

Development of socioscientific issues-based e-module on environmental change topic

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ABSTRACT

This research background was the limitation of online learning resource and lack of e-module in learning process especially in using socioscientific issues approach. Moreover, the teaching material was less attractive and comprehensive that causes lack of students learning interest. This study aimed to produce e-module based on socioscientific issues in environmental change topic for senior high school students grade X. The research was conducted in SMAN 1 Padang Ganting in even semester 2021-2022. 4D (define, design, development and disseminate) model used to develop the e-module. This research result was the e-module produced have 83% in validity and categorized as very valid, 88% in practicality based on teacher's questionnaire and 84% based on student's questionnaire which categorized very practical. This suggests that e-module developed meet all aspects of a research development and in accordance with the characteristics of a teaching materials. It can be concluded that the socioscientific issues-based e-module developed was valid and practice for biology learning in senior high school.

Keywords: e-module, socioscientific issues, validity, 4D

INTRODUCTION

Indonesia has entered the post-pandemic level where the teaching and learning process returns to face-to-face learning. Even though face-to-face learning has started, schools can still use Blended Learning in practice. Blended learning is a learning method by combining face-to-face learning in the classroom and also bold or distance learning (Saputro et al., 2020).

Based on the observation in SMAN 1 Padang Ganting, there is lack of teaching materials that support online learning, such as the absence of online teaching materials made by teachers, low student motivation in online learning, online learning carried out so far the teacher only gives questions and explains a little, so that it has an impact on the lack of style of reasoning or analysis as well as the ability to argue about the problems that exist in the material (Setiono, 2017; Viyanti et al., 2016). The process of learning science must be able to trigger higher-level skills (critical thinking, creative, and have the ability to solve problems) in students.

Based on these findings, online teaching materials and learning approaches are needed

that suit current needs. Online learning resources allow the learning process to obtain results in the form of complex skills needed in the global era while at the same time enabling student centered learning (Mills, 2006) whereas according to Juuti et al. (2009) explains that there are several potentials that can be developed from online learning resources in the learning process, such as (1) drawing on web-based materials for use by students both inside and outside of class hours, (2) teachers modify and adapt web-based resources for use with their students, (3) teachers use the Internet to support their professional needs.

One of the online teaching materials is an electronic module (e-module). E-module is a source or study guide in electronic form (Rokhmania & Kustijono, 2017). E-module designed by lecturers or teachers can control the content being studied so that it can adapt to the planned curriculum (Tsai et al, 2018). With the existence of e-modules it can make it easier to facilitate students who are slow to absorb lessons, because it can provide an atmosphere that feels more effective and interesting. In line with the results of research (Darmayasa et al.,

2018) it can be proven that character education-based e-modules by including character understanding can improve student learning outcomes

The socioscientific issues (ISS) approach is a learning approach that investigates and studies facts that are around, as well as phenomena that are happening, or events that are happening based on issues and problems related to science in people's lives (Sismawarni et al., 2020). According to Zeidler et al., (2009), ISS is open so that it allows students to think critically about these issues together with other people who have different views. The ISS contained in the environment is a contextual issue that can occur in Indonesia, issues that occur around this are important to be raised by students so that students are able to stimulate critical thinking, analysis, reasoning and argumentation skills.

Azizah et al., (2022) stated that ISS approach can improve several student skills such as understanding concepts, independence and learning outcomes, scientific literacy, basic KPS, analytical thinking, critical thinking skills, character education, spatial visualization, and self-efficacy. Strengthened by Kartika et al., (2017) and Dewi et al., (2022), ISS approach has a great influence and can improve students' scientific literacy in both competency and attitude aspects. Argumentation skills are important to develop because they can train them to think scientifically, communicate and act like scientists (Tanfiziyah, 2021). Argumentation skills are very important in everyday life because these arguments play a role in making correct and logical decisions on controversial issues (Yang, 2012 and Tsai, 2018).

Based on the background that has been described, the researcher is interested in conducting research on the development of e-module based on socioscientific issues especially on environmental change topic.

METHOD

The type of research used is research and development with 4D model consisting of Define, Design, Develop, Disseminate, at the disseminate stage it was not carried out due to time and cost constraints. At the define stage, an initial-end analysis is carried out, student analysis, literature/theory analysis, formulation of objectives and selection of learning tools, Design stage, selection of learning devices, preliminary design, determination of the e-module format, determination of the application used, publishing the e-module In the develop stage, an e-module validation test is carried out that has been designed to be validated by three validators who are experts in the fields of education, biology and media, then a practicality test is carried out by teachers and students of SMA 1 Padang Ganting, a practicality test in the form of a validated questionnaire instrument first.

