



Integration of Web and Factual Video Technology in the Development of Interactive Digital Learning Media

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Abstract

This study aims to develop interactive web-based digital learning media that integrates factual videos as learning content, as well as to analyze its feasibility, teacher and student responses, and effectiveness in supporting e-learning. The research employed a Research and Development (R&D) approach using the ADDIE model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. The learning media were developed in the form of an interactive website that allows integrated access to materials, factual videos, and learning assessments. Validation by media experts resulted in a score of 85% (very feasible), while content experts rated it 90% (very feasible). Biology teachers' assessments yielded 91.66% (very feasible). A small group trial with six students obtained 90.62% (very feasible), and a large group trial with 27 students obtained 89% (very feasible). Effectiveness was measured through pretest and posttest on 32 students, with average scores of 48.53% and 88.68%, respectively. Analysis using paired sample t-test and N-gain indicated that the web-based learning media integrated with factual videos is effective in improving student learning outcomes in an e-learning environment.

Keywords: Ixora Flower; Web-Based Learning Media; E-Learning; Factual Video

1 Introduction

Learning media play a crucial role in enhancing the effectiveness and efficiency of the learning process. The use of engaging and interactive learning media can increase students' interest in learning and facilitate a deeper understanding of the material. Learning media also support educators in presenting content in innovative and enjoyable ways [1]. However, interviews with biology teachers at SMA Negeri 13 Kota Jambi revealed that biology instruction still faces challenges such as limited time, scarce learning resources, and the use of monotonous media. The media commonly employed are restricted to student worksheets (LKS), textbooks, and simple presentations, which results in students being less active and less engaged in the learning process.

Observations indicate that the school has adequate facilities to support web-based technology learning, including computer laboratories, projectors, and students' access to smartphones. This condition provides an opportunity to develop e-learning-based instructional media that promote autonomous learning. Interactive web-assisted learning media allow students to access learning materials flexibly, both inside and outside the classroom, and support independent learning [2] [3].

Web-based interactive learning media integrated with factual videos offer a relevant alternative for presenting biodiversity content in a contextual manner. Factual videos provide information based on real-life events that are both informative and educational, enhancing students' learning experiences [4]. Needs analysis showed that 46.2% of grade

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X students preferred audio-visual media as the most effective method for learning biodiversity topics. Furthermore, biology teachers indicated that they had never developed interactive web-assisted learning media but supported its development, as it is easily accessible anytime and anywhere with an internet connection and has the potential to improve the quality of biology learning.

2 Materials and methods

This study employed a Research and Development (R&D) approach aimed at producing interactive web-based learning media integrated with factual videos. The media development process followed the ADDIE model proposed by [5], which consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation. Each stage was conducted systematically to ensure alignment among learning objectives, instructional content, multimedia design, and learning assessment within a web-based learning environment [6] [7].

The research subjects were tenth-grade students at SMA Negeri 13 Kota Jambi, who were involved as participants during the implementation phase. Product trials were conducted in two stages: a small-group trial involving six students and a large-group trial involving twenty-seven students. Data were collected through observation, interviews with biology teachers, documentation, student needs questionnaires, validation questionnaires from subject-matter experts and media experts, and learning outcome tests in the form of pretests and posttests. The collected data comprised both qualitative and quantitative data derived from expert validation results, teacher and student responses, and learning achievement tests.

Data analysis was carried out using descriptive and inferential techniques. Quantitative data from validation results and questionnaires were analyzed using a positive Likert scale to determine the feasibility level of the developed learning media. Meanwhile, the effectiveness of the learning media was examined by comparing pretest and posttest scores using a paired sample *t*-test with SPSS version 27. Furthermore, normalized gain (N-gain) analysis was applied to measure the improvement in students' learning outcomes after using the interactive web-based learning media.

3 Results and discussion

The development of interactive digital learning media integrated with web technology and factual videos was carried out through the stages of analysis, design, and development. During the development stage, the product was validated by subject-matter experts and media experts prior to field testing and classroom implementation.

3.1 Validation Results from Subject-Matter and Media Experts

The results of the subject-matter expert validation indicated an improvement in product quality following revisions. In the first validation stage, the learning media achieved an average score of 76.66%, categorized as feasible; however, several improvements were required before field testing. After revisions were made based on the validators' suggestions, the validation score increased to 90%, classified as very feasible. Accordingly, the learning media was deemed ready for field trials (Figure 1).

