



The Development of Needs An Interactive Learning Model Based On Motion Analysis Videos In Table Tennis Service Learning

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ABSTRACT

The rapid development of digital technology in higher education has created opportunities for the implementation of innovative learning approaches, particularly in sports education, which requires detailed movement visualization and technical skill mastery. In table tennis learning, service technique is a fundamental skill that demands precise coordination and systematic movement understanding. However, conventional learning methods often provide limited opportunities for students to observe, analyze, and evaluate movement execution in detail. Therefore, this study aimed to analyze the need for developing an interactive learning model based on motion analysis videos in table tennis service learning at universities. This study employed a quantitative descriptive approach using a survey method. The participants consisted of 30 students enrolled in the table tennis course, selected through purposive sampling. Data were collected using a Likert-scale questionnaire comprising 30 statement items. Following expert validation and empirical testing, 25 items were declared valid and reliable, with a Cronbach's Alpha coefficient of 0.91. Data were analyzed using descriptive percentage analysis. The findings revealed that students' need for the development of a motion analysis video-based learning model was categorized as very high. The learning effectiveness indicator obtained the highest percentage (90%), followed by motion visualization (88%), learning motivation (86%), ease of learning (84%), and understanding of service techniques (82%). These results indicate that students strongly require interactive learning media that facilitate detailed, systematic, and engaging learning experiences. In conclusion, motion analysis video-based learning has substantial potential to enhance the quality of table tennis service instruction in higher education. The novelty of this study lies in emphasizing motion analysis videos as an interactive learning and evaluation medium specifically designed for table tennis service skills, providing a foundation for future digital learning model development in sports education.

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- Conception and design of the study;
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INTRODUCTION

The rapid advancement of digital technology in the era of the Industrial Revolution 4.0 and Society 5.0 has significantly transformed educational practices across



disciplines, including physical education and sports learning in higher education. Universities are increasingly expected to implement innovative learning approaches that facilitate active student engagement, improve conceptual understanding, and develop practical competencies through technology-enhanced instruction. The integration of digital learning environments has become a strategic necessity for improving educational quality and preparing students for future challenges (Munir, 2021; Bond et al., 2021). Contemporary higher education no longer emphasizes the transmission of knowledge alone but also focuses on fostering critical thinking, creativity, collaboration, and problem-solving skills through interactive learning experiences (OECD, 2021).

In sports education, the adoption of digital technologies presents unique opportunities because many learning contents involve motor skills, movement patterns, biomechanical principles, and technical executions that require visual representation. Unlike theoretical subjects, sports learning demands the observation, analysis, and correction of movement performance. Consequently, instructional approaches supported by multimedia technologies can enhance students' understanding of complex motor skills by providing detailed visualizations and immediate feedback (Mayer, 2021; Koekoek et al., 2019).

One sport that particularly requires accurate movement visualization is table tennis. Table tennis is characterized by high-speed movements, rapid decision-making, and precise technical execution. Among its fundamental skills, the service technique plays a crucial role in initiating attacks, controlling game tempo, and determining tactical advantages during competition (Malagoli Lanzoni et al., 2018). Effective service performance requires coordination between body positioning, racket angle, wrist movement, ball toss, spin generation, and timing precision. Therefore, mastering service techniques is essential for achieving optimal performance in table tennis learning programs.

Despite its importance, table tennis service instruction in many universities remains predominantly dependent on conventional teaching methods, including verbal explanations and direct demonstrations by instructors. Although these methods provide immediate examples, they often fail to present movement details comprehensively, particularly when students must observe complex technical elements occurring within fractions of a second (Hodges & Williams, 2020). As a result, many students encounter difficulties in identifying correct body mechanics, understanding movement sequences, and recognizing technical errors during practice sessions.

Furthermore, the limited use of technology-based learning media in table tennis courses contributes to reduced student engagement and learning motivation. Traditional instructional approaches often provide insufficient opportunities for repeated observation and self-reflection, which are important components in motor skill acquisition (Arsyad, 2019). Consequently, students frequently experience challenges in achieving mastery of service techniques, leading to suboptimal learning outcomes and lower confidence in practical performance.

The integration of multimedia technology into sports education has attracted considerable attention from researchers over the last decade. Multimedia learning

theory suggests that students learn more effectively when information is presented through multiple channels, including visual and auditory representations (Mayer, 2021). Video-based instruction has emerged as one of the most effective approaches for supporting motor learning because it allows learners to observe movements repeatedly, analyze technical details, and compare their performances with ideal models (Fiorella & Mayer, 2018).

