



Development, Validity, and Practicality of Interactive Multimedia Teaching Materials for Long Jump among Undergraduate Sport Science Students

Sinung Nugroho^{1*}, Silvia Fauziah Nasution^{2*}, Regina Rengsi Putri Wahyuni³, Ramlan Sahputera Sagala⁴

^{1,2,3}Sports Science department, Faculty of Sport Science, State University of Medan

⁴ Department of Sports Coaching Education, Faculty of Sport Science, State University of Medan

e-mail: sinungnugroho@unimed.ac.id¹, silviafnt@unimed.ac.id², reginarengsi@unimed.ac.id³, ramlan@unimed.ac.id⁴

Abstract

The integration of digital technology into higher education has created opportunities for instructional resources that combine conceptual explanation with visual and interactive learning support. In athletics education, conventional materials may provide limited opportunities for repeated observation of complex movement sequences. This study aimed to develop interactive multimedia teaching materials for the long jump and to assess their preliminary validity and practicality among undergraduate Sport Science students. A Research and Development (R&D) approach adapted from the Borg and Gall model was used and limited to five stages: research and information collecting, planning, developing the preliminary product, preliminary field testing, and main product revision. The product integrated text, images, animations, instructional videos, movement-analysis content, formative quizzes, feedback, and self-evaluation. Six experts rated 30 items covering subject matter, media, and learning domains, while 20 undergraduate students rated 40 items covering ease of use, learning interest, content presentation, and multimedia appearance. Expert appraisal produced 90.0% overall, with domain scores of 90.0% for subject matter, 88.0% for media, and 92.0% for learning. The overall Aiken's V was 0.875, providing supporting evidence of content relevance based on the expert ratings. Student responses produced an overall score of 90.0%; the dimension scores were 89.8% for ease of use, 91.5% for learning interest, 91.7% for content presentation, and 87.1% for multimedia appearance. All dimension scores fell within the study's Very Practical category. These findings indicate that the product was favorably appraised and practically usable in a limited field setting.

Keywords: interactive multimedia; teaching materials; long jump; movement understanding; research and development; validity; practicality.

corresponding author: sinungnugroho@unimed.ac.id

Artikel Info:

Submitted: 30/07/2026

Revised: 01/09/2026

Accepted: 04/10/2026

Published: 04/10/2026

How to Cite: Sinung, N., Nasution, S. F., Regin, R. P. W., Sagala, R. S. (2026). Development, Validity, and Practicality of Interactive Multimedia Teaching Materials for Long Jump among Undergraduate Sport Science Students. *Journal Coaching Education Sports*, 7(2). 595-607.

Author's Contribution: a) Desain Penelitian; b) Pengumpulan Data; c) Analisis Statistik; d) Penyusunan Naskah; e) Pengumpulan Dana



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A. Introduction

The rapid development of digital technology has transformed higher education by expanding access to multimodal learning resources and enabling students to revisit instructional content beyond scheduled classroom time. In technology-enhanced learning, the role of the lecturer increasingly includes designing learning environments that organize information, provide meaningful guidance, and support students' active engagement with learning materials. These developments are relevant to sport science because learning outcomes combine conceptual knowledge with the acquisition and refinement of movement skills.

Interactive multimedia can combine text, graphics, animation, audio, video, simulation, and formative assessment within a single learning environment. From the perspective of the Cognitive Theory of Multimedia Learning (CTML), coordinated verbal and visual representations can support learners in selecting, organizing, and integrating relevant information (Mayer, 2021; Fiorella & Mayer, 2021). Evidence from digital-learning research also indicates that technology can support access, engagement, and flexible learning, although educational effects depend on instructional design and context (Bond et

al., 2020; Goodyear, 2023; UNESCO, 2023). Thus, multimedia should not be treated simply as a collection of digital media; rather, it should function as an instructional system in which media elements are deliberately organized around learning objectives.

