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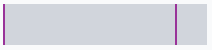
11	www.sportmont.ucg.ac.me www.sportmont.ucg.ac.me/clanci/SM_October_2025_Keskin.pdf	<1%	
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Game-Based Archery Learning in Physical Education: A Qualitative Exploration of Elementary School Students' Attention Experiences

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Abstract

Study purpose. This study aims to qualitatively explore students' attention experiences during game-based archery learning in elementary school physical education.

Materials and methods. This study employed a qualitative approach with a case study design. Participants were 40 fifth and sixth grade elementary school students (20 students from MIMHA Elementary School and 20 students from Istiqomah Elementary School) aged 10-12 years. Data were collected through video observation (3 videos) and analysis of 3 educational images. Data analysis used thematic analysis (Braun & Clarke, 2022) with stages of open coding, axial

coding, and selective coding.

Results. This study identified 33 open codes (OC1-OC33) grouped into 7 categories and produced 3 main themes. The first theme is Game-Based Learning Implementation which reflects the S1-S6 game structure. The second theme is Attention & Executive Function which shows an increase in students' selective and sustained attention as indicated by pause behavior before release (1-2 seconds). The third theme is Social & Discipline Context which reflects social interaction and the formation of discipline without coercion

Conclusions. This qualitative study suggests that game-based archery learning appears to support attention among elementary school students based on participant reports and observation. A notable finding is students' subjective experience of sustained attention, which differs methodologically from Mo et al. (2024) meta-analysis that found non-significant quantitative effects. The S1-S6 game structure is proposed as a tentative framework for game design in precision sports contexts. Further quantitative research is needed to test these qualitative insights.

Keywords: Archery, Attention, Elementary School, Game-Based Learning, Physical Education

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Introduction

The low level of students' attention in physical education learning is a problem occurring in various countries. Data from the United States show that 47% of elementary school teachers report a decline in students' attention during physical education lessons (Giuriato & Lovecchio, 2025). Meanwhile in Europe, approximately 35% of elementary school students experience difficulty maintaining concentration during structured physical activities (Rueda, 2024). In Indonesia, research on junior high school students showed that the game-based learning approach can increase student engagement by 62% compared to traditional methods (Rismanto et al., 2024).

Several factors contribute to low student attention in physical education learning. In the United States, this problem is caused by monotonous and repetitive teaching approaches without game variations (Ezeddine et al., 2025). Additionally, the NASP (National Archery in the Schools Program) in the United States uses a structured and rigid approach without game elements (Skorczewski, 2020). Furthermore, traditional educational approaches where teachers dominate instruction and students act as passive recipients have been widely criticized for limiting active exploration and student engagement (Al-Tamimi, 2025). In Indonesia, physical education teachers still lack understanding of the concept of physical literacy, so the potential of games to support children's cognitive development has not been optimized (Friskawati, 2024).

Game-Based Learning (GBL) in physical education has been reported to increase student engagement and focus. The imbalance between conventional teacher-centered methods and game-based student-centered approaches is the root cause of low attention (Choosang et al., 2023). Teachers often rationalize drill methods because they are considered easier to manage and measure, even though this approach ignores children's natural need to play (Katual et al., 2023). GBL significantly increases students' focus duration through elements of challenge, immediate feedback, and immersive experiences (Shroff et al., 2019). Research by Rymar et al., (2025) also indicates that game-based technologies in physical education increase productivity, stability, span, concentration, and attention shifting in school-age children.

Posner and Petersen's attention theory explains that attention consists of three interacting networks: alerting, orienting, and executive control (Klein et al., 2024; Linkovski et al., 2025). There are three attentional (focus) networks in archery that play an important role,

namely alerting which functions to maintain vigilance and readiness before the arrow is released, orienting to focus the gaze on a single point, and executive control which functions to ignore distractions while also regulating precise body movements. Research findings by Keskin & Van Den Berg, (2025) on Olympic archers show that regular archery practice trains all three systems: attention (focus) becomes sharper, reaction time (response speed) becomes faster, and motor control (body movement coordination) also improves. Unfortunately, in Indonesia, there has been no specific research on whether the same benefits also occur in children learning archery, especially elementary school children.