Several studies have demonstrated the effectiveness of video-assisted learning in improving sports performance and technical understanding. Research conducted by Palao et al. (2020) found that video-based feedback significantly improved volleyball skill acquisition among university students. Similarly, Gómez et al. (2021) reported that digital video analysis enhanced students' understanding of biomechanical principles in sports techniques. In badminton learning, motion visualization technology has been shown to improve stroke accuracy and technical consistency among novice players (Phomsoupha & Laffaye, 2019).

Recent developments have further introduced motion analysis technologies as advanced learning tools in sports education. Motion analysis enables learners to observe movement mechanics frame-by-frame, identify errors, and receive detailed feedback regarding performance execution (Bartlett, 2021). This technology has been widely implemented in elite sports coaching, where biomechanical analysis is used to optimize athlete performance and prevent injuries (Knudson, 2022). Studies conducted in football, tennis, volleyball, and athletics have reported positive outcomes from integrating motion analysis systems into training programs (Baca & Kornfeind, 2020; Rein & Memmert, 2021).

Interactive learning models also continue to gain popularity in higher education due to their ability to promote student-centered learning. Interactive digital platforms encourage learners to engage actively with educational content, participate in self-assessment, and receive immediate feedback (Sailer et al., 2021). Within physical education contexts, interactive learning environments have been associated with increased motivation, improved engagement, and enhanced learning achievement (Casey et al., 2021).

The combination of video analysis and interactive learning models has shown promising results in various educational settings. Students who learn through interactive multimedia environments demonstrate greater retention of motor skills and stronger self-regulation abilities compared with those taught through conventional methods (Moreno & Mayer, 2020). These findings indicate that integrating motion analysis videos into sports learning may provide substantial benefits for skill acquisition and performance improvement.

Although numerous studies have examined the effectiveness of video-based learning and motion analysis technologies in sports education, several limitations remain evident. First, most previous studies have focused primarily on general instructional videos aimed at delivering technical demonstrations rather than facilitating interactive movement analysis and self-evaluation processes (Prasetyo et al., 2021; Casey et al.,

2021). Second, existing research has largely concentrated on athlete training environments, sports performance enhancement, and coaching applications rather than formal learning contexts in higher education. Consequently, limited empirical evidence exists regarding how motion analysis technologies can be integrated into university-level sports learning curricula, particularly within practical table tennis courses (Knudson, 2022). Third, studies investigating table tennis learning predominantly emphasize performance outcomes, tactical strategies, and biomechanical assessments among competitive athletes (Malagoli Lanzoni et al., 2018; Fuchs et al., 2022). Relatively few investigations have explored students' learning needs concerning technology-enhanced instructional models specifically designed for service skill development. Fourth, previous research rarely addresses students' perceptions, expectations, and requirements regarding interactive motion analysis-based learning systems. Needs analysis constitutes a critical initial phase in instructional model development because it ensures that educational innovations are aligned with learner characteristics, technological readiness, and learning objectives (Branch, 2020). Without comprehensive needs assessment, the development of educational technologies may fail to address actual learning challenges experienced by students.

Therefore, there remains a significant research gap concerning the development of an interactive learning model based on motion analysis videos specifically designed for table tennis service learning in higher education. This gap highlights the need for a systematic needs analysis that can provide empirical foundations for designing innovative instructional models capable of enhancing technical understanding and learning effectiveness.

Based on the aforementioned problems and research gaps, this study aims to analyze students' needs regarding the development of an interactive learning model based on motion analysis videos in table tennis service learning at universities. Specifically, the study seeks to identify learning difficulties experienced by students, evaluate the adequacy of existing instructional media, assess students' technological readiness, and determine their expectations toward interactive motion analysis-based learning systems.

The novelty of this research lies in its focus on conducting a comprehensive needs analysis for the development of an interactive learning model that integrates motion analysis videos specifically for table tennis service instruction in higher education. Unlike previous studies that merely utilize videos as instructional media, this research proposes the integration of motion analysis as an interactive mechanism for technical evaluation, self-reflection, and movement correction. The model is expected to facilitate detailed observation of service techniques, promote student-centered learning, and support evidence-based motor skill development.

Moreover, this study contributes theoretically by expanding the application of multimedia learning theory and motor learning principles within sports education contexts. Practically, the findings will provide a scientific basis for developing innovative learning models that align with the demands of digital transformation in higher education

and support the achievement of more effective, engaging, and meaningful sports learning experiences.

