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The Validity of the Online Module of Flipped Classroom Based on Socioscientific Issues Towards Students' Literacy Skills

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Abstract:
This research aimed to determine the validity of the module online of flipped classroom based on socioscientific issues (SSI). This research refered to the Research and Development (R&D) procedure which was carried out up to the develop preliminary form of product stage. The first stage was the research and information collecting stage consisted of literature studies and field studies. The field studies were conducted on one hundred students and thirty science teachers at ten public and private junior high schools in Bandar Lampung and Metro City using a questionnaire of needs analysis and an preliminary test of PISA science literacy skills. The develop preliminary form of product stage, the process of preparing draft of the learning tools was done, then proceed with designing module as developed product model and validated the product by three experts and two teachers. The results of validation test by the experts (100%) and the teachers (95%) on the content, the experts (90%) and the teachers (98%) on the construct, as well as the experts (100%) and the teachers (100 %) on the language stated that the online module of flipped classroom based on SSI was valid toward improve students' science literacy skills.

Key Word*: the validity; online module; flipped classroom; socioscientific issues; science literacy skills.*

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I. Introduction

Science is a key aspect of knowledge-based society in this modern life. Therefore, many countries prioritize improving the quality of science learning in the education of their people[1]. Science education is challenged to prepare good quality human resources, who are not only competent in the fields of science and technology but also have the ability to think logically, critically, and creatively, and have science literacy so that they are able to solve various problems of daily life.

Science literacy is the ability to apply science in understanding and solving scientific and social problems in life[2, 3]. Science literacy according to Program for International Student Assessment (PISA) includes four aspects those are, aspects of context, knowledge, competence, and attitude[4]. This competency aspect can present other aspects with its three indicators: (1) explaining phenomena scientifically; (2) evaluating and designing scientific enquiry and; (3) interpreting data and evidence scientifically.

Science literacy is now a demand to be mastered by every individual. Science literate individuals can use the scientific information they have to overcome problems in their daily lives and produce useful scientific products. However, at this time the quality position of Indonesian students in the international world in terms of science literacy skills is still low[5]. This can be seen from the results of the PISA mapping from 2000 to 2015 which shows that the skills of Indonesian students' science literacy is always below the established international standards and even tends to decrease[6, 7, 8, 9].

This low achievement in Indonesia shows that learning science in Indonesia has not directed students to practice science literacy because the learning process in the classroom does not involve the science process and teaches high-order thinking[10,11] so students are not accustomed to applying their knowledge and science skills to solve problems in daily life[10]. Based on this, the potential learning strategy to be applied in the classroom to practice student science literacy is Sociocientific Issues -based learning (SSI). This is in line with Dawson & Venville's statement which states that in its application in the world of education, SSI has become an important thing in science education because it occupies a central role in the process of science literacy[12].

SSI-based learning is learning that presents social issues in communities that are conceptually related with science[13]. SSI is issues that describe the social problems of society related to the context, conceptual, procedural, or technology of science that require a level of moral reasoning or evaluation of ethical problems in the decision making process about the possibility of resolving these issues[14, 15].

SSI is very potential if used as a basis for learning science in schools because the use of SSI can be used as a liaison for real problems in the community and the foundation by students in exploring science content. This makes students able to not only have an understanding of knowledge, but also concerning understanding of various aspects of the scientific process, as well as the ability to apply knowledge and scientific processes in real situations faced by students, both personally, socially, and globally[16]. Therefore, the application of SSI in science learning is believed to be the right solution that can be used to train and improve students' science literacy skills[15, 13, 17, 11].

Presley et al. stated that the success of SSI-based learning is one of them by utilizing technology as a learning media[18], because in addition to making learning more relevant to students, the use of technology media, especially the internet, can also facilitate student learning experiences by providing more diverse learning resources.

Based on the preliminary study of the 30 science teachers at ten Junior Public and Private schools in the city of Bandar Lampung and Metro, show that teachers have learned the importance of science literacy skills training of students in learning science, but most of the teachers have not trained science literacy 3 the classroom and still fewer teachers who know about SSI. Furthermore, mainly teachers already know the use of Information and Communication Technologies (ICT) in learning science in the classroom, but teachers have not utilized the advancement of ICT especially the internet in learning activities optimally. Utilization of ICT by teachers are merely utilizing the internet to access and download information related to learning material. Learning in the classroom that is done conventionally and is centered on the teacher, of course, has not been able to produce good quality learning. This is in line with Rusman who stated that from various conditions and potentials, efforts that can be made with regard to improving quality in schools are developing student-oriented learning systems (student center) and facilitating students' needs for challenging, active, creative needs, innovative, effective and fun by developing and implementing ICT-based learning[19]. So that utilizing ICT can produce good quality learning.