Archery is a precision sport that naturally demands high concentration and self-control.

In the United States, the NASP program has been implemented in thousands of schools, but its approach remains structured and rigid without game elements (Skorczewski, 2020). Meanwhile in Europe, archery learning in elementary schools is often normalized as a serious and unenjoyable extracurricular activity (Ferriz-Valero et al., 2025). In fact, integrating game-based learning elements into archery has great potential to increase student attention while making learning more meaningful. Research by Pinelli et al., (2025) found that sports with high cognitive engagement (badminton and biathlon) are more effective in improving attention compared to pure aerobic sports. In Southeast Asia, including Indonesia, no study has examined game-based archery learning in elementary school physical education.

The research gaps in this topic are clear and need to be filled immediately. First, no study has specifically examined the game-based learning approach for archery in elementary schools, both in Indonesia and globally. Second, research on attention in GBL is still dominated by quantitative experimental methods using expensive neurofeedback or augmented reality technologies that are not applicable in schools with limited resources (Omarov et al., 2024). Third, qualitative studies exploring students' subjective experiences of how GBL affects their attention are almost non-existent (Quintas-Hijós et al., 2020). Fourth, the meta-analysis by Mo

et al., (2024) concluded that sustained attention was not statistically significant in game-based PE interventions (SMD = 0.03, p = 0.91). However, this conclusion was based on studies that predominantly used divided attention sports (e.g., soccer, basketball), leaving open the question of whether precision sports like archery might yield different patterns. The present study does not aim to 'contradict' this finding methodologically, but rather to explore sustained attention qualitatively in a precision sport context. Based on these gaps, this study aims to qualitatively explore students' attention experiences during game-based archery learning in elementary school.

Materials and methods

Study participants

This study involved 40 fifth and sixth grade elementary school students who participated in a game-based archery extracurricular program. Participants came from two schools: 20 students from MIMHA Elementary School and 20 students from Istiqomah Elementary School, aged 10-12 years. Sampling was conducted using purposive sampling technique. Inclusion criteria included: (1) fifth or sixth grade elementary school students, (2) had participated in at least 3 sessions of game-based archery learning, (3) willing to participate voluntarily with parental consent. Exclusion criteria were: (a) absence during data collection, (b) physical injury preventing archery activity. No invited student declined participation. The research was conducted at two locations: MIMHA Elementary School and Istiqomah Elementary School.

Study organization

This study used a qualitative approach with a case study design. The main data sources consisted of three types: field videos, educational images, and observation notes. Field videos were recorded during learning sessions using a smartphone camera (Xiaomi 11T, 4K at 30fps) placed on a tripod 4 meters from the archery line. Three video files were collected, each lasting 42-58 minutes (total 147 minutes). Educational images consisted of 3 infographics containing archery technique materials, archery benefits, and archery etiquette.

All videos were analyzed using scene segmentation method into six standard segments that repeated across all videos: S1 (Briefing), S2 (Deployment), S3 (Engagement), S4 (Micro-

coaching), S5 (Reset), and S6 (Closing). Scene segmentation was performed independently by two researchers (the first author and a trained research assistant). Inter-rater agreement was 92% (54 of 59 segments). Disagreements were resolved through consensus discussion by reviewing the relevant video segments.

Data analysis

Data analysis followed Braun & Clarke, (2022) six-phase thematic analysis. Phase 1 (Familiarization): Both authors independently watched all videos twice and generated initial memos. Phase 2 (Open coding): The first author produced 112 initial codes. The second author independently coded 30% of the data (Cohen's κ = 0.84). Phase 3 (Axial coding): Codes were grouped into 15 categories. Phase 4 (Selective coding): Categories were synthesized into three themes through four research team meetings. Phase 5 (Theme review): Themes were checked

against raw data. Phase 6 (Writing): Themes were named and defined. NVivo 14 was used for coding management.

