Digitalization of Karate Refereeing Course Based on *Green Screen Animation*

Pangondian Hotliber Purba[1], Albadi Sinulingga[2], David Siahaan[1], Indra Kasih[2], Rafika Ardilla[3], Fajar Apollo Sinaga[2]

[1] Sport Science, Faculty of Sport Science, Universitas Negeri Medan, North Sumatra, Indonesia
[2] Physical Education Health and Recreation, Faculty of Sport Science, Universitas Negeri Medan, North Sumatra, Indonesia
[3] Sport Science, Faculty of Sport Science, Universitas Negeri Medan, North Sumatra, Indonesia
pangondianpurba@unimed.ac.id

Abstract. This study aimed to develop green screen animation–based learning media for karate refereeing courses. It employed a Research and Development (R&D) approach using the ADDIE model, consisting of Analyze, Design, Develop, Implement, and Evaluate stages. The product developed was jury learning media for karate instruction. The participants included language, media, and material experts, as well as students from the Coaching Study Program. Validation results showed that language experts rated the product at 80%, material experts at 80%, and media experts at 82%, indicating that the media was suitable for further testing. Small-group trials yielded an average score of 80%, while large-group trials reached 90%, categorized as highly suitable. Therefore, the developed green screen–based learning media is considered highly appropriate for use in karate refereeing courses.

Keywords: ADDIE model; green screen animation; karate refereeing; learning media; research and development.

1 Introduction

Rule enforcement is a fundamental responsibility of referees in sports, as they serve as the primary agents in ensuring fairness and consistency during competitions. Referees act as guardians of the rules, applying them impartially to all participants to maintain the integrity of the game [1]. In addition to fairness, effective officiating contributes significantly to maintaining safety by minimizing the risk of injury and preventing potential conflicts among players [2]. Nevertheless, the process of decision-making in officiating is often complex and may be influenced by subjective factors, such as pressure from spectators, coaches, or athletes, which can compromise objectivity [3]. In highly competitive settings, these decisions may even escalate into disputes or controversies, thereby requiring referees to demonstrate a high level of professionalism, decisiveness, and ethical responsibility [4].

I. I. I. Pane and Y. Putri (eds.), *Proceedings of the 2nd International Conference of Sport Science, Sport Coaching Science, and Physical Education, Health and Recreation 2025 (ICOSSCOPER 2025)*, Advances in Social Science, Education and Humanities Research 1022,
https://doi.org/10.2991/978-2-38476-591-1_22

Alongside developments in sports practices, technological advancements have played an increasingly important role in transforming educational processes. The integration of technology into education has enabled the development of diverse and interactive learning resources that enhance both the efficiency and effectiveness of instruction [5]. Technology is no longer considered a supplementary tool but has become an essential component of modern educational systems [6]. However, disparities in access to technological resources and digital literacy remain challenges in many educational contexts. These conditions require educators to adopt creative strategies in utilizing digital-based learning media that can facilitate meaningful and engaging learning experiences for students.

The rapid acceleration of technological development has further reshaped the education sector, particularly during the COVID-19 pandemic, which forced a sudden transition from traditional face-to-face learning to online environments [7]. This shift highlighted various challenges, including unequal access to technology, limited readiness among educators and students, and inconsistencies in the quality of learning outcomes. As social institutions, higher education institutions are expected to continuously adapt to these changes and to innovate in response to evolving societal demands [8]. Moreover, the ongoing transition toward the Industrial Revolution 4.0 emphasizes the importance of adaptability, digital competence, and continuous improvement to ensure that educational practices remain relevant and sustainable [9].

In the context of martial arts education, karate represents a discipline that combines physical skill, mental discipline, and philosophical values. Originating from Japan, karate was initially referred to as *Tote*, meaning "Chinese hand," before evolving into its modern form [10]. The term *karate* is commonly associated with its sporting dimension, whereas *karate-do* encompasses broader philosophical and character-building aspects [11]. In Indonesia, the development of karate has been institutionalized through the establishment of the Indonesian Karate-Do Federation (FORKI), which plays a significant role in organizing competitions and standardizing practices [11]. Within karate competitions, referees and judges hold critical responsibilities in managing matches, making accurate decisions, and ensuring that the competition proceeds in a fair and orderly manner.