The digital transformation of higher education necessitates innovative instructional approaches capable of enhancing learning effectiveness and supporting motor skill acquisition. In table tennis education, service techniques require detailed visualization and systematic feedback, which are often inadequately addressed through conventional teaching methods. Although previous studies have demonstrated the benefits of video-based learning and motion analysis technologies, research focusing on their integration into interactive learning models for university-level table tennis instruction remains limited. Therefore, conducting a needs analysis is essential to identify students' learning requirements and establish a foundation for developing an interactive motion analysis video-based learning model. The findings of this study are expected to contribute to the advancement of technology-enhanced sports education and improve the quality of table tennis learning in higher education institutions.

METHODS

This study employed a quantitative descriptive research design using a survey approach to identify students' needs regarding the development of an interactive learning model based on motion analysis videos in table tennis service learning at universities. Quantitative descriptive research is appropriate for systematically describing existing phenomena through numerical data and objective measurements, enabling researchers to obtain comprehensive information about respondents' perceptions, experiences, and expectations (Sugiyono, 2022). In educational technology and instructional design research, needs analysis is recognized as an essential preliminary stage that provides empirical evidence for the development of effective learning models and media (Branch, 2020; Alessi & Trollip, 2021).

The study was conducted at the Department of Physical Education, Health, and Recreation (JPOK), Faculty of Teacher Training and Education (FKIP), Universitas Jambi, during the even semester of the 2025/2026 academic year. The research focused on students enrolled in the table tennis course because they had direct experience in learning and practicing table tennis service techniques, thereby making them appropriate respondents for identifying instructional needs related to motion analysis video-based learning.

The population consisted of all students registered in the table tennis course during the research period. A purposive sampling technique was employed to select participants who met specific inclusion criteria relevant to the objectives of the study (Etikan & Bala, 2017). Purposive sampling is widely used in educational needs assessment studies because it allows researchers to select respondents possessing relevant experiences and knowledge regarding the investigated phenomenon (Creswell & Creswell, 2023).

Tabel 1.

The sample comprised 30 students who fulfilled the following criteria

No	Inclusion Criteria
1	Students enrolled in the table tennis course
2	Students who had participated in table tennis service practice sessions
3	Students willing to participate as research respondents
4	Students who completed all questionnaire items

The selected respondents were considered capable of providing accurate information regarding learning difficulties, technological readiness, instructional preferences, and expectations toward motion analysis video-based learning systems.

Data were collected using a structured questionnaire developed based on indicators derived from multimedia learning theory, motor learning principles, and technology acceptance concepts (Mayer, 2021; Hodges & Williams, 2020; Davis et al., 2019). The questionnaire employed a four-point Likert scale to minimize neutral responses and encourage respondents to express clear perceptions regarding each statement (Joshi et al., 2015).

Table 2.

Likert Scale Scoring System

Response Category	Score
Strongly Agree (SA)	4
Agree (A)	3
Disagree (D)	2
Strongly Disagree (SD)	1

Instrument Validity and Reliability

Prior to implementation, the instrument underwent expert judgment validation involving three specialists: a sports learning expert, a table tennis expert, and a learning media expert. Expert validation is recommended to ensure content relevance, clarity, and construct appropriateness in educational research instruments (Taherdoost, 2016).

Following expert review, 25 items were declared valid and suitable for empirical testing. Construct validity was examined using the Pearson Product Moment Correlation with IBM SPSS Statistics software. Items with correlation coefficients exceeding the critical value at $\alpha = 0.05$ were retained for analysis (Field, 2022).

The validity formula used was:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

Reliability testing was conducted using Cronbach's Alpha, which yielded a coefficient of 0.91. According to Hair et al. (2022), a Cronbach's Alpha value above 0.90 indicates excellent internal consistency and very high reliability, confirming that the instrument was appropriate for data collection.

Data Analysis

Data were analyzed using descriptive percentage analysis, a method commonly applied in educational needs assessment studies to determine the level of respondents'

needs and perceptions (Fraenkel et al., 2021). The percentage score was calculated using the following formula:

$$P = \frac{f}{N} \times 100\%$$

The percentage results were interpreted according to the criteria presented in Table 3.

Table 3.

Interpretation Criteria

Percentage	Category
81-100%	Very High
61-80%	High
41-60%	Moderate
21-40%	Low
0-20%	Very Low

This analytical procedure enabled the researchers to identify the level of student needs regarding motion analysis video-based learning and provided empirical foundations for developing an interactive learning model tailored to table tennis service instruction in higher education.

