Effect of Learning Scaffolds on Shot Execution *and* Amotivation among Archers

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ABSTRACT

The present study investigated the effect of learning scaffolds on shot execution and amotivation among under-15 male recurve archers. The study employed a one-group pre-test-post-test experimental design involving eight male recurve archers selected through simple random sampling. The intervention was conducted over four weeks, with four training sessions per week (Monday, Wednesday, Friday and Sunday). Each session, consisted of scaffold-based drills utilizing a bubble level mounted on the recurve riser, the Astra Archery Shot Trainer and the Elong Bow Trainer. Shot execution was evaluated by an experienced archery coach using a subjective rating scale ranging from one to ten based on five technical components: draw, anchor, release, follow-through and bow-arm elbow position. The average score of these components represented the overall shot execution score. Amotivation was assessed using the amotivation subscale of the Sports Motivation Scale-28 (SMS-28). The Shapiro-Wilk test results indicated that both variables were normally distributed and paired-samples t-tests to compare pre-test and post-test scores resulted in statistically significant improvement in shot execution and a statistically significant reduction in amotivation were observed following the intervention ($p < .05$). The findings suggest that incorporating learning scaffolds into regular archery training enhances technical execution while simultaneously reducing athletes' lack of motivation by promoting self-awareness, immediate feedback and active error correction. The study highlights the effectiveness of scaffold-based learning as an additional training strategy for developing fundamental shooting skills among young recurve archers.

Keywords: motor learning, skill acquisition, extrinsic feedback, learning aids

INTRODUCTION

Archery is a precision sport in which elite performance depends on concentration, consistency, coordination and well-developed technical skills (Wang et al., 2022). In contrast to sports in which strength or speed is primary, success in archery relies on an athlete's ability to reproduce a consistent shooting technique by integrating fine motor control with visuospatial processing (Soylu et al., 2026). Traditional coaching approaches tend to emphasize verbal instruction and observational feedback; however, athletes may find it difficult to detect subtle technical errors while performing complex motor sequences. Over time, this difficulty can contribute to frustration and increased amotivation. Such disengagement is particularly concerning in precision sports, where inadequate support for skill acquisition may reinforce a performance-focused mindset and diminish long-term participation (Hogue et al., 2025).

A concept receiving growing attention in educational psychology and sports pedagogy is learning scaffolding: the provision of temporary supports that bridge the gap between learners' current abilities and their potential performance by offering structured guidance during complex motor tasks, scaffolding can promote autonomy and competence (Zhang et al., 2024). In sport, scaffolding can take the form of specialised training equipment, augmented feedback systems, visual aids, biomechanical constraints and

guided-practice techniques that help athletes detect and correct movement errors. Such aids may shift athletes from passive recipients of coaching to active participants who identify and address their own errors during practice.

Motivation is commonly regarded as a key predictor of competitive achievement. However, the progression from deliberate practice toward mastery may be undermined by emerging amotivation, often associated with stalled improvement or persistent technical shortcomings. Carefully calibrated instructional support may help coaches address these declines while strengthening athletes' perceived autonomy and competence (Li & Zheng, 2026). Learning scaffolds may also enhance motivation by helping athletes recognize immediate, practical gains. In this way, practice can be structured in accordance with autonomy-supportive principles in contemporary motor-learning theory (Parma et al., 2024). Although training aids are increasingly used in archery coaching, evidence of their combined effects on technical performance and psychological outcomes remains scarce, especially for youth recurve archers. Existing studies have primarily examined biomechanics and equipment optimisation, with less emphasis on structured scaffold-based interventions that combine motor-learning principles with motivational outcomes.

The present study therefore examined the effects of learning scaffolds on shot execution and amotivation among under-15 male recurve archers. Specifically, it investigated whether a four-week scaffold-based intervention could improve technical shot execution while reducing amotivation. The findings are expected to provide scientific evidence to support the integration of scaffold-based learning strategies into regular archery coaching programmes for young athletes.

MATERIALS AND METHODS

Research Design

The present study employed a one-group pre-test–post-test experimental design to investigate the effect of learning scaffolds on shot execution and amotivation among under-15 male recurve archers. Pre-test assessments were conducted before the intervention, followed by a four-week scaffold-based training programme. Upon completion of the intervention, post-test assessments were administered using the same measurement procedures.

Participants

The participants consisted of eight (N = 8) male recurve archers belonging to the under-15 age category. Participants were selected using the simple random sampling technique from the available population of eligible archers. All participants were actively involved in regular archery training and were free from injuries during the study period.

Data Collection Procedure

Pre-Test: Before the commencement of the intervention, all participants underwent pre-test evaluations to determine their baseline levels of shot execution and amotivation.

Shot execution was assessed by an experienced archery coach using a subjective rating scale ranging from 1 to 10. The evaluation was based on five essential technical components of the recurve archery shooting process, namely draw, anchor, release, follow-through and bow-arm elbow position. Each component was scored individually and the average of the five scores represented the participant's overall shot execution score. Amotivation was measured using the Amotivation Subscale of the Sports Motivation Scale-28 (SMS-28). Appropriate instructions were provided to ensure accurate responses.

