Journal of Innovative Physics Teaching
Volume 3, Issue 2 December 2025, 143 – 152
ISSN: 3021-8551 (Online)
Doi: https://doi.org/10.24036/jipt/vol3-iss2/96
https://jipt.ppj.unp.ac.id/index.php/jipt

The Validity of *Context-Based E-Module* on Straight Motion Material to Improve the Critical Thinking Skills of High School Students

Putri Zulvia Larasati Br Ginting[1], Desnita[2*], Festiyed[3], Yenni Darvina[4]
[1,2,3,4] Department of Physics, Universitas Negeri Padang, Padang, Indonesia.

Article Info

Article history:

Received June 06, 2025
Revised December 04, 2025
Accepted December 17, 2025

Keywords:

Validity
E-Module
Contextual
Straight Motion
Critical Thinking

ABSTRACT

Critical Thinking is one of the important components in the independent curriculum Critical thinking is essential because it allows us to analyze, assess, and evaluate information, as well as make informed and logical decisions. One way to improve students' critical thinking skills is to use teaching materials. One of the teaching materials that is expected to overcome this problem is an E-Module based on a contextual approach to Straight Motion material to improve students' critical thinking skills. The type of research used in this study is Research and Development (R&D) research with a 4D development model. In this report, the results of the research are presented at the define, design, and develop stages. At the definition stage, observations were made to several schools. In the design stage, the design of the CTL integrated e-module framework was carried out. At the development stage, validation tests and practicality tests are carried out on the products that have been developed. The data instruments used in this study were questionnaires for teachers and students, validity test sheets and practicality test sheets. The data analysis techniques used are product validity analysis using Aiken's V and product practicality analysis. A validity value of 0.90 was obtained with valid criteria. It can be concluded that the E-Module with a contextual approach to Straight Motion material to improve students' critical thinking skills developed is valid.

***Correspondence:**
Desnita,Department of Physics, Universitas Negeri Padang, Padang, Indonesia.
email : desnita@fmipa.unp.ac.id

INTRODUCTION

The curriculum that is currently being launched by the government, especially the minister of education, is the independent learning curriculum. The independent curriculum is a competency-based curriculum with strengthening the profile of Pancasila students for the development of soft skills and student character. The independent curriculum is a refinement of the 2013 curriculum (Dewi, Putri, Puspadiningrum, & Amin, 2021). The independent curriculum focuses on developing students' learning outcomes as a whole, which includes literacy competencies, critical thinking and character education. The concept of the independent learning curriculum emphasizes the provision of freedom in the field of education. In this case, the teacher plays the role of a facilitator for students in providing learning. The world of national education needs to be designed to be able to produce a

generation that has advantages in the era of globalization like today (Hidayati, Munasir, & Sudibyo, 2024). The 21st century skills must be possesed by eeryone to face global compeition 21st cenury skills are known as "The 4C Skills" which include: Critical Thinking Skills, Cretivity, Collaboration, and Communication (Mohkam Kar, Shaterian, & Nikookar, 2024). 4C skills are skills that can train students to communicate, think critically, think creatively, and collaborate in learning (Hufri et al., 2022). Critical thinking skills are skills to carry out various analyzes, assessments, evaluations, reconnections, and decision-making that lead to rational and logical actions (Rifa Hanifa Mardiyah et al., 2021). One of the skills that students must have the ability to think critically. *Critical Thinking* is the ability to think in reasoning, expressing, analyzing and solving problems. Critical thinking can also be defined as reasonable, reflective thinking that focuses on deciding what to believe or do (Khoerunisa & Habibah, 2020).

Students who have critical thinking skills will find it easier to study problems systematically, face millions of challenges in an organized way, formulate innovative questions, and be able to design solutions that are seen as relatively new (Chusni, Saputro, Surant, & Rahardjo, 2022). A person needs to have critical thinking skills and needs to learn them, because these skills are very useful and as a provision in facing life now and in the future (Gastama, Rosyida, Handoyo, & Soelistijo, 2023). The Indonesian government is reassessing the country's educational system (Desnita et al., 2022)These 21st century skills must be given to students so that they are able to face the development of Science and Technology. That they are able to compete in the era of globalization (Fahlelvi & Asrizal, 2021).