RESULTS AND DISCUSSION

Result

Instrument Validation Results

Prior to data collection, the questionnaire instrument was evaluated by three expert validators consisting of a sports learning expert, a table tennis expert, and a learning media expert. The validation process aimed to assess the appropriateness of the instrument in measuring students' needs for the development of an interactive learning model based on motion analysis videos in table tennis service learning. The assessment covered four aspects, namely indicator suitability, language clarity, item suitability, and instrument readability. The results of the expert validation are presented in Table 4.

Table 4.

Expert Validation Results

Assessment Aspect	Percentage	Category
Indicator Suitability	92%	Very High
Language Clarity	88%	Very High
Item Suitability	90%	Very High
Instrument Readability	91%	Very High
Average	90.25%	Very High

The findings indicate that all assessed aspects achieved percentages above 88%, demonstrating that the instrument possessed a very high level of feasibility. The highest score was obtained for indicator suitability (92%), indicating strong alignment between the questionnaire items and the objectives of the study. Meanwhile, language clarity obtained the lowest percentage (88%), suggesting the need for minor revisions to

improve statement comprehension. Overall, the average validation score reached 90.25%, which falls within the “Very High” category. Therefore, the instrument was considered appropriate for implementation in the field.

Based on expert recommendations, five items containing similar wording and overlapping meanings were revised to improve clarity and avoid redundancy. Consequently, the instrument proceeded to empirical testing.

Validity and Reliability Testing

Following expert validation, the instrument was administered to respondents to examine its validity and reliability. The validity test was conducted using Pearson Product Moment correlation analysis with the assistance of IBM SPSS Statistics.

The results revealed that 25 questionnaire items had calculated correlation coefficients (r-count) greater than the critical r-table value of 0.361. These items were therefore considered valid and retained for further analysis. Five items failed to meet the validity criteria and were subsequently excluded.

Table 5.

Instrument Validity Test Results

Description	Total
Initial Number of Items	30
Valid Items	25
Invalid Items	5

The results indicate that 83.33% of the questionnaire items met the validity requirements, demonstrating that the instrument adequately measured the intended constructs related to students’ needs for motion analysis video-based learning.

Reliability analysis was conducted using Cronbach’s Alpha coefficient. The reliability test produced a Cronbach’s Alpha value of 0.91, indicating excellent internal consistency among the questionnaire items. Since the obtained value exceeded the minimum acceptable threshold of 0.70, the instrument was classified as highly reliable and suitable for research purposes.

Table 6.

Reliability Test Results

Variable	Cronbach’s Alpha	Category
Needs Analysis Instrument	0.91	Very High Reliability

The reliability findings confirm that the instrument consistently measures students’ perceptions and needs regarding the development of motion analysis video-based learning models.

Students’ Needs Analysis Results

The main objective of this study was to identify students’ needs regarding the development of an interactive learning model based on motion analysis videos in table tennis service learning. Data were collected from 30 students enrolled in the table tennis course and analyzed using descriptive percentage techniques. The results of the needs analysis are presented in Table 7.

Table 7.
 Results of Students' Needs Analysis

No.	Indicator	Percentage	Category
1	Understanding of Service Techniques	82%	Very High
2	Motion Visualization	88%	Very High
3	Ease of Learning	84%	Very High
4	Learning Motivation	86%	Very High
5	Learning Effectiveness	90%	Very High
Average		86%	Very High

The overall average percentage reached 86%, indicating a Very High level of need for the development of an interactive learning model based on motion analysis videos in table tennis service learning.

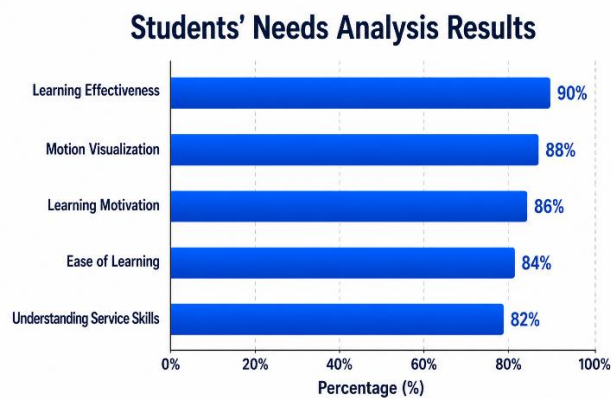


Figure 1.
 Students' Needs Analysis Results

Description of Each Indicator

The highest percentage was obtained by the learning effectiveness indicator (90%), indicating that students strongly believe that motion analysis video-based learning can enhance the effectiveness of table tennis service instruction. This result suggests that students require instructional media capable of providing more comprehensive explanations, visual feedback, and repeated observations of service techniques.

