



The Effectiveness of Using Google Sites-Based E-Modules to Optimize Critical Thinking Skills: Student Perceptions Analysis

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Abstract: 21st century learning emphasizes the importance of students' critical thinking skills and mastery of information technology. One use of technology in the learning process is through interactive learning media such as e-modules. Using e-modules can facilitate the development of critical thinking skills in students. One platform that can be used to create e-modules is Google Sites. This research aims to determine student perceptions of the effectiveness of Google Sites-based e-modules to facilitate students' critical thinking skills. This research uses a quantitative descriptive approach, with data collection techniques using a Likert scale questionnaire. The analysis results show that the assessment of the usefulness or students' perception of the e-module reached 85.48, including the very high sort. Apart from that, the analysis regarding the influence of e-modules on changes in knowledge and skills earned a score of 81.45, including the high kind. Based on the analysis of student perceptions, a positive response was found towards using e-modules, which indicates that the e-modules used are effective. Therefore, e-modules can be an effective learning medium in increasing understanding and facilitating students' critical thinking skills.

Keywords: Critical thinking skills; E-module; Google sites

Introduction

The 21st century learning paradigm involves various competencies, including creativity and innovation, critical thinking and problem-solving abilities, and communication and collaboration skills. In 21st century learning, educators and students are expected to have competence in mastering information technology (Syafitri, 2023). Therefore, the learning process must prepare students to be able to face developments in science and technology and be able to think comprehensively in solving various problems, one of which is by presenting integrated learning with information technology-based learning media that is able to develop student's critical thinking abilities (Muhammad et al., 2023). Critical thinking is one of the high-level thinking skills needed to develop 21st-century skills (Rahardhian, 2022). Critical thinking is a high-level cognitive skill, such as analyzing and evaluating

(Zubaidah & Aloysius, 2015). Critical thinking is a crucial ability because every activity or problem faced by humans requires this ability to make decisions about problems that occur (Setyaningtyas, 2019). Good critical thinking skills can provide good suggestions for all actions taken (Royani & Atun, 2023). Critical thinking skills are thinking skills that involve cognitive processes and invite students to think according to their abilities or think reflectively about (Juliyantika & Batubara, 2022). From these various opinions, critical thinking is not only an important ability in an academic context. However, it is also important to develop deep and analytical thinking skills in various areas of life. Ennis (1996) revealed that students who can think critically can be identified through several indicators, including elementary clarification, basic support, inference, advanced clarification, and strategies and tactics.

The next skill a person must have to enter the 21st Century is mastering information technology. Education

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is now starting to utilize developments in information technology to support the learning process (Kumalasani & Eilmelda, 2022). The application and adaptation of technology in learning are necessary in facing changes in the era of globalization (Effendi & Wahidy, 2019). The development of information technology encourages renewal efforts in the use of technology by integrating technological developments into learning media as an effort to improve the quality of innovative and creative learning one of which is through the use of e-module learning media (Fathurohman & Siahaan, 2023).

E-Module is a set of learning tools that have been structured and specifically designed so that they are easy to use anywhere and at any time with the help of an internet network and support audio-visual displays (Kumalasani & Eilmelda, 2022). E-module is a module that can be run on a computer. Technological advances have also allowed e-modules to be displayed via smartphones (Lubis & Saputra, 2023). E-modules are teaching materials that help students measure and control their learning abilities and intensity (Laili et al., 2019). Using e-modules allows students to be involved in more than one sense. The more senses are used to receive information, the greater the possibility that the information will be remembered and understood (Hutahaean et al., 2019). E-Module is an effective, efficient digital media that prioritizes student independence in learning activities and contains one unit of teaching material to help students solve problems in their way (Fausih & Danang, 2015).

