

The Effect of Pull Up Exercises on Bullet Push Strength in Primary School Students

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Based on the initial observation results, it can be discerned that students' proficiency in shot put technique is not yet at its maximum potential. The research conducted here is of an experimental nature. It involved 20 students as samples, and data were analyzed using pretest and posttest assessments. The findings reveal a significant improvement in shot put ability after pull-up exercises, with posttest scores tending to be higher than pretest scores. Pull-up exercises can enhance shot put performance; the pretest average score was 38.65, which increased to 54.55 in the posttest results. This is evidenced by the t-test result, where the calculated t-value of 7.286 exceeds the tabulated t-value of 1.729. The percentage increase in pull-up exercises on shot put strength for Grade V students experienced an 8.157% improvement. Statistical analysis using the t-test indicates a significant difference between pretest and posttest results, affirming that pull-up exercises have a positive impact on shot put strength improvement in students. In conclusion, pull-up exercises prove to be an effective method for enhancing shot put strength among students. However, careful attention to technique and training focus is necessary to ensure optimal results. These findings also open avenues for further research into the development of more effective training strategies to achieve optimal athletic performance.

Keywords: *Pull Up Training, Bullet Rejection Strength*



1.INTRODUCTION

Sports are physical activities that aim to train the body's physical or bodily aspects. The primary goal of sports is to provide fitness and promote bodily health. During sports activities, various muscles in the body work together, characterized by changes in muscle strength, flexibility, speed, accuracy, movement coordination, and endurance (Arif & Tokan, 2019). Sports serve as both physical and psychological activities for individuals, beneficial for maintaining and enhancing one's health quality post-exercise (Salahudin & Rusdin, 2020). Athletics, encompassing running, jogging, jumping, and throwing, can be considered one of the oldest forms of sports, dating back to the age of the first humans on Earth. This is easily understood, as humans at that time needed to walk, run, jump, and throw to sustain their lives. Athletics, also referred to as track and field, stands as one of the globally acclaimed sports and serves as the centerpiece of the Summer Olympic Games (Kelly et al., 2022) Athletics constitutes a vital element of Physical Education, Sports, and Health, prioritizing physical activity. Hence, it is crucial to impart athletic skills to students from early childhood through higher education via physical education lessons. Currently, the actual levels of physical activity in various regions worldwide, as well as the levels of quality of life and dependency within populations, remain largely unknown (Vázquez et al., 2023). Therefore, a thorough understanding of this subject matter is imperative for enhancing capabilities.

Physical education significantly contributes to the holistic development of individuals, encompassing physical, psychological, and intellectual aspects (Kepoğlu et al., 2021). Essentially, Physical Education is an integral component of the overall education system, aimed at fostering health aspects, physical fitness, critical thinking skills, emotional stability, social skills, reasoning, and moral actions through physical activities. With the intensification of education as a lifelong human development process, the role of Physical Education becomes pivotal, providing learners with opportunities to directly engage in various learning experiences through systematic physical activities, play, and sports.

The evaluation system in physical education is an intuitive outcome of the physical education process and its effects (Wang & Anhouck, 2022). The provision of learning experiences is directed towards nurturing and shaping a healthy and active lifestyle throughout life. The concept of teaching in physical education has evolved from a teacher-centered approach to a more student-centered approach, aiming to cultivate problem-solving skills and critical thinking in games (Tangkudung & Mahyudi, 2022).

In the process of teaching Physical Education, teachers are expected to impart various fundamental movement skills, techniques, and strategies in games and sports, internalize values (sportsmanship, honesty, cooperation, etc.), and foster healthy lifestyle habits. Implementation is



not confined to conventional classroom-based theoretical studies but involves physical, mental, intellectual, emotional, and social elements. Activities provided in teaching must receive didactic-methodical touches, ensuring that the activities undertaken can achieve learning objectives.