The data analysis of questionnaire analysis of validation results and practicality of e-modules using a score in likert scale 1-4.

Table 1. Likert scale

Criteria	Score
Strongly agree	4
Agree	3
Don't agree	2
Strongly disagree	1

The validation results contained in the validation sheet and practicality of the e-module analyzed using the following formula:

$$P = \frac{F}{N} \times 100\%$$

Note:

- P = Number percentage of questionnaire data
- F = Total score obtained
- N = Total maximum score (Sugiyono, 2012)

Table 2. Feasibility presentation of valid and practical interpretation criteria (Sudijono, 2015)

Rating	Validity Criteria	Practicality Criteria
76%-100%	Very Valid	Very Practical
51%-75%	Valid	Practical
26%-50%	Invalid	Not Practical
0%-25%	Very Invalid	Very Not Practical

RESULTS AND DISCUSSION

Define Stage

The e-module based on the socio-scientific issues (SSI) approach was designed based on the definition stage carried out to get an overview in schools. (a) Beginning-final analysis (needs analysis), at the stage of the initial-end analysis process carried out was subject teacher interviews, some information was obtained including related to the lack of teaching materials that support online learning. The teacher also revealed that students' interest in learning learning is still less like reading so that students' understanding of concepts is lacking. The teaching materials used by teachers and students are in the form of a package book published by Tiga Serangkai with the title Exploring the World of Biology 1 based on analysis.

Furthermore, the advantages in developing these products can spur critical thinking skills which include analyzing, making conclusions, provide explanation, evaluate, interpret, and carry out Self-Regulation, while the drawback of the product being developed is that it requires a large memory capacity to deviate from the product.

The school uses the 2013 curriculum with KD 3.10 on environmental pollution material. This research was applied to class X MIA students, the results of the analysis found that there was a lack of student interest in carrying out online learning and the limited textbooks used. From the analysis that the author has done, to overcome the problems in the school both the learning process, curriculum demands, the lack of online learning resources, the lack of a learning approach that is able to train students' argumentation skills, the writer can provide a solution by developing teaching materials in the form of e-modules based on the socioscientific issues (ISS) approach.

The socioscientific issues approach has benefits such as, (1) Fostering scientific literacy in students so they can apply evidence-based science knowledge in everyday life, (2) forming

social awareness where students can reflect on the results of their reasoning, (3) encouraging thinking skills and scientific reasoning about a phenomenon that exists in society, and (4) Improving critical thinking skills which include analyzing, making conclusions, providing explanations, evaluating, interpreting, and carrying out self-regulation (Pandela & Sunyono, 2019).

Design Stage

At this stage, the design of the ISS-based e-module is carried out. some of the work processes in this stage are starting from collecting materials to be used in making the e-module where, making an outline for making the e-module, designing with power point and designing the components that must be in the e-module. The main stages that must be available in the module, namely the need to study the name of the subject, introduction, learning activities, exercises, answer signs, exercises, summaries, tests and answer keys, finally, enter the e-module into the Flip PDF Professional application program.

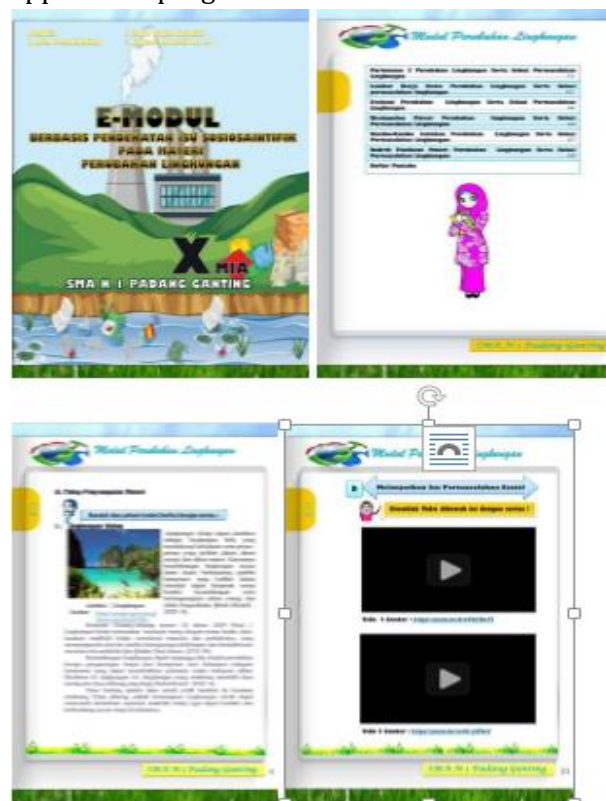


Figure 1. E-module

The HTML format can be used with Android and laptops or computers of any type. Operating the HTML format must use an internet data connection. The e-module design can be seen in Figure 1.

