Differences in Archery Skill Results for Vocational School Students and Beginners Based on Shooting Distance
Diferencias en los resultados de las habilidades de tiro con arco para estudiantes de escuelas vocacionales y principiantes según la distancia de tiro

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Abstract. This research aims to examine differences in archery skill scores for Vocational High School (SMK) students among beginners based on the shooting target distance factors of 5 meters, 10 meters, and accumulated distances of 5 and 10 meters. The sample for this research was 16 male and female students from classes XA, XB and XIA, taken using the cluster random sampling method. Data analysis used descriptive statistics and inferential factorial one-way Anova. One-way anova test results Sig. $0.030 < 0.05$ means there is a significant difference in the average of the three students' archery skill score results at a distance of 5 m, a distance of 10 m, and an accumulated distance of 5 and 10 m. First Post Hoc follow-up test Sig value. $0.088 > 0.05$, meaning that there is no significant difference between the results of students' archery skills at a shooting distance of 5 m and a shooting distance of 10 m. Post Hoc follow-up test for both Sig values. $0.917 > 0.05$, meaning that there is no significant difference in the results of students' archery skills at a shooting distance of 5 m with accumulated shooting distances of 5 and 10 m. Post Hoc follow-up test for the three Sig values. $0.036 > 0.05$, meaning that the results of students' archery skills at a shooting distance of 10 m with an accumulated shooting distance of 5 and 10 m have a significant difference. Thus, it can be concluded that there is a significant difference in the average of the three students' archery skill score results at a distance of 5 m, a distance of 10 m, and an accumulated distance of 5 and 10. The findings of this study suggest the design of an archery training program for beginners, including consideration of starting from a shorter distance and gradually increasing the shooting distance, as well as carrying out various training techniques with a combination of exercises at various appropriate distances and giving priority to the consistency of technical movements and body posture. while archery.
Keywords: Differences, Skills Archery, Vocational School Students, Beginners, Shooting Range

Resumen. Esta investigación tiene como objetivo examinar las diferencias en las puntuaciones de habilidades de tiro con arco de los estudiantes de secundaria vocacional (SMK) entre principiantes en función de los factores de distancia del objetivo de tiro de 5 metros, 10 metros y distancias acumuladas de 5 y 10 metros. La muestra para esta investigación fue de 16 estudiantes y alumnas de los cursos XA, XB y XIA, tomadas mediante el método de muestreo aleatorio por conglomerados. El análisis de los datos utilizó estadística descriptiva y Anova factorial inferencial unidireccional. Resultados de la prueba de anova unidireccional Sig. $0,030 < 0,05$ significa que hay una diferencia significativa en el promedio de los resultados de la puntuación de habilidad de tiro con arco de los tres estudiantes a una distancia de 5 m, una distancia de 10 m y una distancia acumulada de 5 y 10 metros. Primera prueba de seguimiento Post Hoc Valor Sig. $0,088 > 0,05$, lo que significa que no hay diferencia significativa entre los resultados de las habilidades de tiro con arco de los estudiantes a una distancia de tiro de 5 m y a una distancia de tiro de 10 m. Prueba de seguimiento post hoc para ambos valores de Sig. $0,917 > 0,05$, lo que significa que no hay diferencia significativa en los resultados de las habilidades de tiro con arco de los estudiantes a una distancia de tiro de 5 m con distancias de tiro acumuladas de 5 y 10 m. Prueba de seguimiento post hoc para los tres valores Sig. $0,036 > 0,05$, lo que significa que los resultados de las habilidades de tiro con arco de los estudiantes a una distancia de tiro de 10 m con una distancia de tiro acumulada de 5 y 10 metros tienen una diferencia significativa. Por lo tanto, se puede concluir que existe una diferencia significativa en el promedio de los resultados de puntuación de habilidad de tiro con arco de los tres estudiantes a una distancia de 5 m, una distancia de 10 m y una distancia acumulada de 5 y 10 m. Los hallazgos de este estudio sugieren el diseño de un programa de entrenamiento de tiro con arco para principiantes, incluyendo la consideración de comenzar desde una distancia más corta e ir aumentando gradualmente la distancia de tiro, así como realizar diversas técnicas de entrenamiento con una combinación de ejercicios a varias distancias apropiadas y dando prioridad a la coherencia de los movimientos técnicos y la postura corporal. mientras que el tiro con arco.
Palabras Clave: Diferencias, Habilidades De Tiro Con Arco, Estudiantes De Escuelas Vocacionales, Principiantes, Campo De Tiro.