Shot put is one of the throwing events in athletics that is taught within the curriculum and developed for extracurricular programs. Based on observations, it is evident that teaching shot put, as one of the throwing events in athletics, is an integral part of both curricular and extracurricular programs in schools. However, in practice, the implementation of the curriculum has not been entirely optimal, leading to the unmet learning objectives of shot put. Various factors may contribute to the suboptimal nature of this learning, ranging from insufficient time allocated for shot put practice, teaching methods lacking in variation or alignment with student needs, to inadequate attention to the development of specific shot put skills. The issue arises: how can the effectiveness of shot put learning be enhanced for fifth-grade elementary school students, ensuring that curriculum objectives are optimally achieved? This necessitates the search for methods or strategies that can improve students' understanding of shot put techniques and skills, as well as enhancing their interest and motivation to actively engage in this learning process. There are many reasons why individuals are motivated to participate in sports (Moradi et al., 2020)

Considering the aforementioned issues, this research will focus on the impact of pull-up exercises on enhancing shot put strength among fifth-grade elementary school students. It is hoped that through this study, an effective method will be discovered to improve students' understanding and skills in shot put, thereby facilitating better learning alignment with curriculum objectives. Exercise is a systematic physical activity carried out over a prolonged period, progressively and individually enhanced, aiming to achieve predetermined physiological and psychological functions. Another perspective defines exercise as a systematic process of physical and mental refinement for athletes to attain maximum quality through regular, directed, progressive, and repetitive physical and mental loads over time (Kvist & Silbernagel, 2022).

Pull-ups are among several exercises used in muscle formation processes to achieve an athletic-looking and healthy body. Typically, the muscles developed through pull-ups focus on the upper body, contributing to an athletic appearance. Both forms of weight training employ different weights but share the same function and purpose: improving overall muscle fitness and particularly strengthening chest muscles (Arif, 2019) Athletes are defined by their ability to move and are often accustomed to pain as it relates to their sports and exercise regime (Kvist & Silbernagel, 2022).

The Pull Up is a motion where an individual hangs from a single bar with both arms straight, then bends both arms while lifting until the chin passes the bar. Subsequently, the body is lowered



down until both arms are straight again. It's important to note that during the upward movement, the legs should remain straight, and swinging motions are not allowed. The ability to perform Pull Ups is determined by muscle strength, body weight, and the range of motion of the joints. Pull Up is part of the "closed kinetic chain exercise (CKC) and multi-joint upper-body exercise," involving movements that utilize more than one joint, relying on body weight to provide resistance to multiple muscle groups working simultaneously, both agonists and antagonists. By performing Pull Up exercises correctly and adhering to the prescribed rules, one can develop the muscles in the arms. This exercise particularly targets the arm muscles, contributing to a more athletic physique. Typically, the impact of these exercises not only shapes the arm muscles but also affects other body parts, such as the shoulders. To shape the shoulder area, consistent Pull Up exercises, where the body hangs from a bar with hands supporting the bar, can be performed regularly.

Indeed, the benefits of Pull Ups extend beyond just the arms, as they also induce changes in the back, resulting in a broader appearance, particularly in the dorsal area. This exercise significantly impacts the upper body formation process, enhancing one's overall appearance to appear cooler and more athletic (Arif et al., 2021). Pull Up exercises primarily focus on the hands gripping the bar to lift and lower the body until the chin reaches or surpasses the bar. Consequently, such exercises contribute to the development of arm muscles.

In striving to enhance physical quality (biomotorability) to a higher level, it is essential to possess sufficient knowledge of various training principles, systems, and the effects of training on the body's organs and systems. To achieve better training effects, the body's organs must be subjected to loads exceeding those encountered in daily activities. Thus, muscles are stimulated to contract maximally. The principle of increasing load must follow the principles of increasing load or resistance, as both are closely related. This principle is associated with gradual increments, allowing muscles to adapt to subsequent training loads.

Specificity refers to training for a particular sports discipline, leading to morphological and functional changes related to the specificity of that discipline. The principle of individuality focuses on tailoring training to suit individual characteristics, such as body type, fitness level, and training goals. To conduct effective training, coaches must consider individual athlete conditions such as skill level, age, training duration, and health status to systematically and methodically train them to achieve high performance. Training should begin with large muscle groups before targeting smaller muscles. The rationale behind this is that smaller muscles tend to fatigue more quickly, while larger muscles are easier to train. It's important not to train consecutive muscle groups of the same type to allow for recovery time for each group. A coach must be resourceful and creative in selecting and providing variations in training to prevent training boredom for athletes.



Training duration refers to the number of weeks or months a training program is carried out until an athlete achieves the desired condition. The duration of training is determined based on the frequency of training per week, per month, or the training activities conducted over a period of minutes or hours. The duration of training is inversely proportional to training intensity. If the training intensity is high, the training duration is shorter, and vice versa. Training frequency refers to the number of intensive training sessions conducted in a week. When determining training frequency, one must consider an individual's capabilities, as each person adapts differently to training programs. Excessive training frequency can lead to injuries, but insufficient frequency may not yield results because the muscles return to their original condition before training.

