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Advancing students' reading literacy through the development of website-based multimodal instructional content

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ABSTRACT

This study aimed to develop website-based multimodal instructional content to enhance the literacy competency of junior high school students in Indonesia. The study conducted developmental research adopting the ADDIE framework (analysis, design, development, implementation, and evaluation). In the analysis phase, it involved analyzing the educational needs and content through interviews with certified junior high school teachers and literacy experts. The design phase dealt with designing a reading-focused website, learning content, and assessment tools that were based on the analysis of learning goals, competencies, and study materials. In the development phase, it included feasibility testing of the developed website using the Fuzzy Delphi method with 10 experts, content validation with 5 experts, and instrument validation with 5 experts. In the implementation phase, the product was scrutinized through a quasi-experimental design to reveal its effectiveness. In the evaluation stage, it was conducted to evaluate the results of analysis, design, feasibility, and implementation of educational websites, learning content, and instruments. The Fuzzy Delphi method demonstrated that the reading literacy competence, linguistic features, and presentation met established validity and feasibility criteria, affirming the appropriateness of the developed content for instructional use. The empirical testing revealed that website-based multimodal instructional content is effective in enhancing students' reading literacy competence.

Keywords: literacy, multimodality, reading literacy, website-based learning

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INTRODUCTION

Amid the advent of digital era, fostering students' reading literacy skills remains a pivotal part of educational priority. Reading literacy serves as a foundational domain in cultivating students' critical thinking and problem-solving skills (Begum et al., 2024). Astuti et al. (2020) reported that the findings from the Programme for International Student Assessment (PISA) indicate that Indonesian students exhibit low proficiency in reading literacy, with an average score of 371 out of the international average of 487. The deficiency of reading literacy is partly caused by instructional practices. This issue is not only related to students' reading habits, but also to how reading literacy is conceptualized and practiced in schools. In their study, Fauzan et al. (2023) found that reading literacy is still understood as literal and mechanistic reading, whereas it should involve the ability to interpret, evaluate, and use information meaningfully. Saputra et al. (2025) revealed that ineffective pedagogical practices lacking an emphasis on fostering reading interest contribute to students' low reading literacy levels. Furthermore, a lack of meaningful technological integration in literacy instruction has also contributed to the plateau in students' reading literacy outcomes (Khalil et al., 2025).

With the rapid advancement of technology, pedagogical practices have significantly embraced digital integration. Within the digital tools landscape, websites present a viable

technological aid for strengthening teaching and learning practices. The integration of websites into learning activities assists students in accessing instructional content more broadly and flexibly. Prior studies have confirmed that integrating websites into pedagogical practices supports students in grasping the materials effectively and fosters a more meaningful learning environment (DeCoito et al., 2025; Nurhikmah et al., 2025; Tang et al., 2025; Yuniarti et al., 2025). Furthermore, websites provide various forms of instructional media such as text, images, videos, animation which supports engaging and accessible learning. The integration of websites in the instructional practices is expected to facilitate students' learning access anytime and anywhere (Shahmohammadi et al., 2025).

Empirical studies have shown the effectiveness of utilizing websites in pedagogical practices. The implementation of websites in the instructional process provides positive impacts on the students' learning outcomes, including the enhancement of students' material understanding (Knutsen et al., 2025), the development of students' learning motivation (Yuniarti et al., 2025), and the accessibility of flexible learning (Fathalla et al., 2025). Moreover, the use of websites fosters interactive and engaging learning and support students' critical thinking skills (DeCoito et al., 2025; Hoppe et al., 2025). Leveraging website-based learning benefits mitigates students' low literacy and reading interest which enable educators to be more meaningfully support the enhancement of students' reading literacy.

Despite the numerous benefits, the use of websites in student learning presents several challenges. Bédi and Þorláksdóttir (2024) highlighted that it is pivotal to consider pedagogical factors in developing the website. The factors covered student interaction with the platform, the quality of instructional content, and the alignment with individual learning styles. Therefore, the design of website-based instructional needs to consider those aspects and tailor to meet students' learning needs. Studies on developing websites have been explored for many years and many developments dealing with the advancement of technology. Prior studies reveal that the use of websites in pedagogical practices can enhance learning effectiveness due to the flexibility of access. Several studies on the website's development denote that the websites implementation assist students to improve their reading comprehension in language learning (Latifi, 2024), varieties of websites' learning materials enhance students' learning motivation (Zygouris et al., 2025), and the use of various learning strategies activates students' reading literacy skills (Siswanto et al., 2022; Subali, 2023; Küçükoğlu, 2013; Banditvilai, 2020).