Cognitive Load Theory provides a complementary rationale for structuring multimedia materials so that essential information is highlighted and unnecessary processing is reduced (Sweller et al., 2019; Paas et al., 2022). In procedural and motor learning, clear demonstrations, appropriate guidance, practice opportunities, feedback, and reflection are also important components of skill acquisition (Hodges & Williams, 2022; Wulf & Lewthwaite, 2021). In the present study, these theories were used as design rationales for the product. They were not treated as empirical evidence that the developed multimedia improved students' learning.

Long jump is a sequential athletics event in which the approach run, take-off, flight, and landing are technically and biomechanically related. Understanding the characteristics of each phase is important because errors in one phase can influence subsequent movement and overall performance. Instructional resources for long jump should therefore enable students

to observe movement sequences, focus on phase-specific technical features, and connect demonstrations with concise conceptual explanations (Lees et al., 2022).

In higher-education athletics instruction, lecturer demonstrations, printed modules, and presentation slides remain useful, but they can provide limited opportunities for students to replay a movement demonstration independently or examine phase-specific details at their own pace. These limitations become relevant when practical classes contain many students and lecturers have limited time for individualized explanation. A digital resource that organizes demonstrations, explanations, practice questions, and self-evaluation may therefore complement face-to-face practical instruction.

Research in physical education has increasingly examined digital videos, multimedia resources, and other technology-supported learning environments. Reviews and pedagogical research indicate potential benefits for engagement, access, reflection, and learning support, but effects vary according to technology, pedagogy, outcome, and implementation context (Casey et al., 2021; Goodyear, 2023; Zhao et al., 2025). Consequently, claims about improved motor competence or achievement require outcome measures that directly assess those

constructs; perceptions of usability or practicality should not be interpreted as evidence of effectiveness.

Studies of multimedia and video-based instruction in physical education provide a relevant foundation for developing digital resources for athletics. Video variations and interactive multimedia have been used to provide visual demonstrations and learning support in physical-education contexts (Priyambada et al., 2024; Wiguno et al., 2023). The present study addresses a more specific instructional problem: a long-jump learning resource for undergraduate Sport Science students that combines phase-by-phase technical explanation with interactive assessment and self-evaluation. The contribution is therefore positioned at the level of product integration rather than as a claim of superior learning effectiveness.

The development problem is also relevant to the Department of Sport Science, Faculty of Sport Science, Universitas Negeri Medan, where long-jump learning requires students to connect theoretical concepts with practical movement execution. The product was designed around four movement phases—approach run, take-off, flight, and landing—and included technical explanations, examples of movement errors, corrective suggestions, instructional videos, quizzes, and self-evaluation. The

raw dataset supplied for this revision contains the subsequent expert and student appraisal data; it does not contain a separate numerical needs-analysis dataset. Therefore, this article does not invent or retrospectively estimate needs-analysis percentages.

The research gap concerns the development and preliminary appraisal of a long-jump multimedia teaching material that integrates several instructional functions in one product. Previous work has often focused on digital content presentation, video, or general physical-education multimedia. The present study combines movement-analysis content, instructional video, formative assessment, feedback, and self-evaluation within a single product designed for undergraduate athletics learning. Importantly, the study evaluates preliminary validity and practicality rather than causal effectiveness.

Therefore, this study aimed to (1) develop interactive multimedia teaching materials for long-jump instruction among undergraduate Sport Science students, (2) assess the preliminary validity of the product through expert appraisal, and (3) assess its practicality and user response through a limited field test. The novelty is limited to the integration of movement-analysis content, instructional video, formative assessment, feedback, and self-

evaluation within a single multimedia learning environment.

B. Methods

Research Design

This study employed a Research and Development approach adapted from the Borg and Gall model. The original model contains a broader sequence of development, field testing, revision, dissemination, and implementation activities. This study intentionally stopped after the fifth adapted stage because the research scope was directed toward producing and preliminarily appraising an instructional prototype. The five stages were: (1) research and information collecting, (2) planning, (3) developing the preliminary product, (4) preliminary field testing, and (5) main product revision (Borg & Gall, 1983; Sugiyono, 2022). The study therefore did not include operational field testing, dissemination, or effectiveness testing.

