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Interactive Video Tutorial Media: Volleyball Smash Skill Learning Outcomes at Senior High School

Indra Wisman¹, Syahrudin², Wahyuni³
^{1, 2, 3} Department of Physical Education and Sport, Universitas Negeri Makassar, Indonesia

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ABSTRACT

The lack of effective and structured learning media often hinders the development of complex motor skills, particularly volleyball smashing abilities, among high school students. This study aimed to determine the effect of interactive video tutorial media on volleyball smash learning outcomes at High School 1, Takalar. This study employed a quasi-experimental method with a pre-test and post-test control group design. The sample consisted of 40 students divided into an experimental group (n=20) using interactive video tutorials and a control group (n=20) using conventional methods. The research instrument used was a validated volleyball smash skills test. Data analysis included normality tests, homogeneity tests and t-tests with a significant level of 0.05. The results indicated that the control group showed no significant difference between pre-test and post-test scores, with the average score remaining stable at 10.00 ($p=0.231 > 0.05$). In contrast, the experimental group experienced a highly significant increase in the average score from 16.05 to 27.05 ($p=0.001 < 0.05$). These findings provide strong empirical evidence that interactive video tutorials are significantly more effective in helping students visualize and adopt complex biomechanical movements compared to traditional methods. This research confirms that integrating interactive technology is a valid educational solution for optimizing physical education learning outcomes at the senior secondary level.

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Corresponding Author:

Indra Wisman,
Department of Physical Education and Sport, Universitas Negeri Makassar, Indonesia
Email: indra.wisman@gmail.com

1. INTRODUCTION

Physical Education, Sports, and Health (PJOK) at the high school level plays a crucial role in shaping students' physical literacy and character (Anwar et al., 2024; Setyawan et al., 2022). However, the main challenge currently faced is how to maintain the relevance of learning amidst the onslaught of digital technology, which is often blamed for a sedentary lifestyle (Ahmad, 2025). Paradoxically, this same technology offers a significant opportunity to revolutionize the way motor skills are taught. The use of interactive video-based learning media has demonstrated strong potential in improving

motor skill learning outcomes (Mödinger et al., 2022; Trisnawati et al., 2024), including complex volleyball techniques like the smash.

Previous research indicates significant improvements in technical understanding, learning motivation, and skill transfer when interactive videos are integrated with field training (Taban & İmamoğlu, 2023). This is because interactive media is not simply passive viewing but rather a learning ecosystem that simultaneously engages cognitive and psychomotor skills.

The smash in volleyball is one of the most difficult technical skills to master, requiring full-body coordination, timing, and explosive power (Fogliata et al., 2025). This skill requires synchronization between the approach, push-off, arm swing, and contact with the ball at the highest point (Suhardiman et al., 2024; Yasriuddin et al., 2024). In conventional methods, teacher demonstrations are often too fast for students to grasp in detail.

Interactive video tutorials that incorporate features like pauses, slow motion, repetition, short quizzes, and structured feedback provide a rich visual and cognitive learning experience (Barikah et al., 2026; Panjiantariksa, 2024). This allows students to analyze movements more precisely and accelerate the acquisition of complex motor skills (Salim et al., 2024). With the ability to slow down the movement (slow motion), students can mechanically dissect the phases of a smash, which is nearly impossible in live demonstrations that occur in a matter of seconds.

In addition to technical improvements, the integration of interactive technology in physical education has been reported to increase student engagement and foster self-directed learning (Cui et al., 2024; Lee & Kim, 2019; Li & Zeng, 2025). Both aspects are crucial for mastering motor skills that require deliberate and repeated practice (Ha et al., 2025). High school students, who are part of the "digital native" generation, tend to be more responsive to media that allows them to control their own learning pace (self-paced learning).