The motion visualization indicator (88%) achieved the second-highest score. This finding demonstrates that students need learning media capable of presenting service movements in a detailed and systematic manner. Through motion analysis videos, learners can observe body positioning, racket angles, ball contact points, and movement timing more clearly than through traditional demonstrations alone.

The learning motivation indicator (86%) also showed a very high percentage. This result indicates that students perceive interactive video-based learning as more engaging and enjoyable than conventional instructional approaches. The integration of digital technology into sports learning appears to stimulate greater interest and participation among students.

The ease of learning indicator (84%) suggests that motion analysis videos can facilitate better understanding of learning materials. Students reported that repeated

observation of service techniques enables them to identify movement sequences and technical details more effectively.

Finally, the understanding of service techniques indicator (82%) obtained the lowest percentage among all indicators; however, it still fell within the "Very High" category. This result indicates that students continue to experience challenges in mastering service techniques and therefore require additional instructional support through innovative learning media.

Overall, the findings demonstrate a strong need among university students for the development of an interactive learning model based on motion analysis videos. The consistently high percentages across all indicators indicate that such a learning model has substantial potential to improve students' understanding of service techniques, enhance motivation, facilitate learning, and increase the effectiveness of table tennis instruction in higher education.

Discussion

The findings of this study demonstrate that university students have a very high need for the development of an interactive learning model based on motion analysis videos in table tennis service learning. The overall average score of 86% indicates that students perceive digital learning media integrated with motion analysis technology as highly relevant to their learning needs. This finding reflects the increasing demand for innovative instructional approaches in higher education that align with the characteristics of the digital era and support effective skill acquisition in sports learning. The emergence of Industry 4.0 and Society 5.0 has transformed educational paradigms from teacher-centered instruction toward technology-supported student-centered learning environments that promote active engagement, independent learning, and reflective practice (Bond et al., 2021; Zawacki-Richter & Jung, 2023).

The highest percentage was obtained on the learning effectiveness indicator (90%), indicating that students strongly believe that motion analysis video-based learning can improve the quality of table tennis instruction. This result is consistent with the Cognitive Theory of Multimedia Learning proposed by Mayer (2021), which explains that individuals learn more effectively when information is presented through integrated visual and auditory channels. Multimedia learning facilitates dual-channel information processing, allowing learners to build stronger cognitive connections between conceptual knowledge and practical performance. In sports education, this principle becomes particularly important because learning outcomes depend not only on theoretical understanding but also on the accurate execution of motor skills (Fiorella & Mayer, 2018; Moreno & Mayer, 2020).

The effectiveness of motion analysis videos can also be explained through the principles of motor learning theory, which emphasize the importance of observation, feedback, repetition, and self-correction in skill acquisition (Schmidt et al., 2019). Table tennis service techniques involve complex biomechanical movements requiring precise coordination among body posture, arm motion, wrist action, racket angle, and ball

trajectory. Conventional demonstrations often occur too quickly for novice learners to identify critical movement components. Motion analysis videos address this limitation by enabling students to repeatedly observe movement sequences, slow down specific phases, and focus on essential technical elements. Similar findings have been reported in studies involving tennis, badminton, volleyball, and football learning, where video-assisted instruction significantly improved technical understanding and performance outcomes (Palao et al., 2020; Gómez et al., 2021; Rein & Memmert, 2021).

Another important finding concerns the motion visualization indicator, which obtained a percentage of 88%. This result suggests that students highly value instructional media capable of presenting movement details clearly and systematically. In sports education, visualization plays a fundamental role because movement skills are primarily learned through observation and imitation processes. According to observational learning theory, learners acquire motor behaviors by watching models, analyzing movement patterns, and reproducing observed actions (Bandura, 2018). Therefore, the quality of visual information directly influences learning effectiveness.

Motion visualization technologies have become increasingly important in contemporary sports pedagogy because they allow learners to examine movement mechanics beyond what is possible through direct observation alone (Knudson, 2022). Through frame-by-frame playback, slow-motion analysis, and movement comparisons, students can identify subtle technical components that may otherwise remain unnoticed. Previous research has demonstrated that visual feedback systems significantly improve learners' ability to recognize technical errors and develop more efficient movement patterns (Baca & Kornfeind, 2020; Bartlett, 2021). The high percentage obtained in this study indicates that students recognize the value of enhanced visualization for mastering table tennis service techniques.