Introduction

Limited facilities, equipment and funds at schools often become obstacles for students who want to learn archery. It is necessary to support the existence of sports laboratories that provide adequate archery sports equipment, both at universities or schools that hold archery sports classes (Setyawan et al., 2023). Insufficient training can also make things difficult for students, especially if the instructor or trainer does not have sufficient knowledge and skills. Concerns about safety are another influencing factor, especially if there is inadequate supervision or the facilities are not safe enough. In this regard, the existence of sports facilities such as equestrian archery is highly hoped for by many groups(Dawiah et al., 2022). Apart from that, lack of interest or motivation and busy schedules can also be obstacles for students. Without competition or external motivation,

it will have the effect of reducing students' interest in archery. Physical or health problems such as injuries, medical conditions, or lack of physical fitness may also hinder a student's participation in the sport.

Archery skills often focus on aspects such as archery technique, psychological factors, and the influence of physical condition on shooting accuracy. There are many factors that can influence archery performance, both in terms of training management or teaching, application of methods, technical training, physical, tactical and mental (Setyawan et al., 2023). There have been several studies conducted to provide solutions and contributions theoretically and practically regarding this matter. The performance of archery skills can involve the use of technology such as motion sensors to measure parameters such as shot angle, shot power, and consistency of movement. Previous research has used a variety of methods to measure and analyze archery skills. Study (Vlasov et al., 2017) stated that it is also necessary to use video and multimedia technology in the training of archery athletes in order to improve the skills of coaches and athletes, as well as facilitate understanding of all aspects of training implementation. Thus, various innovations are needed to improve archery performance, both in terms of equipment and training techniques.

The importance of varying distances in archery skills is necessary, because target distance affects the accuracy and consistency of shots. The implementation of archery starts from close to long distance and then gradually moves to a greater distance from the target (Arisman & Okilanda, 2020). This is because the study of how distance affects archery skills, especially among beginners, provides insight into the development of archery techniques for beginning students. Accurate data collection techniques, such as using motion sensors, are critical because they can measure key parameters such as shot angle and movement consistency. Modifications to archery equipment, such as the use of paralon pipes, reflect innovations in the sport of archery and expand its accessibility. Comparative studies between various variables, including the effects of equipment modifications on performance and learning can assist in understanding the dynamics of archery skills and the development of more effective training programs. Apart from that, in the sports concept, archery education also needs to be taught to develop various important aspects that students need during their physical and psychological growth and development. As research (Setyawan et al., 2024) there is a need for Physical Education (PE) activities in schools with archery sports as material, because it can develop cognitive, affective, psychomotor and other positive values. Previous research on archery sports has been conducted by (Barrera et al., 2020); (Roldan et al., 2021); (Wibowo et al., 2024); (Setyawan et al., 2024); (Yachsie et al., 2024). However, research related to archery by analyzing differences in archery skill results based on distance has not been done much. Although there has been previous research that discusses the relationship between arm muscle strength and hand-eye coordination on archery accuracy at a distance of 5 meters aged 9 -

12 years (Kurniawan, 2020). Meanwhile, there has been a recommendation from previous research which states that it is necessary for researchers in the field of sports education to carry out other research related to archery as Physical Education (PE) material in schools, because there is still very little research related to this topic (Setyawan et al., 2024). Based on the explanation above, this research aims to test the differences in archery skill scores for beginner Vocational High School (SMK) students based on the shooting target distance factors of 5 meters, 10 meters, and accumulated distances of 5 and 10 meters. It is hoped that this will provide findings on various forms of archery training with variations in shooting distances specifically for beginner vocational school students

Method

This research is a comparative quantitative research which aims to determine the extent of variation or differences between related variables. This research aims to test the differences in archery skill scores for beginner vocational high school students based on the shooting target distance factors of 5 meters, 10 meters, and accumulated distances of 5 and 10 meters. The population in this study were Vocational High School (SMK) students in the Yogyakarta region, Indonesia who had never practiced archery before. The sample for this research used the cluster random sampling method on 16 male and female students from classes XA, XB and XIA.