To support effective teaching and learning in this domain, the use of appropriate instructional media is essential. Learning media can enhance the clarity of material delivery, increase student engagement, and promote independent learning by providing structured and accessible content [12][13]. One form of digital learning media that has gained attention is the flip book, which offers an interactive format that simulates the experience of reading a physical book while incorporating multimedia elements such as images, animations, and videos [14]. This type of media is particularly useful in facilitating the visualization of complex concepts and procedures. Furthermore, advances in multimedia technology have introduced innovative approaches such as the use of green screen techniques. This technique allows for the manipulation and replacement of video backgrounds during the editing process, enabling the creation of more dynamic, contextualized, and visually engaging instructional content.

Despite the availability of various digital learning tools, the integration of innovative media such as green screen technology in karate refereeing education remains limited.

This indicates a gap between technological potential and its practical application in specific instructional contexts. Therefore, the development of green screen–based learning media is expected to provide a more effective and engaging learning solution, particularly in supporting students' understanding of refereeing procedures and decision-making processes in karate competitions.

2 Reasearch Method

This study employed a Research and Development (R&D) approach using the ADDIE model, which consists of five systematic stages: Analyze, Design, Develop, Implement, and Evaluate. The model was selected to guide the structured development of green screen–based learning media for karate refereeing courses.

The research was conducted at the Faculty of Sports Science, Universitas Negeri Medan, specifically in the Coaching Education Study Program. The study took place in April 2025. The population of this study consisted of students from the 2024 cohort of the Sports Coaching Education Study Program. The sample included students from classes A, B, C, and D within the same cohort.

Data were collected using questionnaire instruments based on a Likert scale to evaluate the feasibility and effectiveness of the developed media. The instruments included validation sheets for media experts and material experts, as well as questionnaires distributed to small-group and large-group student samples. These instruments were designed to assess various aspects of the product, including content quality, language clarity, and media design.

Data analysis was conducted using reliability testing techniques, including test-retest, split-half, and one-way analysis of variance (intra-class correlation), to ensure the consistency and validity of the collected data [15]. The results of these analyses were used to determine the feasibility and effectiveness of the developed learning media.

3 Results and Discussion

3.1 Result

This study aimed to develop green screen–based learning media for karate refereeing using the ADDIE development model, which includes the stages of Analyze, Design, Develop, Implement, and Evaluate. Each stage contributed systematically to the refinement of the final product.

During the development stage, expert validation was conducted to assess the feasibility of the media. The results of language expert validation showed a consistent improvement across all indicators. The clarity of language in the video increased from 80% in the first validation to 88% in the second validation. Similarly, pronunciation improved from 78% to 88%, while ease of understanding increased from 80% to 89%. These results indicate that the linguistic quality of the media met the required standards and was suitable for further testing.

Material expert validation also demonstrated notable improvements. The content suitability increased from 80% to 85%, material reinforcement from 78% to 90%, material depth from 80% to 90%, and evaluation aspects from 79% to 95%. These findings indicate that the developed content was comprehensive and aligned with instructional objectives, making it appropriate for use in learning activities.

The results of media expert validation further confirmed the improvement of the product. The sequence of material presentation increased from 78% to 93%, video clarity from 80% to 90%, attractiveness from 80% to 95%, and subtitle clarity and pronunciation from 79% to 90%. These improvements suggest that revisions made after the first validation significantly enhanced the quality of the media design.

Following expert validation, a small group trial was conducted to evaluate the usability of the media. The results showed that the material content obtained a score of 79%, while meaningfulness, attractiveness, ease of use, and ease of learning each scored 80%. These results fall within the "feasible" category, indicating that the product could be used with minor revisions.

The implementation stage involved 75 students from the Sports Coaching Education Study Program. The results of the large group trial showed a substantial improvement compared to the small group trial. The material content, meaningfulness, variation of material, ease of use, and ease of learning each obtained a score of 90%, while media attractiveness reached 95%. These results fall into the "very feasible" category, indicating that the developed media is highly appropriate for use in karate refereeing courses.

At the evaluation stage, feedback obtained from experts and users was used to refine the final product. Several improvements were made to enhance clarity, usability, and overall effectiveness, ensuring that the learning media meets both pedagogical and technical standards.