The product development process was organized around the identified instructional requirements of long-jump learning. The preliminary product integrated learning objectives, theoretical concepts, movement techniques, instructional videos, interactive quizzes, and self-evaluation. The movement content followed the sequence of approach run,

take-off, flight, and landing. Each phase included technical explanations, common

movement errors, corrective suggestions, and formative assessment.

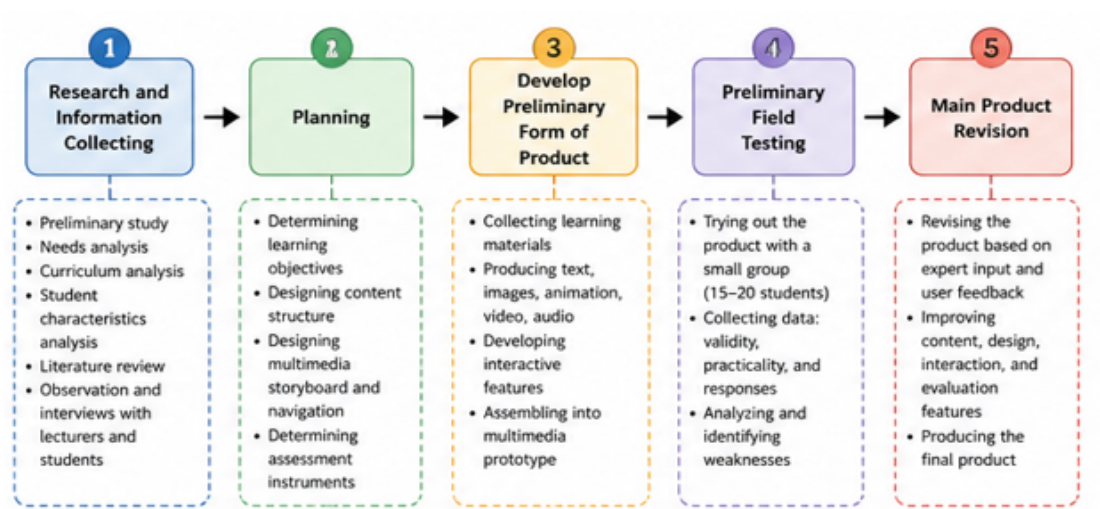


Figure 1. Adapted Borg and Gall development design (Stages 1–5).

Participants and Validation Procedure

The raw dataset contains ratings from six expert validators and 20 undergraduate students. The six experts were grouped into three domains: two subject-matter experts, two media experts, and two learning experts. Each expert completed 10 five-point Likert items within the relevant domain, resulting in 30 expert-rating items. The student field-test dataset contains 20 complete records, with 40 five-point Likert items distributed across four dimensions: ease of use, learning interest, content presentation, and multimedia appearance.

The supplied raw dataset does not contain demographic profiles, academic qualifications, years of professional experience, or the formal selection procedure of the six experts. Accordingly, these characteristics are not fabricated in this article. They should be added from the

researchers' validation records if required by the target journal.

Instruments

The expert instrument comprised 30 statements. The subject-matter domain assessed the accuracy and sequencing of long-jump content, phase-specific explanations, movement-error analysis, corrective suggestions, examples, and overall content suitability. The media domain assessed navigation, menu consistency, image and video quality, animation, text readability, interface, device usability, and overall media quality. The learning domain assessed clarity of objectives, systematic organization, instructional guidance, alignment of video and explanation, formative quizzes, feedback, self-evaluation, independent learning, language, and pedagogical

support.

