The Validity of Socioscientific Issues-Based Science Module For Students' Critical Thinking Skills

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ABSTRACT

The integration of Socio-Scientific Issues (SSI) in the module can link the growing scientific issues in society. The SSI in the module can be explored by students for improving their critical thinking skills. The purpose of this study is describing the content validity of SSI-based science module for students' critical thinking skills. The type of this study is a research and development. The result of this study is a content validity of SSI-based module for students' critical thinking skills. The sample of the study are the students of class VII junior high school 2 of Puger and junior high school 1 of Puger. The issues of environmental pollution are the main issues that used by the module. The instrument consists of a logical validation questionnaire in the form of a questionnaire for expert validators and an empirical validation questionnaire in the form of student response questionnaires. SSI-based science module on environmental themes for critical thinking skills are declared logically valid with an average score of 73.75%. Module are declared empirically valid because students respond positively to the content, presentment, language, and display validity.

Keywords: *Socio-scientific issues; The validity of SSI-based module; Students' critical thinking skills.*

1. Introduction

One of the 21st century skills being targeted is critical thinking skills. Critical thinking skills can be developed through a scientist approach in accordance with what is learned in educational units and other sources independently. One of the scientific approach is by integrating Socio Scientific Issues (SSI) into learning. SSI is a controversial issues without a solution or a definite answer (Hadjichambi et al., 2015). Meanwhile, according to Tekin et al. (2016), SSI is a social dilemma which connect both concepts and technologies with science. SSI also related with society because it contains ethical and moral dilemmas (Morris, 2014).

SSI can serve as a good learning, allowing students to understand the meaning of knowledge in their daily life and unity of student awareness to become scientific information consumers (Evagorou et al., 2012). It is in harmony with the science materials, which contain a content related to daily life or real life. SSI gives a forum for students to involve and connect them through discussion activities. The element of this process is the teacher who can create the students to discover, explore, and construct their knowledge (Karisan and Zeidler, 2017). The integration of SSI in science learning will be used in discussions and debates for duplicating the controversial dilemma to constructing their own knowledge. The students who are actively involved in such activities, their critical thinking skills will increase (Hadjichambi et al., 2015).

The concept of critical thinking is a part of the Bloom's taxonomy. The three highest levels in Bloom's taxonomy such as analysis, synthesis, and evaluation, are often interpreted as a critical thinking procedure (Bloom, 1956).

According to Santos (2017), critical thinking is an active and organized mental process that aims to understand events and how to talk around through their own thoughts and interactions with others. Thus, critical-minded is an organized mental activity in the information space to find yourself or interact with others. The integration of SSI into recent teaching materials that is still rarely done by other researchers. One of the teaching materials that can make students to construct their knowledge independently is the module. Through modules developed with the SSI context context theme technology, students are expected can improve his critical thinking skills.

1.1 Statement of the problem

"The Validity of Socioscientific Issues-Based Science Module For Students' Critical Thinking Skills"

1.2 Need and importance of the study

The SSI-based module is a systematically organized resource that contains scientific issues is socially relevant to the real world and contains an ethical component for students to learn independent with minimal guidance from educators. The use of SSI in the Science module can train students in organizing, processing, and exploring information according to the views of cognitivism and training students in building and discovering knowledge, concepts, and theories according to the view of constructivism.

The selection and use of socio-scientific problems in the module is vital to note. The selection and use of the problems contained in the module must meet the SSI characteristics. Problem which is selected as a topic without a single answer or without a clear answer and something that is possible it is expected that people are entitled to disagree. In addition, socio-scientific issues are good and precise to be used has the following characteristics: (1) in accordance with the learning objectives, (2) supported by (3) real and not contrived, (3) contemporary relevance, (4) controversial, and (5) illustrates the nature and process of science (Lewis, 2003).

1.3 Objectives of the present study

The following are the objectives of the present study:

1. To study the content validity of SSI-based module for students critical thinking skills
2. To study the content validity of SSI-based module for students critical thinking skills
3. To study the content validity of SSI-based module for students critical thinking skills
4. To study the content validity of SSI-based module for students critical thinking skills

2. Methodology

This research type is research and development by using prototype development model McKenney (2001) consisting of (1) needs and context analysis; (2) design, development and formative evaluation; and (3) semi-summative evaluation.

2.1 Sample

The sample of the study were students of grade VII of junior high school 1 of Puger and junior high school 2 of Puger in the even semester of the academic year 2017/2018.

2.2 Data analysis technique

Data analysis technique used in this research is quantitative descriptive analysis. Instruments and techniques of data analysis among others are described as follows:

2.3 Validation Analysis

Validation analysis through logical validation test using the instrument in the form of questionnaire related to content, language, presentation, and Display Validity. The instrument in the form of a questionnaire contains indicators of validity or eligibility. Data analysis techniques use the following formula. The data obtained by using the qualitative data formula using the valid criteria on the following (Akbar, 2013).

Table-1: The validity of the SSI-based module criteria

No	Percentage (%)	Category
1	$81,25 \leq x \leq 100$	Very valid
2	$62,5 \leq x < 81,25$	Valid
3	$43,75 \leq x < 62,5$	Less valid
4	$25 \leq x < 43,75$	Invalid

The content, language, presentation, and display validity is stated to have a good degree of validity if the percentage of validity is ≥ 62.5. If the level of validity achievement below is valid, then a revision is required based on the advice of experts or validators.

