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Analysis Validity, Readability, and Practicality of the Ecosystem E-Booklet Based on the Local Potential of Grogolan Spring to Improve Students' Critical Thinking Ability

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Abstract

This study aims to analyze the validity, readability, and practicallity of e-booklet on ecosystem material based on the local potential of the Grogolan spring in Bojonegoro which can improve students' critical thinking skills through contextual learning. Contextual learning is considered important as it allows students to learn in a real-world context and experience firsthand what they are learning, rather than just reading and memorizing material. The local potential-based e-booklet is expected to make the material more meaningful and relevant to students, thereby improving their critical thinking skills. The subject of the study was a grade X student at Tambakrejo High School. Data analysis included the validity, readability, and practicality of the e-booklet. The research results showed that (1) The e-booklet contain specific information about ecosystem materials that utilize the local potential of Grogolan Spring in Bojonegoro, which is used as a learning resource. (2) The validity of the e-booklet, based on expert assessments, obtained an average score of 95.4% for material assessment and 93% for media assessment, both categorized as very valid, the small-scale readability test by teachers obtained an average score of 94.5% and by students an average score of 88.3%, both in the very good category. (3) The practicality assessment of using the local potential-based e-booklet obtained a score of 95.5% by teachers and 84.3% by students, both showing very practical categories. Based on the researach, it can be concluded that the local potential-based e-booklet is declared feasible, potentially to improve the critical thinking skills of high school learners.

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INTRODUCTION

Critical thinking skills are essential for students, who are the next generation, to overcome global challenges and competition." These skills enable students to become lifelong learners. With critical thinking, they can actively seek information, construct strong arguments, and evaluate existing solutions (Komara et al., 2023). This equips them with the tools to manage rapid changes and new challenges that arise in the workplace and everyday life (Cahyaningsih et al., 2020).

Additionally, critical thinking skills help students develop creativity by analyzing problems from various perspectives and generating innovative ideas. They can also learn to combine knowledge from different disciplines to create more effective and efficient solutions. Prapulla et al. (2023); Utami & Nurcahyono (2023) assert that students must instill critical thinking as an essential aspect of 21st-century education. Not only is it about processing information, it is also about shaping individuals who can think analytically, creatively, and ethically when facing various challenges, they will encounter in the future. Critical thinking skills can be improved with the right approach and strategy in the learning process. One way is to apply contextual learning through a scientific approach (Yustina et al., 2021; Toharudin & Iwan, 2017).

Contextual learning that takes advantage of local potential has proven effective in improving students' critical thinking skills. This approach allows students to engage directly with material relevant to real-life situations, enabling them to analyse and evaluate information more deeply. Through contextual learning, students learn to solve problems effectively and make fact-based decisions, significantly improving their critical thinking abilities (Primayana et al., 2019). Contextual learning can be implemented by providing e-booklets based on local potentials in students' surroundings, aiming to make the material more meaningful and enhance students' critical thinking skills. This statement is supported by research Halim (2020) and Fitriani et al. (2023), which found an increase in students' critical thinking and environmental literacy in terms of knowledge, cognitive skills, and affective aspects after using locally-based e-booklet teaching materials.

In this context, ecosystems are an important topic because they involve direct engagement with the students' surrounding environment. However, it is acknowledged that learning materials about ecosystems often remain general and fail to explore the rich local potential in Indonesia. Therefore, developing e-booklets as learning media that utilize local potential in ecosystem materials becomes a relevant and innovative solution. E-booklets crafted from the students' local environment are deemed highly contextual, practical, and provide a genuine learning experience (Damayanti & Amalia, 2022).

Grogolan Spring is located in the middle of the forest in Bojonegoro. It is still considered very pristine, with extremely clear water that has a bluish-green hue. The area around Grogolan Spring is lush with many large trees, and it never experiences drought, even during long dry seasons. The local community heavily relies on this spring for its daily needs. Additionally, the spring is utilized by the water supply company (PDAM) to supply clean water to the residents of Bojonegoro and for irrigating agricultural land surrounding the area.

The environmental condition of Grogolan Spring is considered pristine, making it a valuable resource for supporting students' learning about ecosystems. Knowledge about local potential needs to be introduced and developed to encompass the diverse natural resources of the region, preparing students with relevant local knowledge related to their surroundings.

