Practicality of Science E-Module with the Argument-Driven Inquiry Model to Improve the 21st Century Abilities Students

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Abstract: The development of an E-module based on Argument-Driven Inquiry assisted by 3D Pageflip Professional has been carried out to improve students' 21st century abilities which include generic science abilities, critical thinking and scientific argumentation. This development aims to describe the validation of e-module teaching materials that are suitable for use in learning activities. The development model design used is 4D which consists of definition, design, development and dissemination stages. This research is limited only to the development stage. Practicality testing activities have been carried out through distributing teacher and student response questionnaires, and the implementation of learning carried out during ongoing learning activities by observers. The results show that the Argument-Driven Iberad based electronic module is in the very practical category and can be used in science learning activities in schools.

Keywords: ADI; E-module; Practicality; 21st century abilities

Introduction

Technology advances have an impact on education. Teachers are required to guide and direct the use of media technology in education, so that the use of technology and information has an important role in learning (Dewi et al., 2022; Ramdani et al., 2023). This is also supported by the character of students who tend to use technology in their daily lives, so that the integration of technology into learning can be done well (Susilawati, Doyan, Muliyadi, et al., 2022).

Science is a type of learning that can be integrated with technology. Abstract science learning can be presented in an interesting way through innovative science learning media so that it can develop students' 21st century abilities (Susilawati et al., 2023, 2021; Susilawati, Kusumayati, et al., 2022). Science learning can develop students' generic science abilities which will support students' critical thinking abilities, which are 21st century abilities (Doyan et al., 2023; Izetbigovic et al., 2019). Critical thinking skills are able to develop the ability to argue by providing scientific evidence as a form of developing communication skills in 21st century competencies (Doyan et al., 2022a; Marudut et al., 2020).

21st century competencies which include generic science skills, critical thinking and scientific argumentation (communication) inquiry activities, students are actively involved in investigating facts to support their arguments (Hardini et al., 2022; Susilawati, Doyan, & Muliyadi, 2022).

Based on observations that have been made, conditions in the field show that learning activities still use textbook learning resources. School facilities such as computer laboratories and internet networks have not been used optimally to support learning activities. The use of smartphones to support learning activities can be done if there is permission from the school. The learning model used does not support students' generic science abilities, critical thinking and scientific argumentation. 21st century competencies can be fulfilled through integrating technology in learning. The way to support these activities is to create new innovations in the
teaching materials used so that existing facilities at schools can be used optimally as a form of technology utilization. Besides that, the learning model used does not support students' generic science abilities, critical thinking and scientific argumentation.

Various kinds of new innovations to support learning activities can be developed according to current learning needs, for example teaching materials. One of the teaching materials that can be developed as a use of technology is e-modules (Lathifah et al., 2023). E-modules are basically the same as printed modules, however, there are differences in the visual presentation format while the constituent components have no differences (Ratnawati et al., 2020; Yanarti et al., 2022). E-modules are presented systematically following the applicable curriculum and use electronic devices with stand-alone characteristics (Lestari et al., 2020; Marnah et al., 2022). E-Modules should be facilitated by an appropriate learning model. One learning model that can be used is Argument-Driven Inquiry (ADI). The ADI model can help students develop generic science skills, critical thinking and scientific argumentation (Salsabila et al., 2019; Siahaan et al., 2019).

Based on several previous studies, developing science e-modules facilitated by the ADI model can be a solution to improve students' 21st century competencies.

**Method**

This research aims to determine the practicality of the science e-module with the Argument-Driven Inquiry model which has been developed using 3D Pageflip Professional software to improve students' 21st century competencies which include students' generic science abilities, critical thinking and scientific argumentation. The e-module was developed using 4D (define, design, develop and disseminate) (Sugiyono, 2015). This research was limited to the development stage by assessing the practicality of the e-module product developed through teacher and student response questionnaires as well as learning implementation observation sheets. The questionnaire score used consisted of 5.5 in the very good category, 4 in the good category, 3 in the sufficient category, 2 in the poor category and 1 in the very poor category. The responses of teachers, students and implementation of learning are analyzed using the equation:

\[
\text{Practicality} \, (\%) = \frac{\text{score earned}}{\text{max score}} \times 100\%
\]  

(1)

The average score of teacher and students responses, and learning implementation are then categorized into the criteria presented in the table 1.