One platform that can help in creating e-modules is Google Sites. Google Sites is a tool used to create custom websites that can be accessed and used for free (Suryana et al., 2023). Using Google Sites is considered very easy, especially for beginners who don't understand programming, because all page creation processes can be done through a simple wizard process (Kurniawan & Sanjaya, 2010). Creating a website via Google Sites can be done through the registration process using a Google account. Google Sites can be used to create learning media that supports and contains teaching materials complete with images, videos, animations, graphics, simulations, etc. Apart from that, Google Sites is an interesting tool to learn because it has several advantages, including it's free, it's easy to create, it allows users to collaborate with its users, it provides 100 MB of free online storage, it's searchable using the Google search engine (Harsanto, 2012). Apart from that, another advantage of Google Sites is its convenience of accessing information quickly because it can add attached files and other Google information such as Google Docs, sheets, slides, awesome tables and others (Maryani et al., 2022). Previous research obtained results that the learning media and teaching materials assisted

by the Google Sites website were of good quality and suitable for use because they met the aspects of validity, practicality and effectiveness (Hidayat et al., 2023).

In this research, the e-module used is a developed e-module that is valid and practical. The e-module was assessed by experts using an expert validation sheet and analyzed based on the results of trials in small groups and large groups using a practicality sheet. The e-module components include a cover, foreword, Modules 1 and 2, learning activities, and a bibliography.

Module sections 1 and 2 present an introduction and learning activity buttons. This introduction contains an introduction to the material to be studied, as well as an explanation of how learning activities will be carried out and the competency achievements after studying the e-module. Learning activities explain the material in detail, including a description of knowledge about the competencies being learned. Furthermore, learning activities also include exercises, skills worksheets, discussion forums, summaries and formative tests. Learning activity exercises strengthen understanding of the concepts, knowledge and important principles being studied. Skills Worksheets contain instructions for practical activities. The practicum activities are based on the Discovery Learning model, which aims to practice critical thinking skills from the specified material.

Furthermore, during learning activities, there is also a discussion forum to facilitate students who wish to have the opportunity to ask questions and provide opinions. There is also a summary which contains a summary of knowledge. And finally, the Formative test aims to determine the development of student's mastery of the material they have studied.

Based on this background, this research aims to determine student perceptions of the effectiveness of Google Sites-based e-modules to facilitate students' critical thinking skills. Perception is a response from a person's point of view to a certain stimulus (Makiyah et al., 2022). Perception is organizing and interpreting sensory impressions to give meaning to the environment (Waluyo, 2021). In the context of this research, perception plays an important role in how students understand and interact with e-modules, forming the basis for their interpretation and response to external stimuli provided by the e-module (Hakim et al., 2023). Therefore, it is important to conduct this research to analyze students' perceptions of the effectiveness of using Google Sites-based e-modules in improving critical thinking skills.

Method

The research design carried out was quantitative descriptive research. This research aims to provide an

overview of the existing variables, supported by data in the form of numbers obtained from the actual situation. The data collection technique used a questionnaire with a percentage score resulting from Likert scale calculations. The Likert scale is a scale used to collect research data in the form of evaluating a person's attitudes, opinions and perceptions of an event by giving a score based on predetermined weights (Waraga et al., 2023).

The sample used in this research was students taking basic Physics 1 courses, totaling 62 respondents. The instrument used to collect data was a student perception questionnaire about the effectiveness of e-modules, which was valid and reliable. The questionnaire was assessed by experts using expert validation sheets and analyzed using product-moment and alpha formulas.

The data analysis techniques include quantitative and descriptive data analysis, which help understand and describe data statistically. Quantitative analysis techniques use the equation:

$$P = \frac{f}{N} \times 100\% \tag{1}$$

P = Final value

f = Score obtained

N = Maximum Score

Based on the results of data analysis, the e-module developed was proven to be effective with a score above 70, according to the categories listed in Table 1 (Rizal et al., 2020)

Table 1. Distribution of Effectiveness Analysis Results

Percentage average	Criteria
85 - 100	Very high
70 - 84	High
55 - 69	Moderate
40 - 54	Low
0 - 39	Very low

Result and Discussion

Students' critical thinking skills in learning basic physics can be seen using e-modules based on Google sites. The e-module components include a cover, foreword, Modules 1 and 2, learning activities, and a bibliography. Implementing the e-module provides the stimulus and several applications and problems that students must solve through the steps of the Discovery Learning model, which can be seen in Figure 1.