2.4 Student Response Analysis

Questionnaire of student response contains student opinions after the use of SSI-based module in learning. The student response questionnaire contains indicators according to the variables described in the form of statements. The statements in the questionnaire of presentation and tge graphics differ from each other according to their respective indicators. Questionnaire in the form of ordinal data is converted into interval data in percentage form. Students respond positively if the percentage of agreement $\geq 50\%$. Student data analysis techniques using the formula percentage of agreement as follows:

$$\textit{Percentage of agreement} = \textbf{(A/B) x100\%}$$

(Trianto, 2009).

Annotation:
A = The number of students who choose
B = The number of students

3. Result and Discussion

3.1 Needs and Context Analysis Result

Field observation aims to needs and context analysis. Field observation aims to obtain the results of subject curriculum analysis, the characteristics of the concept and material substance, the characteristics of students, and the characteristics of teaching materials. The results of curriculum analysis junior high school 2 of Puger and junior high school 1 of Puger already using the curriculum 2013. The results of analysis of the characteristics of the concept and substance of the form of material preparation of the concept of subject matter materials and its substances.

The result of characteristic analysis of class VII students of SMP found that all students of junior high school 2 of Puger and junior high school 1 of Puger aged 12 years and over which based on Piaget theory is in formal operational stage. In this period children can use concrete operations to form more complex operations and already have the ability to think abstractly. Thus, at this stage students are able to think critically. The next step is the analysis of teaching materials, the results of the analysis show that the teaching materials used by teachers and students in learning in the class has not been integrated with SSI. Based on the results of needs and context analysis, SSI-based module need to be designed, developed and piloted in learning.

3.2 Design Results

The design result of Science module integrated with SSI context of environmental pollution theme. The module consists of three learning activities: water, air, and soil pollution. The hallmark of the designed module is the inclusion of the SSI context in each learning activity.

3.3 Development Result

After the finished product is designed, the next stage is the development stage. The first stage is the logical validation. Logical validation is validated by an expert or expert consisting of three validators, those are physicist, chemist, and biologist. Each lecturer provides an assessment of the module that has been designed based on the content validity, presentation, language, and graphic aspects. The results of the assessment by the validator can be described in the following table.

Table-2 Logical validation of SSI-based module result

No	Aspect of Assessment	Average Score (%)	Criteria
I.	Content Validity	**73.78**	**Valid**
II.	Presentment Validity	**79.2**	**Valid**
III.	Language Validity	**69.83**	**Valid**
IV	Display Validity	**70.6**	**Valid**

Based on logical validation result in table 2, the average score of content validity is 73.78%, presentment validity is 79.2%, language validity is 69.83%, and display validity is 70.6%. Thus, the content, presentation, language, and display validity of each module meet the valid criteria, which means the module is feasible to use in the field with a little revision. The revised module is then tested in the formative evaluation stage.

3.4 Formative Evaluation Results

The result of formative evaluation in the form of student response scores obtained from a sample of 20 students of junior high school 2 of Puger. Results of student response analysis can be seen in the following table 3.

Based on Table-3, the results of student response analysis obtained the percentage of agreement is 92%. Thus 92% students respond positively to the use of SSI-based module. After the positive student response, the next step is to test the SSI-based module for students critical thinking skills in semi-summative evaluation phase.

Table-3 The student response analysis result in formative evaluation

Number of Statements	Average Score	Total Score (%)
Content Validity	17.44	87
Presentment Validity	18.79	94
Language Validity	19	95
Display Validity	18	90
Percentage of Agreement		**92**

3.5 Semi-Summative Evaluation Results

The semi-summative evaluation phase to test the validity of module on a wide scale. The semi-summative evaluation results from a sample of 36 students of junior high school 2 of Puger can be described in Table-4.

Table-4 The student of junior high school 2 of Puger response analysis result

Number of Statements	Average Score	Total Score (%)
Content Validity	33.11	92
Presentment Validity	34.21	95
Language Validity	31.50	88
Display Validity	33.75	94
Percentage of Agreement		**92**

Based on the results of student response analysis obtained the percentage of agreement is 92%. So, amount of 92% students respond positively to the use of SSI-based module. Thus, the content, presentment, language, and display validity of module are declared empirically valid. To prove the validity of SSI-based module for critical thinking skill, then, the module tested in different schools. The module tested in junior high school 1 of Puger with a sample of 39 students. The test results module in junior high school 1 of Puger as follows.

Table-5 The student junior high school 1 of Puger response analysis result

Number of Statements	Average Score	Total Score (%)
Content Validity	36.78	94
Presentment Validity	37.79	97
Language Validity	36.00	92
Display Validity	38.50	99
Percentage of Agreement		**96**

Based on Table-5, amount of 96% students respond positively to the use of SSI-based module. Thus, the content, presentment, language, and display validity of module are declared empirically valid.

4. Conclusion

Based on the research results, obtained some information including SSI-based module on the theme of the environment is divided into three learning activities of water, air, and land pollution. Based on the logical validation result in Table-2, the average score of content validity is 73.78%, presentment validity is 79.2%, language validity is 69.83%, and display validity is 70.6%. Thus, the content, presentation, language, and display validity of each module meet the valid criteria with an average score of 73.75%. Based on Table-3 and Table-4, amount of 92% students responded positively to the use of SSI-based module. Then, based on Table-5, amount of 96% students of junior high school 1 of Puger responded positively to the use of SSI-based module. Through logical and empirical validation tests it can be concluded that the module is declared valid to train the students' critical thinking skills.

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