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Effect of Imagery Training on Skeet Shooting Accuracy of High School Students in the People's Republic of China

Guo Wei[1], Suvachai Rittisom[2] and Kiattiwat Watchayakarn[3]
Faculty of Sports Science and Technology, Bangkokthonburi University, Thailand
[1]E-mail: 826565149@qq.com, ORCID ID: https://orcid.org/0009-0000-3162-6047
[2]E-mail: chaivasu5348@gmail.com, ORCID ID: https://orcid.org/0009-0006-6435-8804
[3]E-mail: kiat2504@gmail.com, ORCID ID: https://orcid.org/0009-0005-5169-3761

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Abstract

Background and Aim: Imagery training enhances mental visualization skills, helping high school students improve focus and consistency in skeet shooting. Athletes can refine their technique and boost accuracy without physical practice by mentally rehearsing the shooting process. This study investigated and compared the effects of imagery training on skeet shooting accuracy among high school students from Shenzhen Yuxin High School, Shenzhen City, Guangdong Province, China.

Materials and Methods: This research employed a quasi-experimental design. The study population consisted of 65 high school students, from whom 36 participants were selected and divided into two groups: an experimental group and a control group, with 18 students in each. The experimental group underwent accuracy training combined with imagery training based on the framework proposed (Maulana and Hanief, 2022). Data analysis included measures of central tendency, variability, pre- and post-test comparisons, and statistical significance at the .05 level.

Results: The findings revealed that the control group, which followed standard training methods, achieved a pre-test mean score of 40.00 ± 2.40 and a post-test mean score of 39.77 ± 1.43. In contrast, the experimental group, which engaged in imagery training alongside standard exercises, improved from a pre-test mean score of 39.55 ± 2.35 to a post-test mean score of 51.00 ± 1.67. Statistical analysis demonstrated a significant improvement in the experimental group ($t = -24.81$, $p = 0.03$), while the control group's results showed no significant change ($t = 0.36$, $p = 0.54$).

Conclusion: These results highlight the efficacy of integrating imagery training with accuracy-focused exercises, as the experimental group exhibited a statistically significant improvement in skeet shooting accuracy compared to the control group. The study underscores the potential of imagery training as a valuable tool for enhancing athletic performance.

Keywords: Imagery; Skeet Shooting; High School; Exercises

Introduction

Shooting is a sport defined by its demand for precision and accuracy (Mononen et al., 2007). Its historical significance traces back to the inaugural modern Olympic Games held in Athens in 1896, where shooting was among the featured competitions. Over the years, the sport has evolved significantly, both in terms of format and participants. While shooting was excluded from the Olympic Games only twice—in 1904 and 1928—it remains a core event today. Among its variations, skeet shooting, which originated as a training exercise for shooters between 1910 and 1915, was officially introduced to the Olympics in 1968. Notably, early skeet competitions were conducted without gender restrictions, allowing men and women to compete equally until 1996, when gender-specific events were introduced following debates about fairness. Skeet shooting, an outdoor sport requiring sharp focus and rapid reaction times, has become increasingly popular in China. The country has produced numerous accomplished athletes, such as Jiang Yiting, who won the women's skeet gold medal at the 2023 International Shooting Sport Federation (ISSF) Shotgun World Cup (Zheng and Chen, 2016). Skeet shooting demands a combination of physical and psychological preparation, particularly concentration, as participants must track and aim at fast-moving targets with precision. This has led to the integration of sports psychology, specifically imagery training, into practice routines to enhance focus, reaction time, and overall performance (Pramanik and Chatterjee, 2023).

Imagery training, also known as mental imagery or visualization, is a psychological technique that involves recreating or imagining sensory experiences to enhance performance. As described by Holmes and Collins (2001), imagery training mimics real experiences by engaging various sensory modalities in the absence of actual stimuli. This process is distinct from dreaming as the individual is awake and actively conscious during the visualization process (Moran, 2016). Moran (2016) conceptualized imagery as "perception without sensation," highlighting its unique ability to simulate experiences internally. Among

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athletes, imagery training is a well-accepted strategy for improving motor skills, concentration, and competitive readiness. It allows individuals to mentally rehearse tasks, reducing reaction times and fostering a sense of preparedness. Research by Munroe-Chandler, Hall, and Fishburne (2008) demonstrated that combining imagery training with physical practice significantly enhances performance, as observed in the improved accuracy of penalty kicks in football players. Similarly, Guillot and Collet (2008). emphasized that imagery training aids in developing mental clarity, reducing stress, and enhancing motor performance in various sports. In skeet shooting, visualization is particularly beneficial as it enables athletes to mentally rehearse tracking, aiming, and shooting at high-speed targets. The repetitive nature of this training fosters muscle memory and concentration, vital components for success in competition. Beyond technical skills, mental preparation also equips athletes to handle competitive pressure effectively.