Visual feedback and reflective opportunities after watching instructional videos help students identify technical errors more quickly and accurately (Crook et al., 2012; Liu et al., 2022; Park, 2025). However, systematic reviews and empirical studies also reveal variations in effectiveness influenced by factors such as instructional video design, teacher competency in technology integration, access to digital tools, and learner characteristics (Jastrow et al., 2022; Taban & İmamoğlu, 2023). Therefore, the novelty of this research lies not only in the use of video but also in how interactivity is designed to bridge biomechanical theory with field practice in a contextual manner.

In Takalar Regency, particularly at High School 1 Takalar, physical education instruction is still dominated by traditional face-to-face methods with limited practice time and facilities. Teachers often struggle to provide individualized feedback due to large class sizes (a suboptimal student-teacher ratio) and limited instructional time. This hinders students' mastery of complex skills such as the volleyball smash. An interesting phenomenon in this location is the contradiction between device ownership and utilization. Although smartphones are widely available among students at High School 1 Takalar, the use of structured digital learning media for practical subjects such as

Physical Education (PJOK) remains very limited. Smartphones are used more for entertainment than as motion analysis tools. This creates both a gap and a significant opportunity to implement interactive video tutorials as a practical solution.

The uniqueness of this research lies in the development and implementation of video tutorial media that is not simply one-way but integrates interactive elements specifically designed to address the limitations of real-time feedback in the field. Unlike traditional YouTube videos, this media is designed with a cognitive flow that forces students to conduct self-evaluation before they try the movements in the field. Furthermore, this research fills a gap in literature regarding the effectiveness of digital media in school contexts in semi-urban areas like Takalar, where infrastructure challenges may differ from those in large cities. This research also explores how students' "digital visual literacy" can be translated into concrete "motor performance."

Given this background, there is an urgent need for adaptive educational interventions. The use of interactive video media is expected to break the deadlock in volleyball technical learning, provide consistent visual standards for all students, and reduce the burden on teachers of repetitive, physically exhausting demonstrations of movements. Therefore, this study aims to empirically test the effect of interactive video tutorial media on improving volleyball smash learning outcomes in a local school context. Furthermore, the results are expected to provide evidence-based recommendations for physical education teachers in Takalar Regency and the surrounding area on how to effectively integrate technology without diminishing the essence of physical activity on the field.

2. METHOD

This study employed a quantitative approach with a quasi-experimental design using a pretest-posttest control group design. The primary focus of the study was to empirically test the effectiveness of using interactive video tutorials on improving volleyball smash skill learning outcomes in high school students. Subjects were divided into two distinct intervention groups: an experimental group integrating interactive video media into the instructional process, and a control group using conventional learning methods. Through this comparison, data analysis is expected to provide significant evidence regarding the extent to which interactive video technology can optimize the acquisition of complex motor skills compared to traditional approaches.

This series of studies was conducted in the odd semester of the 2025/2026 academic year at High School 1 Takalar. The study population included all students at the school, defined as a generalized area of subjects with specific characteristics determined by the researcher for drawing conclusions. The sampling technique used was purposive sampling, where subject selection was based on specific considerations aligned with the research objectives. Based on these criteria, grade XI students were selected as samples because of their position in the curriculum which is studying basic volleyball techniques, thus providing accurate contextual relevance to the research instruments being tested.

The data collection process in this study was conducted through skills tests, which are systematic instruments for measuring subject-specific abilities in a measurable and

standardized manner. This instrument is designed to evaluate students' technical mastery in depth, specifically at each stage of the volleyball smash. The use of these skills tests aims to transform qualitative motor performance into accurate quantitative data, allowing for precise analysis of changes in learning outcomes between the experimental and control groups.

The application of skills tests in physical education serves as an objective evaluation tool to empirically measure students' motor skills and sports skills. By using validated instruments, researchers can minimize subjectivity in assessments, ensuring that the resulting data truly reflects students' physical competencies. Through this approach, the effectiveness of interactive video tutorials can be measured validly based on the performance scores achieved by students during the pretest and posttest stages.