Teaching materials are all forms of materials used in carrying out teaching and learning activities (Kosasih, 2021). Teaching materials can be said to be a source of learning for students (Azmi et al., 2022). Teaching materials are useful as an introduction to information for students and educators to increase insight (Nuryasana & Desiningrum, 2020). Along with the development of technology and information, the use of electronic modules (e-modules) is one of the options that teachers can choose to help the student learning process for now (Ismi, 2019).

E-Modules are modules created with the help of technological developments that can integrate text, images, videos, animations, simulations, quizzes and evaluations (Saprudin et al., 2021). E-modules are considered innovative because they can display teaching materials that are complete, interesting, interactive, and carry out good cognitive functions (Saphira & Prahani*, 2022). Modules are used to make it easier for students to understand the material presented independently or through the guidance of educators with interesting module content (Hamid & Albelrida, 2021).

Critical thinking is a process in a which all knowledge and skills are deployed in solving problems that arise, making decisions, analyzing all assumptions that arise and conducting investigations or research based on the data and information that has been obtained so as to produce the desired information or conclusions (Fitriani, Zubaidah, & Hidayati, 2022). Critical thinking skills are essentially skills in solving problems (Problem Solving). Developing critical thinking skills is very important for students to obtain optimal results (Ariyana, 2020).

METHODS

This type of research is research and development or Research and Development (R&D). Research and development methods are research methods used to make a certain product and test the practicality and effectiveness of the product (Yuliarti, Marlina, Siahaan, Fathurohman, & Sudirman, 2023). The development model used in this research is a 4D model which consists of 4 stages, namely define, design, develop and disseminate.

The validation used an instrument that covered six aspects consisting of: (1) material

substance, elaborated into 11 indicator items; (2) visual communication display, elaborated into 9 indicator items; (3) instructional design, elaborated into 9 indicator items; (4) use of software, elaborated into 3 indicator items; (5) components of the contextual approach, elaborated into 7 instrument items; and (6) critical thinking, elaborated into 5 indicator items. This research was conducted to test validation instruments before being used in the next research. Grid Tools for validating the development of context-based E-modules to improve critical thinking skills are seen in Table 1.

Table 1. Validation Instrument Grid

No	Component	Instruments	Statement Number
1	Substance Matter	Do not deviate from the truth of knowledge	1, 2, 3, and 4
		Compatibility with the depth of the material	5, 6, and 7
		Compatibility with the development of knowledge	8 and 9
		Using standard and understandable grammar	10 and 11
2	Visual Communication Display	Ease of access to E-modules	1,2 and 3
		Proportional between font size and slide space	4
		The pictures presented are in accordance with the material presented	5 and 6
		Color harmonization, Contrast level	7
		Animation	8
		Display/layout design	9
3	Learning Design	Compatibility of the title with the material	1
		KI in accordance with KD	2
		KD complies with content standards	3 and 4
		Conformity of the material with competency standards and kd	5
		There is training	6
		There are work steps	7
		There is an identity of the compiler	8
		Listing a reference list	9
4	Software utilization	Interaktif	1
		Use of the software	2
		The authenticity of the E-module work	3
5	Components of the CTL approach	*Construktivism*	1
		Inquiry	2
		Ask	3

		Learning Community	4
		Modeling	5
		Authentic Assessment	6
		Reflection	7
6	Critical thinking	Analyze	1
		Synthesizing learning materials	2
		Troubleshooting	3
		Conclude	4
		Evaluate	5

Validity Test

The validity data on the suitability of the interactive module based on the contextual approach was obtained from the validity questionnaire filled out by the validator. This validity test instrument will be carried out by UNP physics lecturers. The formula used according to Aiken (1985: 135) is as follows:

$$v = \frac{\sum s}{[n(c-1)]}$$

$$S = r - l0$$

information:
l0 = lowest validity rating number (example 1)
c = highest validity rating number (example 5)
r = the number given by the assessor
n = number of validators
s = the number given by the assessor minus the lowest number of assessments
∑s = sum s