To ensure data validity, this study applied four trustworthiness criteria (Mills et al., 2026): credibility (data source triangulation and member checking), transferability (thick description), dependability (audit trail), and confirmability (bracketing and peer debriefing). A reflexive journal was maintained throughout the analysis process to document analytical decisions.

Results

Figure 1. Structure of S1-S6 Game Segments in Game-Based Archery Learning

Figure 1 Flow diagram of S1-S6 game segment structure

This study aims to qualitatively explore students' attention experiences during game-

based archery learning in elementary school. Data analysis was conducted on 3 field videos and 3 educational images collected from extracurricular archery activities at MIMHA Elementary School and Istiqomah Elementary School with a total of 40 fifth and sixth grade students. The analysis process followed thematic analysis procedures (Braun & Clarke, 2022) consisting of open coding, axial coding, and selective coding.

From the open coding process of all videos and images, 33 open codes (OC1-OC33) were found distributed across each game segment. Table 1 presents the distribution of codes by segment.

Table 1 Distribution of Open Codes (OC) by Game Segment

Segment	Code	Description
S1 (Briefing)	OC1, OC2, OC3, OC4	Rule framing, attention gathering, role assignment, safety priming
S2 (Deployment)	OC5, OC6, OC7	Spatial positioning, anticipatory focus, task readiness
S3 (Engagement)	OC8, OC9, OC10, OC11, OC12, OC13, OC14, OC15	Aim stabilization, draw control, release timing, evasive movement, tactical repositioning, opponent tracking, team signaling, risk appraisal
S4 (Micro-coaching)	OC16, OC17, OC18	Feedback injection, error correction, rule

reinforcement

S5 (Reset)
OC19, OC20,

OC21

Rapid iteration, trial-error loop, performance

adjustment

S6 (Closing) OC22, OC23 Positive reinforcement, social bonding

In segment S3 (Engagement), students demonstrated pausing behavior before releasing the arrow. One student expressed:

> "Saya nunggu dulu sebelum nembak biar kena target, kalau buru-buru nanti meleset"

> “I wait before shooting to make sure I hit the target; if I rush, I will miss.”

(Student A, male, grade 5, MIMHA Elementary School).

This quote shows students' awareness of the importance of inhibitory control to achieve accuracy. This behavior is reflected in codes OC10 (release timing) and OC15 (risk appraisal).

From the educational images, specific codes were found as presented in Table 2.

Table 2 Distribution of Open Codes (OC) from Educational Images.

Image Code Description

G1 (Archery

Technique)

OC24, OC25,

OC26

Sequential motor pattern, fine motor alignment,

procedural knowledge

G2 (Archery

Benefits)

OC27, OC28,

OC29, OC30

Attention control, emotional regulation,

confidence building, discipline value

G3 (Archery

Etiquette)

OC31, OC32,

OC33
Intentionality, respect norm, ethical restraint

Another student shared a similar experience regarding focus and concentration:

> "Harus fokus dulu lihat targetnya, jangan lihat yang lain, baru lepas. Kalau tidak fokus, pasti meleset"

> “You have to focus on the target first, don’t look at anything else, then release. If you are not focused, you will definitely miss.”

(Student B, female, grade 6, Istiqomah Elementary School).

This quote reinforces the finding about the orienting network (codes OC8 and OC27)

in Posner's attention theory (Klein et al., 2024; Linkovski et al., 2025). The student explicitly

mentioned the word "focus" which is the main indicator of selective attention.

From the 33 open codes, axial coding was conducted to group codes into 7 categories.

Subsequently, selective coding produced three main themes as shown in Table 3.

