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Development of an Interactive E-Book to Improve Literacy in Martial Arts Competition Rules

Darmaji[1a], Ririn Dwi Agustin[2b*], Rochsun[3c]
[123]Magister of Sport Education Universitas Insan Budi Utomo, Indonesia
[a]darmaji@gmail.com, [b]ririndwiagustin85@gmail.com

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***Correspondence Address:**
ririndwiagustin85@gmail.com

Abstract:
This study aims to develop an interactive e-book titled "Mastering the Ring: An Interactive Guide to Martial Arts Competition Rules Literacy" and to test its validity, practicality, and effectiveness in improving literacy regarding martial arts competition rules. The study employed a Research and Development approach with a simplified seven-stage development model: potential and problems, information gathering, product design, validation, revision, product testing, and final revision. Validation involved two subject matter experts and two media experts using a Likert scale instrument. Practicality was assessed by educators or coaches and students or athletes, while effectiveness was measured through changes in pre-test and post-test scores as well as N-Gain. The product was developed in a digital flipbook format that combines text, images, videos, interactive navigation, and quizzes with immediate feedback. The results showed a validation score of 90.25% from subject matter experts and 91.17% from media experts, both categorized as highly valid. Usability reached 91.12% among educators or coaches and 92.12% among students or athletes. The average literacy score increased from 54.20 to 88.90, with an N-Gain of 0.75. Indicating high improvement. Overall, the developed interactive e-book met the criteria of validity and practicality and demonstrated potential as a digital learning resource for supporting literacy in martial arts competition rules.

Introduction (مقدمة)

Advances in digital technology have brought about changes in various aspects of learning, including physical education. The learning process no longer relies solely on printed books or verbal explanations but has begun to utilize various digital media that are more flexible and interactive. The use of these media provides students with the opportunity to learn independently, access materials at any time, and have a more engaging learning experience

compared to conventional methods of delivering content (Nasution & Tambunan, 2024; Sande & Suyanto, 2024; Patricia, 2020). In physical education, this shift is particularly relevant for learning content that requires learners to understand not only physical performance but also conceptual and procedural knowledge.

In martial arts, understanding the rules of competition is just as important as mastering techniques and physical conditioning. Athletes are expected not only to perform techniques correctly but also to understand the scoring system, rules regarding fouls, referee signals, and applicable competition procedures. Misunderstanding the rules can affect the outcome of a match and even increase the risk of injury. Nevertheless, the learning process on the field still focuses primarily on technical and physical training, while material regarding competition rules is often conveyed only through brief explanations or textual regulatory documents. This situation causes students and athletes alike to have difficulty comprehending the rules in their entirety (Orbanus et al., 2024). Therefore, competition-rule literacy requires learning materials that can translate formal regulations into accessible, visual, and contextual information that learners can study both during and outside training sessions.

One alternative that can be used to address this issue is the development of interactive e-books. Unlike regular digital books, interactive e-books allow content to be presented through a combination of text, images, videos, animations, interactive navigation, and quizzes that provide immediate feedback. These features help users understand the material step by step while providing a more active learning experience . Various studies have also shown that digital learning media can increase learning motivation, clarify complex concepts, and support self-directed learning (Stuart et al., 2025; Patricia & Zamzam, 2021; Davis & Brown, 2021). For martial arts rules literacy, these interactive features are particularly useful because rules, scoring procedures, referee signals, and prohibited techniques can be presented not only as written information but also through visual examples and practice-oriented activities.

Although there has been significant development of digital learning media, most research still focuses on learning movement techniques or sports skills. Research specifically aimed at developing learning media to improve literacy regarding the rules of martial arts competitions remains relatively limited (Verawati, 2024; Tantri et al., 2023; Chen et al., 2023). More specifically, existing studies have not sufficiently addressed the development of an integrated digital learning resource that focuses specifically on competition-rule literacy while combining regulatory information, visual illustrations, demonstration videos, interactive navigation, and immediate-feedback quizzes within a single learning medium. In fact, understanding the rules is one of the key competencies that athletes, coaches, and students must possess in order to make the right decisions during a match. This constitutes the research gap addressed by the present study: the limited availability of interactive digital media designed specifically to help learners understand and apply martial arts competition rules rather than merely learn movement techniques.