Table 2. Category of Validity

Interval	Category
≤ 0.4	Less
0.4 < V ≤ 0.8	Keep
0.8 < V	Valid

The research data were analyzed using qualitative and quantitative analysis. Data from the defining (define) and designing (design) stages were analyzed qualitatively and presented descriptively, while data from the development (develop) stage namely validity were analyzed quantitatively

RESULTS AND DISCUSSION

Results

Validity Test

The validity test in development research refers to the level of accuracy and precision of an instrument in measuring what should be measured (Subhaktiyasa, 2024). In the validity

test, the instrument is tested and processed using *microsoft excel* with six components that were tested.

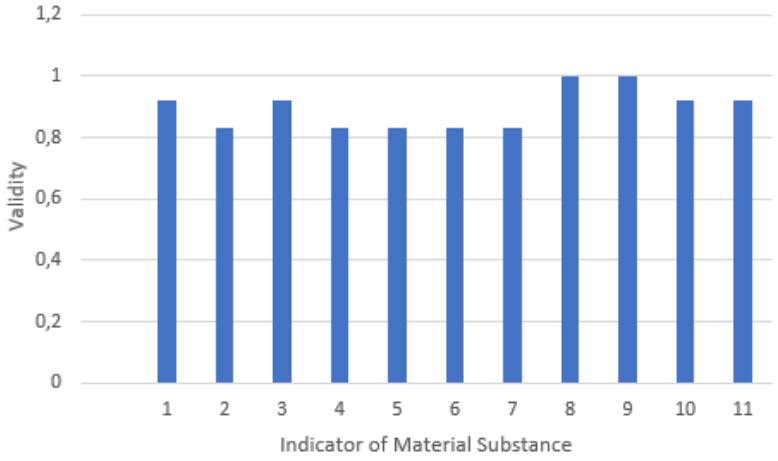

Figure 1. Validity Test of Material Substance

Based on Figure 1, it can be seen that the indicator values for material substance range from 0.83 to 1.00. From all indicators, it was found that the tested indicators were categorized as valid, with values ranging from 0.83 to 1,00. The average validation score for the material substance indicators was 0.89, classified as valid. Second, the visual communication display component consists of six indicators: (1) navigation; (2) typography; (3) media; (4) color; (5) animation; and (6) layout. The plotted data results for each indicator in the visual communication display component can be seen in Figure 2

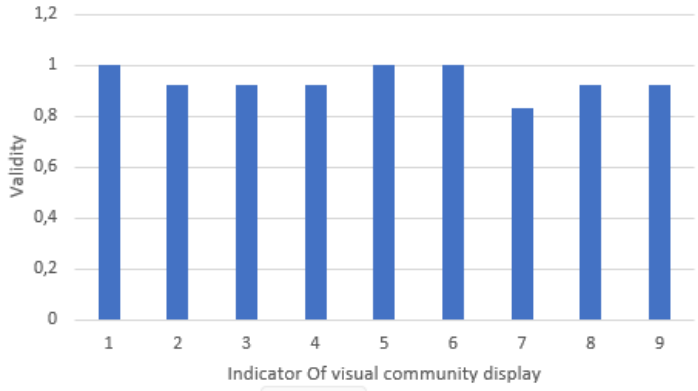

Figure 2. Visual Communication Display Validity Test

From Figure 2, it can be seen that the indicator values for the visual communication display range from 0.83 to 1.00. Based on all the indicators, it was found that the tested indicators are classified as valid, with values ranging from 0.83 to 1.00. The average validation score for the visual communication display indicators is 0.94. Thus, the validation results for the visual communication display component fall into the valid category. The three learning design components consist of seven indicators: (1) title; (2) basic competence; (3) indicators; (4) material; (5) exercises; (6) compiler; and (7) references. The plotted data of the validity scores for the learning design components can be seen in graph 3.