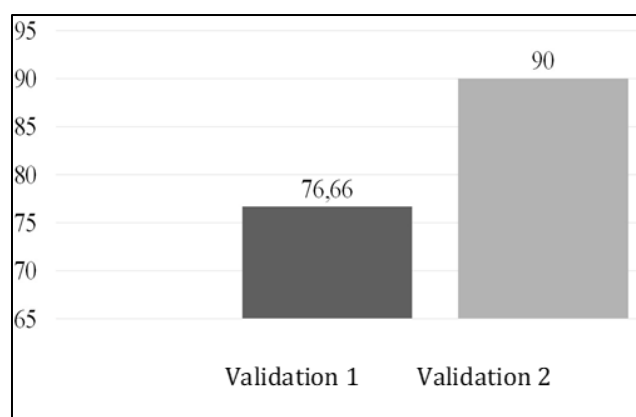


Figure 1 Results of Material Expert Validation

Media expert validation also showed a similar upward trend. In the first validation stage, the learning media obtained an average score of 68.33%, categorized as feasible. After improvements were made to the operational and presentation

aspects of the media, the score increased to 85%, classified as very feasible. These results indicate that the developed learning media meets feasibility criteria in terms of technical functionality and visual design (Figure 2).

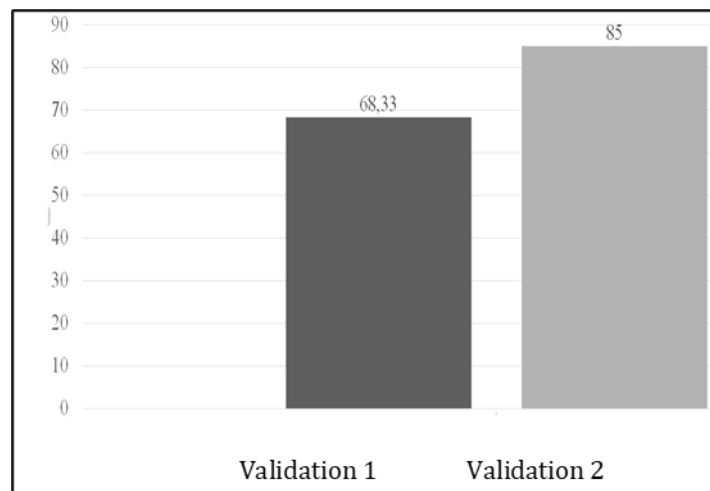


Figure 2 Validation Results from Media Experts

3.2 Product Trial Results

The media trials were conducted through evaluations by biology teachers as well as students in both small-group and large-group settings. The biology teacher assessment yielded a score of 91.66%, classified as very feasible. The small-group trial involving six students obtained a score of 90.62%, while the large-group trial involving twenty-seven students achieved a score of 89%; both results fall into the very feasible category. These findings indicate that the learning media was very well received by users and is suitable for implementation in the learning process (Figure 3).

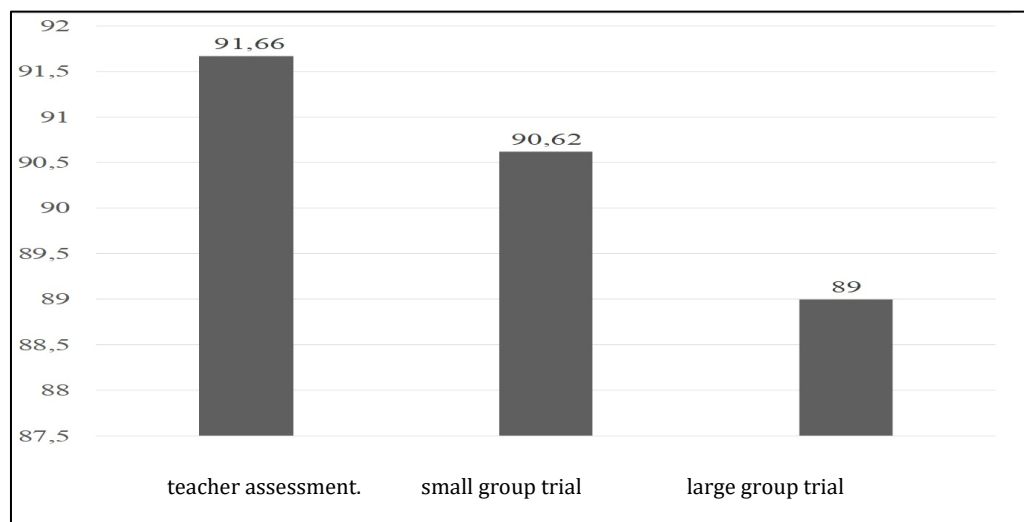


Figure 3 Biology Teacher Assessment Diagram, Small Group Trial and Large Group Trial

3.3 Learning Media Implementation Results

The implementation of the learning media was conducted with 32 students through the administration of pretests and posttests consisting of 20 multiple-choice questions. The results demonstrated an increase in the mean score from 48.53 on the pretest to 88.68 on the posttest after the use of the learning media (Figure 4).