Based on these conditions, this study developed an interactive e-book titled "Mastering the Ring: An Interactive Guide to Martial Arts Competition Rules Literacy," which integrates competition rules, visual illustrations, demonstration videos, digital navigation, and interactive quizzes into a single learning medium. The novelty of this study lies in the integration of competition-rule literacy content with multimedia and interactive learning features in one digital flipbook, allowing users to access explanations, visual representations, demonstrations, and self-assessment activities within the same learning resource. Unlike digital media that primarily emphasizes the acquisition of martial arts techniques, this product is specifically designed to support users in understanding competition regulations and applying them to match-related situations. The product was developed to create a practical learning tool capable of improving competition rules literacy in martial arts.

This study aims to produce an interactive e-book that is valid, practical, and effective in improving literacy regarding the rules of martial arts competitions. Accordingly, the study evaluates the product in three aspects: validity based on expert assessment, practicality based on user responses, and effectiveness based on changes in users' pre-test and post-test literacy scores. In addition to producing a learning resource, this study is also expected to provide an alternative digital medium that can be utilized by coaches, teachers, and athletes to support the learning process regarding competition rules in a more engaging, systematic, and easy to understand manner.

Method (منهج)

This study employs a Research and Development (R&D) approach aimed at producing a learning product while testing its feasibility before it is used by end-users. The development procedure is based on the Borg and Gall model, as adapted by Sugiyono (2024), and then simplified into seven stages to suit the needs of the study. These stages include identifying potential and problems, gathering information, designing the product, validating the product, revising the product, testing the product, and final revision. The seven-stage procedure was selected to provide a systematic development process while maintaining a manageable sequence of needs analysis, product development, expert evaluation, user testing, and product refinement. The development procedure was implemented as follows. First, the potential and problems stage identified the need for accessible learning materials on martial arts competition rules. Second, information was gathered through observation and interviews to identify users' needs and difficulties in understanding competition rules. Third, the product design stage involved developing the content structure, visual presentation, multimedia components, navigation system, and interactive quizzes. Fourth, the initial product was submitted to subject matter and media experts for validation. Fifth, the product was revised based on the experts' comments and suggestions. Sixth, the revised product was tested with educators or coaches and students or athletes to assess its practicality and usability. Finally, the product was revised again based on the results of the validation and user testing to produce the final version of the interactive e-book. The stages were simplified to ensure that the development process remained systematic without compromising the essence of the development model used. The resulting product was an interactive e-book entitled "Mastering the Ring: An Interactive Guide to Martial Arts Competition Rules," developed in a digital flipbook format.

The product developed in this study is an interactive e-book titled "Mastering the Ring: An Interactive Guide to Martial Arts Competition Rules." The validation process involved four validators, consisting of two subject matter experts and two media experts. The subject matter experts were selected based on their expertise in martial arts or their experience as national-level referees, while the media experts possessed expertise in the development of digital-based learning media. After undergoing the validation phase, the product was pilot-tested with educators or coaches as well as students or athletes to gather information regarding the practicality of using the media. The use of two subject matter experts and two media experts enabled the product to be evaluated from two complementary perspectives: the accuracy and appropriateness of the competition-rule content and the quality of the digital learning media. The user testing involved educators or coaches and students or athletes as the intended users of the product, allowing practicality to be examined from both instructional and learner perspectives.

Research data was collected through observation, questionnaires, and structured interviews. Observations were conducted to identify users' needs regarding learning materials, while questionnaires were used to obtain feedback from both validators and users regarding the quality of the product. Interviews were conducted to gather input that would serve as the basis

for revising and refining the e-book so that the final product would meet users' needs. The questionnaire was used at two stages of evaluation. First, the validation questionnaire was administered to the subject matter and media experts to assess the quality and suitability of the developed product. Second, the practicality questionnaire was administered to educators or coaches and students or athletes after product testing. In addition, pre-test and post-test instruments were used to measure changes in users' literacy regarding martial arts competition rules before and after using the interactive e-book.

