



Pratidhwani the Echo

A Peer-Reviewed International Journal of Humanities & Social Science

ISSN: 2278-5264 (Online) 2321-9319 (Print)

Impact Factor: 6.28 (Index Copernicus International)

Volume-XIV, Issue-IV, July 2026, Page No. 113-124

Published by Dept. of Bengali, Karimganj College, Sribhumi, Assam, India

Website: <http://www.thecho.in>

DOI: 10.64031/pratidhwanitheecho.vol.14.issue.04W.123



Cognitive Arrows: Exploring the Power of Psychological Skills Training in Competitive Archery

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Received: 16.07.2026; Accepted: 27.07.2026; Available online: 31.07.2026

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Abstract

This experimental study examined the effects of imagery training and self-talk interventions on state anxiety and archery performance among competitive archers. A total of 30 archery athletes (aged 18–30) from SMS Stadium Jaipur were randomly assigned to one of three groups: imagery training, self-talk, or control. The intervention groups underwent four-week mental skills training program, consisting of guided imagery sessions or structured self-talk practice, while the control group continued regular training. Post intervention assessments included the State-Trait Anxiety Inventory (STAI) and a standardized archery performance test. Repeated measures ANOVA revealed significant reductions in state anxiety and improvements in archery performance in both intervention groups, with no notable changes in the control group. Post-hoc analyses confirmed the superiority of the mental training techniques over standard practice. These findings highlight the effectiveness of psychological skills training in enhancing athletic performance and managing competitive anxiety in precision-based sports.

Keywords: archery performance, imagery training, self-talk, state anxiety

Introduction:

• Mental Training Techniques in Sports:

Mental training techniques such as imagery and self-talk are integral to sports psychology and have garnered significant attention for their impact on athletic performance. Imagery, or visualization, involves mentally rehearsing specific performance scenarios, which helps athletes develop a clear mental picture of their execution (Cumming & Ramsey, 2009). This technique is grounded in the concept of mental practice, where the cognitive rehearsal of physical skills enhances actual performance by reinforcing neural pathways associated with the skill (Driskell, Copper, & Moran, 1994).

Self-talk, another crucial mental strategy, refers to the internal dialogue athletes engage in to influence their thoughts, emotions, and behaviors during performance (Hardy, 2006). Positive self-talk can enhance confidence, reduce anxiety, and improve focus by shifting attention away from negative thoughts and promoting a constructive mindset (Tod, Hardy, & Oliver, 2011). Research shows that athletes who use self-talk effectively experience improved performance outcomes, particularly in high-pressure situations (Hatzigeorgiadis, Zourbanos, Golias, & Theodorakis, 2008).

- ***Imagery Training:***

Imagery training is a well-documented intervention that helps athletes visualize successful execution and overcome performance barriers. According to Cumming and Ramsey (2009), imagery training involves creating vivid mental images of performance scenarios, which can enhance skill acquisition and refine technique. The effectiveness of imagery training is supported by numerous studies showing its positive impact on various sports, including archery (Taylor & Wilson, 2005). By mentally rehearsing tasks, athletes can improve their focus, self-confidence, and overall performance (Feltz & Landers, 1983).

- ***Self-Talk Interventions:***

Self-talk interventions have been shown to play a significant role in managing anxiety and enhancing athletic performance. Hardy (2006) highlights that self-talk can be categorized into motivational self-talk, which encourages and energizes athletes, and instructional self-talk, which provides specific performance-related cues. Research by Hatzigeorgiadis et al. (2008) indicates that self-talk interventions can reduce state anxiety and improve performance, especially when tailored to the individual's needs and the specific demands of the sport.

- ***State Anxiety in Sports:***

State anxiety, a temporary emotional state characterized by apprehension and nervousness, can significantly affect athletic performance (Spielberger, 1983). Athletes experiencing high levels of state anxiety may encounter difficulties in concentration, decision-making, and overall execution of skills. The relationship between state anxiety and performance has been extensively studied, with findings suggesting that higher state anxiety can negatively impact performance outcomes (Martens, Vealey, & Burton, 1990). Interventions like imagery training and self-talk are commonly employed to manage and mitigate state anxiety, enabling athletes to perform at their best under pressure.

- ***Relevance to Archery:***

Archery, a sport requiring high levels of concentration and precision, is particularly susceptible to the effects of state anxiety (Loehr, 1982). The ability to manage anxiety and maintain focus is crucial for archers, as even minor distractions can affect their performance. Thus, understanding and applying mental training techniques such as imagery and self-talk can be beneficial for archers seeking to improve their competitive edge (Bull, Shambrook, James, & Brooks, 2005).