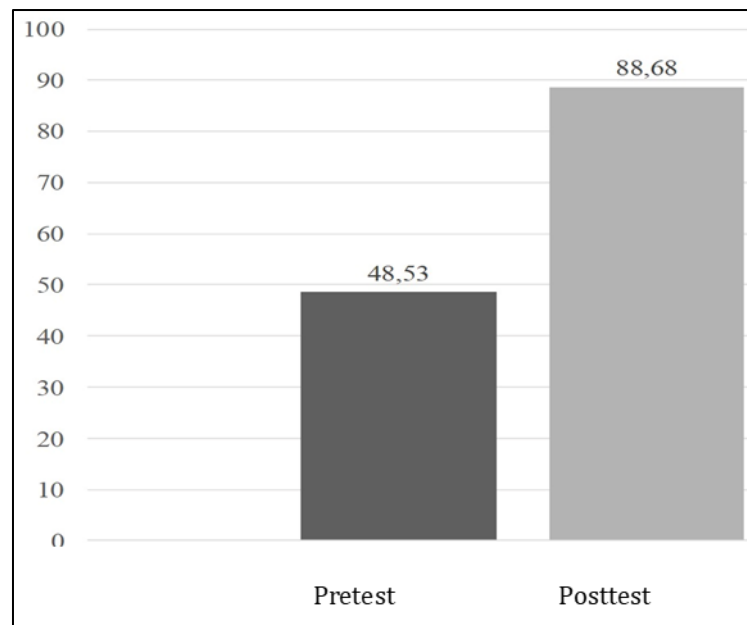


Figure 4 Comparison of Students' Pretest and Posttest Results

The paired sample *t*-test results showed a significance value of 0.000 (< 0.05), indicating a statistically significant difference between students' learning outcomes before and after the use of the web-assisted interactive learning media integrated with factual videos (Table 1). To measure the level of improvement in learning outcomes, an N-gain analysis was conducted. The results revealed an average N-gain value of 0.767 or 76.71%, which falls into the high category. These findings demonstrate that the developed learning media is effective in improving students' learning outcomes (Table 2).

Table 1 Results of the Paired Sample *t*-Test

Paired Samples Test										
			Paired Differences				t	df	Sig. (2-tailed)	
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
						Lower				Upper
Pair 1	Pretest	-	-40.40625	16.20605	2.86485	-46.24915	-34.56335	-14.104	31	0.000

Table 2 N-Gain Test Results for Pretest and Posttest

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_Score	32	0.19	1.00	0.7672	0.20822
Ngain_Persen	32	19.05	100.00	76.7186	20.82161
Valid N (listwise)	32				

The development of this learning media emphasizes the utilization of digital technology through the structured ADDIE model, particularly the integration of website-based learning as a solution to limitations in time, space, and biology learning resources. The needs analysis revealed that students require learning media that can be accessed flexibly and independently through various digital devices. A website was selected because it is capable of presenting complex

content, such as biodiversity topics, in a more visual, interactive, and contextual manner. This finding is consistent with [8], who stated that technology-based learning media can enhance active engagement and conceptual understanding, and is further supported by [9], who emphasized the effectiveness of multimedia technology in the learning process.

During the design and development stages, web technology was optimally utilized through the use of Google Sites as the primary platform, enabling integrated presentation of text, images, factual videos, and assessments without requiring additional application installation. The factual videos, developed through field recording, object identification, and digital editing processes, became a key component in visualizing abstract concepts. Expert validation results indicated an improvement in media quality to the "Very Feasible" category, suggesting that the interface design, navigation, and multimedia integration met established technological feasibility standards. These findings are consistent with studies by [10] [11], which reported that audio-visual and website-based media are effective in enhancing understanding by engaging multiple learning modalities.

The implementation of the website-assisted learning media demonstrated that interactive learning technology significantly improved students' learning outcomes, as evidenced by differences between pretest and posttest scores and high N-gain values. The strengths of this technology lie in its ability to support self-directed learning, interactivity, and content repetition through digital materials that can be accessed anytime. These results align with previous studies by [12] [13] [14], which concluded that website-based biology learning is not only technically feasible but also effective in improving students' competencies. Therefore, interactive learning media integrated with factual videos and supported by website technology has strong potential as an adaptive learning solution for meeting the demands of 21st-century education.

4 Conclusion

The interactive learning media integrated with factual videos and supported by a website, developed using the ADDIE model, demonstrates that the proper utilization of information technology can enhance the quality of biology learning. The integration of a website platform, interactive multimedia, and factual videos enables the presentation of content in a more visual, flexible, and easily accessible manner across various digital devices, thereby supporting independent learning and active student engagement. Expert validation, teacher assessments, and product trials indicated a high level of feasibility, and the implementation of this technology-based media was proven effective in significantly improving students' learning outcomes. Therefore, this IT-based learning media is suitable as an innovative solution for biology education in the digital era.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that No conflict of interest

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