Based on the result of survey using questionnaires of 111 grade X respondents revealed that students' critical thinking skills still require improvement. The survey results showed that 69.4% of students tend to memorize sentences from books rather than understand them in depth. Additionally, 60.2% of students indicated a need for improvement in critical thinking skills, particularly in the areas of inference, evaluation, and analysis. Another finding showed that 65.7% of students lack awareness of the local potential in their environment that could serve as learning resources. Therefore, 95.5% of students expressed interest in studying ecosystem material linked to local environmental potentials, packaged in the form of an e-booklet. Based on the description, there is a need to analyze the validity, readability, and practicality of e-booklet based on local potential which effective in enhancing students' critical thinking skills.

METHOD

This product is an e-booklet teaching material based on local potential in Bojonegoro Regency on Ecosystem material which includes a front cover, preface, table of contents, instructions for use, material map, introduction, subject matter, summary, glossary, quiz, evaluation, and

author biography. The test was conducted to determine the validity of the e-booklet. This test was carried out by material experts consisting of one material expert lecturer and one practitioner (a biology teacher). Meanwhile, media validation was conducted by two media expert lecturers and one practitioner (a biology teacher). The results of the validity test were then used to improve the e-booklet teaching materials. The responses from the validation, readability and practicality data was analyzed using the following formula proposed by (Sugiyono, 2017).

$$P = \frac{\text{obtained score}}{\text{maximum score}} \text{ x } 100\%$$

The validation results of media experts and material experts are then interpreted using the score interpretation as Table 1.

Table 1. Validity Criteria Based on Percent

Persentage	Interpretation
Score ≥ 76%	Highly Valid
51% - 75%	Valid
26% - 50%	Less Valid
Score ≤ 25%	Not Valid

Products that are valid can then be followed by small-scale trials or product readability tests to determine their readability. This test was conducted using a questionnaire given to 36 class XI students who had studied ecosystem material. The responses from the readability test are then used to improve the product. The readability results are then interpreted using the score interpretation as Table 2.

Table 2. Readability Criteria Based on Percent

Percentage	Interpretation
Score ≥ 81 %	Very High
61 % - 80 %	High
41 % - 60 %	Enough
21 % - 40 %	Low
≤ 20 %	Very Low

The large-scale trial was conducted to determine the practicality of e-booklets developed as teaching material for learning activities. The sample consisted of 111 grade X students. The trial was conducted by implementing the e-booklet in biology lessons on ecosystem topics. To evaluate its practicality, a questionnaire was distributed to both students and biology teachers after the learning sessions using the e-booklet as the teaching material. The practicality results are then interpreted using the score interpretation as Table 2.

RESULT AND DISCUSSION

The ecosystem e-booklet based on the local potential of the Grogolan water source is packaged digitally using a website-based application, Heyzine, in the form of a flipbook in HTML format that can be accessed via smartphone, tablet, or PC. The educational material can be used and accessed online or downloaded for offline use, making it convenient for students to access and study both inside and outside the classroom independently.

The e-booklet consists of several sections, such as the introduction, which includes a foreword, a user guide, a table of contents, and a material diagram. The main content covers introducing the Grogolan water source location, ecosystem materials according to the curriculum, and issues and conservation efforts. The final section includes a glossary, quiz, summary, student worksheets (LKPD), and the author's profile. The local potential ecosystem e-booklet for the Grogolan water source is illustrated in Figure 1.

Figure 1. The Local Potential Ecosystem Grogolan Springs E-Booklet

The characteristics of this ecosystem e-booklet are different from other teaching materials that can be seen in terms of material. The content of the e-booklet material focuses on discussing local potential, which is packaged into ecosystem teaching materials so that students will gain a more relevant and concrete learning experience that will affect their learning outcomes. In line with the statement of Noor & Purnamasari (2019); Kundariati et al. (2022) the use of teaching materials that are directly connected to the local environment and culture can make it easier for students to understand the material because

they see real applications of the concepts being studied. This not only improves their understanding but also makes learning more interesting and meaningful. In addition, the contents of the ecosystem E-Booklet are the results of research through direct data collection found at the Grogolan spring, namely in the form of photos and videos in detail so that students can explore the local potential without having to visit the location. In line with the statement of Olivia et al. (2022) that the use of contextual learning strategies with technology-based tools, such as learning videos, has led to increased understanding and achievement among students in the subject.