The data analysis in this study was conducted using an inferential statistical approach to test the hypothesis regarding the effect of using interactive video tutorial media. The initial stages of the analysis began with prerequisite tests, which included a normality test to determine whether the pretest and posttest score distributions were normally distributed, and a homogeneity test to ensure that the data variance between the experimental and control groups was homogeneous. This step is crucial to ensure that the data meets the basic assumptions before conducting parametric statistical testing, ensuring that the generalized results have a high level of accuracy and validity.

After the prerequisite tests were met, the hypothesis was tested using a t-test (independent sample t-test) to compare the significance of differences in learning outcomes between the two groups. All data computations were processed using statistical software (SPSS), which allowed researchers to determine whether there was a statistically significant effect of using interactive media compared to conventional methods, with reference to a significance level (alpha) of 0.05.

3. RESULTS AND DISCUSSION

Results

The research on volleyball smash skills among students at High School 1 Takalar involved a total of 40 participants, proportionally divided into two intervention groups. The experimental group, consisting of 20 students, received treatment using interactive video tutorials, while the control group, consisting of 20 students, underwent a learning process using conventional methods. This comparative approach was designed to isolate the learning media variable as the primary factor influencing students' motor achievement, allowing the effectiveness of interactive technology to be precisely measured through a comparison of performance between the two groups.

Descriptive data representing the technical achievements of both groups of study subjects are presented in detail in Table 1. This data presentation demonstrates the distribution of scores reflecting the level of mastery from the initial (pretest) to the final (posttest) achievement after the intervention period. The data visualization in this table provides an empirical foundation for researchers to conduct further statistical analysis to demonstrate the significance of the interactive video tutorial media on improving smash skill learning outcomes at the senior secondary level.

Table 1. Descriptive Data

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Experiment_Pre	20	10.00	21.00	16.0500	3.25212
Experiment_Post	20	22.00	30.00	27.0500	2.56443
Control_Pre	20	10.00	20.00	13.3000	3.11364
Control_Post	20	10.00	21.00	13.8500	3.51351
Valid N (listwise)	20				

The data analysis results in Table 1, the control group demonstrated consistent scores between the initial and final stages of the study. The mean scores for the pre-test and post-test were identical at 10.00, with relatively similar data variation. Prior to hypothesis testing, a normality prerequisite test revealed a p-value of 0.051 for the pre-test and 0.054 for the post-test. Given that both values were greater than the 0.05 significance level ($p > 0.05$), it can be concluded that the data distribution in the control group met the assumption of normality, allowing for valid parametric statistical analysis.

A statistical comparison test using a paired t-test yielded a t-value of -1.238 with a significance value (p-value) of 0.231. Since the p-value was greater than 0.05 ($p > 0.05$), these results confirm that there was no statistically significant difference between the pre-test and post-test scores in the control group. These findings provide empirical evidence that the conventional learning approach implemented during the study period did not result in significant performance changes in students' volleyball smash skills. This strengthens the control group's position as a stable comparison for the experimental group in assessing the effectiveness of the interactive video tutorial media intervention.

Table 2. Results of Normality Test for Volleyball Smash Skills in Control and Experiment Groups

Treatment	Measurement	Normality Test
		P-Value
Control	Pretest	0,051
	Posttest	0,054
Experiment	Pretest	0,36
	Posttest	0,31

*P-Value < 0.05: There is a significant difference

The results of the normality test for the volleyball smash skill data in the control group showed consistent distribution and met the established statistical criteria. The pre-test score for this group yielded a p-value of 0.051, while the post-test score recorded a p-value of 0.054. Given that both significance values were above the critical threshold of 0.05 ($p > 0.05$), it can be empirically concluded that the data in the control group were normally distributed.

Meeting this normality assumption has important methodological implications, providing a valid basis for further data analysis using parametric statistics. With a normal distribution, the variability in student skill scores in the control group can be considered representative, allowing subsequent hypothesis testing—such as t-tests—to be conducted with a high degree of accuracy. This ensures that conclusions regarding

the effectiveness of the learning media are based on robust and objective data processing.