Despite its significance, the role of imagery training in skeet shooting remains underexplored in the context of Chinese athletes. Given the sport's rising prominence and its psychological demands, studying the impact of imagery training on skeet shooting performance is both timely and relevant (Guillot and Collet, 2010). This research aims to build on existing knowledge and offer practical insights for athletes and coaches, particularly in designing training programs that integrate physical and psychological preparation. By investigating the effects of imagery training on skeet shooting accuracy, this study seeks to contribute to the broader field of sports psychology and performance enhancement. The findings may provide a foundation for future research and practical applications in training regimens for athletes aiming to excel in high-pressure competitive environments.

Objectives

To examine and compare the effects of skeet shooting training, combined with imagery training, on the accuracy of skeet shooting performance.

Conceptual Framework

This research seeks to examine the impact of imagery training on the target shooting accuracy of high school students in China. The study involves a comparison between two groups: an experimental group undergoing target shooting training combined with imagery techniques, and a control group practicing standard shooting exercises. The conceptual framework is structured to investigate the relationship between the training methodologies and the resulting improvements in shooting accuracy. (Figure 1)

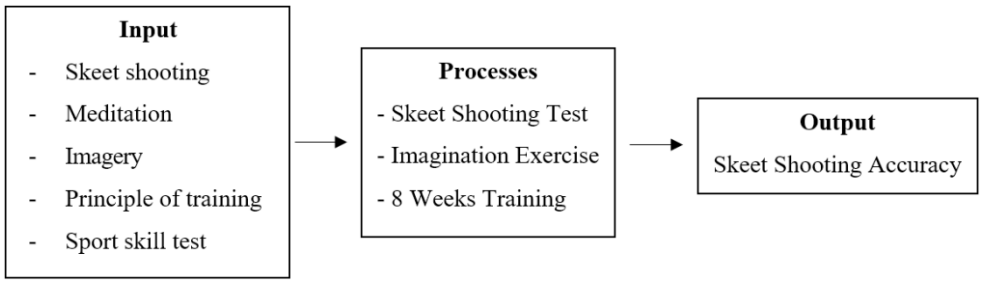

Figure 1 Conceptual framework

Methodology

Population

The population for this study comprised 65 male high school students enrolled in the shooting club during the 2023 academic year at Shenzhen Yuxin High School, located in Shenzhen City, Guangdong Province, China. These students represented the pool of individuals actively engaged in skeet shooting activities at the school level. The sample was derived from the total population of 65 students. A systematic selection process was employed to ensure representation and fairness: 1. Each student's shooting accuracy was tested using 10 stationary target shots with dummy bullets. 2. Scores were recorded and ranked from highest to lowest. 3. Students were alternately assigned to two groups based on their rankings to ensure an equitable distribution of skill levels. 4. A lottery method finalized the grouping, resulting in 18 students in the experimental group and 18 in the control group. To ensure optimal participation, the following additional criteria were applied to select athletes: 1. Voluntary enrollment in the high school shooting club. 2. Consistent attendance with a minimum participation rate of 80% in class sessions. 3. No health conditions that could impede participation in shooting activities. 4. Dedication to training, as evidenced by active

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engagement in shooting practices. 5. Positive interpersonal skills, including the ability to collaborate and work effectively with peers.

Exclusion Criteria

Participants who met any of the following conditions were excluded from the study:

1. Inability to participate due to injury or other health-related factors.
2. Failure to meet the 80% training attendance threshold.
3. Presence of a congenital or chronic illness affecting shooting performance.
4. Poor interpersonal relationships, such as difficulty in collaborating with teammates.
5. Lack of discipline, including frequent absences or disruptive behavior.
6. Aggressive or inappropriate behavior toward instructors or peers.
7. Lack of responsibility or commitment to practice and team activities.

