Analysis development of guided inquiry based physics e-module to improve critical thinking ability of students high school

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Abstract. Industry 4.0 Revolution is an era in human life that is developing at this time, where in this era human life is oriented to technology. Mastery of technology today is a challenge for humans to make life easier. In this era also more human resources will be replaced by machines and technology. The industrial revolution 4.0 also influenced the education sector, for example in the development of teaching materials. Teaching material is one of the learning resources that can help students in the learning process so as to improve the competency of students. The teaching materials needed must lead to the development of technology that can facilitate students in learning. One example of teaching materials that are currently developing is the e-module. E-modules can help students understand physical concepts. It is hoped that with the help of physics guided E-module based on Guided Inquiry can improve the critical thinking skills of students in understanding physics. The ability to think critically is one of the characteristics of the 4.0 industrial revolution in education. The purpose of this study is to identify the critical thinking skills of high school students with the help of e-module based on Guided Inquiry. This type of research is quantitative descriptive with an instrument in the form of an observation questionnaire given to students and educators. Based on the results of observations given there are teaching materials that have not been oriented to the critical thinking skills of students. Therefore it is necessary to do an analysis in the development of physics guided e-module based on Guided Inquiry to improve the critical thinking skills of high school students.

1. Introduction
Revolution Industry 4.0 is one of the implementation of the modern German technology strategy project 2020. This strategy implements technological improvements in the industrial sector, the creation of consistent strategic policy frameworks, as well as the establishment of certain priorities in dealing with global competition.

The industrial revolution 4.0 has fundamentally changed human life and work. This is because the 4.0 industrial revolution will make it easier for humans to live their lives. However, indirectly human resources will be replaced by machines and technology. The industrial revolution 4.0 also affected the education sector, according to Minister of Education and Culture Muhadjir Effendy, the education sector needs to revise the curriculum by adding five competencies in entering the revolutionary era, including: having critical thinking skills, having creativity and abilities which are innovative communication skills, able to work together and collaborate and have confidence.
Education in the revolutionary era 4.0 took the form of changes in the way of learning, thinking patterns and ways of acting of students in developing creative innovations in various fields. One way that can be done to optimize the use of technology as an educational tool that is expected to produce output that can follow and change the times for the better and improve the quality of human resources so that they can compete in the global. It is hoped that educators can carry out creative and innovative learning. It is time for us to leave the learning process that tends to prioritize memorization or just find one right answer from the problem. The learning method used must produce visionary thinking including honing the ability of creative and innovative. This is needed to deal with various technological and scientific developments today.

Critical thinking is one of the systematic, directed and clear processes that can be used to form and build trust and take action in an organized manner such as problem solving, decision making, analyzing and conducting research [1].

However, in reality learning currently applied in schools is still said to be ineffective. This is caused by various factors, one of which is the teaching material used and the approach model used. The teaching materials used today are not yet effective in improving students' critical thinking processes, so some students lack understanding of learning, especially the pursuit of physics. This requires electronic teaching materials such as e-modules.

Modules are one of the teaching materials in the form of a self-contained textbook that includes a series of learning experiences that are planned and arranged systematically with of helping students, while e-modules are digital modules and are packaged more interactively that can make students learn actively.

One of the constructivist learning models is the inquiry learning model. In this model it is hoped that students can actively engage in thinking and find out for themselves what they want to know. In this model students are involved in the discovery process through collecting data and hypotheses. The knowledge and skills acquired by students are derived from their own needs, not the results of remembering facts and formulas. Inquiry-based learning is direct learning to develop knowledge, skills and understanding of physical concepts.

Learning based on guided inquiry is a process of knowledge obtained by students to be meaningful through thinking skills. But the current e-module teaching material cannot guide students in understanding the concepts of physics learning that can improve students' critical thinking skills so it is necessary to develop guided inquiry-based e-module teaching materials to improve students' critical thinking skills

2. Method

This research method is quantitative descriptive research. [6] One descriptive study is survey research. In survey research an instrument is needed to survey a preliminary study. Descriptive research is one type of research used to reveal events or facts about phenomena that occur under current conditions.

Data collection techniques with questionnaires (questionnaire) [7]. The questionnaire is one of the efficient data collection techniques. This questionnaire was distributed to students and educators.

The type of instrument used in collecting data was in the form of a questionnaire filled out by 23 high school students in Pekanbaru. Each item is given a score in analyzing data from the questionnaire and then adding up the total scores for all indicators contained in the questionnaire, after obtaining the total score of the indicators can be searched for the average obtained from the questionnaire that has been distributed. To determine the level of competence obtained from questionnaire shown in Table 1.

| No. | Category   | Value         |
|-----|------------|---------------|
| 1   | Very good  | 90 <N ≤ 100   |
| 2   | Good       | 75 <N ≤ 90    |
| 3   | Less       | 60 <N ≤ 75    |
| 4   | Very less  | ≤ 60          |

Table 1. Descriptive Analysis of Observations [15]
3. Result and Discussion

The instruments given to students and educators are observational forms. Analysis conducted on students in the form of knowledge, initial abilities, learning styles, learning resources and motivation while the analysis of the educator is the performance analysis and analysis of student development and new concepts.

In Figure 1 can be seen the results of student analysis which includes knowledge, skills, initial abilities, learning styles, learning resources and motivation.

![Student Analysis](image1)

**Figure 1. Student Analysis**

In figure 1 the results obtained knowledge that is in the poor category 64.78%, skills 61.47%, initial ability 64.13%, learning styles 70.65%, learning resources are in the very bad category 52.8% and motivation in the good category is 75.85%.

From Figure 1, it can be seen that the analysis of learning resources gets the lowest score, which is 52.8%, including 7 indicators, which can be seen from Figure 2.

![Learning Resources](image2)

**Figure 2. Learning Process**

The results of the educator's analysis include performance analysis and student development analysis and new concepts can be seen from Figure 3.
Figure 3 shows an analysis of poor performance of educators 74.5% shows the lack of educators in preparing teaching materials to be used in the learning process. Whereas for the analysis of the development of students and new concepts included in the unfavorable category 61.25% shows the development of students in finding new concepts.

The results of the initial analysis of students who have done at SMAN in Pekanbaru indicate that the category of knowledge, skills, initial abilities, learning styles of students get unfavorable categories, whereas in the category of learning resources get very less value, because the learning resources used by participants students have not been able to support and help students in the learning process, where learning resources that are used are still difficult to understand by students and learning resources currently do not utilize the existing technology. For the category of motivation in the good category, students already have high motivation to study physics. In the analysis of educators including performance analysis and analysis of student development and new concepts, from these two indicators, the category is quite good.

4. Conclusion
Based on an analysis of student needs, it was found that student learning resources were still low. This is due to the lack of development of teaching materials used and questions that have not been oriented to improving the critical thinking skills of students. So it takes the development of guided inquiry-based e-module teaching materials that can improve critical thinking skills of high school students.

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