Develop Stage

At this stage the validity and practicality of the product is tested. (1) ISS Approach E-Module Validity Stage on Environmental Change Material. Products that have been designed will be validated by 3 validators who are experts in the fields of education, biology and learning media. based on the validation results from the validator regarding the ISS-based E-Module, it is very valid with an average percentage of 83%, which can be seen in Figure 2.

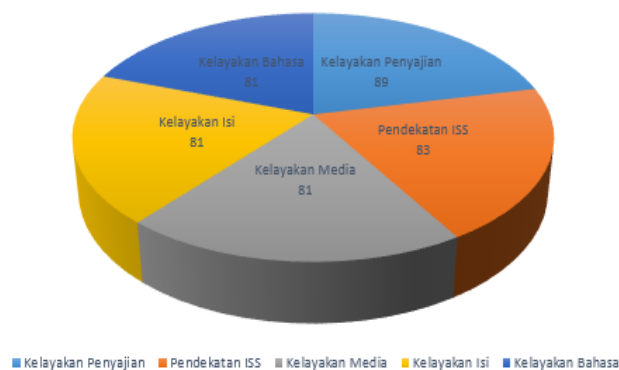


Figure 2. Validation Results

Based on Figure 2, it can be seen that the highest aspect of the validity of the ISS-based E-Module is the feasibility aspect of presentation with a percentage of 89% eligibility in presentation consisting of presentation techniques, presentation support, presentation of learning, coherence and coherence of the flow of thinking very much in accordance with characteristics of the ISS. then the ISS Approach with a percentage of 83% where in the e-module it is very clear that there are steps to the ISS approach, then media eligibility with a percentage of 81% where the e-module is very effectively used by students, Content Eligibility with a percentage of 81% where there is a

suitability of the material description with KI, KD, material accuracy that can encourage students' curiosity, and finally Language Eligibility with a percentage of 81% where language eligibility consists of straightforward, communicative, conformity with student development, conformity with Indonesian language rules, use of terms, symbols or icon. Straightforward consisting of electronic modules has the right sentence structure, so it can be proven that the contents of the designed E-Module are in accordance with the objectives of developing the e-module. This is in accordance with [Linda & Putra \(2021\)](#) in the use of e-modules in the online learning process can increase understanding of concepts, where this research is supported by the results of tests conducted by researchers. In line with [Linda et al. \(2018\)](#), e-modules are clear, easy and systematic. In independent learning by students can take place optimally.

The results of e-module validation based on the ISS approach can also improve students' critical thinking skills through understanding the concepts in the e-module. This is in line with [Armani & Rahmad \(2021\)](#) that using the ISS approach can increase students' understanding of concepts, this research is also in line with (2) the E-Module practicality stage based on the Socio-Scientific Issues Approach on Environmental Change Material. At the practicality stage, the teacher and students were given a response questionnaire on the practicality of the product

Student Response

Based on the results of the practicality of student responses, namely the efficiency of learning time 85% with a very valid category, which contains material and questions that are very easy for students to understand, then the ease of use is 83% and the benefits obtained are 83% with a very valid category where the convenience and the benefits that students can get are very useful. In line with research [\(Suastrawan et al., 2021\)](#) the use of the ISS

approach in the learning process is very interesting to use. Furthermore, Azizah et al., (2022) and Kusumaningtyas et al., (2020) stated that student responses were very interesting using the ISS approach.

Teacher Response

From the results of the practicality of the teacher's response, the highest learning time efficiency is 92% with a very valid category where the use of e-modules is very helpful in time efficiency. Furthermore, the benefits obtained are 88% with a very valid category where this e-module can reduce the teacher's role as a facilitator and ease of use 86% with a very valid category, the e-module provided is equipped with instructions, instructions, language and material that is appropriate so that it makes it easier teachers in understanding the e-module.

E-modules will be said to be very practical if e-modules can be used easily by teachers and students in biology learning. Desyandri et al., (2019) and Rizta (2016) explain that the science e-module developed helps teachers and students understand the material presented. E-modules based on the socio-scientific issues (ISS) approach only reach the develop stage, it is hoped that future researchers can develop these products up to the disseminate stage.

CONCLUSION

Based on the results of the data analysis that the researchers have done, it can be concluded that e-module based on the Socio-Scientific Issues (ISS) approach are categorized as very valid with an average validation result of 83%. Moreover, e-module based on the Socio-Scientific Issues (ISS) approach are categorized as very practical with an average student response questionnaire practicality of 84% and an average teacher response questionnaire of 88%.

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