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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, Mulyadi, 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

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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:

$$\text{Practicality (\%)} = \frac{\text{score earned}}{\text{max score}} \times 100\% \quad (1)$$

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)

Percentage Range of Values from Validation (%)	Practicality Level
0-20	Impractical
21-40	Less Practical
41-60	Practical enough
61-80	Practical
81-100	Very Practical

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

Product	Respondent	Percentage	Criteria
Science E-Module	Teacher	100 %	Very Practical
	Students	91 %	Very Practical

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%.

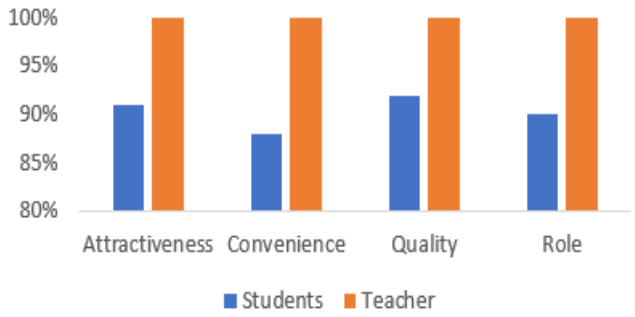

Figure 1. Percentage of practicality

Ease of use of e-modules is at very practical criteria, namely 88% where in implementation, e-modules can be accessed via smartphone as well as computers. Students 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.

Table 3. Results of Learning Implementation

Learning Activity	Opening Activity	Core Activity	Closing Activity	Average
I	88%	93%	80%	87%
II	96%	91%	80%	89%
III	100%	100%	80%	93%
Criteria				Very Practical

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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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

Arikunto, S. (2010). *Prosedur Penelitian*. Rineka Cipta.

Aslik, M., Karyono, H., & Gunawan, W. (2022). Pengembangan E-Modul IPA Berbasis Literasi untuk Mendukung Pembelajaran Daring Bermakna. *JINOTEP (Jurnal Inovasi Dan Teknologi Pembelajaran): Kajian Dan Riset Dalam Teknologi Pembelajaran*, *9*(1), 56–67. https://doi.org/10.17977/um031v9i12022p056

Dewi, A. M., Widyanto, A., & Ahadi, R. (2022). Respon Siswa Terhadap Media Pembelajaran lembar Kerja Peserta Didik Elektronik Pada Materi Sistem Pernapasan di SMA 7 Banda Aceh. *Jurnal Ar-Raniry*, *10*(2), 89–95. Retrieved from https://jurnal.ar-raniry.ac.id/index.php/PBiotik/article/view/14512

Doyan, A., Susilawati, Harjono, A., Muliyadi, L.,

Hamidi, Fuadi, H., & Handayana, I. G. N. Y. (2023). The effectiveness of modern optical learning devices during the Covid-19 pandemic to improve creativity and generic science skills of students. *The 1st International Conference on Science Education and Sciences*, 020005. https://doi.org/10.1063/5.0122553

Doyan, A., Susilawati, S., Hadisaputra, S., & Muliyadi, L. (2022a). Effectiveness of Quantum Physics Learning Tools Using Blended Learning Models to Improve Critical Thinking and Generic Science Skills of Students. *Jurnal Penelitian Pendidikan IPA*, *8*(2), 1030–1033. https://doi.org/10.29303/jppipa.v8i2.1625

Doyan, A., Susilawati, S., Hadisaputra, S., & Muliyadi, L. (2022b). Analysis Validation of Quantum Physics Learning Devices using Blended Learning Models to Improve Critical Thinking and Generic Science Skills of Students. *Jurnal Penelitian Pendidikan IPA*, *8*(3), 1581–1585. https://doi.org/10.29303/jppipa.v8i3.1920

Hardini, S. D., & Alberida, H. (2022). Analisis kemampuan argumentasi peserta didik. *Biodidaktika: Jurnal Biologi Dan Pembelajarannya*, *17*(1), 93–99. https://doi.org/10.30870/biodidaktika.v17i1.16108

Izetbigovic, M. A., Solfarina, & Langitasari, I. (2019). Penerapan Model Discovery Learning untuk Meningkatkan Keterampilan Generik Sains Siswa. *EduChemia (Jurnal Kimia Dan Pendidikan)*, *4*(2), 164. https://doi.org/10.30870/educhemia.v4i2.6118

Lathifah, F., & Rokhmat, J. (2023). Pengembangan E-Modul Elastisitas dan Hukum Hooke untuk Meningkatkan Kemampuan Berpikir Kreatif Peserta Didik. *Journal of Classroom Action Research* , *5*(Special Issue), 326–331. https://doi.org/10.29303/jcar.v5iSpecialIssue.4693

Lestari, H. D., & Putu Parmiti, D. P. P. (2020). Pengembangan E-Modul Ipa Bermuatan Tes Online Untuk Meningkatkan Hasil Belajar. *Journal of Education Technology*, *4*(1), 73. https://doi.org/10.23887/jet.v4i1.24095