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3.2 Discussion

The results of this study demonstrate that the development of green screen–based learning media for karate refereeing is effective and feasible for instructional use. The consistent improvements observed across expert validation stages highlight the importance of iterative development in producing high-quality learning media. This process ensures that both content and media design meet the required standards before implementation.

From a content perspective, the improvement in material validation reflects the importance of delivering accurate and structured instructional materials, particularly in sports officiating. Referees are responsible for ensuring fairness, consistency, and safety during competitions [1][2]. Therefore, learning media that clearly present rules and decision-making procedures are essential for developing these competencies. The results also support previous findings that officiating decisions may be influenced by subjective factors, emphasizing the need for clear and standardized instructional support [3][4].

In terms of media design, the significant increase in attractiveness and usability indicates that the integration of digital technology enhances the quality of learning

experiences. Technology-based learning media have been shown to improve engagement and learning effectiveness by providing interactive and visually rich content [5][6]. This is particularly relevant in the context of modern education, where the integration of digital tools is necessary to meet the demands of technological advancement and the Industrial Revolution 4.0 [9].

The findings from the small and large group trials further confirm that the developed media is well accepted by students. The improvement from "feasible" to "very feasible" categories indicates that revisions based on expert feedback successfully enhanced the usability and effectiveness of the product. This supports previous studies highlighting the role of digital media in facilitating learning, especially during periods of rapid transformation such as the COVID-19 pandemic [7]. In addition, higher education institutions are expected to continuously adapt and innovate to remain relevant in changing educational landscapes [8].

Furthermore, the use of multimedia-based learning approaches, including flip book and video-based media, contributes to increased student motivation and comprehension. Learning media that integrate visual, textual, and interactive elements have been proven to support deeper understanding and independent learning [12][13][14]. In the context of karate refereeing, where procedural understanding and visual demonstration are essential, such media provide a more effective alternative to traditional teaching methods.

Overall, the integration of green screen technology in learning media offers significant advantages in both pedagogical and practical aspects. It enhances the clarity of instruction, improves student engagement, and supports the development of essential competencies in sports officiating. Therefore, this study contributes to the advancement of technology-based learning by demonstrating the potential of innovative media in supporting sports education.

4 Conclusion

Based on the results of expert validation, small group testing, and large group implementation, the development of green screen–based learning media for karate refereeing has been proven to be feasible and effective. The validation results showed consistent improvements across all aspects. Language validation indicated increases in clarity (8%), pronunciation (10%), and ease of understanding (9%). Material validation demonstrated improvements in content quality (5%), material reinforcement (12%), depth of material (10%), and evaluation aspects (20%). Media validation also showed significant enhancement, including material sequencing (15%), clarity (10%), attractiveness (15%), and subtitle clarity and pronunciation (11%).

Furthermore, the results of small and large group trials revealed a substantial increase in user acceptance and effectiveness. Improvements were observed in material content (11%), meaningfulness (10%), ease of use (15%), and ease of learning (10%), with overall results categorized as "very feasible." Therefore, it can be concluded that the developed green screen–based learning media is highly suitable for use in karate refereeing courses and has strong potential to support effective and engaging learning.

5 Recommendation

Based on the findings of this study, several recommendations can be proposed. First, the developed green screen–based learning media is recommended to be implemented more widely in karate refereeing courses to enhance students' understanding and engagement. Second, future studies are encouraged to expand the use of this media to other sports or practical subjects that require visual and procedural learning, in order to examine its broader applicability.

In addition, further research may involve experimental designs to measure the effectiveness of the media in improving learning outcomes compared to conventional methods. It is also recommended to integrate more advanced multimedia features, such as interactive elements or augmented reality, to further enhance the learning experience. Finally, institutions and educators should be encouraged to adopt and develop innovative technology-based learning media to support the demands of modern education.

Acknowledgments. The authors would like to express their sincere appreciation to Universitas Negeri Medan (UNIMED) for its institutional support in facilitating this study. Gratitude is also extended to colleagues and academic peers who provided valuable insights and constructive feedback throughout the research process. Their contributions have significantly enhanced the conceptual clarity and academic quality of this work.

Disclosure of Interests. The authors declare that there are no competing interests associated with this study. The research was conducted independently, without any financial or commercial relationships that could be interpreted as a potential conflict of interest.

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