The student instrument comprised 40 statements, with 10 items per dimension. Ease of Use assessed navigation, instructions, movement between sections, video replay, menu clarity, quiz and self-evaluation use, independent use, technical assistance, and overall usability. Learning Interest assessed interest in long jump, attractiveness of demonstrations, exploration, willingness to review, engagement with quizzes, perceived non-boredom, interest in movement phases, intention to reuse the product, active attention, and overall interest. Content Presentation assessed systematic presentation, phase-specific explanations, complementarity of video and text, error examples, corrective suggestions, language, and overall support for understanding. Multimedia Appearance assessed visual attractiveness, text-image balance, readability, image clarity, video quality, animation, color and layout, icon recognition, menu consistency, and overall comfort. All items used a five-point Likert scale, with 1 representing the lowest and 5 the highest rating.

Data Analysis

Descriptive percentages were calculated using $P = (\Sigma X / \Sigma X_{\max}) \times 100$, where ΣX is the observed total score and

$\Sigma X_{\max}$ is the maximum possible score. The interpretation criteria adopted from the study protocol were: 81–100% = Very Valid/Very Practical; 61–80% = Valid/Practical; 41–60% = Quite Valid/Quite Practical; 21–40% = Less Valid/Less Practical; and 0–20% = Not Valid/Not Practical.

Because the expert data were item-level ratings, Aiken's V was additionally calculated as a supporting content-validity indicator using $V = \Sigma(r - 1) / [n(c - 1)]$, where r is the rating, 1 is the lowest score, n is the number of raters, and c is the number of response categories (5) (Aiken, 1985). Given that only two experts rated each domain, Aiken's V is interpreted cautiously as supporting evidence rather than as a definitive psychometric estimate.

The student data were summarized using total score, percentage, mean item score, and participant-level standard deviation. No inferential effectiveness test was performed because the study design did not include pretest-posttest measurement or a comparison group. The raw dataset supplied for this analysis contains quantitative Likert responses; it does not contain coded qualitative comments, so qualitative thematic analysis was not performed.

Ethical Considerations

The supplied research files did not

contain an ethics-approval number or a documented informed-consent procedure. These details should be completed from the institutional research record before journal submission. The present article therefore does not invent an approval number or consent statement.

C. Result and Discussion

Expert Validation

The six expert validators produced a

Table 1. expert validation

Validation Domain	Experts	Items	Obtained Score	Mean	Percentage	Aiken's V
Subject Matter	2	10	90	4.50	90.0%	0.875
Media	2	10	88	4.40	88.0%	0.850
Learning	2	10	92	4.60	92.0%	0.900
Overall	6	30	270	4.50	90.0%	0.875

The subject-matter domain obtained 90.0%, indicating favorable appraisal of the accuracy and organization of the long-jump content. The media domain obtained 88.0%, reflecting favorable ratings of navigation, visual presentation, video, animation, readability, and interface. The learning domain obtained the highest percentage, 92.0%, indicating favorable appraisal of the learning objectives, sequencing, formative questions, feedback, self-evaluation, and pedagogical organization.

At item level, the lowest Aiken's V values were 0.750 and occurred on several items receiving ratings of 4 from both validators. These items should be treated as specific revision points rather than ignored

combined score of 270 out of a maximum possible 300, corresponding to 90.0%. The domain-level percentages were 90.0% for subject matter, 88.0% for media, and 92.0% for learning. The overall Aiken's V was 0.875. At the item level, Aiken's V ranged from 0.750 to 1.000. The domain results indicate that the product received consistently high ratings across content, media, and learning-design aspects.

because the domain averages were high. In particular, the lower-rated items concerned take-off explanation, movement-error analysis, sequencing of content, video quality, text readability, device practicality, and some learning-design features. The original product revision therefore remains consistent with the expert-rating pattern: the product was acceptable overall, while selected technical and instructional details could be refined.

Preliminary Student Field Test

The student dataset contained 20 complete responses. Across 40 items, students produced a combined score of 3601 out of 4,000, corresponding to 90.0% (mean item score = 4.50). The participant-

level standard deviation of the overall mean score was 0.08. All 20 students had overall

scores within the Very Practical category under the study's interpretation criteria.