To the best of the authors' knowledge, there are few studies focusing on the websites' development that enhance students' reading literacy skills and provide multiple website features. To fill the gap, the current study presents a novel contribution through a website development in alignment with reading strategies to support students' reading literacy skills and accommodate diverse students' learning styles. Therefore, this study is conducted to develop website-based instructional content aimed at advancing students' reading literacy. The research questions formulated are as follows. (1) How is the feasibility of the website-based multimodal instructional content in supporting students' reading literacy development? (2) How effective is website-based multimodal instructional content in enhancing students' reading literacy skills?

METHOD

Informed by the pragmatist-critical realism paradigm, this current study adopted developmental research using the ADDIE framework to develop website-based instructional content aimed at improving students' reading literacy skills. The ADDIE framework consisted of five stages, including analyzing, designing, developing, implementing, and evaluating (Branch, 2009). The analysis phase consisted of analyzing the research problem, the needs for website development, the learning objectives, teaching competencies, and the subject matter. To analyze the learning objectives and teaching competencies, certified junior high school teachers were interviewed. Besides, five experts on reading literacy were also interviewed to obtain data about the subject matter, which was incorporated into instructional content. In the design phase, it dealt with designing a website-based reading activity, designing instructional content within the website, and constructing research instruments to assess students' reading literacy. The

development phase involves evaluating the feasibility of both the developed website and the instructional content. For the feasibility testing of the website and instructional content, they used Fuzzy Delphi. During the development phase, the feasibility of the website was assessed by ten experts, while the instructional content was evaluated by five subject-matter specialists. In the implementation phase, it referred to scrutinizing the effectiveness of website-based learning implementation using quasi-experimental research. In the evaluation phase, the results were evaluated in the analyzing, designing, developing, and implementing phases.

This study was conducted in state junior high schools in Magelang, Central Java, Indonesia. The research instruments in this study included semi-structured interviews, documentation, and tests. The instruments were validated by five experts, and Aiken's V scores were used to analyze the instruments' validity. Furthermore, the semi-structured interview was conducted to obtain data on learning objectives and teaching competencies, involving certified junior high school teachers as participants. Besides, the interview also involved five experts in reading literacy to gather data on experts' feedback on the subject matter. The documentation was utilized to get the data of the developed website and instructional content. The tests were used in the quasi-experimental research to find out the effectiveness of website-based learning in improving students' reading literacy. In analyzing the data, this study adopted thematic analysis and N-Gain analysis. Thematic analysis was used to analyze the interview data and the documentation. N-Gain analysis was used to analyze the pre-test and post-test data of the experimental research.

FINDINGS AND DISCUSSION

Findings

The website-based instructional content is designed and developed to enhance students' reading literacy skills. This study's findings consist of two themes, including the feasibility of website-based instructional content and the effectiveness of website-based instructional content in enhancing reading literacy.

Feasibility of website-based instructional content

By adopting the ADDIE framework, this study has utilized all phases of analysis, design, development, implementation, and evaluation. After conducting analysis phases, the authors designed and developed the instructional content integrated with multimodal modes. Then, the feasibility assessment was conducted using a consensus-based approach through the Fuzzy Delphi method (Hendrastuti et al., 2021).

Table 1. Feasibility aspects of the website-based instructional content

No	Content Feasibility Aspects	Indicator Aspects	Indicator Code
1.	Reading Literacy	The content effectively facilitates students' reading literacy in the aspect of literal comprehension.	I1
		The content effectively facilitates students' reading literacy in the aspect of mindful comprehension.	I2
		The content effectively facilitates students' reading literacy in the aspect of critical comprehension.	I3
2.	Linguistic Features	The content uses appropriate grammatical rules.	I4
		The content uses simple language suited to the students' level.	I5
		The content uses communicative and interactive language.	I6
3.	Content Delivery	The content is presented utilizing engaging multimodal modes (text, images, videos, comic strips, and/or audio texts)	I7
		The content is presented with illustrations, supporting images, and well-organized visual elements that align with the material's context.	I8
		The content uses appropriate font size, spacing, and paragraph alignment.	I9

The feasibility assessment involved ten certified English teachers who are also experts in instructional media development. Besides, the authors focus on three key domains to assess the feasibility of website-based instructional content. Table 1 provides a detailed explanation. Table 1 presents three important aspects to assess the content feasibility, including reading literacy, linguistic features, and content delivery or presentation. Based on the three fundamental aspects, the experts provide assessment on the content feasibility. If each aspect is deemed valid by the experts, the content is used and inlined with its development goals. The results of experts' assessment are presented in the Table 2.