Another characteristic of this ecosystem e-booklet is that each chapter includes exploration activities presented in the form of Student Worksheets (LKPD), which are designed to develop critical thinking skills. Additionally, the e-booklet features quizzes and games that can be played during learning breaks, helping to maintain focus and increase student engagement. The e-booklet also addresses various issues occurring at the Grogolan water source, which are expected to enhance students' critical thinking abilities and foster environmental awareness. This aligns with the statements of Arvianto et al. (2022); Wies et al. (2023), who assert that utilizing contextual teaching materials related to local issues can improve students' environmental awareness, responsibility, and critical thinking skills.

Overall, evidence suggests that implementing electronic teaching materials with contextual teaching content focusing on local potentials positively impacts students' environmental awareness, responsibility, and critical thinking abilities.

E-Booklet Validation Stage

The validation of the teaching materials in the e-booklet is conducted to assess the suitability of the previously developed local potential-based ecosystem e-booklet. The validation process involves experts in the subject matter and media, including experienced professors and biology teachers. The goal of this validation is to gather feedback and suggestions regarding the developed teaching materials, aiming to ensure they meet high-quality educational standards and fulfill the needs of students. The assessment components of this e-booklet validation are adapted and tailored according to the students' requirements.

Table 3. Material Expert Validation Result

Aspect	Percentage	Category
Material eligibility	96	Highly valid
Presentation	95.8	Highly valid
Contextual assessment	93.7	Highly valid
Average	95.1	Highly valid

Based on the validation results from the subject matter experts on indicators of content/material feasibility, presentation feasibility, and contextual assessment, it was found that the local potential-based ecosystem e-booklet teaching materials received an average score of 95.1% with the criterion of "very valid." These results indicate that the e-booklet has completeness, coherence, and depth of content and material, as well as activities relevant to the Learning Outcomes (CP). The materials and activities in the module can encourage students' critical thinking skills through content, evaluation, and discussion activities. The materials taught are aligned with the students' real-life situations through local potential-based learning. The subject matter experts also assessed the presentation of the materials in the e-booklet as sequential and visually appealing.

Table 4. Media Expert Validation

Aspect	Percentage	Category
Graphical Components	92	Highly valid
Functionality	94.4	Highly valid
Average	93.2	Highly valid

According to validation results from the media expert lecturer and the teacher, it was found that the local potential-based ecosystem e-booklet teaching materials received an average score of 93.2% with the criterion of "highly valid" so that the local potential-based ecosystem e-booklet is said to be suitable for use in learning. The first aspect pertains to the graphic components, which encompass factors such as the accuracy of text size and type, color combination, image and video quality, text layout, image layout, and the presentation of image and video sizes. This aspect earned an average score of 92% in a highly valid category. The graphic components of instructional media must be considered before distribution to students, as these aspects can affect their interest and understanding of the material, ultimately impacting educational outcomes (Safuroh et al., 2024).

The second aspect is a functionality with highly valid category. The functionality aspects include the benefits of the e-booklet in aiding the learning process, motivating students to learn,

training critical thinking skills, serving as an innovative and creative learning medium, and making it easier for students to understand ecosystem material. The fanctionality aspects in the development of teaching materials need to be considered because they play an important role in enhancing students' motivation, engagement, understanding, and critical thinking skills, which ultimately lead to improved learning outcomes (Manalu et al., 2018; Perdanasari & Sangka, 2021).

According to the media experts' assessment, the e-booklet is suitable for use in terms of visual appeal and design, being both attractive and effective. Additionally, in terms of usability, the experts also evaluated that the e-booklet is easily accessible, interactive, and can be used independently by students. This indicates that the e-booklet teaching materials are suitable for use in learning with some minor revisions.

Small-Scale Trial Run (Readability)

After the e-booklet was revised according to the experts' suggestions, it was then tested on a small scale. The small-scale trial was conducted with a biology teacher and 36 class XI students who had already studied the ecosystem material. The purpose of this small-scale trial was to measure the responses of the teacher and students regarding the readability of the e-booklet before it is tested on class X students.