By exploring the effects of imagery training and self-talk on state anxiety and archery performance, this study aims to contribute valuable insights into the practical applications of these mental strategies in sports. The findings may provide evidence for the effectiveness of these interventions in reducing anxiety and enhancing performance, particularly in high-precision sports like archery.

- ***Imagery Training and Its Impact on Performance:***

Imagery training, also known as mental imagery or visualization, involves creating vivid mental representations of performance scenarios. This technique is grounded in the concept of mental practice, which has been shown to enhance motor skills and performance in various sports. Driskell, Copper, and Moran (1994) conducted a meta-analysis and found that mental practice significantly improves performance across a range of motor tasks. They suggest that mental imagery facilitates the reinforcement of motor programs, thus enhancing actual performance.

In the context of archery, imagery training is particularly beneficial due to the sport's demand for precision and focus. Taylor and Wilson (2005) examined the effects of imagery on archery performance and found that athletes who engaged in regular imagery practice demonstrated improved accuracy and consistency. The use of imagery allows archers to mentally rehearse successful shooting techniques, thereby increasing their confidence and reducing performance anxiety.

- ***Self-Talk and Its Role in Enhancing Performance:***

Self-talk refers to the internal dialogue athletes use to influence their cognitive, emotional, and behavioral states. It can be classified into motivational self-talk, which aims to boost confidence and enthusiasm, and instructional self-talk, which provides specific task-related cues (Hardy, 2006). Hatzigeorgiadis, Zourbanos, Golias, and Theodorakis (2008) conducted a meta-analysis on the effects of self-talk on sports performance and found that positive self-talk significantly enhances performance by improving concentration and reducing anxiety. Self-talk is particularly effective in managing state anxiety, which is crucial for sports requiring high levels of precision and focus. For example, studies by Theodorakis, Weinberg, and Natsis (2005) have shown that athletes who employ positive self-talk experience lower levels of state anxiety and better performance outcomes. The ability to focus on positive affirmations and instructions helps athletes remain composed and perform optimally under pressure.

- ***The Interaction Between Imagery and Self-Talk:***

Recent research has explored the combined effects of imagery and self-talk on athletic performance. Cumming and Ramsey (2009) reviewed various studies and concluded that integrating both techniques can provide synergistic benefits. They argue that imagery and self-talk complement each other by addressing different aspects of mental preparation. Imagery provides a vivid mental rehearsal of performance, while self-talk offers immediate cognitive and emotional support during performance.

In a study specifically examining the combination of imagery and self-talk in sports, Williams, Cumming, and Borkoles (2011) found that athletes who used both strategies reported greater improvements in performance and reductions in anxiety compared to those who used only one technique.

Similarly, Robin, Carien, and Dominique (2022) reported that a combined use of motor imagery and self-talk significantly enhanced service performance in skilled tennis players, highlighting the synergy between these two cognitive strategies. Extending these findings to archery, Gmamdya (2023) demonstrated that combining motor imagery, action observation, and coach feedback led to improved archery accuracy among youth athletes. These results collectively suggest that the integrated application of imagery and self-talk,

especially when tailored to task-specific demands, can meaningfully boost performance in precision sports.

- **State Anxiety and Its Effects on Performance:**

State anxiety, characterized by temporary feelings of nervousness and apprehension, can adversely affect performance in sports. Martens, Vealey, and Burton (1990) highlight that high levels of state anxiety are associated with decreased concentration, increased muscle tension, and poorer performance outcomes. In sports such as archery, where precision is critical, managing state anxiety is essential for maintaining performance levels.

Studies have shown that mental training techniques like imagery and self-talk can be effective in reducing state anxiety. For instance, a study by Jones and Swain (1992) found that imagery and self-talk interventions led to significant reductions in state anxiety among athletes, resulting in improved performance. This aligns with the findings of recent research suggesting that mental strategies can buffer the negative effects of anxiety and enhance athletic performance (Smith, Wright, & Cantwell, 2012).

- **Relevance to Archery:**

Archery, as a sport that requires high levels of focus and precision, is particularly sensitive to the effects of state anxiety. The ability to manage anxiety and maintain concentration is crucial for archers, as even minor distractions can impact performance. The integration of imagery training and self-talk into training regimens can provide archers with effective tools to enhance their performance and manage anxiety (Bull, Shambrook, James, & Brooks, 2005). By exploring the effects of these mental training techniques on state anxiety and archery performance, this study aims to contribute to the understanding of how mental strategies can be optimized to improve athletic outcomes in precision sports.