Data Collection

The data collection process in this study involved the following steps: 1) Reviewing educational and sports psychology literature, particularly studies on mental imagery and skeet shooting. 2) Developing a visualization training framework based on the RIFEE model (Sinlapachai Suwannathada, 2016) and refining it through expert consultations. 3) Validating the research tools, including mental imagery and accuracy training exercises, using the Index of Item-Objective Congruence (IOC) with input from four experts. 4) Conducting pilot testing of the tools with a group of 20 students with similar age and education levels over 8 weeks to assess reliability and applicability. 5) Organizing a panel of experts to inspect the shooting equipment and assess its reliability and consistency for the study. 6) Administering initial accuracy tests to all 65 participants using stationary targets and ranking their scores to form balanced experimental and control groups. 7) Implementing the mental imagery and accuracy training intervention for the experimental group, while the control group followed standard training routines for 8 weeks.

Data Collection

The data collection process for this study was conducted systematically to ensure accuracy, reliability, and adherence to ethical guidelines. The steps were as follows: 1. Sent letters to relevant government agencies and organizations involved in shooting sports to seek permission and gather supplemental information about target shooting practices. 2. Organized a meeting with advisors and experts to explain the research objectives, ensuring their alignment with the study's goals and objectives. 3. Conducted a stationary target shooting test to evaluate participants' baseline accuracy. Divided participants into experimental and control groups based on their scores, ensuring balanced skill levels across both groups. 4. Initiated the training program for both groups, with the experimental group undergoing imagery training combined with shooting accuracy exercises, while the control group followed standard shooting training routines. Conducted the training program over 8 weeks, following the planned schedule and protocols. 5. Monitored and recorded participants' progress throughout the 8-week training period. Collected post-training data to evaluate changes in shooting accuracy for both the experimental and control groups. 6. Analyzed the collected data using statistical tools and techniques. Data Analysis: Statistics used in the research: The researcher used descriptive statistics, including mean ($\bar{x}$) and standard deviation (s.d.), and used test statistics.

Results

This chapter presents the results of a quasi-experimental study conducted to investigate the effects of imagery training on the accuracy of target shooting among students at Shenzhen Yuxin School, Shenzhen City, Guangdong Province, China. The study integrated mental imagery training with physical target shooting practice to determine its impact on performance. The experiment spanned 8 weeks, with participants divided into control and experimental groups. Data were collected through pre-tests and post-tests and analyzed using descriptive and inferential statistics, including the calculation of mean, standard deviation, and t-tests for comparative analysis.

Table 1 Data Analysis Results of Skeet Shooting Test with Imagery Training for Control and Experimental Groups Before Training and After 8 Weeks

Group(n=36)	Before Training		After Training(week8)	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Control Group	40	2.40	39.77	1.43
Experimental group	39.55	2.35	51.00	1.67

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The results of the mental imagery training test on the accuracy of target shooting among students at Shenzhen Yuxin High School are presented in Table 1. Before training, the control group achieved an average accuracy score of 40.00 ± 2.40. After 8 weeks of standard target shooting training, their average score slightly decreased to 39.77 ± 1.43. The experimental group, which underwent combined mental imagery training and target shooting exercises, had a pre-training average accuracy score of 39.55 ± 2.35. After 8 weeks of training, their average accuracy score improved to 51.00 ± 1.67

Table 2 Results of the Evaluation of Skeet Shooting with Imagery Training on the Accuracy of Students at Shenzhen Yuxin High School (Control group Week 8).

Group(n=18)	Control group (Week8)					
Variable	Pretest		Posttest		t	P
	x̄	SD	x̄	SD		
Accuracy in skeet shooting	40	2.4	39.77	1.43	0.36	0.54

P>.05

Table 2 demonstrates the accuracy in target shooting for the control group before and after the 8-week training period. The pre-test mean score was 40.00, while the post-test mean score slightly decreased to 39.77. A comparison of the mean scores indicates that there was no significant difference in the accuracy of target shooting for the control group before training.

Table 3 Results of the Evaluation of Skeet Shooting with Imagery Training on the Accuracy of Students at Shenzhen Yuxin High School (Experimental Group, Week 8).

Group(n=18)	Control group (Week8)					
Variable	Pretest		Posttest		t	P
	x̄	SD	x̄	SD		
Accuracy in skeet shooting	40	2.4	39.77	1.43	0.36	0.54

P>.05

Table 3 illustrates the accuracy in target shooting for the experimental group, highlighting a significant improvement following the training period. The pre-test mean score was 39.55, which increased to 51.00 after 8 weeks of training. A comparison of the mean scores indicates that before the training, the students in the experimental group exhibited comparable levels of target shooting accuracy. However, post-training results demonstrated a statistically significant improvement in accuracy, with the mean score being significantly higher than the pre-test score at the 0.05 level.