Table 5. The Results of the Readability e-Booklet

Respon	Aspect	Score	Category
Teacher	Letters & Sentences	100	Very High
	Language	95.8	Very High
	Design & Image	92.8	Very High
	Presentation	87.5	Very High
	Interest	100	Very High
		94.5	Very High
Students	Letters & Sentences	84	Very High
	Language	87.5	Very High
	Design & Image	88	Very High
	Presentation	92.6	Very High
	Interest	89.4	Very High
		88.3	Very High
	Average	91.4	Very High

Based on the readability test results from teachers and students through questionnaire completion, a percentage score of 94.5% was obtained by teachers and 88.3% by students, both categories being at an excellent level. This readability test indicates that the local potential-based ecosystem e-booklet of Grogolan Spring has an excellent readability level in all aspects. Additionally, the readability test results also include several suggestions for improvement to enhance the e-booklet's readability further. This test aims to ensure the readability of the e-booklet, or how well teachers and students can understand it as prospective users. The readability test for teachers and students aims to assess text comprehension and readability and gather feedback on font & sentences, language, design layout, images, material presentation, and interest.

Small-scale readability testing is crucial before using teaching materials in learning activities. According to Dewi et al. (2022), the readability of teaching materials is an important aspect of ensuring an effective learning experience for students. Several studies have highlighted the importance of assessing the readability of educational materials to match the cognitive levels of students. Suntoro et al. (2022) assert that readability testing strives to prevent excessive complexity in teaching materials and tailor them to the readers' cognitive abilities, thereby fostering effective learning. Moreover, the validity and readability of new teaching materials determine their suitability for the learning process (Irianti & Mahrudin, 2021).

Based on the findings of the small-scale test, the product was revised. The revision included several suggestions for improvement, such as increasing the duration of the videos and adding brief descriptions corresponding to the displayed content, to enhance the e-booklet's readability further.

Large-Scale Trial Run (Practicality)

The validated and revised e-booklet product was then implemented in biology lessons on ecosystem materials at SMA Negeri 1 Tambakrejo Bojonegoro, class X IPA. Teacher and student response questionnaires were used to test the practicality of using e-booklets in learning. The large-scale test carried out aims to know students' responses to the practicality level of e-booklet. Practicality was evaluated based on several aspects: effectiveness, usability, accessibility and flexibility.

Table 6. The results of the practicality of using e-booklet

Respon	Aspect	Score	Category
Teacher	Effectiveness	92.6	Very Good
	Usability	100	Very Good
	Accessibility	92.5	Very Good
	Flexibility	96.8	Very Good
		95.5	Very Good
Students	Usability	83.9	Very Good
	Accessibility	84.2	Very Good
	Flexibility	84.8	Very Good
		84.3	Very Good
	Average	89.9	Very Good

Based on the results of the analysis of the practicality of using e-booklets obtained from the results of filling out the response sheets by students and teachers, the e-booklet developed obtained an average score of 89.9% with very practical criteria. This shows that the e-booklet developed is very practical to use in learning which is assessed based on several aspects such as effectiveness in improving critical thinking skills, ease of access and use, and flexibility for use in certain conditions. The practicality of using e-booklets is very important to note because it is related to its effectiveness in improving student learning outcomes, in line with Diman et al (2024), that practical and easy-to-use teaching materials facilitate better access to learning materials, allowing students to learn more effectively. The results of the practicality trial showed that the developed e-booklet had provided benefits and convenience in the learning process, making it easier for students to understand the material being taught. High practicality test results are an important indicator in evaluating the quality of teaching materials because they indicate that the teaching materials are effective in use and can achieve learning objectives well (Mukhlisin et al., 2024). The conclusion of the practicality test of the use of the developed teaching materials is that the local potential-based ecosystem e-booklet can be disseminated and used for learning activities by students.

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CONCLUSION

Based on the research the E-Booklet has characteristics of digital teaching materials. The content presented pertains to the ecosystem at Grogolan Springs, which is dominated by images and supported by videos. The E-booklet's validation test yielded scores of 95.1% for content and 93.2% for media, indicating their high validity for trial use. Additionally, the readability test results show the e-booklet has a readability score of 91.4% in a very good category, making it suitable for trial. The practicality assessment of using the local potential-based e-booklet obtained a score of 95.5% by teachers and 84.3% by students, both showing very practical categories. Based on the research, it can be concluded that the ecosystem e-booklet based on the local potential of the Grogolan spring water source is declared feasible for use and has the potential to improve the critical thinking skills of high school students.

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