Purpose of the Study:

The purpose of this study is to examine the effects of imagery training and self-talk on state anxiety and archery performance among archery athletes in India. The research aims to provide empirical evidence on the effectiveness of these mental training techniques in reducing anxiety and improving performance in archery athletes.

Hypotheses:

1. Imagery training will significantly reduce state anxiety and improve archery performance.
2. Self-talk will significantly reduce state anxiety and improve archery performance.
3. The control group will not show significant changes in state anxiety or archery performance.

Method:

- **Participants:**

Thirty archery athletes (15 male, 15 female) from the Archery Ground at SMS Stadium Jaipur were recruited for this study. Participants' ages ranged from 18 to 30 years ($M = 23.1$, $SD = 3.4$). All participants had a minimum of one year of competitive archery experience and were screened for any psychological or physical conditions that could affect their performance.

- **Design:**

This study employed a randomized controlled trial design with three groups: imagery training, self-talk, and control. Participants were randomly assigned to one of the three groups ($n = 10$ per group).

• **Materials:**

1. State-Trait Anxiety Inventory (STAI): A widely used measure of state anxiety with high reliability and validity (Spielberger et al., 1983).
2. Archery Performance Test: A standardized test measuring the accuracy and consistency of archery shots, with scores recorded for both pre- and post-intervention performance.

• **Procedure:**

1. Pre-Intervention Assessment: All participants completed the STAI and the archery performance test. Baseline data on demographic variables and training history were also collected.

2. Intervention:

Imagery Training Group: Participants engaged in 15-minute guided imagery sessions focusing on successful archery performance, conducted thrice weekly for four weeks. The imagery scripts were tailored to include visual, kinesthetic, and emotional components relevant to archery.

Self-Talk Group: Participants practiced positive self-talk techniques for 15 minutes thrice weekly for four weeks. The self-talk phrases were designed to enhance focus, confidence, and relaxation.

Control Group: Participants continued their regular training routine without any additional intervention.

3. Post-Intervention Assessment: All participants completed the STAI and the archery performance test again. Additional qualitative feedback was collected through interviews to understand participants' experiences with the interventions.

• **Data Analysis:**

Repeated measures ANOVA was used to analyze changes in state anxiety and archery performance within and between groups. Effect sizes were calculated using Cohen's d, and significance was set at $p < .05$. Statistical significance was established a priori at $p < .05$. However, several results in the analysis yielded p-values less than .001, indicating highly significant effects that exceed the conventional threshold, thus providing strong evidence for the impact of the interventions.

Additionally, qualitative data from participant interviews were analyzed using thematic analysis to identify common themes related to the interventions' impact.

Results:

• **Descriptive Statistics:**

Descriptive statistics for state anxiety and archery performance pre- and post-intervention across the three groups (Imagery, Self-Talk, and Control) are detailed in Table 1.

Table 1. Descriptive Statistics for State Anxiety and Archery Performance Scores

Group	N	Pre-Anxiety (M ± SD)	Post-Anxiety (M ± SD)	Pre-Performance (M ± SD)	Post-Performance (M ± SD)
Imagery	10	45.3 ± 4.2	33.0 ± 3.2	85.1 ± 5.3	100.5 ± 4.5
Self-Talk	10	46.1 ± 4.0	35.3 ± 3.5	84.0 ± 5.5	97.2 ± 4.0
Control	10	44.5 ± 3.9	43.3 ± 4.1	83.5 ± 5.4	84.3 ± 5.3

For state anxiety, the Imagery group exhibited the largest reductions, with pre-intervention mean scores of 45.3 (SD = 4.2) and post-intervention mean scores of 33.0 (SD = 3.2). The Self-Talk group demonstrated similar trends, with pre-intervention scores of 46.1 (SD = 4.0) and post-intervention scores of 35.3 (SD = 3.5). Minimal changes were observed in the Control group, where pre-intervention scores were 44.5 (SD = 3.9) and post-intervention scores were 43.3 (SD = 4.1). Figure 1 shows the reduction in state anxiety scores from pre- to post-intervention for all three groups.