Data analysis used descriptive statistics and inferential factorial one-way Anova. One-way anova analysis is a one-way classification analysis that is based on observing one criterion or factor that causes variation. Data prerequisite tests were carried out using the Shapiro-Wilk normality test and homogeneity tests using Levene's Test of homogeneity of variance. The results of the Shapiro-Wilk normality prerequisite test show that the result of the shooting distance value of 5 m has a Sig value. $0.194 > 0.05$, the resulting shooting distance value of 10 m has a Sig value. $0.803 > 0.05$, and the results of the accumulated shot distance values of 5 and 10 m have a Sig value. $0.182 > 0.05$ so the data is normally distributed. Homogeneity prerequisite test results *Levene's Test of homogeneity of variance* shows the Sig value. $0.590 > 0.05$ so that the variation in the data obtained is homogeneous. The data collection technique for archery skills was carried out using archery tests at distances of 5 and 10 m by shooting 3 arrows at each distance. The arrow equipment used is the Indonesian national standard type which is modified and made from simple paralon pipe material, but can still be used to practice consistent archery movement techniques for beginner archers. The score data obtained from archery shooting skills is added up and converted into a numerical value on a scale of 1-100. Next, the data was grouped into three, namely: 5 m shot score results, 10 m shot score results, and accumulated 5 and 10 meter shot score results, as shown in (Table 1) below:

Table 1.
Results Archery Skill Value Based on Shooting Distance

No	Student's name	Class	Value Score Based on Distance			Value Score Conversion		
			5 AD	10 AD	Ak. 5 +10 AD	5 AD	10 AD	Ak. 5+10 AD
1	BP	XA	20	8	28	74	44	74
2	DAAG	XA	24	9	33	89	50	87
3	ERH	XA	23	8	31	85	44	82
4	EHT	XA	12	7	19	44	39	50
5	E.F	XA	18	8	26	67	44	68
6	FDPP	XA	26	5	31	96	28	82
7	GNS	XIA	12	16	28	44	89	74
8	TAP	XIA	15	0	15	56	0	39
9	J.M	XB	16	14	30	59	78	79
10	ADS	XA	25	5	30	93	28	79
11	AJR	XA	27	11	38	100	61	100
12	AAEP	XA	17	6	23	63	33	61
13	CHS	XA	14	18	32	52	100	84
14	FDA	XA	0	11	11	0	61	29
15	CG	XIA	18	0	18	67	0	47
16	FSA	XB	21	12	33	78	67	87

Results

Based on the results of the descriptive analysis as shown in (Table 2), it is known that (N) is 48 with details: 16 data results for the value of the shooting distance of 5 m; 16 data results for shooting distance values of 10 m; and 16 data results for accumulated shooting distance values of 5 and 10 meters. The mean value result at a shooting distance of 5 m is 66.69 with an SD of 25,239, the mean value result at a shooting distance of 10 m is 47.88 with an SD of 27,988, and the mean value result at an accumulated shooting distance of 5 and 10 m is 70.13 with an SD of 19,684. Based on the results of this analysis, it shows that the results for the shooting distance of 10 m are the lowest, while the results for the accumulated shooting distances of 5 and 10 m are the highest.

Table 2.
Descriptive Analysis Test Results of Students' Archery Skills

Descriptives								
Archery Skill Value Results								
	N	Mean	Std. Dev.	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Shooting Distance 5 Meters	16	66.69	25,239	6,310	53.24	80.14	0	100
Shooting Distance 10 Meters	16	47.88	27,988	6,997	32.96	62.79	0	100
Accumulated Shot Distance 5 & 10 Meters	16	70.13	19,684	4,921	59.64	80.61	29	100
Total	48	61.56	25,974	3,749	54.02	69.10	0	100

The results of the One-Way Anova test as in (Table 3) show that the Sig. 0.030 < 0.05 indicates that there is a significant difference in the average of the three students' archery skill scores, namely between the 5 m shooting distance score, the 10 m shooting distance score, and the accumulated shooting distance scores of 5 and 10 m. The test results show that the hypothesis which states that there is a difference in the results of students' archery skill scores is accepted, so it can be continued with further post hoc Tukey test analysis.