Based on observations of one hundred students, it is known that the science literacy skills of students is still low. This is reflected by the results of students' preliminary science literacy skills tests who are below the average target score of PISA 2015 assessment. The learning process in the classroom still relies entirely on the teacher. The students have not independently to learn and seek additional information regarding the science material are studied so students are very dependent toward the role of the teacher in the classroom. In response to this, one of the efforts that can be done is to apply independence in the learning process of students so it can improve the quality of student learning. Therefore the selection of appropriate teaching materials becomes very important in the attention of the teacher. The module was chosen as an excellent teaching material to be developed. This is because the module is a printed teaching material designed to be studied independently by learning participants, it means that the module is written with the aim that students can study independently without or with the guidance of the teacher[20, 21].

Improving the quality of student learning can also be done by efforts to use the internet as a media to access the widest possible knowledge by including ICT as a process at Educational Institutions (Schools). E-Learning enables online learning and provides online learning resources that can be accessed anytime and anywhere. Alomari said that the use of online learning resources is not only beneficial because of its interactivity and accessibility, but also can increase the students' active independence in learning[22]. However, Juuti et al. found that learning science based on online learning resources still had to be accompanied by a face-to-face communication model[23]. Based on this, it can be said that the use of online modules still requires face-to-face learning in order to obtain optimal results. The learning method that can be used to achieve this is the flipped classroom method.

Flipped classroom is defined as learning that is normally done in class by students is done at home and homework that is normally done at home is completed at school[24]. Learning by using the flipped classroom method involves the active participation of students individually to explore the material outside the classroom with unlimited time before class begins, can help students to be more active and more independent in the learning process and the time in class is used for solving problems found by students in learning at home[25]. One of the online media that can be used to support this learning is Edmodo. Edmodo is a media school-based environment, making Edmodo as a secure learning platform for teachers and students to interact, collaborate and share content[26, 27].

Learning for junior high school students is more effective when using media that is familiar with the daily lives of students. Edmodo can answer these needs, because Edmodo uses a similar design to Facebook and can be accessed via a laptop or smartphone. This is also supported by the results of observations from one hundred students in ten public and private junior high schools in the city of Bandar Lampung and Metro which show that all students already have a smartphone but have not optimally used it as a media that can be used to support learning. Therefore it is necessary to develop an online module of flipped classroom based on socioscientific issues towards improve students' science literacy skills.

II. Material And Methods

The method in this study refers to the R&D procedure[28] which is in the procedure there are 10 steps to implementing a research and development strategy. However, in this study only carried out up to three initial stages those are research and information collecting, planning, and develop preliminary form of product. The research and information collecting stage is conducted to gather data about existing conditions as a reference for product which is developed. The research and information collecting stage consists of literature studies and field studies. Literature study is carried out to obtain data that is used as a theoretical basis in order to strengthen the argument for the product produced. A field study conducted on a hundred students and thirty science teachers in ten junior public and private schools in Bandar Lampung and Metro City by using questionnaire of needs analysis and an preliminary test of PISA science literacy skills on students. After analyzing the results of the data obtained, planning and product development are carried out. Furthermore, at the develop preliminary form of product stage, the process of preparing draft of the learning tools was done, then proceed with designing modules as a product model that is developed (draft of product I) and validate the product by experts afterward. The product validation is carried out by three experts and two teachers to produce the validity of the products in terms of content, constructs and language. At this stage a draft of Product II is produced and developed according based on input from experts and practitioners.

The data analysis technique for the needs analysis questionnaire for teachers and students was done by calculating the percentage of respondents' answers on each item using the following formula:

$$\%J_{in} = \frac{\sum J_i}{N} \; x \; 100 \; \% \tag{1}$$

Where $\%J_{in}$ is the percentage of answer choices i, $\sum J_i$ is the number of respondents who answered answer i, and N is the total number of respondents.

The data analysis techniques of expert validation questionnaire and teacher responses were calculated from the results of the response score given based on the Likert scale using the following formula:

$$\%\, X_{in} = \frac{\sum s}{S_{maks}} \; x \; 100\% \tag{2}$$

Where $\%\, X_{in}$ is the percentage of respondents' answers to the questionnaire, $\sum s$ is the number of answer scores, and S_{maks} is the maximum expected score. Then the results of the analysis of the percentage of response scores are interpreted using Arikunto's interpretation.

The technique for calculating the average percentage of response scores is done by using the following formula:

$$\overline{\%X_i} = \frac{\sum \%\, X_{in}}{n} \tag{3}$$

Where $\overline{\%X_i}$ is the average percentage of answers, $\sum \%\, X_{in}$ is the percentage of each item in the questionnaire, and n is the number of questions. Then persentage of the answers interpreted as a whole into the criteria.

The data analysis technique of students' science literacy test is done by calculating the students 'answers on each item test indicators of PISA science literacy by using the following formula:

$$\%\, X_{in} = \frac{\sum s}{S_{maks}} \; x \; 100\% \tag{4}$$

Where $\%\, X_{in}$ is the score percentage of students' answers on the PISA science literacy test, $\sum s$ is the sum of answer scores, and S_{maks} is the expected maximum score [29]. Then the results of the analysis of the percentage of answer scores are interpreted based on scoring items at PISA 2015[4].