Table 3 Summary of Three Themes from Thematic Analysis

Theme Related Codes Main Indicators Supporting Theory

Game-Based

Learning

Implementation

OC1-OC4,

OC16-OC21

S1-S6 structure,

short cycles, immediate

feedback, clear rules

		(Choosang et al., 2023; Katual et al., 2023; Shroff et al., 2019)
	Attention & Executive Function	OC6, OC8, OC10, OC15, OC27
	Pause before release (≥1-2 seconds), focus on target, risk appraisal	(Klein et al., 2024; Linkovski et al., 2025)
	Social & Discipline Context	OC11-OC14, OC22-OC23, OC31-OC33
	Team coordination, compliance without coercion, value internalization	(Pinelli et al., 2025; Rusakov et al., 2025; Rymar et al., 2025)

The first theme, Game-Based Learning Implementation, was identified through four key elements: standardized S1-S6 game structure, short and repeated round cycles, immediate

feedback, and clear rules delivered at the beginning of the session. These four elements areconsistent with game-based learning theory (Choosang et al., 2023; Katual et al., 2023; Shroff et al., 2019).

The second theme, Attention & Executive Function, is the most important finding of this study. Based on Posner's attention theory (Klein et al., 2024; Linkovski et al., 2025), all three attention networks (alerting, orienting, executive control) were identified in the data. The alerting network was seen in segment S2 through code OC6 (anticipatory focus). The orienting network was seen in segment S3 through codes OC8 (aim stabilization) and OC27 (attention control). The executive control network was seen in segment S3 through codes OC10 (release timing) and OC15 (risk appraisal), which is pausing behavior before releasing the arrow with a duration of ≥1-2 seconds.

The third theme, Social & Discipline Context, was identified through three aspects: social interaction seen from codes OC12 (tactical repositioning), OC13 (opponent tracking), and OC14 (team signaling); formation of discipline without coercion seen from the absence of rule violations throughout the game; and value internalization through educational images G2 and G3.

Although most students demonstrated sustained attention, two students (one from each school) mentioned moments of distraction. Student C (male, grade 5, Istiqomah Elementary School) stated:

"Kadang-kadang saya melihat teman saya jika mereka ramai".

"Sometimes I look at my friend if they are noisy".

Student D (female, grade 5, MIMHA Elementary School) noted:

"Ketika tim lawan bersorak dengan keras, saya melirik sebentar"

"When the other team is cheering loudly, I look away for a moment".

Although learning through game-based methods can improve focus, this focus can be disrupted if the surrounding environment is noisy and full of loud sounds. This is something that needs to be addressed in further research.

Figure 2. Conceptual Model of Game-Based Archery Learning for Elementary School

Students' Attention

Figure 2 Conceptual model of attention formation through game-based archery learning

This model shows that play creates micro experiences that are repeated quickly (rapid repetition). This repetition trains self-control seen from impulse delay behavior and maintaining focus. This self-control gradually forms internalized discipline, and ultimately forms habitus embedded in the body (embodied habitus).

Discussion

Mechanisms of Students Maintaining Selective and Sustained Attention

This study found that students are able to maintain both selective and sustained attention through three interrelated mechanisms: (1) maintaining visual focus on the target (orienting), (2) inhibiting impulses before releasing the arrow (executive control), and (3) adjusting strategies based on visual feedback from previous shots. These mechanisms indicate that attention in archery learning is not a singular process, but rather an integration of multiple attention networks as conceptualized in Posner's attention theory.

These findings are consistent with (Rymar et al., 2025), who reported that game-based technologies in physical education enhance productivity, stability, attention span, concentration, and attention shifting in school-aged children. This study found that in training focus improvement, it is not necessary to use digital technology. A simple game model with the S1-S6 structure was sufficient to train students' focus.