Shot put is a form of pushing a round object of a certain weight made of metal. It can be described as a complex ballistic movement involving translational and rotational motions of segments (Soares et al., 2023). Both technical and biological factors play a role in achieving shot put performance. Shot put is a rapid and forceful activity, with the speed of the shot being the key determinant of sports performance (Du et al., 2023). The most important factors in achieving shot put performance include: the trajectory of the shot's acceleration, the take-off height and angle of the shot, the rotation between the shoulder and waist axes, the shot's acceleration at the start of the push, the coordination of all parts of the push force at the right moment, and particularly the coordination between arm and leg movements.

Pushing involves directing force onto an object to generate speed and strong forward thrust. The difference from throwing lies in the release of the object; in pushing, the wrist remains stationary, and the force is generated from straightening the elbow. Shot put is the ability to push a spherical object as far as possible, and there are two styles of shot put: orthodox style (sideways force) and reverse style (backward force). For a shot put athlete, mastering the fundamentals is paramount, starting with how to grip the shot, body positioning when pushing the shot, the technique of shot put, the final posture after the push, and how to take the starting position. The basic technique of shot put involves several steps that must be carefully followed to achieve optimal results. The initial position begins with standing erect behind the shot put circle, with feet shoulder-width apart to provide stability. The multiple regression equation for the dependence of the shot put result on swing speed, shot angle, shot height, and shot point has been found to be reliable (Almadhkhori et al., 2021). The non-dominant arm is placed in front of the body, while the dominant arm is behind the body. The shot put grip should be comfortable in the dominant hand, with the fingers below and the thumb on top.

Next, the initial movement is made by shifting most of the body weight onto the back foot. Take the initial step with the front foot (usually the foot opposite the dominant hand) to initiate the movement. During this process, ensure that the body remains upright and stable. Then, swing the dominant arm backward, bringing the shot put behind the body. The non-dominant arm also moves parallel to the body to maintain balance. Ensure that the shot put is in a comfortable and

controlled position. When at the lowest point of the movement, quickly shift the weight from the back foot to the front foot. This will provide propulsion and momentum when launching the shot put forward. As the shot put is released, ensure to maintain a stable and upright body position. Focus your gaze towards the desired target and release the shot put with a strong and directed motion of the dominant arm.

Finally, after releasing the shot put, continue the body movement forward to maintain momentum and stability. Make sure not to violate any rules and end with a safe position after throwing the shot put. Continuous practice and guidance from a coach can help improve shot put technique and enhance achieved results.

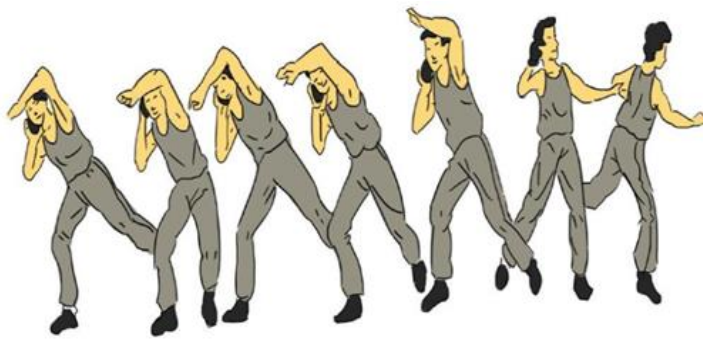


Figure.1. How to do sideways shot put (Jusman, 2016)

The optimal release angle of an object being thrown or pushed depends on various factors, including the intended purpose of the throw. Mathematically and supported by the majority of research, it is widely accepted that launching or pushing an object forward at a 45-degree angle can result in maximum distance. Maximum distance in shot put must establish a reciprocal relationship between speed and push; thus, it should leverage the laws governing falling objects to achieve the best results. We obtain the joint angles of each stage of the shot throw through experimental design, time-consuming, final speed, limb displacement, shot-put shot speed, height, angle, and other kinematic parameters, as well as the shot-put motion trajectory (Zhou & He, 2023).

The results of shot put heavily rely on the athlete's ability to push as far as possible. To achieve optimal shot put results, several factors come into play, including technical and physical factors. In relation to this research, explosiveness of arm muscles, arm muscle strength, and leg strength are physical factors influencing shot put results. Arm muscle strength is crucial when a shot putter performs the sequence of shot put movements, starting from gripping the shot, adopting the pushing posture, and executing the push itself. Additionally, a shot putter must possess explosive arm muscle power to generate maximum thrust. Explosive arm muscle power is required during the shot put push movement, particularly when straightening the arm muscles to propel the shot.