Table 3.
Results Anova Test

Anova					
Archery Skill Value Results					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4590.875	2	2295.438	3,809	,030
Within Groups	27116.938	45	602,599		
Total	31707.813	47			

Based onThe Post Hoc Follow-up Test revealed that the average differences in each variant were divided into three parts as can be seen in (Table 4) below:

Table 4.
Results Multiple Comparisons Test

Multiple Comparisons						
Dependent Variable: Archery Skill Value Results						
Tukey HSD						
(I) Shot Distance	(J) Shot Distance	Mean Difference (IJ)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Shooting Distance 5 M	Shooting Distance 10 M	18,813	8,679	,088	-2.22	39.85
	Accumulated Shot Distance 5 & 10 M	-3,438	8,679	,917	-24.47	17.60
Shooting Distance 10 M	Shooting Distance 5 Meters	-18,813	8,679	,088	-39.85	2.22
	Accumulated Shot Distance 5 & 10 M	-22,250*	8,679	,036	-43.28	-1.22
Accumulated Shot Distance 5 & 10 M	Shooting Distance 5 M	3,438	8,679	,917	-17.60	24.47
	Shooting Distance 10 M	22,250*	8,679	,036	1.22	43.28

*. The mean difference is significant at the 0.05 level.

Furthermore, in the first Post Hoc Tukey follow-up test as (Table 4), it was discovered that the difference in the average results of students' archery skill scores at a shooting distance of 5 m and a shooting distance of 10 m was 18,813. The average difference in shot scores ranges from -2.22 (Lower Bound) to 39.85 (Upper Bound) at a 95% confidence level. Based on the Multiple Comparisons Output, it is known that the significance value is 0.088 > 0.05, so it can be concluded that there is no difference in the results of students' archery skills at a shooting distance of 5 m and a shooting distance of 10 m. Thus, the conclusion is that there is no significant difference in the average results of students' descriptive archery skill scores between the two variants.

The results of the second follow-up test revealed that the difference in the average results of students' archery skill

scores at a shooting distance of 5 m with accumulated shooting distances of 5 and 10 m was -3.438. The average difference in shot scores ranges from -24.47 (Lower Bound) to 17.60 (Upper Bound) at a 95% confidence level. Based on the Multiple Comparisons Output, it is known that the significance value is $0.917 > 0.05$, so it can be concluded that there is no difference in the results of students' archery skills at a shooting distance of 5 m with an accumulated shooting distance of 5 and 10 m. Thus, the conclusion is that there is no significant difference in the average results of students' descriptive archery skill scores between the two variants.

The results of the third follow-up test revealed that the difference in the average results of students' archery skill scores at a shooting distance of 10 m with accumulated shooting distances of 5 and 10 m was -22,250. The average difference in shot scores ranges from -43.28 (Lower Bound) to -1.22 (Upper Bound) at a 95% confidence level. Based on the Multiple Comparisons Output, it is known that the significance value is $0.036 > 0.05$, so it can be concluded that there is a difference in the results of students' archery skills at a shooting distance of 10 m with an accumulated shooting distance of 5 and 10 m. Thus, the conclusion is that there is a significant difference in the average results of students' descriptive archery skill scores between the two variants.