The results of this study are in line with the findings of (Rusakov et al., 2025) which showed that active games in sports learning can improve focus, memory, observation, and imagination in elementary school children. An additional finding from previous research is that

precision sports such as archery have their own unique advantage, namely that archery can train two types of focus simultaneously: selective attention and sustained attention. This is because archery requires focusing on a single target point while ignoring distractions in the surrounding environment.

This is reflected in the following student statement:

> "Saya nunggu dulu sebelum nembak biar kena target, kalau buru-buru nanti meleset."

> "I wait before shooting so I can hit the target; if I rush, I will miss."

This statement indicates that the students are aware of exercising self-control (impulse control) so that their arrows hit the target accurately. This awareness is consistent with Posner's theory regarding executive control, which is the brain's ability to regulate itself and inhibit impulses (Klein et al., 2024; Linkovski et al., 2025).

The study by (Alvarado-Melo et al., 2026) showed that school children who engaged in various physical activities of moderate to vigorous intensity (MVPA) for eight weeks experienced an improvement in selective focus. The study by (Rosa Guillamón et al., 2021) also found similar results, showing that aerobic exercise can improve selective focus in elementary school children. Both studies relied solely on general physical activity without including structured cognitive challenges.

The difference between this study and previous research is that this study integrates physical activity with cognitive challenges in the form of decision-making and risk evaluation within the context of archery games. This integration stimulates the students' attentional systems in a more complex way.

This finding is further reinforced by one of the students who stated:

> "Harus fokus dulu lihat targetnya, jangan lihat yang lain, baru lepas. Kalau tidak fokus, pasti meleset."

> "You have to focus on the target first, don't look at anything else, then release. If you're not focused, you will definitely miss."

The student's statement clarifies that the orienting network functions to direct attention to relevant stimuli. Furthermore, one of the determinants of success in archery is how sharp the eye's focus is on the target.

Interpretation needs to be done carefully when connecting the findings of this qualitative study with previous quantitative research. The findings from Mo et al., (2024), who conducted a meta-analysis of 15 studies, found that practice did not have a significant effect on sustained

attention (SMD = 0.03; p = 0.91). This study found that students consistently reported experiencing sustained focus. Mo et al.'s study analyzed quantitative experimental studies using standardized tests, while this study used a qualitative approach that explores subjective experiences. The findings of these two studies are considered complementary because qualitative methods are able to provide depth of (phenomenological) experience that quantitative measures cannot capture.

The difference in the results of this study is also due to the different types of sports observed. Mo et al., (2024) conducted observations on soccer and basketball, both of which require divided attention, where players must pay attention to many things simultaneously. In contrast, this study employed archery, which demands sustained attention focused on a single target. Therefore, differences in the cognitive demands inherent in each type of sport constitute a key factor explaining the divergent findings.

This argument is further supported by Pinelli et al., (2025), who reported that cognitively engaging sports such as badminton and biathlon are more effective in enhancing attention compared to running. Using a longitudinal design with 57 preadolescent participants, their study found improvements in divided attention and Stroop task performance. The present study adds to these findings by suggesting that precision sports such as archery also have strong potential, particularly in enhancing sustained attention.

Furthermore, Keskin & Van Den Berg, (2025) found that archery training combined with breathing and imagery techniques improves attention, reaction time, and motor control inelite athletes. While their study focused on trained athletes in a laboratory setting, the present study provides preliminary evidence suggesting that similar benefits can also be observed

among beginner elementary school students through a game-based learning approach in a real-world educational context.

In the Indonesian context, these findings are consistent with Rismanto et al., (2024), who reported that play-based approaches in physical education improve students' physical fitness by up to 62%, compared to only 51% with traditional methods. Similarly, (Hasibuan et al., 2025) demonstrated that a target game-based training model is effective in significantly improving beginner players' skills ($p < 0.05$). The consistency of these findings is consistent with the view that game-based learning may be more effective than conventional drill-based approaches, though causal claims require experimental validation.