Marnah, Y., Suharno, & Sukarmin. (2022). Development of physics module based high order thinking skill (HOTS) to improve student's critical thinking. *Journal of Physics: Conference Series*, *2165*(1), 012018. https://doi.org/10.1088/1742-6596/2165/1/012018

Marudut, M. R. H., Bachtiar, I. G., Kadir, K., & Iasha, V. (2020). Peningkatan Kemampuan Berpikir Kritis dalam Pembelajaran IPA melalui Pendekatan Keterampilan Proses. *Jurnal Basicedu*, *4*(3), 577–585. https://doi.org/10.31004/basicedu.v4i3.401

Ramdani, A., Jamaluddin, & Sukarso, A. A. (2023). The impact of Android media development on students' scientific argumentation skills. *AIP Conference Proceedings*, *2619*(1). https://doi.org/10.1063/5.0122852

Ratnawati, D., Martono, R., & Rabiman, R. (2020). Pengembangan E-Modul Sistem Rem untuk Siswa Sekolah Menengah Kejuruan. *Jurnal Dinamika Vokasional Teknik Mesin*, *5*(1), 20–26. https://doi.org/10.21831/dinamika.v5i1.30987

Salsabila, E. R., Wijaya, A. F. C., & Winarno, N. (2019). Improving Students' Sustainability Awareness through Argument-driven Inquiry. *Journal of Science Learning*, *2*(2), 58. https://doi.org/10.17509/jsl.v2i2.13104

Saprudin, S., Irfan Ahlak, Astuti Salim, Ade Hi Haerullah, Fatma Hamid, & Nurdin Abdul Rahman. (2022). Pengembangan e-Modul Interaktif Getaran dan Gelombang (eMIGG) untuk Pembelajaran IPA di SMP. *Jurnal Pendidikan MIPA*, *12*(1), 97–106. https://doi.org/10.37630/jpm.v12i1.549

Siahaan, A. T., Liliasari, & Hernani. (2019). Effectiveness of Argument-Driven Inquiry Model on Student' Generic Science Skills and Concept Mastery. *Journal of Physics: Conference Series*, *1233*(1), 012020. https://doi.org/10.1088/1742-6596/1233/1/012020

Sugiyono. (2015). *Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D)*. Alfabeta.

Surahman, E., Kuswandi, D., Wedi, A., Degeng, I. N. S., Setyanti, D. A., & Thaariq, Z. Z. A. (2019). Adaptive learning analytics management system (Alams): An innovative online learning approach. *International Journal of Innovation, Creativity and Change*, *5*(4), 413–430. Retrieved from https://www.ijicc.net/images/vol5iss4/Pt_2/54203_Suraham_2019_E_R.pdf

Susilawati, Doyan, A., Rokhmat, J., & Muliyadi, L. (2023). Analysis Validation of Modern Physics Learning Media Based on Smartphone Integrated Project Based Learning to Improve Students' Creativity and Scientific Literacy. *Jurnal Penelitian Pendidikan IPA*, *9*(10), 7888–7892. https://doi.org/10.29303/jppipa.v9i10.5404

Susilawati, S., Doyan, A., Ayub, S., Wahyudi, W., Ardu'ha, J., & Mulyadi, L. (2021). The Effectiveness of Guided Inquiry-Based on Nuclear Physics Learning Devices with PhET Media to Increase Student Creativity. *Jurnal Penelitian Pendidikan IPA*, *7*(4), 770–774. https://doi.org/10.29303/jppipa.v7i4.978

Susilawati, S., Doyan, A., & Muliyadi, L. (2022). Effectiveness of Guided Inquiry Learning Tools to Improve Understanding Concepts of Students on Momentum and Impulse Materials. *Jurnal Penelitian Pendidikan IPA*, *8*(3), 1548–1552. https://doi.org/10.29303/jppipa.v8i3.1919

Susilawati, S., Doyan, A., Mulyadi, L., Abo, C. P., & Pineda, C. I. S. (2022). The Effectiveness of Modern Physics Learning Tools Using the PhET Virtual Media Assisted Inquiry Model in Improving Cognitive Learning Outcomes, Science Process Skills, and Scientific Creativity of Prospective Teacher Students. *Jurnal Penelitian Pendidikan IPA*, *8*(1), 291–295. https://doi.org/10.29303/jppipa.v8i1.1304

Susilawati, S., Kusumayati, B. A., Sutrio, S., & Doyan, A. (2022). Practicality of Learning Devices Based on Conceptual Change Model to Improve Concept Mastery of Students in the Gas Kinetic Theory Material. *AMPLITUDO : Journal of Science and Technology Inovation*, *1*(2), 54–57. https://doi.org/10.56566/amplitudo.v1i2.13

Yanarti, Y., Jumadi, J., Lelita, I., & Rosiningtias, W. (2022). Development of Archimedes Law Material E-Module on Motion Systems to Improve Student's Concept Understanding. *Jurnal Penelitian Pendidikan IPA*, *8*(4), 2439–2447. https://doi.org/10.29303/jppipa.v8i4.1905