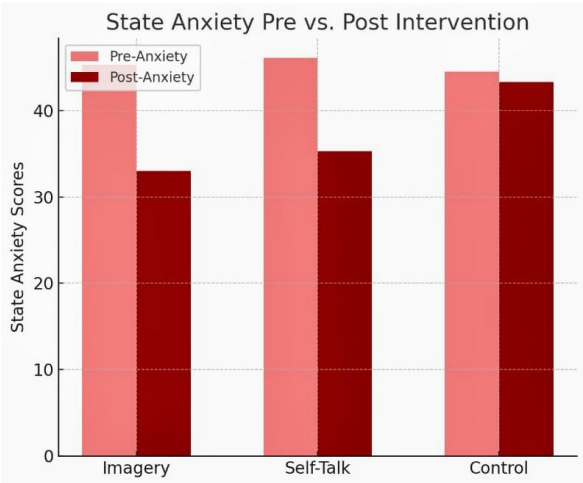


Figure 1

Pre- and post-intervention state anxiety scores across groups. Imagery and self-talk groups exhibited substantial reductions in anxiety, while the control group showed minimal change.

For archery performance, post-intervention scores improved significantly in the Imagery group (M = 100.5, SD = 4.5), followed by the Self-Talk group (M = 97.2, SD = 4.0), with minimal change in the Control group (M = 84.3, SD = 5.3). As illustrated in Figure 2, archery performance scores improved significantly in the imagery and self-talk groups, with minimal change observed in the control group.

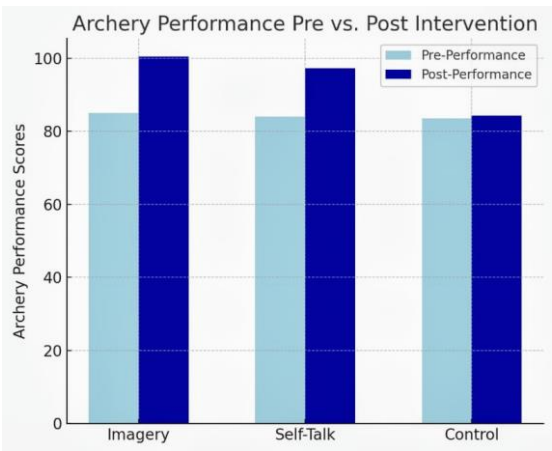


Figure 2

Pre- and post-intervention archery performance scores across groups. The imagery and self-talk groups showed marked improvements, while the control group exhibited negligible change.

- **Inferential Statistical Analysis:**

Paired-samples t-tests were conducted to compare pre- and post-intervention state anxiety and archery performance scores within each group. The results are summarized in Table 2.

Table 2. Inferential Statistical Analysis for State Anxiety and Archery Performance Scores

Measure	Group	Pre (M ± SD)	Post (M ± SD)	t-value	p-value	Effect Size (d)
State Anxiety	Imagery	45.3 ± 4.2	33.0 ± 3.2	8.65	<.001	1.4
	Self-Talk	46.1 ± 4.0	35.3 ± 3.5	7.12	<.001	1.1
	Control	44.5 ± 3.9	43.3 ± 4.1	1.10	.29	0.2
Archery Performance	Imagery	85.1 ± 5.3	100.5 ± 4.5	9.33	<.001	1.5
	Self-Talk	84.0 ± 5.5	97.2 ± 4.0	8.02	<.001	1.3
	Control	83.5 ± 5.4	84.3 ± 5.3	0.55	.59	0.3

Paired-samples t-tests (Table 2) confirmed significant reductions in state anxiety and improvements in archery performance for the Imagery and Self-Talk groups, while the Control group exhibited no significant changes.

For state anxiety, the Imagery group showed a significant reduction with $t(9) = 8.65$, $p < .001$, $d = 1.4$, and the Self-Talk group also showed a significant reduction with $t(9) = 7.12$, $p < .001$, $d = 1.1$. No significant change was observed in the Control group, $t(9) = 1.10$, $p = .29$, $d = 0.2$. Figure 3 illustrates the magnitude of intervention effects on state anxiety, showing large improvements in the imagery and self-talk groups compared to the control group.

