

The Effect of Individualized Learning Using Digital Tools on Learning the Volleyball Serving Skill and Enhancing Attention Focus

Saif Alaa Naji

Al-Iraqia University

saif.a.naji@aliraqia.edu.iq

Abstrak

This study investigates the impact of individualized digital learning on the development of volleyball serving skills and attentional focus among middle school students. Results revealed statistically significant improvements in both the volleyball serve and attention scores within the experimental group. The present study aims at exploring the effects of using Personalized Digital Learning on volleyball serving and selective attentional focus of (40) middle school students, aged (12-14), from Al-Thabrat Middle School. With a quasi-experimental design, two equivalent groups of participants was assigned to one of the two conditions: a) an experimental condition where they learned individually with digital content, or b) to control condition, in which were subject to traditional teaching methods. Measurement tools consisted of the standardized volleyball serve performance test and Borden-Anfimov attention scale. Pre-post scores were examined with paired and independent sample t-tests. The findings indicated that there were significant gains for the experimental group in volleyball serve performance (mean score was increased from 18.8 to 40.5; $t = 12.45$, $p < 0.001$) and attentional focus (score was increased from 150.7 to 139.1; $t = 9.68$, $p < 0.001$). Of the control participant, on average, serve performance was slightly higher following an intervention (18.1 to 33.4; $t = 8.21$, $p < 0.001$) and we found no moderation effect of attention ($p = 0.221$). These results highlight the combined advantage of individualized digital instruction for not only improving motor but also cognitive engagement and, thus, justify the incorporation of digital tools to develop skills in physical education.

Keywords: *Individualized Learning, Digital Instruction, Volleyball Serve, Attention Focus, Middle School*

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1. INTRODUCTION

In recent decades, technological advancements have profoundly impacted educational methodologies, introducing new forms of learning that prioritize flexibility, accessibility, and personalization. Among these personalized learning—referred to as differentiated or tailored instruction—has gained prominence as an effective approach for accommodating the diverse abilities, needs and learning paces of students. Within this context, digital learning tools, including instructional videos, educational apps, and learning management systems have proven effective in facilitating student-centered learning environments (Ahmed Baha'uddin (2018). These tools not only offer engaging content but also provide learners with the opportunity to review repeat, and interact with materials at their own pace (Arkorful, V., & Abaidoo, N., 2014). In physical education where skills acquisition is both cognitive and motoric, integrating digital tools such as video modeling, feedback systems, and augmented reality applications have shown significant potential in improving skill performance (Allawi, M. H., 2015). In particular, the volleyball serve—a complex skill requiring high levels of precision and concentration—benefits from instructional environments that allow for repetitive practice, feedback, and visual modeling. Several studies, such as Warriar Boss (2006), Arkorful & Abaidoo, (2014), and O'Donnell & Sharp (2012), highlight the positive impact of digital learning in improving motivation, attention, and performance across various academic domains, including sports and physical education (Creswell, J. W., 2014).

Despite the documented benefits of digital and individualized learning approaches, significant gaps remain in their implementation, particularly in physical education contexts in developing countries (Field, A., 2013). Most studies have focused on theoretical or classroom-based subjects, while research addressing the integration of digital learning in skill-based, motor activities remains scarce. For example, while individualized digital learning has been applied extensively in math and language learning, few empirical studies have explored its utility in sports education, especially among middle-school students (Mayer, R. E. 2009). Moreover, most of the available literature addresses the use of generalized digital resources, with limited attention given to customized, student-paced video-based instruction tailored to specific sports skills. This lack of targeted research

limits the transferability and effectiveness of digital strategies in improving specific physical skills such as the volleyball serve (Nour Hamza & Khmas, R. K., 2020). Furthermore, while there is general acknowledgment of the role of attention and focus in motor skill development, little has been done to connect how digital instruction affects attentional focus during skill execution in sport-specific contexts (O'Donnell, A. M., & Sharp, D., (2012).

A second significant gap exists about the effects of digital personalized learning on students cognitive engagement, like concentration and attention in motor learning. While the face-to-face methods of teaching offer immediate direction and feedback, they may not always accommodate variations in learning rates, attentional abilities, and learning styles (Patton, M. Q., (2002). Digital learning tools on the other hand can provide multiple visually presented cues, targeted feedback and multisensory input, which may be more in line with the individual cognitive make-up of the learner. However, few studies have systematically investigated the effects of these devices on attentional systems of middle school students who are learning complex physical skills (Sweller, J., (1988). Given that concentration is crucial in the acquisition of skills, like serving in volleyball, what constitutes and promotes concentration in digital contexts is all the more important (though underdeveloped). It is this gap that this study seeks to fill as well as providing much warranted empirical evidence on the effect of individualized digital instruction on skill development as well as cognitive factors, thus informing best practices for physical education in the 21st century (Warrier Boss, S., 2006).