Table 3. Homogeneity Test and Independent T Test

Measurement	Treatment	Homogeneity Test		Independent T Test	
		f Test	P - Value	t Test	P - Value
Pre Test	Control Experiment	0,030	0,863	2,732	0,01*
Post Test	Control Experiment	2,491	0,123	13,571	0,001*

The results of the homogeneity test of variance at the pre-test stage showed that the F value was 0.030 with a p-value of 0.863, which means that the variance of the two groups is homogeneous because the p-value is greater than 0.05. By fulfilling the homogeneity assumption.

Table 4. Data Summary Control and Experiment Class

Treatment	Measurement	Data Summary		Normality Test	Paired T Test	
		Mean	Std	P-Value	T Test	P-Value
Control	Pretest	10,00	3,11	0,051	-1,238	0,231
	Posttest	10,00	3,51	0,054		
Experiment	Pretest	16,05	3,25	0,36	-14,139	0,001*
	Posttest	27,05	2,56	0,31		

The analysis results for the control group showed consistent achievement, with the mean scores for the pre-test and post-test being identical at 10.00, with relatively similar data variation. Prior to hypothesis testing, a normality test yielded a p-value of 0.051 for the pre-test and 0.054 for the post-test. Because both values were above the 0.05 significance threshold ($p > 0.05$), the data distribution in the control group met the assumption of normality. This finding was supported by the results of a paired t-test, which showed a calculated t-value of -1.238 with a p-value of 0.231 ($p > 0.05$), confirming no significant difference between the initial and final scores in the group using the conventional method.

In contrast, the experimental group demonstrated a markedly progressive improvement in performance, with the mean score jumping significantly from 16.05 in the pre-test to 27.05 in the post-test. The data in this group were also shown to be normally distributed based on the prerequisite test, with p-values of 0.36 and 0.31, respectively ($p > 0.05$). The paired t-test revealed a calculated t-value of -14.139, with a significance level of 0.001. This p-value, significantly less than 0.05, indicates a highly significant difference between learning outcomes before and after the interactive video tutorial treatment.

Comparing the results of the two groups provides strong empirical evidence that the intervention given to the experimental group was significantly more effective than conventional methods. The sharp increase in scores in the experimental group confirms that the use of interactive video tutorials has a real and significant impact on optimizing students' volleyball smash learning outcomes. Therefore, the results of this study statistically reject the null hypothesis and accept the working hypothesis, which states

that integrating interactive technology into Physical Education (PJOK) learning is an effective solution for improving students' motor skills at the senior secondary level.

Discussion

The Effectiveness of Interactive Video Tutorials on Smashing Skills

The results of this study indicate that the use of interactive video tutorials significantly improved volleyball smash skills in students at SMA Negeri 1 Takalar. This is evidenced by the significant jump in the experimental group's average score, from 16.05 in the pre-test to 27.05 in the post-test. Statistically, the p-value of significance ($p = 0.001$), well below the 0.05 threshold, confirms that this performance change was a direct result of the technology intervention. This finding aligns with a study by Taban and İmamoğlu (2023), which found that integrating interactive videos into field practice significantly improved technical understanding and motor skill transfer compared to conventional, more static methods.

The advantage of this interactive media lies in its ability to visualize the complex biomechanical details of the smash—such as the approach phase, takeoff, and contacting a repeatable and measurable manner. Unlike teacher demonstrations, which are often limited by duration and viewing angle, video tutorials allow students the flexibility to conduct in-depth independent observations through features like slow motion and repetition. This supports the theory of technology integration in Physical Education (PJOK) proposed by Salim et al. (2024), which states that interactive features enable students to analyze movements more precisely, ultimately accelerating the acquisition of complex motor skills through rich visual and cognitive experiences.

