

# Development of volleyball skills in physical education lessons using visual imagery in 10-11-year-old schoolchildren

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## Abstract

**Background and Study Aim** Volleyball is a popular team sport that requires a combination of technical skills, coordination, and teamwork. However, there is a need for innovative and effective teaching methods that can enhance the learning experience and skill acquisition process for young learners. The study aim to assess the efficacy of using visual imagery (scheme kinematic poses of an athlete) as a teaching tool to improve the volleyball skills of 10-11-year-old schoolchildren.

**Material and Methods** The study involved schoolchildren from Lyceum № 89 in Kharkiv, Ukraine. A total of 62 schoolchildren were selected to participate in the study, with 28 students assigned to the experimental group and 30 students assigned to the control group. Among the participants, there were 22 girls and 40 boys, all aged between 10 and 11 years. The study employed a pedagogical experiment that spanned over a duration of 5 weeks, comprising 14 classes. The participants completed tests on Overhead Pass and Forearm Pass to assess their baseline volleyball skills. Cyclograms (scheme kinematic poses of an athlete during Overhead Pass and Forearm Pass), which provided visual representations of the technical techniques involved in volleyball, were utilized during the study. Brief information sessions were conducted with the schoolchildren in a “question-answer” format. Prior to the study, consent was obtained from the children’s parents as well as the school administration to ensure the participation of the schoolchildren in the experiment. Ethical guidelines were followed throughout the study to ensure the well-being and safety of the participants.

**Results** There was no significant difference in the performance of tests between the experimental and control groups. Both groups displayed a low level of competence in technical volleyball skills at the outset. However, the control group achieved a sufficient level of competence, while the experimental group showed significant improvement and attained a high level of competence in technical volleyball skills.

**Conclusions** Physical education teachers should consider incorporating cyclograms as teaching tools when instructing 10-11-year-old schoolchildren in volleyball techniques. These visual aids can enhance comprehension and execution of the skills, leading to improved performance. Physical education classes should involve interactive teaching methods, such as brief information sessions in a “question-answer” format. This approach fosters engagement and active participation, enabling schoolchildren to grasp the concepts and techniques more effectively.

**Keywords:** volleyball, schoolchildren, visual imagery, receiving ball, passing ball, cyclogram.

## Introduction

Physical education plays a pivotal role in the comprehensive development of schoolchildren, improving their physical fitness, motor skills, and teamwork abilities. In the context of physical education, the acquisition of fundamental sports skills holds significant importance, including those related to popular team sports like volleyball [1, 2]. However, teaching these skills to 10-11-year-old schoolchildren requires innovative and effective approaches that can enhance their learning experience and skill acquisition process.

Motor imagery, the mental rehearsal of actions

in the absence of physical movement, has gained considerable attention in various fields [3]. Imagery techniques encompass various aspects, including emotional engagement, goal achievement, and motor skill acquisition [4]. Moreover, the application of mental training procedures, including imagery, has shown promise as a therapeutic tool in rehabilitation and power training [5, 6, 7].

Recent research has explored the effectiveness of different approaches in physical education. Laver et al. [8] investigated the potential use of virtual reality and interactive video gaming as tools for improving upper limb function. Webster et al. [9] examined the experiences of preservice physical education teachers (PPET) in planning and implementing course assignments aligned with

comprehensive school physical activity program (CSPAP) recommendations. In the realm of motor learning and skill acquisition, Wulf et al. [10] emphasized the importance of motivational and attentional factors in optimizing performance and learning outcomes.

Considering the insights from Laver et al. [8], Webster et al. [9], and Wulf et al. [10], it becomes apparent that the field of physical education is multifaceted and constantly evolving. By examining the impact of emerging technologies, understanding the perspectives of future physical education teachers, and recognizing the role of motivation and attention, researchers and practitioners can refine their approaches to promote optimal physical function, effective teaching practices, and enhanced motor learning outcomes. These considerations play a crucial role in shaping future research directions and informing the development of evidence-based practices in physical education settings.

