy in extracurricular activities at Public Elementary School 02 Pakintelan. This is indicated by an increase in the average score from 63.95 in the pretest to 120.86 in the posttest, and is supported by the results of the paired-samples t-test, which show a significance value of 0.000 ($p < 0.05$). In addition, there is a shift in the distribution of student abilities from predominantly "poor" to "moderate" and "good", indicating a real increase in skills. The use of a modified bow has been proven to help students control movements, increase self-confidence, and increase practice frequency, making the learning process more effective, enjoyable, and in line with the characteristics of elementary school students. Thus, learning archery using a modified bow can be recommended as an alternative, innovative, and applicable learning strategy to improve learning outcomes and students' archery accuracy skills.

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