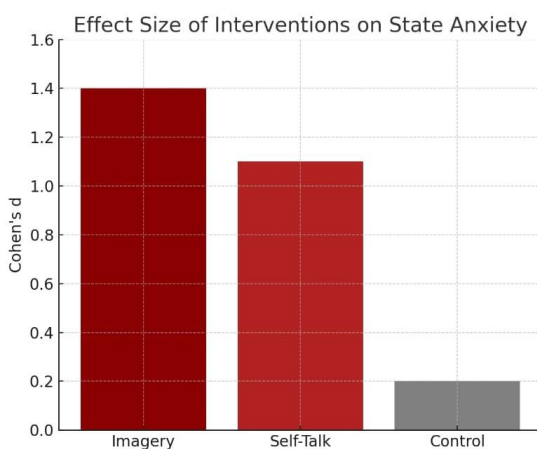


Figure 3

Effect size (Cohen's d) of interventions on state anxiety across groups. The imagery group exhibited the strongest reduction in anxiety, followed by the self-talk group. The control group showed minimal change.

For archery performance, the Imagery group demonstrated significant improvements with $t(9) = 9.33, p < .001, d = 1.5$, as did the Self-Talk group with $t(9) = 8.02, p < .001, d = 1.3$. However, the Control group showed no significant change, $t(9) = 0.55, p = .59, d = 0.3$. As shown in Figure 4, the interventions also produced large effect sizes for archery performance, with both imagery and self-talk groups outperforming the control group.

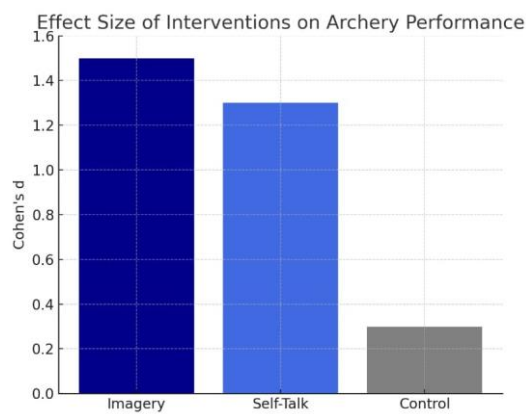


Figure 4

Effect size (Cohen's *d*) of interventions on archery performance. Performance gains were largest in the imagery group, followed closely by the self-talk group. The control group showed negligible improvement.

ANOVA (Analysis of Variance):

A repeated measures ANOVA was conducted to evaluate the effects of the interventions on state anxiety and archery performance. The results are presented in Table 3.

Table 3. ANOVA for State Anxiety and Archery Performance Scores

Source	SS	df	MS	F	p-value	η² (effect size)
STATE ANXIETY						
Between Groups	1182.7	2	591.35	15.23	<.001	0.53
Within Groups	1048.3	27	38.82			
Total	2231.0	29				
ARCHERY PERFORMANCE						
Between Groups	864.2	2	432.10	11.67	<.001	0.46
Within Groups	999.4	27	37.01			
Total	1863.6	29				

The repeated measures ANOVA results revealing significant main effects of time and interactions between time and group.

For state anxiety, the main effect of time was $F(1, 27) = 45.67, p < .001, \eta^2 = 0.63$, with a significant interaction between time and group, $F(2, 27) = 15.23, p < .001, \eta^2 = 0.53$.

For archery performance, the main effect of time was $F(1, 27) = 30.98, p < .001, \eta^2 = 0.57$, with a significant interaction between time and group, $F(2, 27) = 11.67, p < .001, \eta^2 = 0.46$. Figure 5 compares the proportion of variance explained by the interventions for state anxiety and archery performance. Both outcomes demonstrated strong effect sizes.

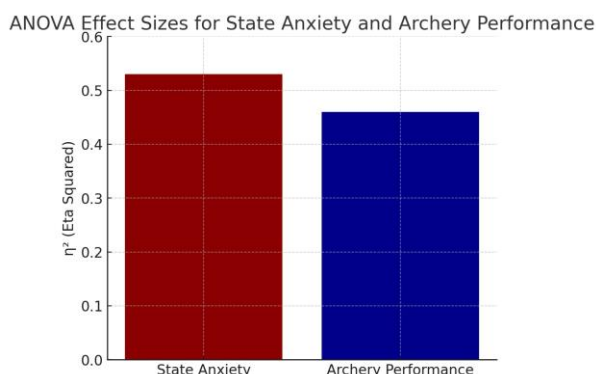


Figure 5

ANOVA effect sizes (η^2) for state anxiety and archery performance. The interventions accounted for a large proportion of variance in both psychological and performance outcomes, with a slightly stronger effect on state anxiety.

Post-hoc pairwise comparisons (Table 3) revealed significant differences between the Imagery and Control groups ($p < .001$) and the Self-Talk and Control groups ($p < .001$). No significant differences were observed between the Imagery and Self-Talk groups.