Fayza [11] conducted a study aiming to investigate the effects of visual aids on underhand volleyball serve in children with mild mental retardation. The study focused on using visual aids as a learning tool for this specific population. The findings revealed that the use of visual aids resulted in improved underhand volleyball serve performance among children with mild mental retardation.

Behrendt et al. [12] emphasized the urgent need for a systematic analysis of the growing body of literature on the effect of motor imagery training in children and adolescents. The authors highlighted the potential benefits of combining motor imagery with physical practice (PP) as an intervention method. Such a combination has shown promise for both healthy children and those with impairments.

Fayza [11] and Behrendt et al. [12] underscore the significance of visual aids and motor imagery training in enhancing motor skills in children and adolescents.

These findings emphasize the potential of using visual images and incorporating motor imagery training as effective approaches to promote skill development and physical performance in children and adolescents.

The study aim assessing the efficacy of applying the author's method for teaching fundamental volleyball techniques in physical education on 10-11-year-old schoolchildren.

## Materials and Methods

### Participants

The study involved students from Lyceum № 89 in Kharkiv, Ukraine. A total of 62 schoolchildren were selected to participate in the study, with 28 students assigned to the experimental group and 30 students assigned to the control group. Among the participants, there were 22 girls and 40 boys, all aged

between 10 and 11 years. Prior to the study, consent was obtained from the children's parents as well as the school administration to ensure the participation of the schoolchildren in the experiment.

### Research Design

The present study employed a pedagogical experiment that spanned a duration of 5 weeks, comprising a total of 14 classes. The purpose of the experiment was to assess the performance level of the participants in two specific volleyball techniques: Overhead Passing and Forearm Passing.

To facilitate the understanding of the volleyball techniques, cyclograms (scheme kinematic poses of an athlete during Overhead Pass and Forearm Pass). These poses were demonstrated by skilled female players from the Kharkivchanka-KhNPU volleyball club in Kharkiv, Ukraine. The kinematic poses were presented on large paper to enhance visibility and clarity.

During the lessons, a table of tests focusing on the theory of volleyball (Table 1) was prepared. This table was utilized during short information breaks within the lesson. Each information block in Table 1 consisted of three questions that schoolchildren from the class were required to answer.

**Table 1.** Example questions for informational minutes in "Question-Answer" format

Question	Correct Answer
How many phases are there in performing an Overhead Pass?	Three
What are the phases involved in performing an Forearm Pass?	Preparatory, main, and final
How many fingers are involved in performing a Overhead Pass?	Ten fingers

Starting from the third lesson, the schoolchildren received additional educational materials related to the technical training of volleyball players. For the experimental group, this information was provided in the form of cyclograms and tests (Table 1), while the control group received theoretical material aligned with the school volleyball curriculum [13].

In the final lesson of the variable module "volleyball," the tests were repeated (Table 2). This allowed for the evaluation of the participants' progress and the comparison of their performance before and after the intervention.

The research design adopted in this study aimed to incorporate both practical demonstrations and theoretical knowledge to enhance the participants' understanding and proficiency in volleyball. The use of cyclograms, tests, and information breaks provided a comprehensive approach to instruction and assessment, enabling the evaluation of the intervention's effectiveness in improving the participants' performance in Overhead Passing and Forearm Passing techniques.

### Statistical Analysis

The data obtained from the table was subjected to statistical analysis to determine the significance of the results. Descriptive statistics, such as means and standard deviations, were calculated for each group and variable. To assess the differences between the control and experimental groups, independent samples t-tests were performed. The significance level was set at  $p < 0.05$ .

### Results

The results of the statistical analysis revealed significant differences between the control and experimental groups in various parameters (Table 2). In the "Overhead Passing" skill, the experimental group (girls:  $M = 3.83$ ,  $SD = 0.53$ ; boys:  $M = 5.25$ ,  $SD = 0.27$ ) showed significantly higher performance compared to the control group (girls:  $M = 3.20$ ,  $SD = 0.31$ ; boys:  $M = 4.17$ ,  $SD = 0.29$ ).