Next, students are asked to identify problems according to the stimulation stage. Critical thinking skills can be seen in how students convey ideas to solve a problem from a given phenomenon (Pratiwi et al.,

2023) because critical thinking is emphasized related to intellectual processes and procedures rather than the outcome (Altun & Yildirim, 2023). Identify the problems stage, as seen in Figure 2.



Figure 1. Problem in e-module



Figure 2. Identify the problems stage

The data obtained is from students' perceptions of the effectiveness of using Google Sites-based e-modules in Basic Physics 1 lectures. Data is presented based on aspects observed in a quantitative descriptive manner based on the responses submitted by students. Analysis was carried out on evaluations regarding the usefulness or students' perceptions of the e-modules used and the implications of the e-modules for changes in students' knowledge and skills. Assessment of benefits or usability is also called evaluation. Guskey (2000) hows that evaluation has a direct impact at five different levels, namely: participants' reaction, namely the results of evaluations regarding the usefulness or perceptions of participants towards the product being developed; participants' learning, namely evaluations regarding changes in knowledge competency, skills and attitudes of participants; organization support and change,

namely evaluation of the form of organizational support and environmental conditions for participants; participants' use of knowledge or skills, namely evaluation of participant behavior in using skills and knowledge in their performance; student learning

outcomes, namely evaluation of the impact of the product being developed on student competency. The evaluation results regarding the usefulness or student perceptions of the e-modules used can be seen in Table 2.

Table 2. Results of Analysis of Student Perceptions of E-Modules

Statement	Percentage	Category
E-modules can increase the effectiveness of my learning	85.48	Very high
E-modules can provide new learning experiences	87.90	Very high
E-modules provide sufficient guidance for students in studying and understanding the material.	83.47	High
E-modules can accommodate my learning style and learning speed.	81.45	High
E-modules make it possible to collect assignments and assess assignments in one place.	85.48	Very high
E-modules are suitable for use in basic physics lectures	84.27	Very high
With this module, I am free to express my opinions during discussions with friends and lecturers in solving the problems given	83.06	High
In this e-module, I was trained to find concepts in a fun way	83.06	High
Average	85.48	Very high

Based on Table 2, the evaluation regarding the usefulness or student perceptions of the e-modules used is in the Very high category. It can be seen from the e-module used, which can increase the effectiveness of student learning. Technology integration in Google Sites-based e-modules can provide new experiences for students and enable higher interactivity. By using Google Sites, knowledge will be complete and interesting, with taking advantage of the features in Google Sites and get learning information quickly (Japrizal & Irfan, 2021). Furthermore, Google Sites-based e-modules can encourage active student involvement in the learning process through exercises, practical activities, discussion forums, and other learning elements (Rusni et al., 2023). It is can improve understanding and retention of the material studied. Using e-modules makes it easier for students to access

learning materials anytime and anywhere, allowing them to learn according to their own pace and learning style. It aligns with the opinion of Laili et al. (2019), who stated that E-modules are teaching materials that can help students measure and control their learning abilities and intensity in no limited place and time. It is can reduce physical and time barriers in the learning process. The e-modules used are equipped with a feedback feature, which allows students to evaluate their understanding directly and immediately get information about their successes or shortcomings (Pratiwi et al., 2023). It can motivate students to continue to improve their abilities effectively.

Furthermore, the results of the evaluation of the implications of e-modules on changes in student knowledge and skills can be seen in Table 3.