Discussion

The results of this research have found significant differences in scores between shooting distances of 5 meters, 10 meters, and the accumulation of both, meaning that distance has a significant influence on students' archery skills. The results of this research underline the importance of adapting to the limitations of archery sports equipment, because this equipment can be modified from simple materials (made from paralon pipe) which have been adapted to Indonesian national standard bows. Study (Sahabuddin et al., 2022)concluded that the archery training method using a paralon pipe at a distance of 10 meters was able to improve the archery performance test scores for students. Students who are already proficient can use standard arrows, while students who not yet advanced are directed to use arrows or modified bows made from paralon pipe (Purba & Haryanto, 2020). Apart from that, the important role of correct teaching regarding basic archery techniques is also needed, because it will produce accurate archery skills. Another important factor in realizing this goal is that teachers or lecturers are expected to be serious about conveying knowledge, providing motivation and also using appropriate teaching methods or techniques.(Mukarromah et al., 2021). Because success in sports is every athlete's dream, so maximum coaching and approaches or methods are needed(Nur & Kamaruddin, 2021). With simple innovations in equipment and also teaching correct basic techniques, learning archery skills can be carried out effectively, and can become an input for educational institutions with limited sports facilities and infrastructure.

In the sport of archery, various training methods are also required, such as circuit training (Saputro et al., 2022); visualization and relaxation training methods (Wattimena, 2020); SPT-drill imagery training method as an effort to control panic targets (Priambudi & Mashud, 2023); core stability training method (Dewi & Palgunadi, 2021); drawing training method using rubber towards mastering basic archery techniques (Hardi & Faturrohman, 2022); (Prasetyo, 2016). Apart from that, based on other related research, variations in the visualization training method are more effective than the relaxation method in improving students' ability to shoot at a distance of 10 meters (Wattimena, 2020). This variation can also be done using close range shooting techniques of 5-10 meters, such as the blind shoot training technique. The blind shoot technique is a close-range archery exercise with your eyes closed which is useful for getting a better feel for the correct technique and maintaining technical posture so that archers are more focused, more concentrated, more confident and able to produce shots right on target (Faqiha & Pratama, 2022). This research also suggests the need for differentiation in physical education, which allows students to develop at a rate appropriate to their individual abilities. Additionally, further research may be needed to understand other factors that influence archery skills, such as motivation, physical fitness, and mental training, as well as the potential of archery as a means to develop students' psychomotor and concentration skills, impacting daily life and overall student academic achievement. Thus, it is necessary to design an archery training program for beginners, including consideration of starting from a shorter distance and gradually increasing the distance. Apart from that, training techniques can also be carried out with a combination of exercises at various appropriate distances and giving priority to the consistency of technical movements and body posture when archery. Finally, it can be understood that the influence of shooting distance also results in differences in various aspects needed to encourage archery skills at various distances, such as eye perception when aiming, adjustment of the arrow's speed to the earth's gravitational force, the strength of the bow draw/throw, adaptation of techniques made by beginners. to changes in distance, and so on. Apart from that, in terms of equipment, modifications made from paralon pipes are also highlighted and considered about how this tool affects shot scores and archery performance. However, at least this modified equipment has provided the potential benefits of using simpler equipment in the context of archery education or training. The results of this research can also provide practical implications for archery teaching and training, including adjusting teaching strategies based on shooting target distance, as well as providing new research regarding the archery skill results of beginner Vocational High School (SMK) students based on shooting distance.

Conclusion

There is a need for differentiation in physical activity or sports education that allows students to develop at a level

appropriate to their individual abilities. It is also necessary to understand other factors that influence archery skills, such as motivation, physical fitness, and mental training, as well as the potential of archery as a means to develop students' psychomotor and concentration skills, which impact students' daily lives and overall academic achievement. Thus, it is necessary to design an archery training program for beginners, including consideration of starting from a shorter distance and gradually increasing the distance. Various training techniques can also be carried out with a combination of exercises at various appropriate distances and giving priority to consistency of technical movements and body posture when archery. Apart from that, the effect of shooting distance also results in differences in various aspects needed to encourage archery skills at various distances, such as eye perception when aiming, adjustment of the arrow's speed to the earth's gravitational force, the strength of the bow pull/throw, technical adaptations made by beginners to distance changes, and so on. Apart from that, in terms of equipment, modifications made from paralon pipes are also highlighted and considered about how this tool affects shot scores and archery performance. However, at least this modified equipment has provided the potential benefits of using simpler equipment in the context of archery education or training. The results of this research can also provide practical implications for archery teaching and training, including adjusting teaching strategies based on shooting target distance, as well as providing new research regarding the archery skill results of beginner Vocational High School (SMK) students based on shooting distance.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

Acknowledgments

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