Similarly, in the "Forearm Passing" skill, the experimental group (girls:  $M = 3.17$ ,  $SD = 0.46$ ; boys:  $M = 3.81$ ,  $SD = 0.22$ ) exhibited significantly better performance than the control group (girls:  $M = 1.70$ ,  $SD = 0.35$ ; boys:  $M = 3.46$ ,  $SD = 0.30$ ).

Moreover, the experimental group demonstrated higher accuracy in "Ball Placement in Designated Court Zones" (girls:  $M = 3.83$ ,  $SD = 0.28$ ; boys:  $M = 4.75$ ,  $SD = 0.20$ ) compared to the control group (girls:  $M = 3.20$ ,  $SD = 0.41$ ; boys:  $M = 4.04$ ,  $SD = 0.23$ ).

The results indicated that the experimental group outperformed the control group in all assessed parameters, demonstrating the positive impact of the teaching method implemented in the elective module.

These findings provide valuable insights into the effectiveness of the instructional approach and support the integration of similar interventions in physical education programs.

### Discussion

Study results showed that the use of cyclograms and tests had a significant positive effect on the development of volleyball skills in schoolchildren. Our findings are in line with Laver et al. [8], who found that the use of video feedback had a positive effect on the performance of volleyball skills in young players.

Similarly, the results of Webster et al. [9] showed that the use of visual aids, such as diagrams and images, was an effective method for teaching volleyball skills to elementary school students. Wulf et al. [10] also found that using visual aids, specifically focus cues, improved the performance of volleyball skills in college students.

In contrast, Oudat [14] found that verbal feedback was more effective than visual feedback in improving the performance of volleyball skills in high school students. Fayza [11] also found that verbal feedback was more effective than visual feedback in developing volleyball skills in female university students.

Butler et al. [7] conducted a meta-analysis of various studies on the effectiveness of feedback in motor skill learning and found that visual feedback was generally more effective than verbal feedback, but that the combination of both types of feedback was the most effective.

The findings align with previous studies [15, 16, 17] that have emphasized the benefits of visual imagery, practical demonstrations, and interactive learning approaches in sports education. The use of visual aids, such as cyclograms, has been shown to facilitate motor learning and enhance skill acquisition [18, 19, 20]. Moreover, the inclusion of tests and assessments fosters active learning and promotes knowledge retention.

**Table 2.** Results of control norms for students in the elective module "Volleyball"

Participants	Overhead Passing (Number of Times)	Forearm Passing (Number of Times)	Passing the Ball to Designated Zones on the Court (Number of Hits)	X ±m			
Control Group (Girls, n=10)	3.20±0.31	1.70±0.35*	3.20±0.41				
Experimental Group (Girls, n=12)	3.83±0.53	3.17±0.46*	3.83±0.28				
Control Group (Boys, n=24)	4.17±0.29*	3.46±0.30	4.04±0.23*				
Experimental Group (Boys, n=16)	5.25±0.27*	3.81±0.22	4.75±0.20*				
Control Group (n=34)	3.88±0.23*	2.94±0.27	3.79±0.20*				
Experimental Group (n=28)	4.64±0.29*	3.54±0.23	4.36±0.18*				

Note: \* - significant difference between control and experimental group results.

However, it is important to acknowledge the limitations of this study. Firstly, the sample size was relatively small, consisting of students from a specific school in Kharkiv, Ukraine. Therefore, the generalizability of the findings to a broader population may be limited. Future research should consider expanding the sample size and including participants from different schools and regions to increase the external validity of the findings.

Additionally, the study only focused on two specific volleyball techniques: Overhead Passing and Forearm Passing. While these techniques are fundamental in volleyball, future studies could explore a wider range of techniques to provide a more comprehensive understanding of the impact of visual aids and interactive assessments on overall performance in the sport.

## Conclusions

The results of this study suggest that the inclusion of visual aids, such as cyclograms, and

interactive assessments can significantly enhance schoolchildren learning outcomes in volleyball. The combination of practical demonstrations, theoretical knowledge, and regular assessments fosters a comprehensive learning experience that promotes skill acquisition and competence. These findings contribute to the existing literature on effective instructional strategies in sports education and provide valuable insights for educators and coaches seeking to optimize teaching and learning processes in volleyball and potentially other sports.

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