Table 3. Evaluation Regarding Changes in Knowledge and Skills

Statement	Percentage	Category
by using e-module		
I can understand the learning material well	81.45	High
I can carry out practical activities well	87.50	Very high
I learned to think critically	82.67	High
Facilitate me to provide a simple explanation	90.87	Very high
Facilitate me to give more explanation	87.0	Very high
Facilitates me to decide on a course of action	86.5	Very high
enables me to make conclusions	89.9	Very high
helped me to build basic skills	88.9	Very high
I learned to develop communication skills	84.27	Very high
I developed my ability to work together in groups	86.69	Very high
Average	86.6	Very high

Based on Table 3, the evaluation regarding the implications of e-modules for changes in student knowledge and skills is in the Very high category. E-modules can present learning material in various formats, including text, images, audio and video, to help

students understand the learning material. This diversity can be used to channel messages in the form of knowledge, skills and attitudes and can stimulate students' thoughts, feelings, attention and willingness to learn (Rahmat, 2015). This diversity can also trigger

questions and critical thinking in students as they are exposed to information presented in a comprehensive manner. E-modules have interactive elements, such as exercises, reflective questions, and assignments that require analysis and evaluation. Through this interactivity, students can practice their critical thinking skills in a directed and structured context. Google Sites-based e-modules include a discussion forum feature that allows students to interact with each other and with the instructor. This kind of discussion can develop communication skills and trigger critical thinking through exchanging ideas, arguments, and joint evaluation of a particular topic or problem.

Practical activities based on the Discovery Learning model aim to encourage students to find and analyze information independently and develop the ability to work together in groups. The discovery learning model is learning that was developed to help students develop critical thinking skills (Susanti, 2018). The steps of the Discovery Learning model consist of stimulation, problem statement, data collecting, data processing, verification and generalization. These steps are appropriate and effective means of achieving indicators of critical thinking skills (Salmiah & Ramdiah, 2019).

At the stimulation and problem statement stages, the Discovery learning model often involves solving real problems, which allows students to connect theory with practical applications. By facing complex problems, students can hone their critical thinking skills, such as the ability to analyze situations, make questions, and focus questions. At the data collecting stage, by exploring real problems, students will carry out the experiments needed to find the answer. It can help hone their critical thinking skills, strategies and tactics by developing the ability to determine solutions to problems and write down answers to problems. At the data processing stage, after conducting experiments, students need to analyze and evaluate the information they have collected. It involves the ability to differentiate between valid and invalid information. This can hone advanced Basic Support's critical thinking skills. Based on the results of experiments and analysis, at the verification stage, students are expected to be able to develop arguments or hypotheses that are supported by relevant evidence. This process involves formulating coherent and convincing arguments based on a deep understanding of the topic studied. This can hone advanced clarification critical thinking skills. After considering the existing evidence and arguments, at the generalization stage, students need to make conclusions that are supported by the evidence they find. This hones Inference's critical thinking skills by involving the ability to relate their findings to broader concepts and identify the implications of their findings.

With Google Sites-based e-modules, students can experience learning centred on themselves while having easy access and flexibility. E-modules can facilitate learners to repeat sections of the material for clarity and provide a self-regulated learning opportunity for students (Logan et al., 2021). Moreover, through this technology, they can hone their critical thinking skills engagingly and interactively while expanding their abilities in evaluating information, constructing structured arguments, and making conclusions supported by solid evidence. Thus, this e-module is not only an effective means of facilitating independent learning but also helps students develop the critical thinking skills needed to face 21st-century learning. Critical thinking skills are considered essential if higher education students are to succeed not only academically but also in personal and professional domains (Hart et al., 2021).

Conclusion

Based on the analysis, it was found that there was a positive response to the use of Google Sites-based e-modules to facilitate students' critical thinking skills. Evaluations regarding the usefulness or student perceptions of the e-modules used are in the Very high category and evaluations regarding the implications of e-modules for changes in students' knowledge and skills are in the Very high category. So it can be concluded that based on the research results, Google Sites-based e-modules can be an effective learning medium to facilitate and develop students' critical thinking skills through a structured and interactive approach.

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Author Contributions

Conceptualization, E.S, I.M.R; data curation, E.S, S.S; methodology, E.S, S.M; investigation, E.S, I.M.R; writing – original draft preparation, E.S; writing – review and editing, S.S, S.M. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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