The instruments consisted of expert validation questionnaires, user-practicality questionnaires, and literacy tests. The expert validation instrument used a five-point Likert scale to assess the suitability of the content and media. The subject matter experts assessed aspects related to the compliance and accuracy of competition rules as well as language and technical terminology. The media experts assessed visual design, layout, typography, navigation, interactivity, and audio-visual integration. The practicality instrument assessed users' perceptions of navigation and access, visual and video clarity, ease of use, and the appeal of interactive quizzes. The literacy test was administered before and after the use of the e-book. The pre-test provided a baseline measure of users' understanding of martial arts competition rules, whereas the post-test was used to identify changes following the use of the developed product.

The data from the validation and usability testing were analyzed using quantitative descriptive methods, specifically percentages. Validators' assessments were based on a five-point Likert scale, and the resulting scores were compared with ideal scores to determine the product's suitability. Meanwhile, data in the form of comments and suggestions from the validators were analyzed descriptively to inform product revisions. The effectiveness of the e-book was analyzed by comparing pre-test and post-test results, which were then calculated using the N-Gain value to determine the level of improvement in knowledge of game rules following the use of the learning medium. The percentage scores obtained from the validation and practicality questionnaires were interpreted according to the predetermined feasibility categories. The validation results were used to determine whether the product was sufficiently suitable for further testing, while the practicality results were used to determine the extent to which the product could be used easily and appropriately by educators or coaches and students or athletes. For effectiveness, the increase between pre-test and post-test scores was examined using the normalized gain (N-Gain). An N-Gain score of 0.70 or higher was interpreted as indicating a high level of improvement. The combination of expert validation, practicality assessment, and pre-test–post-test analysis was used to provide a comprehensive evaluation of the developed e-book in terms of its content and media quality, usability, and potential effectiveness in supporting martial arts competition rules literacy.

Result (نتائج)

The needs analysis revealed that martial arts training tends to emphasize physical and technical aspects, while a deep understanding of the rulebook remains lacking. The overly textual presentation of rules was deemed boring and made it difficult to understand changing regulations. Therefore, users require digital materials in the form of a flipbook that combines text, video visuals, and quizzes. The needs analysis indicated that users required a learning medium that could present competition rules in a more accessible, visual, and interactive form. Based on these needs, the developed e-book was designed to integrate regulatory information with multimedia and interactive features rather than relying solely on conventional textual explanations.

The product was developed with a systematic content structure. The content covers an introduction and the importance of rules literacy, arena foundations and specifications, material

on pencak silat, BJJ, karate, and boxing, official referee signals, illegal techniques, and the scoring system. Interactive features consist of tutorial or demonstration videos, automatic page navigation, and quizzes with immediate feedback.

Table 1. Results of validation by subject matter experts and media experts

Expert Group	Evaluation Aspect	Score	Category
Content Experts	Compliance and Accuracy of Rules	92,50%	Highly valid/acceptable
Subject Matter Expert	Language and technical terminology	88,00%	Highly valid/acceptable
	Average subject matter expert	90,25%	Highly valid
Media experts	Visual design, layout, typography	90,00%	Highly valid/acceptable
Media experts	Navigation and interactivity	94,00%	Highly valid/acceptable
Media Specialist	Audio-visual integration	89,50%	Highly valid/acceptable
	Average media expert	91,17%	Highly valid
	Overall average	90,71%	Highly valid/suitable for pilot testing

Validation involved four experts using a 1–5 Likert scale. Subject matter experts gave an average score of 90.25%, while media experts gave 91.17%; the combined score reached 90.71%. These results indicate that the product meets the criteria for being highly valid and suitable for further pilot testing. The highest score among the subject matter assessment indicators was obtained for compliance and accuracy of the competition rules (92.50%), whereas language and technical terminology received 88.00%. For media evaluation, navigation and interactivity received the highest score (94.00%), followed by visual design, layout, and typography (90.00%) and audio-visual integration (89.50%). These results indicate that both the content and digital presentation of the e-book were considered appropriate for subsequent user testing. The overall validation score of 90.71% demonstrates that the product fulfilled the predetermined validity criteria before being implemented in the practicality and effectiveness stages.