It has been shown that the use of educational technology can have positive effects on student performance, encouraging a certain extent of self-paced learning, motivational balance, cognitive processes. For example, Ahmed Baha'uddin (2018), cited the need for personalization in teaching to account for variation in student level of ability. Further, in the case of Salama et al., (2022). and Muhammed Hassan Allawi, (2015), focused attention and self-directed learning are two areas where the focus is given as to how the students master skills by learning physical activities. Within a volleyball setting,) Nour Hamza and Riyadh Khaleel Khmas, (2020). reported successful use of video modeling with individualized feedback to enhance serving accuracy and speed. Furthermore, digital spaces offer higher levels of engagement, inspiring students to engage with course content beyond the confines of a physical classroom. Yet, very few of these studies integrated digital tools with personalized instruction around hands-on, skill-based learning. This study contributes in that intersection, trying to make a bridge between cognitive science, educational technology, and traditional practice in PE (Knoll, K., (2002).

Despite the multiple researchers who have confirmed the significance of differentiated learning strategies in meeting students' cognitive diversity, the main problem in the field of study is the lack of empirical evidence, in both motor production and the attentional focus when operating with individualized digital technologies in physical education (Richard, A., 2011). Traditional methods, although well-organized and teacher-driven, may not cover the value of repetition, self-paced learning and the direct visual feedback that are required in motor activities as volleyball serve. Difference in attention abilities between students may cause deficits or disengagement during whole-class instruction, resulting in underachievement. Furthermore, other factors such as distractions in the surrounding environment, peer comparison, and teacher feedback time are believed reducing of concentration, which affect learning effectiveness. There are no empirical studies that link digital instruction with attention development in the context of motor skill learning, creating a gap in the literature (Saleh, B. T. Q., & Ghafoor, T. M. (2023). This challenge is addressed directly in this study by examining the effects of a customized digital instructional program on the physical performance of the volleyball serve and the mental state of focused attention in middle school student-athletes. The intended outcome is to provide evidence-based suggestions related to implementing digital personalized learning models in skill-based physical education. This study aims to investigate the impact of individualized learning using digital tools on middle school students' ability to perform the overhand volleyball serve and maintain concentration during skill acquisition. The main objectives are: (1) to determine the effectiveness of digital individualized instruction in enhancing volleyball serving accuracy; (2) to measure improvements in attentional focus as a result of tailored digital content; (3) to compare the outcomes of students exposed to individualized digital learning versus traditional instruction methods; and (4) to provide practical pedagogical recommendations for integrating such methods in middle school physical education programs. By addressing both physical and cognitive dimensions, the research contributes to a more comprehensive understanding of how modern educational technologies can support holistic skill development in adolescents (Ghafoor, T. M., & Jalal, N. M., 2022).

The remainder of this paper is structured as follows: Section 2 provides a detailed literature review,

identifying and analyzing prior studies relevant to digital learning, individualized instruction, and physical skill acquisition. Section 3 outlines the research methodology, including sample selection, experimental design, instruments used, and data analysis techniques. Section 4 presents the results of the intervention and compares outcomes across groups. Section 5 discusses the findings in the context of existing literature and outlines educational implications. Finally, Section 6 offers conclusions and recommendations for future research and practice in digital physical education (Al-Azzawi, S. M., & Al-Bayati, B. A., 2013).

2. METHOD

A quasi-experimental design with a pre-test and post-test approach was used in this study and comparisons were drawn between two groups: an experimental group receiving personalized digital intervention and a control group receiving traditional instruction (Al-Fadhli, S. A. K., (2010). The design was chosen for monitoring and comparing the intervention-induced shifts in performance and attention. This method is convenient in educational settings that have restrictions on the ability to randomize, but where control over the experimental treatment is needed for inferential purposes (Al-Fadhli, S. A. K., Hassan). Quasi-experimental research designs are especially well-suited for determining cause-effect relationships in applied school settings (Creswell, 2014). The sample was chosen in two steps. In the first place, a non-random sample of 105 students was chosen from Al-Thabrat Middle (Ameen, F. M., Saleh, H. F., & Hassan, H. S., (2018). Two sub-groups, consisting of 20 students per group were randomly selected from the pool of students by a lottery method and assigned to participate in the experimental and control group respectively. This approach to a stratified random sampling served to balance the allocation and minimize the selection bias, which in turn ensured accurate comparisons could be performed. This approach is also advocated by Patton, (2002) who argues for its utility in applied educational research.