Table 2. Fuzzy Delphi evaluation results of the content feasibility

No	List of Materials	Indicator Code	d-Value	DV-Value	Remarks
1.	Procedural Text (How to Make Something): How to Make Indonesian Fried Rice	I1	0.04	0.76	Valid
		I2	0.04	0.76	Valid
		I3	0.02	0.78	Valid
		I4	0.04	0.76	Valid
		I5	0.02	0.78	Valid
		I6	0.00	0.80	Valid
		I7	0.02	0.78	Valid
		I8	0.02	0.78	Valid
		I9	0.04	0.76	Valid
2.	Descriptive Text (Favorite Snack): My Favorite Snack — Doughnuts	I1	0.00	0.80	Valid
		I2	0.04	0.76	Valid
		I3	0.02	0.78	Valid
		I4	0.04	0.76	Valid
		I5	0.00	0.80	Valid
		I6	0.16	0.76	Valid
		I7	0.00	0.80	Valid
		I8	0.16	0.76	Valid
		I9	0.02	0.78	Valid
3.	Descriptive Text (My Sweet Home): The Heart of the House	I1	0.02	0.78	Valid
		I2	0.04	0.76	Valid
		I3	0.16	0.76	Valid
		I4	0.04	0.76	Valid
		I5	0.00	0.80	Valid
		I6	0.02	0.78	Valid
		I7	0.04	0.76	Valid
		I8	0.00	0.80	Valid
		I9	0.04	0.76	Valid

Table 2 shows that the three learning content themes have been validated by the experts. In the Fuzzy Delphi testing, the agreement refers to the threshold value (d) and the defuzzification process value (DV). The threshold value is considered valid if it is less than 0.2. Conversely, the defuzzification process value is considered valid if it is greater than or equal to 0.5. Building on the validation results, the website-based instructional content is feasible for instructional use. To further scrutinize its effectiveness, this study conducts a statistical testing which is discussed in the preceding section.

Effectiveness of website-based instructional content in enhancing reading literacy

To scrutinize the effectiveness of website-based instructional content, an experiment was conducted in the experimental group with website-based instructional content and in the control group without website-based instructional content. In both groups, the pretest and posttest were used to measure the students' reading literacy performance before and after the utilization of website-based instructional content and to compare the learning outcomes between the

experimental and control groups. Before conducting an independent sample t-test, it used normality tests. The results of the normality test are presented in the Table 3.

Table 3. Normality test results

Indicators	Kolmogorov-Smirnov (Sig. value)		Shapiro-Wilk (Sig. value)	
	Control	Experiment	Control	Experiment
Pretest	0.059	0.053	0.537	0.051
Posttest	0.195	0.000	0.088	0.004

Table 3 displays that the data distribution of pretest-control, pretest-experiment, and posttest experiment is normal, as indicated by the results of the significance value are greater than 0.05 (Sig. value > 0.05). However, the data show that the posttest scores of the experimental group were not distributed normally. Therefore, the pretest scores of the control and experimental groups were analyzed using a parametric test (Independent Sample T-test), while the post-test scores of the control and experimental groups were analyzed using a non-parametric test (Mann-Whitney). The results of the comparative analysis between pretest and posttest mean scores are shown in the Table 4.

Table 4. Statistical results: Independent samples t-Test and Mann-Whitney test

Indicators	Sig. value (*2-tailed*)
Pretest Control and Experiment (Independent Sample T-test)	0.684
Posttest Control and Experiment (Mann-Whitney Test)	0.000

Table 4 presents the results of the Independent Sample T-test and Mann-Whitney Test comparing pretest and posttest scores between the control and experimental groups. The result of the Independent Sample T-test shows that the Sig. value (2-tailed) is 0.684, which is greater than 0.05. It is indicated that there is no significant difference between the two groups, suggesting that both groups have relatively similar initial reading literacy skills. In contrast, the Mann-Whitney Test yields the Sig. value (2-tailed) is 0.000, which is less than 0.05. The result indicated a significant difference between the two groups after the intervention of website-based instructional content and demonstrated diverse levels of reading literacy performance. In addition, the N-Gain test was employed to measure the improvement from the pretest and posttest. The N-Gain results are presented in the Figure 1.

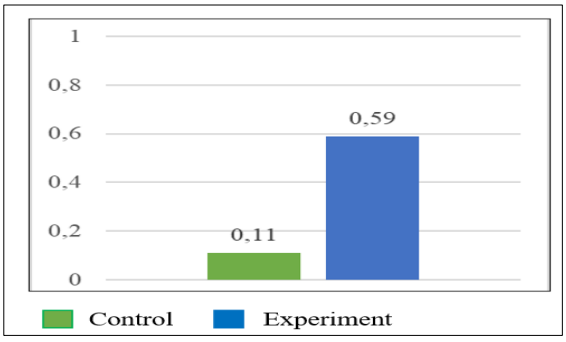

Figure 1. N-Gain Analysis Results for Control and Experimental Groups

Figure 1 presents N-Gain values for both the control and experimental groups. The control group recorded an N-Gain score of 0.11, which falls into the low category. In contrast, the experimental group achieved an N-Gain score of 0.59, which is categorized as the moderate category. Based on the statistical tests conducted, it can be inferred that the website-based instructional content is effective in enhancing students' reading literacy skills in English language learning.