The results also revealed a very high percentage for the learning motivation indicator (86%), highlighting the motivational benefits of motion analysis video-based learning. Motivation is widely recognized as a critical determinant of learning success because it influences effort, persistence, engagement, and willingness to practice (Ryan & Deci, 2020). Educational technologies that provide interactive and visually attractive learning experiences have been shown to increase students' intrinsic motivation by creating more engaging instructional environments (Sailer et al., 2021). These findings support the views of Arsyad (2019), who argued that attractive learning media can stimulate students' attention and encourage active participation. In sports learning contexts, traditional instructional approaches frequently rely on repetitive demonstrations and verbal explanations, which may reduce student interest over time. Interactive video-based learning introduces novelty, autonomy, and immediate feedback, factors known to enhance motivational engagement (Chen et al., 2022). Similar results have been reported in physical education studies where multimedia-based instruction improved students' enthusiasm, participation rates, and learning satisfaction (Casey et al., 2021; Koekoek et al., 2019). Consequently, the integration of motion analysis videos may contribute not only to technical development but also to creating a more motivating learning environment.

The ease of learning indicator, which achieved a percentage of 84%, further confirms the educational value of motion analysis videos. Students reported that the technology helped them understand service techniques more easily by allowing repeated observation and detailed analysis of movements. This finding aligns with constructivist learning theory, which emphasizes that learners actively construct knowledge through meaningful experiences and interactions with learning resources (Jonassen, 2018). Motion analysis videos provide opportunities for self-paced learning, enabling students to control the speed and frequency of observation according to their individual learning needs.

Research on digital learning environments consistently demonstrates that interactive multimedia resources improve comprehension and knowledge retention compared with traditional instructional methods (Martin et al., 2020; Alammary et al., 2021). In motor skill learning, repeated visual exposure facilitates the development of accurate mental representations, which serve as cognitive frameworks for movement execution (Hodges & Williams, 2020). Consequently, students become more capable of understanding complex movement sequences and translating theoretical explanations into practical performance.

The understanding of service techniques indicator obtained a score of 82%, which, although the lowest among the assessed indicators, still falls within the very high category. This finding suggests that students continue to experience difficulties in mastering table tennis service techniques and perceive a strong need for instructional support. Service execution is widely regarded as one of the most technically demanding skills in table tennis because it requires precise coordination of multiple movement components and tactical considerations (Malagoli Lanzoni et al., 2018). Therefore, instructional media capable of providing detailed visual feedback and performance evaluation are essential for facilitating skill mastery.

The findings also highlight the growing importance of technology integration in sports education. Digital technologies have transformed learning environments by enabling personalized instruction, interactive content delivery, and evidence-based performance assessment (Zawacki-Richter & Jung, 2023). In higher education, students increasingly expect learning experiences that leverage technological innovations to enhance understanding and engagement (Bond et al., 2021). The strong demand identified in this study reflects broader educational trends emphasizing digital literacy, technological adaptability, and learner-centered pedagogical approaches.

A significant contribution of this study lies in its identification of the need for motion analysis videos as interactive evaluation tools, rather than merely as instructional videos. Most previous studies have focused on using videos for demonstration purposes, where students passively observe expert performances (Palao et al., 2020; Gómez et al., 2021). In contrast, the present findings suggest that students desire learning systems that facilitate active analysis, self-reflection, and performance evaluation. This distinction is important because effective motor learning requires not only observation but also critical assessment of one's own performance and continuous adjustment based on feedback (Schmidt et al., 2019; Knudson, 2022).

From a research and development perspective, the findings provide a strong empirical foundation for the next phase of instructional model development. Needs analysis is widely recognized as the first and most critical stage in educational product development because it ensures that innovations address actual user requirements (Branch, 2020; Borg et al., 2021). The consistently high percentages obtained across all indicators demonstrate that students are ready to adopt technology-enhanced learning approaches and perceive substantial benefits from motion analysis-based instructional systems.

The novelty of this research lies in proposing the integration of motion analysis videos as an interactive medium for evaluating table tennis service techniques within university learning contexts. While previous studies have examined multimedia learning, video feedback, and sports technology separately, few have specifically investigated the need for a learning model that combines these components into a comprehensive instructional framework. Therefore, this study contributes both theoretically and practically by providing evidence supporting the development of innovative sports learning models that integrate multimedia learning principles, motor learning theories, and digital technology applications.