However, not all studies report consistent results. (Gelabert et al., 2021) found that high-intensity interval training did not improve sustained attention in children aged 11–12 years. Likewise, (Reigal et al., 2023) reported that small-sided handball games improved selective attention but did not significantly affect sustained attention. Both studies involved activities that require divided attention across multiple elements such as body movement, the ball, teammates, and spatial dynamics.

The consistency of these contrasting findings across studies further reinforces the argument that improvements in sustained attention are highly dependent on the nature of the activity (Gelabert et al., 2021; Mo et al., 2024; Reigal et al., 2023). Archery has been proven to be more effective in training sustained attention on a single object compared to invasion games such as soccer and basketball.

Therefore, this study highlights that sport type is a crucial moderating variable in attention-related research. Game-based archery learning not only enhances student engagement but also contributes specifically to the development of sustained attention through structured and continuous focus demands.

Factors in Game Design that Support Focus

This study identified four key factors in game design that support the emergence of student focus. The first factor is a standardized S1–S6 game structure. The second factor is the

use of short game cycles (30–60 seconds) with repetition of at least three to five times. The third factor is the provision of immediate feedback. The fourth factor is the delivery of clear rules at the beginning of the session.

A distinctive contribution of this study lies in the identification of the S1–S6 structure. Previous research in Indonesia, employed game-based activities such as dodgeball relay and TikTok-based fitness videos (Manurung et al., 2025; Rismanto et al., 2024). However, these studies did not provide detailed descriptions of session structure. Similarly, international studies did not specify structured learning sequences (Rusakov et al., 2025; Rymar et al., 2025). This study addresses this gap by proposing the S1–S6 framework (Briefing, Deployment, Engagement, Micro-coaching, Reset, Closing) as a tentative and potentially replicable model.

The effectiveness of this structure is illustrated by the students' experiences, as in the following statement:

> “Seneng banget mainnya, jadi pengen terus nembak. Padahal biasanya kalau latihan biasa cepat bosan.”

> “I really enjoy the game, it makes me want to keep shooting. Usually, I get bored quickly during regular practice.”

From this argument, a well-structured game such as S1–S6 can increase student engagement and sustain their focus. According to (Choosang et al., 2023) from a Game-Based Learning (GBL) perspective, a structured game can reduce cognitive load, allowing students to focus more on the task itself. Without a clear structure, students will become confused, which in turn impacts their focus and the learning objectives.

According to (Shroff et al., 2019), the effectiveness of Game-Based Learning (GBL) lies in the precision between the challenge and the students' ability (creating flow). In this study, the game cycles were made short (30–60 seconds) so that the brain does not tire easily and can maintain student engagement. Furthermore, a balance of cognitive load according to Camilleri, (2023) is necessary for GBL effectiveness. Rules delivered clearly and concisely at the beginning of the session (approximately 5–20 seconds), and subtly reminded during gameplay,

can improve learning efficiency and help prevent confusion.

The findings of this study complement previous research findings from Spain and England which show that gamification in physical education is beneficial. Sotos-Martínez et al., (2024) revealed that gamification can improve students' basic psychological needs such as autonomy, competence, and relatedness, as well as promote positive behaviors. Meanwhile, Rice et al., (2025) found an increase in emotional intelligence and a reduction in student stress levels. This study complements this evidence by qualitatively explaining the reasons behind the effectiveness of specific game designs in improving student focus.

The game-based fundamental movement learning model for elementary school students, developed by Aprriyadi et al., (2026) achieved a validity score of 86.80 percent (valid category) and a practicality score of 87.40 percent (practical category). This further strengthens that the game-based approach is indeed feasible for use in elementary education.

The Relationship Between Play Enjoyment and Concentration Ability

This study found that play enjoyment actually triggers concentration (rather than disrupting focus). Therefore, a more flexible, game-based approach to archery may be more suitable for elementary school children. This finding differs from Skorczewski, (2020) in the United States, who noted that the National Archery in the Schools Program (NASP) uses a structured, rigid approach without game elements. Meanwhile, Ferriz-Valero et al., (2025) found that in European elementary schools, archery learning is conducted seriously and is less enjoyable (merely as a regular extracurricular activity).