III. Result

Based on the results of the preliminary study data analysis, it shows that the teachers already know the importance of training students' science literacy skills in learning science, but only 57% of teachers practice science literacy in the classroom. Then only 30% of the teachers knew about SSI and only 23% had used SSI in science learning. Furthermore, the amount of 97% of teachers have known the use of ICT in learning science in the classroom, but teachers have not utilized the advancement of ICT especially the internet in learning activities optimally. The 100% of teachers stated that it is necessary to develop the online module of flipped classroom based on SSI towards improve students' science literacy skills. Meanwhile, based on the results of the analysis of assessment data on the students' preliminary science literacy skills based on three indicators of science literacy by PISA: (1) explaining phenomena scientifically; (2) evaluating and designing scientific enquiry and; (3) interpreting data and evidence scientifically [4], is still below average the target score of science literacy skills achievment of PISA 2015. The results of the analysis of the score percentage of students' preliminary science literacy skills are presented in Figure 1 below.

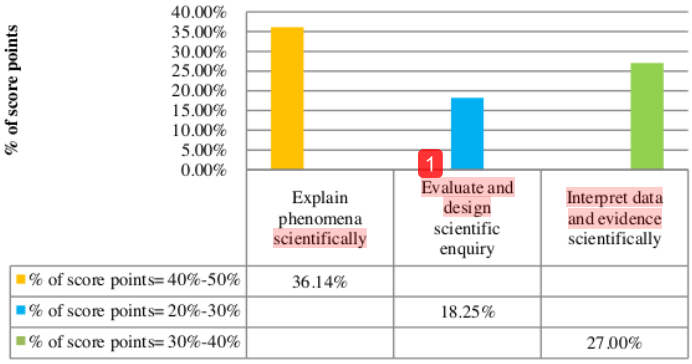

Figure 1. The score percentage of students' preliminary science literacy skills

Validation activities are carried out after product development is done. Validity in this study was carried out by experts in the fields of content, construct (design) and language and two teachers. Testing of the resulting product is in the form of expert validation and teacher responses using a validation questionnaire. The results of expert validation and teacher responses are in the following Table 1.

Table 1. The result of expert validation and teacher response

No	Aspect	Percentage		Criteria
		Expert	Teacher	
1	Content	100%	95%	Valid
2	Construct	90%	98%	Valid
3	Language	100%	100%	Valid

IV. Discussion

Based on the results of the analysis of the needs analysis questionnaire and results of preliminary science literacy skills of students (Figure 1), teaching materials are developed in the form of the online module of flipped classroom based on SSI towards improve literacy skills. This online module of flipped classroom is structured based on SSI characteristics: (1) the online module of flipped classroom based on SSI uses problems or issues that are controversial and subject to debate in the community; (2) the online module of flipped classroom based on SSI uses problems that have not yet been resolved and uses issues or problems in the community with relative or uncertain answers to solutions; (3) the online module of flipped classroom based on SSI includes elements of ethics and morals; (4) the online module of flipped classroom based on SSI has a relationship between science and social also has influence in society life[15, 30, 13].

Based on Table 1, validation of experts (100%) and the response of teachers (95%) state that contents of the online module of flipped classroom based on SSI have material depth that is in line with the Core Competencies and Basic Competencies. The Facts, data, examples, cases, pictures and videos are presented in the online module of flipped classroom based on SSI accordance with real life and SSI-based that can improve student understanding. The description of the material in each learning activity in the online module of flipped classroom based on SSI can foster students' science literacy skills. The practice exercises, formative tests, and

discussion sheets that have been compiled in the online module of flipped classroom based on SSI are in accordance with the indicators of achievement and can guide students to develop science literacy skills.

Expert validation (90%) and teacher response (98%) state that module construction of the online module of flipped classroom based on SSI are compatible with specified indicators of online module components. Videos and images that are presented in accordance with the description of the material. There is input from the validator that the layout of images and text should be linear in explaining the narrative and the pictures should be taken directly from the surrounding environment.

Expert validation (100%) and teacher response (100%) state that the language used in online module of flipped classroom based on SSI is communicative and easy for students to understand. The use of punctuation and grammar is appropriate. The sentences used are effective and do not cause plural or ambiguous notions. The language used is also polite, without reducing educational values. Based on the elaboration of the results of the validation stage above, the results of the validation of the contents, constructs, and language online module of flipped classroom based on SSI are appropriate and valid to use and are arranged according to SSI characteristics[15, 30, 13].

V. Conclusion

Based on the results and discussion, validation results are obtained from three experts (content, construct and language experts) and two teachers are the results of expert validation (100%) and teacher response (95%) on content, expert validation (90%) and teacher response (98%) on construct, and expert validation (100%) and teacher response (100%) on language state that the online module of flipped classroom based on SSI is valid for improving students' science literacy skills.

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