Intervention: The learning scaffold intervention was conducted for four consecutive weeks, with training sessions held four days per week (Monday, Wednesday, Friday and Sunday), resulting in a total of sixteen intervention sessions. Each participant followed the regular two-hour archery training programme. The intervention was incorporated as an additional learning component by modifying the regular practice

schedule.

The scaffold training schedule consisted of

- Routine archery practice – 60 minutes
- Learning scaffold-based drills – 45 minutes
- Cool-down exercises – 15 minutes

Tuesday was observed as a complete rest day from archery practice. The athletes' followed their regular coaching schedule for the rest of the days.

The scaffold-based training consisted of the following instructional aids:

Bubble Level Mounted on the Recurve Riser: The bubble level provided immediate visual feedback regarding bow canting. Participants learned to maintain vertical bow alignment throughout the aiming and release phases, thereby improving shooting consistency.

Astra Archery Shot Trainer: The Astra Shot Trainer enabled participants to rehearse the shooting sequence without releasing an arrow. It emphasized proper muscular coordination, scapular engagement, expansion and release mechanics while allowing athletes to identify technical errors immediately.

Elong Bow Trainer: The Elong Bow Trainer was used to reinforce correct posture, shoulder alignment, bow-arm stability, elbow positioning and follow-through. Repetitive practice using the trainer enhanced muscle memory and improved overall shooting mechanics.

Throughout the intervention, athletes were encouraged to observe their own performance, recognize technical errors and immediately correct them using the feedback provided by the learning scaffolds. The coach supervised every session to ensure correct execution of all drills and to provide additional guidance whenever necessary.

Post-Test: After the four-week intervention, all participants underwent post-test assessment using the same procedures employed during the pre-test. The same expert coach evaluated shot execution under identical testing conditions, while the participants completed the SMS-28 Amotivation Subscale once again. The post-test scores were subsequently compared with the pre-test scores to determine the effectiveness of the learning scaffold intervention.

Statistical Analysis

The Shapiro–Wilk test was employed to examine the normality of the data distribution for both shot execution and amotivation. The results indicated that both variables followed a normal distribution ($p > .05$), satisfying the assumptions required for parametric statistical analysis.

To determine the effectiveness of the learning scaffold intervention, paired-samples *t*-tests were performed to compare the pre-test and post-test scores for shot execution and amotivation.

Table I: Descriptive Statistics for Pre-Test and Post-Test of Amotivation and Shot Execution

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE-AMOTIVATION	3.69	8	.42	.15
	POST-AMOTIVATION	2.19	8	.26	.09
Pair 2	PRE-SHOT EXECUTION	3.45	8	.50	.18
	POST-SHOT EXECUTION	5.73	8	.28	.10

The paired samples statistics for the pre-test and post-test of Amotivation and Shot Execution are presented in Table I and the pre and post-test means were showed in Figure 1. A total of eight archers (N = 8) completed both pre-intervention and post-intervention assessments, allowing for a within-subject comparison of performance following the learning scaffold training. The pre-test mean score of Amotivation was **3.69** (SD = .42), while the post-test mean score decreased to **2.19** (SD = .26). This represents a positive effect of the training intervention on Amotivation. The pre-test mean score of Shot-Execution was **3.45** (SD = .50), while the post-test mean score increased to **5.73** (SD = .28). This indicates the importance of learning scaffolds in improving the shot execution through better acquisition of skills.

