

# Need Analysis for Development of Physics E-Module Integrated with Critical Reading to Enhance Critical Thinking and Scientific Literacy in Senior High School

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**Abstract:** The purpose of this study was to analyze the needs of development of physics e-module integrated with critical reading. Development using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). This is descriptive qualitative research with questionnaire and interview methods. The data were analyzed using descriptive descriptively with the results of data processing in percent (%). The result showed that 86 % of physics teacher use the textbooks for teaching materials and 65.14 % of student's thinking skills still in the low categories. Furthermore, the results also showed that 62.13 % of students have no interest in reading. It can be concluded that the development of physics e-module not only can be improving student's critical thinking but also student's scientific literacy.

**Keywords:** Critical reading; Critical thinking; Electronic modules; Scientific literacy

## Introduction

The development of the industry revolution 4.0 has made significant changes in various sectors, including education. Learning does not only focus on the ability to find information, but also on human resource development (Benešová & Tupa, 2017). According to (Yoshino et al., 2020), there is some skills need in the Industrial revolution 4.0. These skills were divided into 3 major groups, personal, social, and professional competences. Personal competence can be understood as the skill to enhance analytical thinking (Motyl et al., 2017). Social competence refers to an individual inserted in a social context like teamwork, knowledge transfer, knowledge acquiring, collaboration, and analyzing defects (Schallock et al., 2018). Last, Professional competence refers to the domain to have IT knowledge, including IT tools, manufacturing, and digital thinking (Bedolla et al., 2017).

According to the World Economic Forum, there are some skills demand across sectors such analytical thinking and innovation, creativity, technology design and programming, critical thinking and analysis, and emotional intelligence. All of these success indicators can be trained by a good quality education. Education is not only an effort to improve the quality of human resources and the survival of nation both at present and in the future (Rasmi et al., 2023), But also as a part of national development and aims to increase human welfare (Wijaya et al., 2016).

The government of the Republic of Indonesia recognises the importance of preparing human resources to be able to compete in the 21st century. One of the 21st-century competencies is having good critical thinking skills (Sinaga et al., 2022). Critical thinking skills as one of the most essential learning skills for 21 st century for students to be able to differentiate, analyse, and evaluate the data (Kaowiwattanakul, 2021). Based on the minister of national education regulations

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number 144 and number 104 of 2014 concerning graduate competency standards and assessment for primary and secondary education units, competencies that must be mastered by students related to critical thinking skills include that graduates must be able to: build, use and apply information about the surrounding environment logically, critically, and creative; demonstrate the ability to think logically, critically, creatively and innovatively; demonstrate high curiosity and realize one's potential; and demonstrating problem-solving abilities.

Besides, 21st-century skills also focus on scientific literacy skills. science literacy is characterized by individual's ability to understand, communicate and apply science knowledge to solve problems of daily life based on science considerations (Jufrida et al., 2019). Scientific literacy plays a very role in every aspect of human life. UNESCO states that people with good literacy can reduce various problems and lead to sustainable development (Udompong & Wongwanich, 2014). OECD has been developed an important assessment program called "Program for International Student Assessment (PISA). Indonesia has participated in PISA since 2001. Since that time, performance in science has fluctuated but remained flat overall, while performance in both reading and mathematics has been hump-shaped. Reading performance in 2018 fell back to its 2001 level after a peak in 2009, while mathematics performance fluctuated more in the early years of PISA but remained relatively stable since 2009 (Markus, 2019).

Based on observations made in three senior high schools in the city of Padang, it showed that in the aspect of knowledge, the average result was 72.86% in the medium category. The result also showed that for interest in learning physics, an average was 58.8% in the low category. Then, critical thinking and literacy aspects obtained an average of 62.13% and 65.14% in the low category. One of the reasons for the low level in several aspects is the lack of learning resources that suit the characteristics of students and do not train student's critical thinking skills (Muttaqin & Sopandi, 2016). Besides, Many teachers still apply to learn in the fields of C1 (remembering), C2 (understanding), and C3 (applying) in Bloom's Taxonomy. Thinking may not happen towards a certain purpose, but critical thinking is an organized process (Dinçer & Çilek, 2022). Therefore, there is a need for renewal in the implementation of learning by applying learning with higher-order thinking skills (Widjanarko, 2022).

One of the learning resources is e-module. E-module is a digital-based interactive module that can be used as independent teaching material and accessed via a computer, laptop, or smartphone (Putri, 2022). According to Prihatiningtyas et al. (2020), an e-module

is an electronic teaching material with audio, video, animation, and other interactive features. E-module can make it easier for teachers to integrate technology, information, and communication in learning (Solihudin et al., 2018). It is related to Permendikbud number 22 of 2016 about process standards for primary and secondary education stated that teachers asked to use ICT as a learning resource.

Some research about e-module already did, like the development of physics e-module to enhance critical thinking (Latifah et al., 2020) and development of physics e-module to enhance science literacy (Muzijah et al., 2020). The result shows the validity, practicality, and effectiveness to enhancing critical thinking and science literacy. But the research has a limits, like e-module not trained student's reading habits. The process of reading should also include understanding, questioning, interpreting, predicting, defining the words, and the writer's meaning of the passage (Balan et al., 2019). Therefore, reading skills have important effects on an individual's cognitive and affective development (Epeçan, 2018).

Based on the description of the problems found in the field, the researcher is interested in conducting a needs analysis to develop physics e-modules that are integrated with critical reading. Why critical reading? Because critical thinking skill can be stimulated by critical reading (Wikanengsih et al., 2020). Critical reading is different from literal reading which focuses only on surface meaning to find out the main ideas and supporting details (A. Al Roomy, 2022). Besides, with critical reading skills, the individual will be successful in distinguishing between reliable and unreliable information, passing information through a logic filter, and analyzing information (Can & Biçer, 2021). In this context, critical reading can lead individuals to critical thinking skills.