Discussion

Website-based multimodal instructional content has proved its effectiveness as a learning medium to enhance students' reading literacy. Website-based multimodal instructional content utilizes various communication modes, which is called multimodal (Karatza, 2020). The use of multimodal texts in reading has a significant impact on students' literacy, particularly in the literal, critical, and comprehensive aspects (Basaraba et al., 2013). Within the context of this current study, multimodal texts consist of many semiotic modes, including images, layout, graphics, comic strips, tables, audio-visual videos, and similar elements that contribute to the meaning construction (Danielsson et al., 2016).

By using multimodal modes, the meaning construction provides a positive impact on literal comprehension in written and multimodal texts (Karatza, 2020). Besides, it broadens the students' literacy in grasping the main idea of the texts on the website-based multimodal instructional content. Bearne (2009) highlights that grasping multimodal texts encourages students to develop new discourse to critically explain various types of modes. Therefore, they can read multimodal texts. This process cultivates students' critical thinking skills, as they are required to evaluate multimodality to convey meaning (Unsworth, 2014). Besides, students leverage their critical literacy by comparing and explaining the multimodal texts. The findings of this study support the proposition that providing multimodal materials to students can assist them in reconstructing meaning through the interaction between verbal and visual modes. This aligns with the argument put forward by Fajriah et al. (2021), that images in instructional texts should function not only to capture students' attention, but also to support deeper interpretation and meaning making.

The implementation of multimodal texts offers many benefits in the teaching and learning process. Januarty and Nima (2018) proved that multimodal texts enhance students' motivation and concentration in reading. The use of multimodality helps students to engage and be more engaged in reading activities (Kress, 2010). This affirms that multimodality is an effective strategy in reading literacy. In the digital era, the utilization of multimodal text significantly improves the students' literal and holistic comprehension (Mariam et al., 2025; Nurviyani et al., 2020). Thus, multimodality has proven to be a pedagogical strategy in the development of 21st-century reading literacy.

In addition to its relation to multimodal texts, the contents in the websites have an impact on the enhancement of students' literacy (Sadiah & Hidayah, 2022; Wita et al., 2025). Furthermore, website-based learning fosters students' engagement in literacy learning due to its flexibility in accessing the interactive materials in the ubiquitous learning context. It is in line with the prior studies that underscore the use of websites to enrich students' learning experiences and improve literacy understanding effectively (Ardianti et al., 2023; Susanti & Suripah, 2021). The implementation of website-based learning media for reading literacy instruction fosters literacy in all subjects and other skills (Fitri et al., 2023; Suryandaru & Setyaningtyas, 2021; Susanti & Suripah, 2021).

The effectiveness of the website-based multimodal instructional content can be attributed to the factors underlying its effectiveness. One of the factors deals with the website's characteristics, including its interactive and flexibility which helps students to learn and access the materials in real time through the domain and hosting (Wita et al., 2025). In the present study, the website provides reading activities which assess students' reading comprehension directly and provide automatic feedback. This feature highlights the effectiveness of the website. As the previous studies reveal that website-based learning can significantly enhance students' reading comprehension, particularly in the context of academic literacy (Sadiah & Hidayah, 2022; Van Wart et al., 2020).

CONCLUSION

This study reveals that website-based multimodal instructional content is effective in enhancing students' reading literacy. The implications of the study focus on the integration of technology in literacy learning, fostering students' engagement, and promoting meaningful learning experiences. By utilizing website-based multimodal instructional content, students are

encouraged to read and understand the texts because of the varied and engaging learning materials. Besides, educators benefit from the availability of flexible learning resources that can be tailored to students' needs. Hence, support from schools and stakeholders is notable to provide educational infrastructure and workshops for educators to implement digital-based media optimally and meaningfully.

Although this current study offers valuable insights into the development of students' reading literacy, it is important to acknowledge the limitations of the study. Nevertheless, the authors acknowledge that a key limitation of this study concerns its duration, as it did not capture the long-term impact of the utilized website-based multimodal instructional content. Therefore, it is recommended that future studies focus more on the implementation stage over a longer duration for more comprehensive interventions.

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