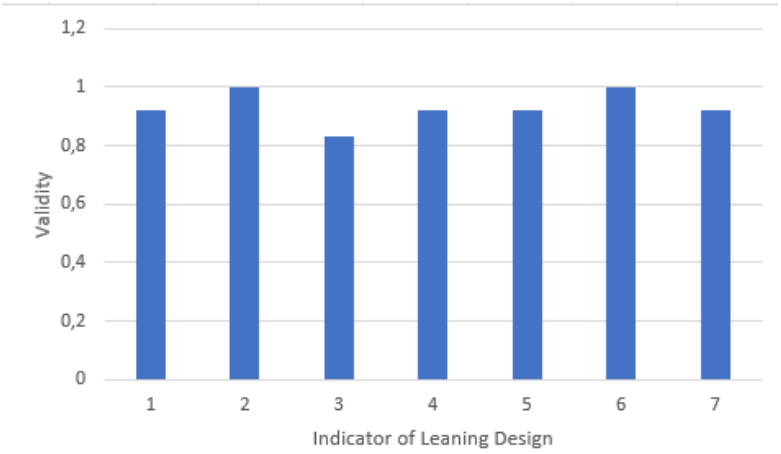

Figure 3. Learning Design Validity Test

Based on Figure 3, it can be seen that the indicator values for the learning design range from 0.83 to 1.00. From all the indicators, it was found that the tested indicators are classified as valid, with values ranging from 0.83 to 1.00. The average validation score for the learning design indicators is 0.93. Fourth, the software utilization component consists of three indicators: (1) interactivity; (2) supporting software; and (3) authenticity. The plotted data of the validity scores for the software utilization component can be seen in Figure 4.

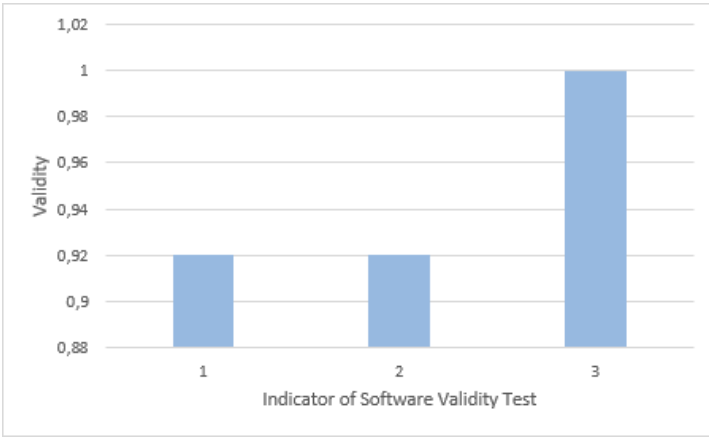

Figure 4. Software Validity Test Usage

Based on Figure 4, it can be seen that the indicator values for the software usage component range from 0.92 to 1.00. From all the indicators, it was found that the tested indicators are classified as valid, with values ranging from 0.92 to 1.00. The average validation score for the software usage indicators is 0.95. Fifth, the assessment component of the context approach consists of seven indicators: (1) constructivism; (2) inquiry; (3) questioning; (4) learning community; (5) modeling; (6) authentic assessment; and (7) reflection. The plotted data of each indicator in the e-module assessment component using a contextual approach can be seen in Figure 5.