## Method

This is descriptive research with qualitative approach. Basic idea reason using this method is because this is preliminary research to know the needs of the development of physics e-module integrated with critical reading in senior high school (Putri et al., 2022). In this study, an analysis of the needs of students and teachers was conducted in three senior high schools in Padang. In this needs analysis, there are several activities, namely literature analysis, student's characteristic analysis, learning resources, and graduate competency standard.

This research starts with a literature study to know the common issue in the teaching and learning field, and also to research and analyzes relevant research to

support the development process. The next step is researchers collected data using questionnaires. In the second stage, the researcher investigated the aspects of student characteristics. These aspects have three components which are interest in physics, motivation, interest in reading, and thinking skills. Then, in the third stage, the researcher investigated the learning resources. Last, the researcher investigated the aspects of graduate competency standards. These aspects have three components which are knowledge, attitude, and skills. The sample for this research are senior high school students. The data that researcher get from the quisionnare was processed. The analysis method used was persentation descriptive analysis. For research process can be seen in figure 1.

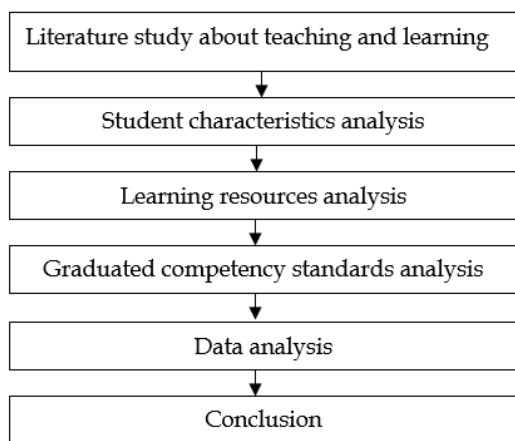


Figure 1. Research process

The score process with persentation formula.

$$\% = \frac{n}{N} 100 \tag{1}$$

**Result and Discussion**

Based on the student characteristics analysis, the results show that 58.8 % of students are interested in physics, 77.53% of students are motivated to study physics, 65.14% of students are interested in reading, and critical thinking skills at a score of 62.13%. This data can be seen in figure 2.

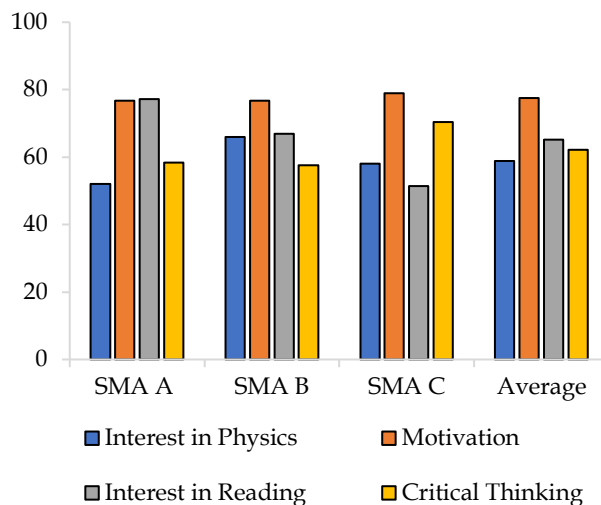


Figure 2. Student characteristics

As shown on figure 1, %. It absolutely not match with the 21st century competence. Next, based on observations, 86% of teachers still use textbooks as a learning resource. It concluded that teachers’ teaching materials are not yet digital-based. We know that 21st century learning requires educators to integrate technology in education.

Last, the researchers also investigated on the aspects of graduate competency standards. These data can be seen in figure 3.

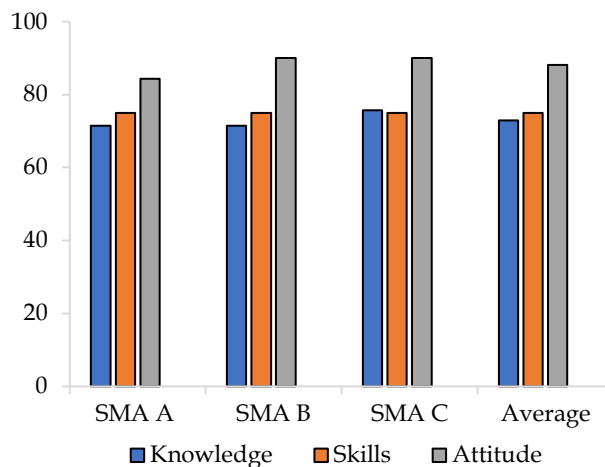


Figure 3. Graduate competency standards

As shown on figure 2, we can conclude that the knowledge competence of students is also still in the medium categories. E-module help students to study interactively and trains their critical thinking and scientific literacy, especially integrated with critical reading. Critical reading more than a normal reading, it can train your cognitive (Elhefni et al., 2020). Thats the why reason critical reading really need to add on e-module development.

## Conclusion

Based on the results, there is an urgency to develop a physics e-module integrated with critical reading. Therefore, this e-module can practice students' critical thinking and scientific literacy.

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## Author Contributions

Conceptualization, validating the instrument, guiding the research process and writing articles, S.S; creating research instruments, conducting research and writing articles, Y.S.

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## Conflicts of Interest

There is no conflict of interest in this research. Funding plays a role in validating instruments, guiding research and the process of creating articles.

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