**Table 1. Practicality Criteria for Science E-Modules (Arikunto, 2010)**

<table>
<thead>
<tr>
<th>Percentage Range of Values from Validation (%)</th>
<th>Practicality Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>Impractical</td>
</tr>
<tr>
<td>21-40</td>
<td>Less Practical</td>
</tr>
<tr>
<td>41-60</td>
<td>Practical enough</td>
</tr>
<tr>
<td>61-80</td>
<td>Practical</td>
</tr>
<tr>
<td>81-100</td>
<td>Very Practical</td>
</tr>
</tbody>
</table>

**Result and Discussion**

This research is included in development research by adapting the 4D model. The 4D development model consists of 4 stages consisting of define, design, develop and disseminate. This research is limited to the development stage of product practicality testing in the form of an Argument-Driven Inquiry (ADI) based e-module using 3D Pageflip Professional software to improve students' generic science, critical thinking and scientific argumentation abilities.

The product in the form of an e-module was tested in class VIII A SMP/MTs. The practicality test in this research was obtained through a teacher and student response questionnaire with data sources from class VIII science teachers and class VIII A students. Data from the analysis of teacher responses is presented in table 2.

**Table 2. Results of the Teacher and Student Response Analysis**

<table>
<thead>
<tr>
<th>Product</th>
<th>Respondent</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science E-Module</td>
<td>Teacher</td>
<td>100 %</td>
<td>Very Practical</td>
</tr>
<tr>
<td></td>
<td>Students</td>
<td>91 %</td>
<td>Very Practical</td>
</tr>
</tbody>
</table>

Based on table 2, the results of teacher responses show that the e-module is in the very practical criteria with a percentage of 100%. Meanwhile, student responses were also in the very practical criteria with a percentage of 91%. The results of the teacher and student responses showed a positive response to the e-module being developed. The aspects used as the basis for assessing the practicality of e-modules are the attractiveness of the e-module, the ease of accessing the e-module, the quality of the content of the e-module and the role of the e-module. The following are the percentages of several aspects of student and teacher response assessment that have been analyzed based on Figure 1.

Based on Figure 1, the percentage of e-module practicality from teacher and student responses in terms of attractiveness, convenience, quality of content and role is in the range of 88% - 100%. Based on the teacher's response, the e-module has an attractive appearance that can attract students' attention in learning activities. The students' response to the attractiveness of the e-module...
was "good" where students were interested in learning because there were videos of phenomena related to everyday life and there were practice questions in the form of games. This research is in line with (Saprudin et al., 2022). Apart from that, the e-module is equipped with modifications to student worksheets in the form of simple virtual experiments. This is in line with (Doyan et al. (2022b) modifying the module with student worksheets with module practicality results of 88.90%.

Based on table 3, learning has been implemented well. There was improvement at every meeting. This is due to adaptation in learning activities using e-modules based on argument-driven inquiry.

Thus, the electronic module in this research can be used to optimize learning activities that support students’ 21st century abilities. Based on the results of the practicality test as assessed from the teacher and student response questionnaire, the implementation of learning is in the very practical category.

**Conclusion**

The Argument-Driven Inquiry-based e-module developed meets very practical criteria based on teacher, student responses and learning implementation. Thus, it can be concluded that Argument-Driven Inquiry based electronic modules can be used in science learning activities in schools to support 21st century skills that students must master.

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We would like to say thanks to all those who contributed to the research, including the team of expert validators.

**Authors Contribution**

The author's contributions include A.S: collecting data, analyzing data, and S. and A.A.S: focus on methodology, and review of writing.

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**Conflicts of Interest**

No conflict interest.

**References**


Doyan, A., Susilawati, Harjono, A., Muliyadi, L., and teachers are already familiar with using smartphones in daily activities so that using e-modules can be accessed easily. This is in line with Aslik et al. (2022) that teachers and students are helped by the existence of e-modules in learning activities which can be accessed using mobile phones or computers which can be accessed online or offline. The development of online e-modules can facilitate the delivery of information adaptively (Surahman et al., 2019). The quality of e-modules and the role of e-modules are very practical criteria.

The learning implementation observation sheet is used as a reference to see the implementation of learning with argument-driven inquiry based e-modules. The learning implementation sheet was used when the learning activity took place over three meetings and was carried out by the class VIII science teacher as observer. The results of learning implementation can be seen in table 3.

![Figure 1. Percentage of practicality](image)

**Table 3. Results of Learning Implementation**

<table>
<thead>
<tr>
<th>Learning Activity</th>
<th>Opening Activity</th>
<th>Core Activity</th>
<th>Closing Activity</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>88%</td>
<td>93%</td>
<td>80%</td>
<td>87%</td>
</tr>
<tr>
<td>II</td>
<td>96%</td>
<td>91%</td>
<td>80%</td>
<td>89%</td>
</tr>
<tr>
<td>III</td>
<td>100%</td>
<td>100%</td>
<td>80%</td>
<td>93%</td>
</tr>
</tbody>
</table>

**Criteria** Very Practical