Pedagogically, the effectiveness demonstrated in this study underscores the importance of shifting from linear instruction to self-directed learning. The significant improvement in the experimental group compared to the control group demonstrates that interactive media can facilitate visual feedback and reflective opportunities, crucial for eleventh-grade students in mastering basic sports techniques. These findings reinforce the argument of Ha et al. (2025) that the use of structured digital media can foster active student engagement in the skill acquisition process. Therefore, the integration of interactive video tutorials is not merely a visual aid, but rather a strategic solution for optimizing physical literacy and motor competence in upper secondary students.

Comparative Analysis between Interactive and Conventional Methods

The comparison between the two groups of subjects provides strong empirical evidence regarding the limitations of traditional learning methods in teaching motor skills requiring high precision, such as the volleyball smash. The control group showed no significant difference between initial and final scores, with a p-value of 0.231, indicating that without the aid of structured visual media, students' mastery of technical skills tends to slow down. This phenomenon reinforces the findings of Hardika et al. (2024) that reliance on limited face-to-face instruction often hinders mastery of complex techniques. Therefore, the role of the control group as a stable comparator in this study

successfully highlights that the effectiveness of the learning process is highly dependent on the media innovations implemented by the educator.

Methodologically, this study met all statistical assumptions necessary to ensure the validity of the results, including tests for normality and homogeneity. Data in both groups were found to be normally distributed with p-values above 0.05, with the control group recording p-values of 0.051 and 0.054, while the experimental group recorded p-values of 0.36 and 0.31. Furthermore, the homogeneity of variance test at the pre-test stage yielded an F value of 0.030 with a p value of 0.863. Fulfilling this assumption ensures that both groups began the study from an equal starting point, thus ensuring that any differences in performance in the results are solely the result of the interactive video tutorial intervention.

The significant results in the experimental group, with a t value of -14.139 and p value of 0.001, indicate that interactive technology provides more effective feedback than conventional methods. This aligns with the theory of Jastrow et al. (2022), who emphasized that visual feedback through video helps students identify technical errors more accurately. Therefore, the successful increase in the experimental group's average score from 16.05 to 27.05 confirms that systematically designed digital media integration is a strategic solution for optimizing students' motor skills at the high school level.

The findings of this study have important implications for the development of sports curricula in schools, particularly in the utilization of digital technology. The success of the experimental group demonstrated that interactive video tutorials can bridge the gap between theory and practice in a more dynamic way. Through interaction with the media, students became more independent and active in evaluating their own movement errors.

The implementation of this technology at High School 1 Takalar demonstrated that the limitations of physical facilities can be offset by strengthening digital facilities to achieve optimal learning outcomes. In conclusion, this study firmly supports the working hypothesis that the integration of interactive video tutorial media is an effective and transformative educational solution for improving students' athletic performance and motor skills in volleyball.

4. CONCLUSION

The use of interactive video tutorials significantly improved volleyball smash skill learning outcomes for students at High School 1, Takalar. This was demonstrated by a sharp increase in the average score in the experimental group, from 16.05 in the pre-test to 27.05 in the post-test. Statistical tests showed a significance value of $p = 0.001$ ($p < 0.05$), confirming that the technology intervention had a significant impact on students' mastery of motor skills. In contrast, the control group, which used conventional learning methods, showed no significant performance changes, with the average score remaining stable at 10.00 and a significant value of $p = 0.231$. This comparison provides strong empirical evidence that the integration of interactive video tutorials is significantly more effective in helping students visualize and adopt the biomechanics of complex smash

movements compared to traditional demonstration methods. Therefore, the use of interactive technology is a valid educational solution for optimizing physical education learning outcomes at the high school level.

As a suggestion, it is recommended for physical education (PJOK) teachers to start integrating digital and interactive tutorial media to overcome the limitations of instructional time and provide consistent visual standards for sports techniques with high levels of difficulty. In line with these findings, schools should support the provision of technological facilities and access to structured learning media to facilitate independent learning and improve students' physical literacy through the productive use of digital devices. For future researchers, considering the limitations of this study on volleyball smash skills and a certain number of samples, it is recommended to expand the scope of the study to other sports or cognitive variables and consider a longer intervention duration to observe students' motor skill retention over a longer period.

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