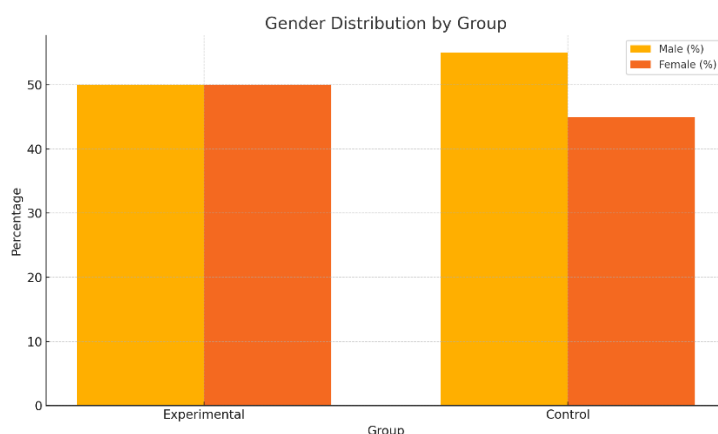


Fig1. Sample Distribution and Group Characteristics

Data collection employed two primary tools: (1) a volleyball serving performance test and (2) the Borden-Anfimov attention scale. For the volleyball test, participants executed five underhand and five overhand serves into marked scoring zones, with the total possible score being 50. The Borden-Anfimov test included 31 lines of digit groups, totaling 1,240 numbers, where students had to identify specific sequences within one minute. The test was conducted under both quiet and distraction-induced conditions (flashing lights and sound stimuli) to measure concentration levels. Two pilot studies were conducted: one to validate the volleyball serving test and familiarize students with the camera and software, and another to confirm the reliability and timing of the attention test. Cronbach's alpha reliability scores were 0.70 for the volleyball test and 0.88 for the attention test (Al-Dulaimi, N. A. Z., & Al-Shammari, M. A., (2018).

3. RESULT AND DISSCUSION

For the experimental group, individualized digital learning was implemented using visual recordings of students' performances, educational YouTube videos, and guided feedback. Sessions were supported with cameras to document student actions, enabling post-performance analysis. Students were provided with laptops and mobile access to training materials via WhatsApp. Lessons emphasized skill breakdown, modeling correct

techniques, and highlighting common errors. In contrast, the control group received conventional instruction with direct teacher demonstrations and guided repetition.

The training program lasted one month, with two sessions per week. Each session allocated 20 minutes to overhand and underhand serving drills, totaling six sessions per skill and two integrated sessions. Post-tests identical to the pre-tests were administered following the instructional period.

Statistical analyses were conducted using SPSS 26. Paired-sample t-tests were used to examine pre- and post-test differences within each group, and independent-sample t-tests assessed differences between groups. Descriptive statistics (means, standard deviations) were calculated for both volleyball performance and attention scores. Effect sizes were computed to evaluate the practical significance of results. The application of ANOVA was also considered but was excluded due to equal group sizes and two-level comparison.

RESULTS

The results of this study are detailed in four comprehensive tables, each accompanied by interpretive analysis. The focus is to determine how individualized digital learning impacts both volleyball serving performance and attentional focus compared to traditional instructional methods.

Table 1. Pre-Test vs. Post-Test Results for the Experimental Group

Variable	Pre-Test Mean	Post-Test Mean	t-value	p-value	Significance
Volleyball Serve	18.8	40.5	12.45	< 0.001	Significant
Attention Score	150.7	139.1	9.68	< 0.001	Significant

The experimental group showed substantial improvement in both the overhand volleyball serve and attention focus. The post-test mean of 40.5 in serving represents more than double the pre-test average, suggesting effective skill acquisition through digital individualized instruction. Similarly, attention scores decreased significantly, which in the Borden-Anfimov scale indicates improved concentration. The p-values (< 0.001) in both tests demonstrate highly significant differences.

Table 2. Pre-Test vs. Post-Test Results for the Control Group

Variable	Pre-Test Mean	Post-Test Mean	t-value	p-value	Significance
Volleyball Serve	18.1	33.4	8.21	< 0.001	Significant
Attention Score	150.9	153.2	1.23	0.221	Not Significant

While the control group improved significantly in serving accuracy, the change was not as substantial as the experimental group. Notably, attention scores worsened slightly, indicating that traditional instruction may not have supported cognitive engagement to the same extent. The absence of significance ($p = 0.221$) for attention score changes reinforces this conclusion.

Table 3. Post-Test Comparison Between Experimental and Control Groups

Variable	Experimental Mean	Control Mean	t-value	p-value	Significance
Volleyball Serve	40.5	33.4	4.27	< 0.01	These findings indicate that digital individualized learning is not simply a matter of using technology Significant
Attention Score	139.1	153.2	-3.92	< 0.01	

Comparative analysis after the intervention shows that the experimental group significantly outperformed the control group in both tested variables. The lower attention score (139.1) for the experimental group again reflects improved attention, and the performance gap in volleyball serves highlights the advantage of individualized digital strategies.