Table 4 Comparison of Post-Test Scores Between Control and Experimental Groups.

Variable	Control group (n=18)		Experimental group (n=18)		t	P
	x̄	SD	x̄	SD		
Accuracy in target shooting	39.77	1.43	61.00	2.27	31.93	.00*

P<.05

Table 4 presents the post-test accuracy scores in target shooting for the control and experimental groups. The control group achieved a post-test mean score of 40.00, whereas the experimental group achieved a significantly higher mean score of 47.11. A comparison of the post-test mean scores indicates that the experimental group outperformed the control group in target shooting accuracy, with the difference being statistically significant at the 0.05 level.

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Conclusion

The results of this study demonstrate the significant impact of mental imagery training on the accuracy of target shooting among students at Shenzhen Yuxin High School. Both the control and experimental groups showed improvements in target shooting accuracy after 4 weeks of training. However, the experimental group, which integrated imagery training into their practice, exhibited a markedly greater enhancement compared to the control group, which followed standard training methods. Specifically, the control group's accuracy increased slightly from a pre-test mean of 40.00 ± 2.40 to a post-test mean of 39.77 ± 1.43. In contrast, the experimental group's performance improved significantly, with a pre-test mean of 39.55 ± 2.35 rising to 51.00 ± 1.67 after 8 weeks of training. These findings confirm that combining mental imagery with physical training principles leads to substantial gains in accuracy over standard methods alone.

Discussion

The findings of this study underscore the significant impact of mental imagery training on improving skeet shooting accuracy, providing substantial evidence for its effectiveness in precision-based sports. The results align with previous research emphasizing the critical role of mental preparation and repetitive practice in enhancing athletic performance, particularly in individual sports. Holmes and Collins (2001) highlighted the PETTLEP model's ability to enhance confidence through structured mental imagery, which was similarly observed in this study. The integration of imagery training with physical practice cultivated confidence and precision, essential for successful skeet shooting.

The experimental group, which underwent 8 weeks of skeet shooting training combined with imagery exercises, demonstrated a statistically significant improvement, with mean scores increasing from 39.55 ± 2.35 to 51.00 ± 1.69. Conversely, the control group, which followed standard training methods, showed negligible improvement, with scores increasing marginally from 40.00 ± 2.40 to 39.77 ± 1.43. This notable disparity highlights the value of incorporating mental imagery into traditional training regimens, emphasizing its role in enhancing focus, agility, and performance accuracy. This study's findings are consistent with prior research by Kabat-Zinn (2003), which emphasized the importance of repetitive accuracy training combined with mental imagery in building confidence and mindfulness. Similarly, Chambers, Lo, and Allen. (2008) demonstrated that individual sports like archery benefit significantly from the integration of mindfulness and visualization, enabling athletes to refine their precision and achieve success. The results also align with Hare, Evans, and Callow. (2008), who emphasized the necessity of mental focus and long-term practice in improving penalty kick accuracy in football, demonstrating the applicability of mental imagery across various sports. The study further supports the argument that effective training programs must integrate strategies for error prevention, mental resilience, and skill development. In skeet shooting, the use of mental imagery not only facilitates the development of shooting accuracy but also helps athletes identify and address weaknesses, refine their techniques, and build mental resilience against performance pressures (Weinberg and Gould, 2023; Guillot and Collet, 2008). This integration of mental and physical preparation is vital for achieving competitive success in precision-based sports. Additionally, the study aligns with the perspectives of Williams and Ford. (2009), who emphasized the importance of agility and strategic planning in individual sports. By fostering mental visualization alongside physical agility, the experimental group demonstrated improved precision and adaptability, critical for success in skeet shooting and transferable to other sports disciplines. Coaches play a crucial role in implementing such comprehensive training programs, which balance physical repetition with mental conditioning, enabling athletes to enhance their performance and minimize errors.

Recommendation

1. It is recommended to involve experts with extensive experience in mental imagery techniques and their application in sports training. Their expertise is essential for designing and implementing effective programs tailored to the specific needs of athletes.

2. Training regimens should include a variety of exercises designed to target different skill sets, ensuring a holistic and comprehensive approach to athletic development.

Recommendations for Future Research

1. Future research should explore a wider range of skills and exercises associated with the sport, incorporating additional content to provide a more in-depth understanding of effective training methodologies.

2. Further studies should focus on analyzing and optimizing training formats to ensure alignment with specific objectives. This may include detailed investigations into the suitability of various training methods for different athlete profiles and the long-term impacts of these approaches.

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