Pull-ups are commonly utilized for strength training across various sports disciplines (Vigouroux et al., 2023). A pull-up is a strength exercise involving lifting the body from a hanging position with the hands positioned overhead. To perform it, one hangs from a horizontal bar with hands shoulder-width apart, then lifts the body by contracting the arm, shoulder, and back muscles until the chin reaches or surpasses the level of the bar. Lower the body slowly and with control to the starting position. This exercise strengthens the arm, shoulder, and back muscles. Pull-ups serve as a prevalent training method for sports involving overhead movements (Prinold & Bull, 2016)

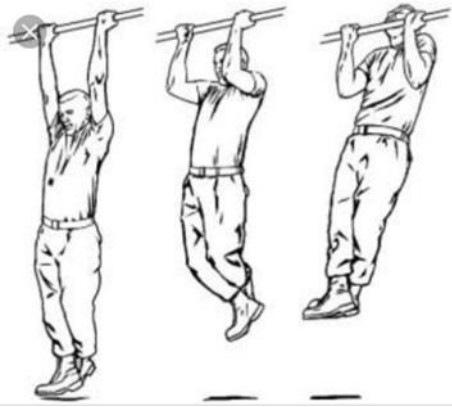


Figure 2. Pull Up technique (Haeril et al., 2022)

2.METHOD

The research method employed in this study is quantitative research. This choice was made because the researchers aimed to obtain a clearer understanding of the steps that needed to be taken. The research method utilized by the researchers is quantitative, with the objective of providing an overview of the research design (Tan, 2022). Quantitative research is fundamentally based on a deductive-verification approach. The type of research used in this quantitative study is experimental research. Experimental research prioritizes methods of manipulating the research objects in such a way that aligns with the desired research format. There are two main variables of concern in experimental explanation: variables that are not manipulated and variables that are manipulated. The research design employed in this study utilizes a quasi-experimental method with the form of a One Group Pre-test Post-test Design. The advantage of this design is that both pre-test and post-test are conducted, allowing for a clear determination of the difference in outcomes resulting from the treatment given.

This study falls under the category of field experimental research, where the researchers aim to investigate the effect of arm muscle strength training through pull-up exercises on shot put ability among fifth-grade students at SDK Santo Arnoldus Penfui Kupang. Based on the quantitative research method, the research design employed is a pretest-posttest randomized one-group design, which is described as follows:

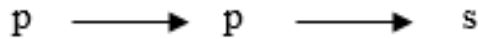


Figure 3 Research design, (Stamatis et al., 2020)

The research was conducted on fifth-grade students of SDK Santo Arnoldus Penfui Kupang. The study lasted for 2 months, with meetings held twice a week and each session lasting for 60 minutes. The entire fifth-grade student population of SDK Santo Arnoldus Penfui Kupang was considered the target population for this research. Based on the fact that the population of fifth-grade students at SDK Santo Arnoldus Penfui Kupang consists of only 20 individuals, the researchers decided to include all of them as the sample for the study. Therefore, the sample size for this research comprised 20 students. There are two variables involved in this study: the independent variable and the dependent variable. Both variables will be identified in this study. The independent variable (X) is the variable that influences the dependent variable. In this research, the independent variable is Pull-up exercises. The dependent variable (Y) is the outcome or the variable influenced by the independent variable. The dependent variable in this study is Shot Put Strength in the fifth grade of SDK Santo Arnoldus Penfui Kupang.

Data for this research was obtained from both primary and secondary sources. Primary data refers to information collected directly from the research subjects, obtained by the researcher from the source without intermediaries. This was done by directly engaging with the respondents, in this case, the fifth-grade students of SDK Santo Arnoldus Penfui Kupang. Secondary data, on the other hand, refers to information that is not directly obtained from the primary source but serves to complement and reinforce the research data. Secondary data is typically collected through literature reviews and documentation related to the research object.

The data collection techniques employed in this study include testing and measurement. Specifically, for testing the strength of the arm muscles, the standing vertical arm press test was used. To measure shot put strength in a lateral direction, a direct measurement test was conducted using a shot put and the distance of the throw in centimeters was recorded as data. Three methods of data collection were utilized in this research: observation, measurement, and documentation.