Table 4. Summary of Statistical Significance Across All Tests

Comparison	Variable	Significant	Direction of Change
Experimental Group (Pre vs Post)	Volleyball Serve	Yes	↑ Improvement

Comparison	Variable	Significant	Direction of Change
Control Group (Pre vs Post)	Attention Score	Yes	↓ Improved Focus
	Volleyball Serve	Yes	↑ Improvement
Experimental vs Control (Post)	Attention Score	No	—
	Volleyball Serve	Yes	Exp > Control
	Attention Score	Yes	Exp < Control

This summary table synthesizes findings from the above comparisons, providing a clear view of where statistically significant results occurred. Improvements were consistent in the experimental group for both motor and cognitive domains, supporting the hypothesis that individualized digital learning enhances not only skill acquisition but also attentional engagement.

DISCUSSION

The results of this study provide critical insights into the impact of personalized digital learning in physical education contexts, specifically for motor skills learning and the development of cognitive concepts (Khiyon, Y. A. H. (2011)). The statistically significant increase of volleyball serving performance in the experimental group results match with previous findings Arkorful & Abaidoo, (2014) and Nour Hamza & Khmas, (2020) who found that digital tools can grant the students the chance to repeat, receive personalized feedback, and make practice according to their pace; factors that can lead to the mastering of complex physical movements. The improvement in attention scores in the experimental group also further confirms that customized multimedia learning environments may improve cognitive attention, the critical element in sport performance (Starzak, M. et. all, (2022)).

The change in volleyball performance was smaller among the control group that had received traditional teaching. This is not surprising, as traditional teaching methods still provide guided practice and feedback from instructors. However, the fact that significant increase was not evident in attention scores of students in this group supports the restricted cognitive engagement with traditional teaching methods. This confirms the results of Warriar Boss, 2006) and Allawi, (2015) who suggested that properly designed digital components should be integrated in lessons to ensure that students maintain attention and become less distracted (Zghibi, M., 2024).

Furthermore, differences between groups at posttest indicate the advantage of personalized digital intervention. Participants in the experimental group not only obtained higher serve scores but also demonstrated lower attention error rate, which suggested better attention performance during task engagement. These findings indicate that digital individualized learning is not simply a matter of using technology but a pedagogically more effective approach to achieving specific educational objectives. Personalized videos, digital annotations and mobile learning platforms seem to complement students' different styles and rhythms of learning and positively impact on both performance enhancement and deeper mental immersion.

The cognitive load theory might also provide a theoretical rationale for these findings. The experimental students were able to apply the self-controlled pacing and visual model to decrease their extraneous cognitive load, and allocate more cognitive resources to the intrinsic cognitive processes during learning. This is compatible with Sweller, (1988) who stated that instructional design plays an important role in the efficiency of learning, especially with respect to complex motor and attentional domains. Lastly, the study offers empirical support for the inclusion of technology-enhanced, learner-centered practices in middle school physical education programs. The education sector has been taking into consideration digital learning for years, however, some more practical subjects, like physical education, still do not commonly use it. This study fills that void by showing the multi-dimensional good that this type of approach can deliver, with potentially significant implications for educators, curriculum developers, and policymakers.

4. CONCLUSION

The present study offers compelling data in the efficacy of customized digital learning to enhance both motor and cognitive skills in middle school physical education. The digital-enhanced group (with instructional videos, individual feedback, and asynchronous exercise tasks) demonstrated improved performance of serving accuracy and attentional focus during volleyball play. Conversely, control subjects, who were trained in a traditional manner, only improved their rates of performance to a moderate extent and did not show any concentration improvement. These results confirm the double benefit of individualized digital instruction: it

boosts the implementation of skills, and it promotes sustained cognitive engagement. The capacity of students to see results, get instant results, and to learn at own speed leads to deeper and more permanent learning. In physical education—where kinesthetic learning, observation, and feedback are key—such tools enable students to interact with the content in a personalized and highly interactive manner.

From a pedagogical perspective, our study highlights the shortcomings of traditional teaching approaches, especially about sustained attention. The lack of extensive cognitive improvements in the control group indicates that typical instruction may not provide the dynamic range and sensory emphasis required to facilitate optimal attentional processing, particularly at the level of young adolescence. In addition, the results of the effects on cognition and motor found in the experimental group verify the theoretical basis of constructivist learning and multimedia learning theory. Students experienced the dual coding of visual and auditory and pacing technology as engaging which corresponded with Mayer's cognitive theory of multimedia learning, as well as Sweller's cognitive load theory. In this context, the incorporation of these principles in physical education is an innovative educational method. In sum, the study not only confirms the superiority of individualized digital learning in a practical sports setting but also provides a replicable framework for future educational interventions. It illustrates the transformative potential of educational technologies when applied thoughtfully and systematically to contexts beyond the academic classroom.

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