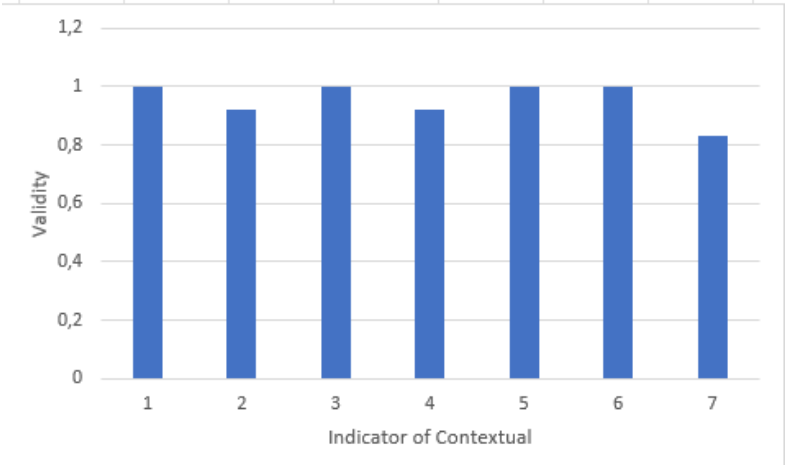

Figure 5. Test of the Validity of the Assessment of the Contextual Approach

Based on Figure 5, it can be seen that the indicator values for the contextual approach range from 0.83 to 1.00. From all the indicators, it was found that the tested indicators are classified as valid, with values ranging from 0.83 to 1.00. The average validation score for the contextual approach indicators is 0.95. Sixth, the critical thinking assessment component consists of five indicators: (1) analyzing; (2) synthesizing; (3) problem-solving; (4) concluding; and (5) evaluating. The plotted data for each indicator of the critical thinking skill assessment component can be seen in Figure 6.

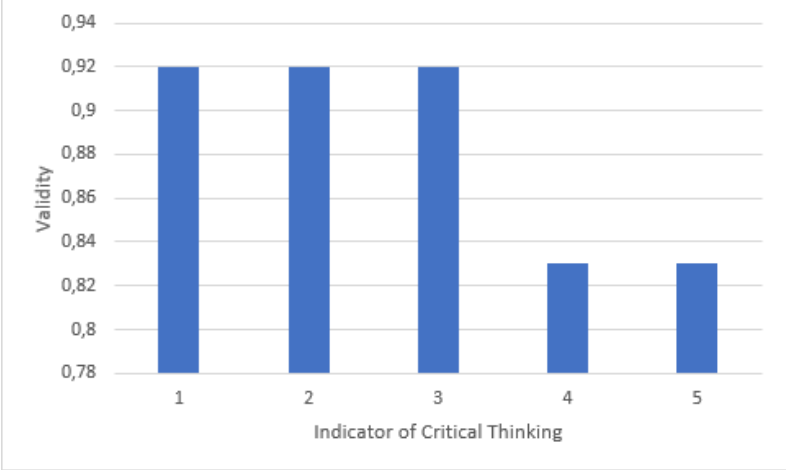

Figure 6. Test the Validity of the Critical Thinking Ability Assessment

In graphic 6, it can be seen that the indicator value in the Critical Thinking Ability Assessment ranges from 0.83 to 0.92. The average validation value on the Critical Thinking Ability indicator is 0.9 with a valid category. Based on the results of the summarized validity test, it was obtained that the overall validation value was 0.90 with the category Valid. It can be concluded that context-based e-modules are valid and can be used in the next stage of research.

Discussion

The discussion explains the results obtained in the research that has been conducted, the obstacles encountered during the study, alternative solutions, and suggestions for overcoming problems in the research. The research results obtained are the validation outcomes from experts. Based on the description of the research findings, the results include a developed product and data regarding the validity level of the e-module on the context-

based Straight Motion material aimed at improving high school students' critical thinking skills. The product is an e-module equipped with material, images, videos, and practice questions.

The e-module contains components of the contextual approach that stimulate students to develop critical thinking skills. Through the contextual approach components in the e-module, students can discover physics concepts independently and r elate them to real-world situations. The presentation of materials in the form of videos and images also makes it more engaging for students to understand the content. The e-module is also designed to be more interactive. Practice questions and competency tests train students to think critically. The e-module is presented in an online format, allowing teachers and students to access it smartphones and laptops.

Based on the data analysis carried out and the validation of the context-based Straight Motion e-module to improve critical thinking skills, which was conducted by three expert lecturers from the Physics Department of FMIPA UNP, the product validation resulted in an average validity score of 0.92.

CONCLUSION

Based on the research that has been conducted, a context-based e-module product is produced to improve critical thinking skills in Straight Motion Materials for high school physics learning. The e-module developed has a validity value with valid criteria both in terms of material substance, visual communication display, learning design, software use, contextual approach assessment and critical thinking assessment. Based on a limited trial, namely a practicality test is obtained on the practicality of teachers and students with very practical criteria. Referring to the results of the validity and practicality tests that have been developed, it can be concluded that the context-based e-module on Straight Motion Materials is a material to improve critical thinking skills is suitable for use as high school physics teaching materials.

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