Table 2. preliminary student field test

Student Dimension	Items	N	Obtained Score	Mean Item	Percentage	SD
Ease of Use	10	20	898	4.49	89.8%	0.14
Learning Interest	10	20	915	4.58	91.5%	0.14
Content Presentation	10	20	917	4.58	91.7%	0.13
Multimedia Appearance	10	20	871	4.36	87.1%	0.14
Overall	40	20	3601	4.50	90.0%	0.08

Content Presentation received the highest student rating at 91.7%, followed by Learning Interest at 91.5%, Ease of Use at 89.8%, and Multimedia Appearance at 87.1%. The relatively lower score for Multimedia Appearance indicates that visual and interface elements were the aspect with the greatest room for refinement, even though the score remained within the Very Practical category.

At the item level, Content

Presentation ranged from 88.0% to 96.0%; Ease of Use ranged from 86.0% to 94.0%; Learning Interest ranged from 89.0% to 94.0%; and Multimedia Appearance ranged from 84.0% to 89.0%. The lowest student-rated item was MA5, concerning video display quality, at 84.0%, followed by MA6 concerning the contribution of animation/visualization at 85.0%. These findings provide concrete targets for subsequent product refinement.

Table 3. content presentation for student

Dimension	Highest-rated item	Score	Lowest-rated item	Score
Ease of Use	EU7 – self-evaluation is easy to use	94.0%	EU3 – moving between sections is easy	86.0%
Learning Interest	LI1/LI7/LI9 – interest, movement phases, active attention	94.0%	LI4 – encouraged to review unclear material	89.0%
Content Presentation	CP5 – landing explanation is easy to understand	96.0%	CP4 – flight explanation is easy to understand	88.0%
Multimedia Appearance	MA1/MA2 – attractive appearance and text-image balance	89.0%	MA5 – video display quality	84.0%

Product Characteristics

The final preliminary product consisted of six main menus: learning objectives, theoretical concepts, movement

techniques, instructional videos, interactive quizzes, and self-evaluation. The content was arranged according to the sequence of approach run, take-off, flight, and landing.

The product also included movement-error examples and corrective suggestions so that students could connect visual

demonstrations with technical explanations.



Figure 2. Main interface of the interactive multimedia teaching material.

Discussion

The present findings establish two empirical characteristics of the developed product: high expert appraisal and favorable student practicality responses. The overall expert percentage of 90.0% and Aiken's V of 0.875 indicate that the six validators generally considered the content, media, and learning design relevant and appropriate. Because only two experts represented each domain, however, the Aiken's V result should be interpreted as preliminary supporting evidence rather than as a definitive estimate of content validity.

The subject-matter rating of 90.0% is consistent with the structure of the product, which organizes long-jump instruction around the four technically connected phases. The inclusion of phase-specific explanations, movement-error analysis, corrective suggestions, and video examples allows the material to address both declarative and procedural aspects of the

skill. From the CTML perspective, the combination of verbal explanation and visual demonstration provides a plausible instructional mechanism for organizing information (Mayer, 2021). The present data, however, only show expert appraisal; they do not demonstrate that students learned the technique better because of this design.

The media domain obtained 88.0%, slightly below the subject-matter and learning domains. This pattern is informative because the student data also showed that Multimedia Appearance was the lowest-rated student dimension at 87.1%. The convergence of these two datasets suggests that visual and technical presentation deserves continued refinement. The item-level student data particularly identified video display quality (84.0%) and animation/visualization (85.0%) as lower-rated aspects. These findings provide a more precise basis for

revision than a single overall practicality percentage.

The learning domain obtained the highest expert rating at 92.0%. The learning instrument explicitly assessed objectives, systematic sequencing, alignment between verbal and visual explanations, formative quizzes, feedback, self-evaluation, independent learning, language, and pedagogical support. This pattern supports the argument that the product's instructional architecture was well aligned with the intended learning process. Again, the finding is an appraisal of instructional design quality, not a direct measure of learning gain.