In terms of archery performance, post-hoc analyses indicated significant improvements in the Imagery group ($M = 15.4, SD = 4.5, d = 1.5$) and the Self-Talk group ($M = 13.2, SD = 4.0, d = 1.3$) compared to the Control group ($M = 0.8, SD = 2.3, d = 0.3$).

Discussion:

This study investigated the effects of imagery training and self-talk on state anxiety and archery performance, revealing significant improvements in both outcomes for athletes who received the interventions. These findings align with existing literature on mental training techniques and highlight their role in enhancing athletic performance and emotional regulation.

• *Reduction in State Anxiety:*

The results demonstrated that both imagery training and self-talk effectively reduced state anxiety. Imagery training allows athletes to mentally rehearse successful performance scenarios, fostering confidence and reducing anxiety by simulating real-life challenges in a controlled mental environment (Cumming & Ramsey, 2009). Self-talk, on the other hand, serves as a cognitive tool for redirecting negative thought patterns, enabling athletes to maintain focus and composure under pressure (Hardy, 2006). These mechanisms are consistent with the cognitive-behavioral framework, which emphasizes the relationship between cognitive appraisals, emotions, and performance (Beck, 1976).

However, it is important to note that the control group did not show significant changes in either state anxiety or archery performance. This absence of improvement underscores the specific efficacy of the interventions, confirming that the reductions in anxiety observed

in the Imagery and Self-Talk groups were attributable to the interventions rather than to external or extraneous factors. This finding strengthens the validity of the study and highlights the importance of incorporating structured mental training into athletic programs.

• ***Improvements in Archery Performance:***

Both interventions significantly enhanced archery performance, consistent with research demonstrating the role of mental skills training in precision sports. Imagery training enhances motor skill acquisition and execution by engaging sensory and cognitive processes, which mirror physical practice and strengthen neural pathways (Feltz & Landers, 1983; Taylor & Wilson, 2005). Self-talk, particularly instructional and motivational self-talk, supports athletes by promoting focus, regulating arousal, and reinforcing task-specific strategies (Hatzigeorgiadis, Zourbanos, Golias, & Theodorakis, 2008).

The control group's lack of improvement in performance further reinforces the effectiveness of the interventions. Without structured mental training, performance gains were minimal, suggesting that the Imagery and Self-Talk groups benefited directly from the targeted psychological strategies. This highlights the necessity of mental training as a deliberate component of sports preparation, especially in archery, where success depends on precision, concentration, and emotional stability.

• ***Integration of Findings and Practical Implications:***

The findings emphasize the value of combining imagery training and self-talk in athlete development. Imagery enables long-term mental rehearsal, while self-talk provides immediate, actionable strategies for managing performance demands. Together, these techniques align with dual-process theories in psychology, suggesting that cognitive and verbal strategies work synergistically to enhance performance (Williams, Cumming, & Borkoles, 2011).

These findings are further supported by recent empirical evidence. Robin, Carien, and Dominique (2022) demonstrated that skilled tennis players utilizing combined mental imagery and self-talk exhibited superior service performance compared to control groups. Similarly, Gmamdy (2023) found that integrating motor imagery, observational learning, and coach feedback significantly improved archery accuracy in young athletes. The convergence of these results with the present study underscores the cross-sport applicability and robustness of psychological training interventions, particularly in precision-based disciplines like archery.

Coaches and sports psychologists can implement these interventions to address both performance and psychological well-being. Tailored programs that integrate mental skills training into routine practice can provide athletes with tools to manage anxiety and optimize performance, particularly in high-pressure environments.

Limitations and Future Research:

Although this study provides robust evidence for the efficacy of imagery training and self-talk, its findings are subject to certain limitations. The sample size limits generalizability, and the four-week intervention period may not reflect long-term effects. Future research should explore the sustainability of these interventions and assess their applicability across different sports and levels of competition. Examining the combined use of imagery and self-talk could also reveal additional benefits that enhance both immediate and sustained performance outcomes.

Conclusion:

This study demonstrates that imagery training and self-talk are effective in reducing anxiety and enhancing performance in precision sports like archery. The control group's lack of improvement confirms the impact of these targeted interventions.

Imagery training boosts emotional regulation and confidence through mental rehearsal, while self-talk enhances focus and motivation by combating negative thoughts. Together, they address the psychological demands of competition and support athletic success.

Future research should explore their long-term effects, broader application in various sports, and potential combined benefits. This study highlights psychological preparation as a key factor in athlete development and performance optimization.

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