Overall, the findings confirm that motion analysis video-based learning possesses significant potential to enhance learning effectiveness, improve movement visualization, increase motivation, facilitate understanding, and strengthen technical mastery in table tennis service instruction. These results provide valuable guidance for future Research and Development (R&D) initiatives aimed at designing, validating, and implementing interactive learning models capable of supporting high-quality sports education in higher education institutions.

CONCLUSION

This study concludes that university students demonstrate a very high need for the development of an interactive learning model based on motion analysis videos in table tennis service learning. The findings revealed that all assessed indicators were categorized as Very High, with learning effectiveness obtaining the highest percentage (90%), followed by motion visualization (88%), learning motivation (86%), ease of learning (84%), and understanding of service techniques (82%). These results indicate that students strongly expect the integration of innovative and technology-based learning media to support the acquisition of technical skills in sports education.

The findings suggest that motion analysis video-based learning has considerable potential to enhance the quality of table tennis instruction by providing detailed, systematic, and repeatable visualizations of movement execution. Through interactive video analysis, students can observe service techniques more accurately, identify technical errors, evaluate their own performance, and develop a deeper understanding of correct movement patterns. Consequently, such learning media can improve motivation, facilitate comprehension, and increase overall learning effectiveness.

From both conceptual and empirical perspectives, this study provides important evidence supporting the integration of digital technology into higher education sports learning. The results serve as a scientific basis for future Research and Development (R&D) initiatives aimed at designing, validating, and implementing motion analysis video-based learning models. Ultimately, this innovation is expected to contribute to the advancement of student-centered, interactive, and technology-enhanced learning practices in university sports education.

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REFERENCES

- Alammary, A., Sheard, J., & Carbone, A. (2021). Blended learning in higher education: Three different design approaches. *Australasian Journal of Educational Technology*, 37(2), 1-15. <https://doi.org/10.14742/ajet.6310>
- Arsyad, A. (2019). *Media Pembelajaran* (Revised ed.). Jakarta: Rajawali Pers. <https://rajagrafindo.co.id>

- Baca, A., & Kornfeind, P. (2020). Rapid feedback systems for elite sports training. *Journal of Sports Sciences*, 38(7), 789–798. <https://doi.org/10.1080/02640414.2020.1721254>
- Bandura, A. (2018). Social cognitive theory of self-regulation and observational learning in sport. *Sport, Exercise, and Performance Psychology*, 7(2), 123–136. <https://doi.org/10.1037/spy0000112>
- Bartlett, R. (2021). *Introduction to Sports Biomechanics: Analysing Human Movement Patterns* (4th ed.). Routledge. <https://doi.org/10.4324/9781003168139>
- Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education*, 18(50), 1–24. <https://doi.org/10.1186/s41239-021-00282-x>
- Borg, W. R., Gall, M. D., & Gall, J. P. (2021). *Educational Research: An Introduction* (10th ed.). Pearson Education. <https://www.pearson.com>
- Branch, R. M. (2020). *Instructional Design: The ADDIE Approach*. Springer. <https://doi.org/10.1007/978-0-387-09506-6>
- Casey, A., Goodyear, V. A., & Armour, K. M. (2021). Digital technologies and learning in physical education: Pedagogical cases. *Physical Education and Sport Pedagogy*, 26(3), 288–302. <https://doi.org/10.1080/17408989.2020.1799968>
- Chen, S., Chen, A., & Zhu, X. (2022). Technology-enhanced motivation in physical education learning environments. *European Physical Education Review*, 28(2), 355–372. <https://doi.org/10.1177/1356336X211048945>
- Creswell, J. W., & Creswell, J. D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (6th ed.). Sage Publications. <https://us.sagepub.com>
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (2019). User acceptance of computer technology: A theoretical perspective. *Management Science*, 35(8), 982–1003. <https://doi.org/10.1287/mnsc.35.8.982>
- Etikan, I., & Bala, K. (2017). Sampling and sampling methods. *Biometrics & Biostatistics International Journal*, 5(6), 00149. <https://doi.org/10.15406/bbij.2017.05.00149>
- Field, A. (2022). *Discovering Statistics Using IBM SPSS Statistics* (6th ed.). Sage Publications. <https://uk.sagepub.com>
- Fiorella, L., & Mayer, R. E. (2018). What works and doesn't work with instructional video. *Computers in Human Behavior*, 89, 465–470. <https://doi.org/10.1016/j.chb.2018.07.015>
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2021). *How to Design and Evaluate Research in Education* (11th ed.). McGraw-Hill Education. <https://www.mheducation.com>
- Gómez, M. A., Courel-Ibáñez, J., & Ibáñez, S. J. (2021). Video feedback and performance analysis in sports education. *International Journal of Performance Analysis in Sport*, 21(5), 765–779. <https://doi.org/10.1080/24748668.2021.1939382>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2022). *Multivariate Data Analysis* (9th ed.). Cengage Learning. <https://www.cengage.com>