Observations were conducted to gather information about the activities of both the teacher and students during the shot put learning process. The researcher employed the overt observation method, meaning that the students being observed were aware that they were the subjects of the research. Observations were systematically and directly conducted on the behaviors of students and teachers during the learning process.



Measurement:

- PreTest: Students underwent an initial test to measure their shot put strength before the treatment was administered. The test was conducted with students standing upright facing the pull-up bar and performed twice. The best result from the two attempts was recorded.
- Treatment: After the initial test, students received treatment by participating in a pull-up training program for 16 sessions, with predetermined intensity and volume of training.
- Posttest: Following the treatment, students were retested to measure their shot put strength. The posttest was conducted in the same manner as the initial test.
- Documentation: Documentation was carried out to record the activities of students and teachers, as well as other relevant data related to the research. Documentation included photographs or images capturing the learning process, as well as relevant data about the school, teachers, and students.

By combining these three methods, the research can provide comprehensive and relevant data to evaluate the effect of pull-up training on the improvement of shot put strength in fifth-grade students at SDK Santo Arnoldus Penfui Kupang.

Data Analysis Technique

The data analysis technique employed in this research is the test of influence analysis. Its purpose is to assess whether pull-up training has a significant effect on the improvement of shot put strength in students. The formula used to calculate the t-test value is as follows:

$$t = \frac{\sum D}{\sqrt{N \sum D^2 - (\sum D)^2}} \\ \frac{N - 1}{N - 1}$$

Figure 4 Test Formula (Meiryani, 2021)

Information :

D=Difference of each pair of scores (pretest-posttest)

N=Number of samples

By implementing these steps, researchers can determine whether pull-up training has a significant effect on improving shot put strength in students. If the calculated t-value is greater than the critical value in the t-distribution table, it can be concluded that the treatment has a significant effect. The research instrument is a tool used to measure the observed phenomenon. In this study, the instrument used is the shot put strength test, utilizing a field, shot put, whistle, and writing materials.

The initial test (pretest) was conducted by the researcher to equalize the training load for each subject. This aims to ensure that the differences in results after treatment can be clearly identified. The initial test was conducted in November 2018 to ensure consistency in the implementation



method of both pretest and posttest. The treatment was carried out for 16 sessions, as it was considered sufficient to bring about significant changes. The research followed the minimum training time limit set (Bompa, 1996). Training was conducted from 4:00 PM until completion, three times a week, on Mondays and Thursdays.

The final test (posttest) was conducted to evaluate the results achieved by each test participant after undergoing treatment. This test was conducted in December 2018 to see if there was a significant improvement in shot put ability after the training. The results of the posttest were recorded and analyzed to determine the impact of the training conducted.

Table 1. Assessment Score Category (Ghatsaghautsan et al., 2023)

No	Category Assessment	Results
1	> 3,82 m	Very Good
2	2,89 m – 3,81 m	Good
3	1,96 m – 2,88 m	Enough
4	1,03 m – 1,95 m	Less
5	0,50 – 1,02 m	Very less

3.RESULTS AND DISCUSSION

Result

Based on the results of the research conducted on fifth-grade students at SDK St. Arnoldus Penfui, it can be concluded that pull-up training has a significant effect on improving shot put strength in students. The study involved 20 students as samples, residing at Jln. Adisucipto Penfui Kupang. The data analyzed consisted of pretest and posttest assessments to evaluate students' shot put abilities before and after the treatment. The pretest was conducted to establish the baseline abilities of students before the treatment was given, while the posttest was used to evaluate the impact of the treatment.

The results of the pretest and posttest showed a significant improvement in shot put abilities after the treatment was given. Overall, the posttest scores tended to be higher than the pretest scores, indicating a consistent improvement in students' abilities after undergoing pull-up training. Statistical testing using the t-test showed a calculated t-value of 7.286, which is significant at the 95% confidence level. This value is much greater than the critical t-value (1.729), indicating a significant difference between the pretest and posttest results. In other words, pull-up training had a positive and significant impact on improving shot put strength in students.