Fig. 1: BAR DIAGRAM SHOWING MEAN VALUES OF PRE & POST TEST OF AMOTIVATION AND SHOT EXECUTION

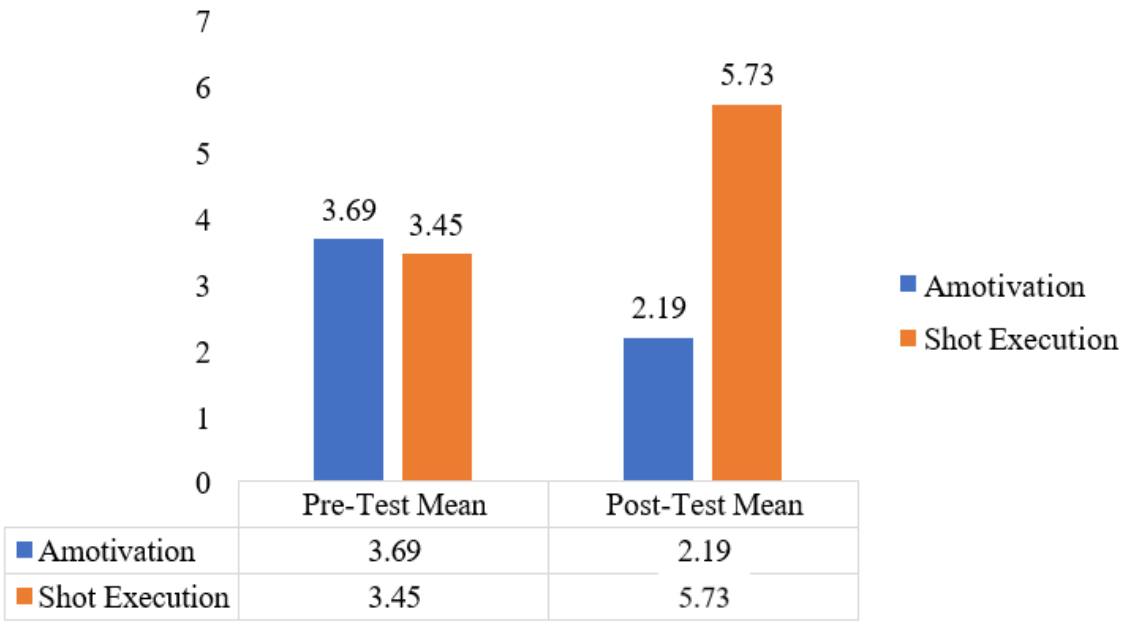

Table II: Results of Paired-Samples T-Test Comparing Pre-test and Post-test of Amotivation and Shot Execution

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	SD	SEM	95% of CI				
					Lower	Upper			
Pair 1	PRE-AMOTIVATION POST-AMOTIVATION	1.50	.42	.15	1.15	1.85	10.04	7	.000
Pair 2	PRE-SHOT EXECUTION POST-SHOT EXECUTION	-2.28	.43	.15	-2.63	-1.92	-15.07	7	.000

The level of statistical significance was set at 0.05.

The results of the paired-samples t-test shown in Table II indicates a statistically significant improvement in both amotivation and shot execution from the pre-test to the post-test ($t = 10.04$, $p < 0.05$) and ($t = -15.07$, $p < 0.05$) respectively. Hence the mean differences suggest that the intervention incorporating learning scaffolds, substantially reduced the participants' amotivation and increased the shot execution scores.

DISCUSSION ON FINDINGS

The findings of the present study demonstrated that the four-week learning scaffold intervention positively influenced both the technical and psychological characteristics of the participants. The paired-samples *t*-test revealed a statistically significant reduction in amotivation following the intervention ($p < .05$). The decrease in amotivation suggests that participants became more engaged and confident during practice as they experienced observable improvements in their shooting technique. The immediate feedback provided by the learning scaffolds may have strengthened the athletes' perception of competence, thereby reducing feelings of helplessness and lack of purpose during training. Similarly, the paired-samples *t*-test revealed a statistically significant improvement in shot execution following the intervention ($p < .05$). This finding indicates that the use of learning scaffolds effectively enhanced the participants' technical shot execution and the improvement in shot execution can be attributed to the continuous augmented feedback provided by the learning scaffolds. Unlike traditional coaching methods that rely primarily on verbal instruction, the bubble level, Astra Archery Shot Trainer and Elong Bow Trainer enabled athletes to identify technical errors as they occurred. This immediate feedback promoted active error correction and reinforced correct movement patterns during repeated practice. The improvements observed in draw, anchor, release, follow-through and bow-arm elbow position suggest that immediate feedback and self-correction contributed substantially to motor skill acquisition.

Managerial Implications

The findings of the present study have important implications for archery coaches, sports scientists, sports psychologists, academies and governing bodies involved in athlete development. The study demonstrated that incorporating learning scaffolds into regular training significantly improved shot execution while reducing amotivation among under-15 male recurve archers. Therefore, coaches may consider integrating scaffold-based learning into routine technical training rather than relying solely on verbal instruction and observation. The reduction in amotivation observed following the intervention indicates that scaffold-based learning contributes not only to technical improvement but also to psychological well-being. Coaches may therefore use learning scaffolds to enhance athletes' confidence, competence and engagement during practice sessions, particularly among young beginners who often struggle with technical consistency.

Sports academies and training centres may incorporate scaffold-based drills into their long-term athlete development programmes as an additional training component. The intervention requires relatively little additional training time, making it practical for integration into existing coaching schedules without disrupting regular practice.

CONCLUSION

The present study examined the effect of learning scaffolds on shot execution and amotivation among under-15 male recurve archers. A four-week scaffold-based intervention incorporating the Bubble Level mounted on the recurve riser, Astra Archery Shot Trainer and Elong Bow Trainer was implemented as an additional component of the participants' regular training programme. The findings revealed statistically significant improvements in shot execution following the intervention, indicating that learning scaffolds effectively enhanced the technical quality of shooting. The intervention also resulted in a statistically significant reduction in amotivation. The results support the application of learning scaffolds as an effective pedagogical strategy for improving both technical and psychological outcomes in youth archery. Integrating scaffold-based learning into regular coaching programmes may accelerate motor skill acquisition while fostering a more motivating and learner-centred training environment.

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