Student responses were favorable across all four dimensions, with an overall score of 90.0%. Content Presentation was the highest-rated dimension (91.7%), indicating that students generally viewed the organization and explanation of the material positively. Learning Interest was also high (91.5%). Importantly, this construct should be interpreted as perceived interest measured by the supplied questionnaire, not as a validated measure of motivation or long-term engagement. Ease of Use reached 89.8%, indicating favorable usability, while Multimedia Appearance reached 87.1%, identifying the visual presentation as the clearest area for future refinement.

The findings are compatible with the CTML rationale because the product deliberately integrates visual and verbal information. They are also compatible with Cognitive Load Theory because the content is segmented by movement phase and presented with supporting demonstrations (Sweller et al., 2019; Paas et al., 2022). Nevertheless, the current study did not measure cognitive load, retention, transfer, or movement performance. Therefore, these theories explain why the design was selected, but they do not constitute empirical evidence of the product's effectiveness.

From a motor-learning perspective, the product provides repeated observation, feedback-oriented questions, and self-evaluation. These features are theoretically relevant to skill acquisition and reflective practice (Hodges & Williams, 2022; Wulf & Lewthwaite, 2021). However, the study did not assess changes in the quality of the approach run, take-off, flight, or landing. Future studies should therefore operationalize movement understanding and motor performance using appropriate performance-based instruments and pretest-posttest measurement.

The study contributes to digital sport-science education by integrating multiple instructional functions into one product rather than presenting an instructional video

alone. This product-level integration responds to the broader call for pedagogically purposeful use of digital technologies in physical education (Casey et al., 2021; Goodyear, 2023). The contribution should not be framed as proof that multimedia is superior to conventional teaching; the present design cannot answer that question.

Several limitations should guide interpretation. First, the field test involved 20 students from one institutional context, limiting transferability. Second, expert representation was limited to two raters per domain. Third, the raw dataset did not include demographic or professional profiles of validators. Fourth, no pretest-posttest outcome measure or comparison group was included. Fifth, the supplied quantitative dataset did not contain coded qualitative comments. Finally, the ethics approval number and informed-consent documentation were not present in the supplied files. These limitations should be addressed in subsequent research and in the final submission package.

Future studies should proceed to larger field testing and effectiveness evaluation. A quasi-experimental pretest-posttest design could compare the multimedia-supported class with conventional instruction and directly measure movement understanding and

technical performance. A subsequent study could also examine retention, transfer, learning motivation, and usability across multiple universities. If the multimedia is further developed, higher-quality video, more precise movement analysis, and adaptive feedback could be investigated.

D. Conclusion

This study developed interactive multimedia teaching materials for long-jump instruction using an adapted five-stage Borg and Gall R&D process. Expert appraisal produced an overall score of 90.0%, with subject-matter, media, and learning domain scores of 90.0%, 88.0%, and 92.0%, respectively. The overall Aiken's V was 0.875. In the limited student field test, 20 students produced an overall practicality/user-response score of 90.0%, with 89.8% for ease of use, 91.5% for learning interest, 91.7% for content presentation, and 87.1% for multimedia appearance.

Under the descriptive criteria used in the study, the product was categorized as Very Valid by expert appraisal and Very Practical by students. The evidence supports the feasibility and preliminary quality of the multimedia as a complementary instructional resource for undergraduate long-jump learning. Because no pretest-posttest, comparison group, or

direct performance outcome was included, the study does not establish causal effectiveness or improvement in movement understanding. The next research stage should test learning effectiveness and motor-performance outcomes with a larger and more rigorous design.

E. Acknowledgments

The authors gratefully acknowledge the Institute for Research and Community Service, Universitas Negeri Medan, for research support, and thank the Faculty of Sport Science, the Department of Sport Science, the expert validators, and the students who participated in the product appraisal and preliminary field testing.

F. Conflict of Interest

The authors declare that they have no competing interests.

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