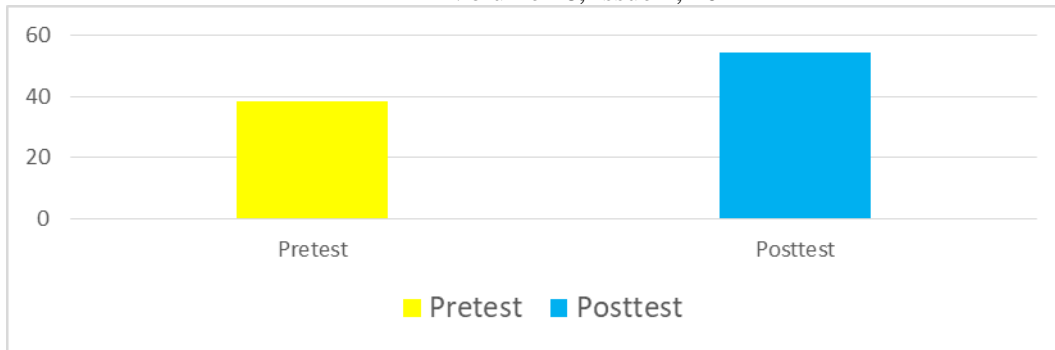


Figure 5. diagram of pretest and posttest data results

Furthermore, the analysis of the pretest and posttest data diagrams also reveals a significant improvement from the pretest to the posttest. The data processing results indicate an increase of 8.157% in the accuracy of shot put after undergoing pull-up training. Therefore, it can be concluded that pull-up exercises effectively enhance shot put strength among fifth-grade students at SDK St. Arnoldus Penfui. This research outcome provides a crucial contribution to understanding the effectiveness of pull-up training in improving students' physical abilities in shot put, and it offers guidance for the development of better training methods in the future.

Discussion

Pull-up training stands as a cornerstone in the arsenal of strategies aimed at elevating athletic prowess, underpinned by the realms of science and technology. Its essence lies in the fusion of proven theoretical constructs and methodological approaches, meticulously crafted to enhance physical prowess, particularly in domains like shot put. By delving into the intricacies of anatomical kinetics, pull-up regimens consistently furnish athletes with the requisite muscular fortitude essential for executing potent shot put maneuvers, thereby paving the path towards optimal performance on the field.

This study casts a spotlight on the pivotal role of pull-up training in augmenting shot put strength among students enrolled at SDK St. Arnoldus Penfui Kupang. The research findings serve as a testament to the profound impact of pull-up exercises on refining the shot put capabilities of the students. However, it is imperative to underscore the indispensable role of thorough warm-up routines preceding pull-up sessions. A meticulously designed warm-up regimen serves as the linchpin in priming students for optimal motion adaptation during pull-up exercises. Conversely, a lackadaisical approach to warm-up protocols may engender disruptions in training performance, thereby undercutting the efficacy of pull-up exercises in fortifying shot put strength.

Moreover, the efficacy of pull-up training hinges significantly on the precision and focus devoted to executing each repetition. A nuanced understanding of pull-up mechanics coupled with a steadfast commitment to proper form and technique lays the foundation for maximal gains in shot



put strength. Hence, a holistic approach encompassing both meticulous warm-up routines and meticulous execution of pull-up exercises is indispensable in unlocking the full potential of pull-up training as a catalyst for enhancing shot put prowess among students. Nevertheless, through the analysis of shot put test results, it is evident that pull-up exercises have a significantly positive impact on students' shot put abilities. The utilization of the t-test in statistical analysis indicates a significant difference between the pretest and posttest results, affirming that the implementation of pull-up exercises is effective in enhancing shot put strength.

Proven effective in improving shot put strength, the implementation of pull-up exercises involving barbell lifts yields a significant increase in shot put power. The research findings demonstrate an increase in strength by 0.218%. Thus, it is concluded that pull-up exercises are an effective method for enhancing shot put strength among students. However, careful consideration of exercise techniques and focus is necessary to ensure optimal results. Furthermore, further research may be required to gain a deeper understanding of the mechanisms and long-term effects of pull-up exercises on students' physical abilities.

4.CONCLUSION

Based on the findings obtained from this research, it can be confirmed that there is a significant influence between the scores obtained by each student during shot put training. The research also proves that the method of pull-up training significantly affects shot put ability. Although pull-up training has long been recognized as one of the effective methods to enhance physical strength, in the context of shot put, this finding asserts that pull-up training can significantly impact students' shot put abilities. This study provides a deeper understanding of the relationship between shot put training and the pull-up training method in the effort to improve athletic performance. With significant results, these findings open up opportunities for further research and exploration into more effective training strategies to enhance shot put strength in a more profound and specific manner.

Thus, it can be concluded that shot put training through the pull-up method yields significant effects, offering valuable contributions to the world of sports and sports science as a whole. The results of this research can serve as a strong foundation for the development of training and coaching methods in athletics in the future.

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