Table 2. Results of the interactivity assessment of the interactive e-book

Indicator	Educators/Coaches	Learners/Athletes	Category
Ease of navigation and access	90,0%	93,5%	Very practical
Visual and video clarity	92,0%	91,0%	Very practical
Ease of use	88,5%	89,0%	Very practical
Appeal of interactive quizzes	94,0%	95,0%	Very practical
Overall average	91,12%	92,12%	Very practical

The product's practicality was rated very highly. The average response from educators or coaches reached 91.12%, while that from students or athletes reached 92.12%. The appeal of the quizzes was an indicator with a high score, while the aspect of independent use received a relatively lower score but still fell within the "very practical" category.

Among educators or coaches, the highest practicality score was observed for the appeal of interactive quizzes (94.0%), followed by visual and video clarity (92.0%) and ease of navigation and access (90.0%). Among students or athletes, the appeal of interactive quizzes also received the highest score (95.0%), followed by ease of navigation and access (93.5%). Although ease of use received the lowest score in both groups, the scores remained within the "very practical" category. The overall practicality scores of 91.12% for educators or coaches and 92.12% for students or athletes indicate that the interactive e-book was considered easy to access, navigate, and use by both groups.

Table 3. Changes in game rules literacy scores

Category	Pre-test	Post-test
90–100 (Grandmaster)	2 people	24 people
70–80 (Master)	7 people	6 people
<70 (Beginner)	21 people	0 people
Average score	54,20	88,90
N-Gain	—	0,75

The effectiveness is evident from the increase in the average literacy score from 54.20 to 88.90. In the pre-test, 21 participants were in the beginner category, whereas after using the product, no participants remained in that category, and 24 participants were in the 90–100 score category. An N- Gain of 0.75 indicates a significant improvement. The distribution of participants also shifted toward the higher literacy categories after the use of the interactive e-book. The number of participants in the 90–100 category increased from 2 to 24, while the number of participants scoring below 70 decreased from 21 to none. The average score increased by 34.70 points, from 54.20 in the pre-test to 88.90 in the post-test.

The resulting N-Gain of 0.75 indicates a high level of improvement in competition rules literacy. These results show that the participants demonstrated greater understanding of the rules after using the interactive e-book. Taken together, the validation, practicality, and pre-test–post-test results indicate that the developed e-book fulfilled the intended development criteria: it was highly valid according to experts, highly practical according to users, and associated with a high level of improvement in martial arts competition rules literacy.

Discussion (مناقشة)

The validation results show that the interactive e-book developed was rated as "highly valid" in terms of both content and media. The high ratings from subject matter experts indicate that the e- book's content complies with competition regulations, uses appropriate terminology, and presents the material systematically so that it is easy to understand. On the other hand, the high ratings from media experts indicate that the visual aspects, navigation, and multimedia integration have effectively supported the learning process. This demonstrates that the quality of instructional media is determined not only by the accuracy of the content but also by how the information is presented to users. Presenting the material through a combination of text, illustrations, videos, and interactive navigation allows users to absorb information more gradually, thereby reducing the cognitive load involved in understanding the competition rules (Trisnawati et al., 2024; Nielsen & Budiardjo, 2023)

These findings are consistent with the research by Siagian and Aufan, which showed that interactive multimedia in pencak silat instruction can improve students' understanding of both theoretical and practical material (Siagian & Aufan, 2022). Similar results were also reported by

Widiastuti, who stated that the integration of various forms of digital media can enhance the effectiveness of the learning process (Widiastuti et al., 2024).

The practicality of the e-book, which falls into the "very practical" category, shows that the developed medium can be easily used by both instructors and learners. The high scores in the areas of navigation and quiz appeal indicate that users did not experience any difficulty accessing the material or utilizing the available features. These results are likely influenced by the e-book's ability to be accessed across various devices without requiring the installation of a specific app. These findings align with the research which explain that flipbook-based media provide learning flexibility and enhance learners' independence (K. Zamzam et al., 2026; Barikah et al., 2026; Sutopo & Munir, 2023). However, several studies indicate that digital media do not always offer a high level of practicality if navigation and interface design have not been tailored to user characteristics (K. F. Zamzam et al., 2026; Yorganci, 2022; Hwang, 2022).