The third finding of this study is that enjoyment in playing can reduce anxiety (anxiety-reduction mechanism), thereby increasing concentration. This is illustrated by the following student statement:

> “Kalau seru, aku lebih semangat. Pokoknya harus konsentrasi biar bisa menang sama tim lawan.”

"When it's fun, I feel more motivated. I have to concentrate so I can beat the opposing team."

Based on this statement, enjoyment plays a dual role: increasing enthusiasm and strengthening students' motivation to concentrate.

From a theoretical perspective, this phenomenon can be explained using Attentional Control Theory (ACT) (Eysenck et al., 2023). ACT posits that anxiety disrupts the goal-directed attention system while increasing reliance on the stimulus-driven attention system. In a game-based learning context, a positive and enjoyable atmosphere helps reduce students' anxiety levels. As a result, students are better able to maintain goal-directed attention on the task, specifically focusing on the archery target.

Empirically, these findings are consistent with several previous studies. (Mahardhika et al., 2026) reported that 90% of students rated basketball learning as "very enjoyable" or "enjoyable." (Nurhasanah et al., 2024) found that the traditional egrang game improved elementary students' static balance from 14.28% to 71.57% after two learning cycles. Muliadin et al., (2025) demonstrated that the traditional Bola Nyawa game had a significant effect on improving elementary students' motor skills ($p = 0.002; 0.001; 0.003$). In addition, Isnaini et al., (2026) developed the "Pass To The Wall" educational game, which received positive responses from students (87.5%) and teachers (91.3%).

The consistency of these findings strengthens the argument that enjoyment is a critical factor in physical education learning. Beyond enhancing engagement, enjoyment also functions as a psychological mechanism that supports the development of students' concentration.

Limitations and Future Research Agenda

This study has several limitations. First, this study is qualitative with a limited sample (40 fifth and sixth grade students from two schools). Second, this study did not measure attention using standardized instruments such as the Attention Network Test (ANT). Third, this study did not include a control group. Fourth, the intervention duration was short (one session) so long-term effects were not measured.

Future research is recommended to do five things. First, replicate these findings with a mixed-method design and larger sample. Second, measure attention using ANT to obtain objective quantitative scores. Third, test whether the S1-S6 structure applies to other precision

sports (golf, shooting, bowling). Fourth, test long-term retention effects. Fifth, compare the effectiveness of embedded soft discipline versus punishment-based discipline approaches.

Conclusions

Based on the research results and discussion, this qualitative study suggests that game-based archery learning may support attention among fifth and sixth grade elementary school students, as perceived by participants and observed by researchers. These findings are context-specific and not statistically generalizable. The study successfully identified three themes that offer a preliminary understanding of how attention might emerge in game-based archery contexts: Game-Based Learning Implementation, Attention & Executive Function, and Social & Discipline Context.

The unique findings of this study are: (1) students' subjective experience of sustained attention, which differs methodologically from Mo et al., (2024) meta-analysis that found non-

significant quantitative effects, (2) identification of the S1-S6 structure as a tentative framework for game design in precision sports contexts, and (3) play enjoyment as a catalyst for concentration through an anxiety reduction mechanism explained by Attentional Control Theory (Eysenck et al., 2023).

Suggestions for future research are: (1) replicate these findings with a mixed-method design and larger sample, (2) measure attention using the Attention Network Test (ANT), (3) test whether the S1-S6 structure applies to other precision sports (golf, shooting, bowling), (4) test long-term retention effects of game-based archery learning, and (5) compare the effectiveness of embedded soft discipline versus punishment-based discipline approaches. For elementary physical education teachers, it is recommended to consider adopting the S1-S6 structure and making games enjoyable to potentially increase student concentration.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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