- Hodges, N. J., & Williams, A. M. (2020). *Skill Acquisition in Sport: Research, Theory and Practice* (4th ed.). Routledge. <https://doi.org/10.4324/9781315180607>
- Jonassen, D. H. (2018). Learning to solve problems with technology: A constructivist perspective. *Educational Technology Research and Development*, 66(3), 781–784. <https://doi.org/10.1007/s11423-018-9585-1>
- Joshi, A., Kale, S., Chandel, S., & Pal, D. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology*, 7(4), 396–403. <https://doi.org/10.9734/BJAST/2015/14975>
- Knudson, D. (2022). *Fundamentals of Biomechanics* (3rd ed.). Springer. <https://doi.org/10.1007/978-3-030-80904-0>
- Koekoek, J., Knoppers, A., & Stegeman, H. (2019). Digital technology and student engagement in physical education. *Journal of Teaching in Physical Education*, 38(2), 123–131. <https://doi.org/10.1123/jtpe.2018-0121>
- Malagoli Lanzoni, I., Di Michele, R., & Merni, F. (2018). A notational analysis of shot characteristics in top-level table tennis players. *European Journal of Sport Science*, 18(5), 689–697. <https://doi.org/10.1080/17461391.2018.1439181>
- Martin, F., Sun, T., & Westine, C. D. (2020). Systematic review of research on online teaching and learning from 2009–2018. *Computers & Education*, 159, 104009. <https://doi.org/10.1016/j.compedu.2020.104009>
- Mayer, R. E. (2021). *Multimedia Learning* (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781316941351>
- Moreno, R., & Mayer, R. E. (2020). Interactive multimedia learning: Theory and practice. *Educational Psychology Review*, 32(2), 215–232. <https://doi.org/10.1007/s10648-019-09483-6>
- Munir. (2021). *Pembelajaran Digital*. Bandung: Alfabeta. <https://www.alfabeta.co.id>
- OECD. (2021). *21st-Century Readers: Developing Literacy Skills in a Digital World*. OECD Publishing. <https://doi.org/10.1787/a83d84cb-en>
- Palao, J. M., Hastie, P. A., Cruz, P. G., & Ortega, E. (2020). The impact of video feedback on motor skill learning in physical education. *Journal of Human Sport and Exercise*, 15(4), 874–886. <https://doi.org/10.14198/jhse.2020.154.12>
- Prasetyo, Y. (2021). Video analysis in sports learning: Improving technical understanding and movement correction. *Jurnal Pendidikan Jasmani Indonesia*, 17(2), 105–114. <https://journal.uny.ac.id/index.php/jpji>
- Rein, R., & Memmert, D. (2021). Big data and video analysis in elite sports: Future directions. *International Journal of Computer Science in Sport*, 20(1), 1–17. <https://doi.org/10.2478/ijcss-2021-0001>
- Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective. *Contemporary Educational Psychology*, 61, 101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Sailer, M., Schultz-Pernice, F., & Fischer, F. (2021). Contextual facilitators for learning activities involving technology in higher education. *Computers in Human Behavior*, 121, 106794. <https://doi.org/10.1016/j.chb.2021.106794>

- Schmidt, R. A., Lee, T. D., Winstein, C., Wulf, G., & Zelaznik, H. (2019). Motor Control and Learning: A Behavioral Emphasis (6th ed.). Human Kinetics. <https://us.humankinetics.com>
- Sugiyono. (2022). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta. <https://www.alfabeta.co.id>
- Taherdoost, H. (2016). Validity and reliability of the research instrument: How to test the validation of a questionnaire/survey in a research. International Journal of Academic Research in Management, 5(3), 28–36. <https://hal.science/hal-02546799>
- Zawacki-Richter, O., & Jung, I. (2023). Handbook of Open, Distance and Digital Education. Springer. <https://doi.org/10.1007/978-981-19-2080-6>