The effectiveness of the e-book is evident from the increase in game rules literacy scores following the use of this medium, as indicated by an N-Gain score of 0.75, which falls into the "high" category. These results suggest that students not only gained additional information but also demonstrated improved understanding of how to apply game rules. One factor believed to have contributed to this improvement is the presentation of material that combines explanations of regulations with visual illustrations, demonstration videos, and interactive quizzes (Kamaruddin et al., 2025; Wiguno et al., 2024; Wijaya et al., 2024). Through this approach, rules that were previously abstract can be understood within the context of real game situations, making it easier for students to connect concepts with practice (Yao, H., liu, W., & Chen, S, 2024; Sutopo & Munir, 2023; Damayanti, P., & Qohar, A, 2019). This finding supports the results of a study by Mayer, which states that interactive multimedia can improve learning outcomes by presenting information in various forms of representation (Mayer, 2024). However, improved learning outcomes are not entirely determined by the learning medium. Learning motivation, prior experience, and the intensity of media use can also influence student achievement; therefore, the effectiveness of e-books must be understood within the context of the overall implementation of the learning process.

These findings support the results of previous studies showing that interactive multimedia can improve learning outcomes by presenting information in various forms of representation. However, the magnitude of the improvement observed in this study does not imply that e-books are the sole factor influencing students' abilities. Other factors, such as prior practice experience, learning motivation, intensity of media use, and instructor guidance during the learning process, may also contribute to the results obtained. Therefore, the findings of this study are best understood as evidence that interactive e-books have the potential to serve as a learning support medium, rather than as the sole cause of improved knowledge of game rules.

From a theoretical perspective, the results of this study reinforce the view that the effectiveness of digital learning media is influenced by the integration of content quality, visual design, and interactivity. These three components work in a complementary manner to help learners build an understanding of complex material. These findings also expand the application of interactive multimedia concepts to the context of learning the rules of martial arts competitions an area that has been relatively under-researched compared to the teaching of movement techniques or athletic skills.

In practice, the e-book can be used as a supplementary resource for both learning and training. Coaches no longer need to rely on verbal explanations or lengthy regulatory documents when explaining the rules of the game. Instead, students can review the material on their own outside of practice hours using their own devices. As a result, learning does not take place only during practice sessions but can continue flexibly according to each user's needs.

The validation and revision process also makes a significant contribution to the quality of the final product. Input from subject matter experts regarding improvements to the arena visualization and the use of technical terms, as well as suggestions from media experts regarding navigation and quiz feedback, demonstrate that the development of instructional media is an iterative process. The final product not only meets aesthetic standards but is also refined based on the academic considerations and practical experience of the validators. This approach is essential to ensure that the instructional media is not only visually appealing but also effectively supports the achievement of learning objectives.

Conclusion (خاتمة)

Conclusions should answer the objectives of research. Tells how your work advances the field from the present state of knowledge. Without clear Conclusions, reviewers and readers will find it difficult to judge the work, and whether or not it merits publication in the journal. Do not repeat the Abstract, or just list experimental results. Provide a clear scientific justification for your work, and indicate possible applications and extensions. You should also suggest future experiments and/or point out those that are underway.

The research produced an interactive e-book titled "Mastering the Ring: An Interactive Guide to Martial Arts Rule Literacy," which integrates text, arena images, demonstration videos, interactive navigation, and self-assessment quizzes. The product was deemed highly valid based on evaluations by subject matter experts and media experts, highly practical based on feedback from educators or coaches as well as students or athletes, and effective in improving rule literacy. The increase in literacy scores from 54.20 to 88.90, with an N-Gain of 0.75, demonstrates that the product has the potential to serve as a digital learning resource to support the understanding of martial arts competition rules. These findings address the research objectives focused on the product's development, validity, practicality, and effectiveness.

The practical implication of this study is that coaches, teachers, and athletes can use e-books as a supplement to technical training to strengthen their understanding of the rules. Future research is recommended to test the product with a larger sample size, across different martial arts disciplines, and using a more robust experimental design so that the impact of e-book use on rule literacy can be examined more comprehensively.

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