

Development of Authentic Assessment instruments for Critical Thinking skills in Global Warming with a Scientific Approach

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Abstract: This study aims to develop an *authentic assessment* instrument to measure critical thinking skills in global warming learning and to describe the suitability, easiness, and usefulness of the use instruments which are developed base on the teacher's opinion. The development design is carried out by Borg & Gall (2003) development model, which is conducted with seven stages: information gathering stage, planning stage, product development stage, product test stage, product revision stage, field trial stage, and final product. The test subjects are students and teachers in SMA Lampung Tengah by using *purposive sampling* technique. Global warming learning using *authentic assessment* consists of a series of learning activities, including observing, discussing, exploring, associating and communicating. The results show the *authentic assessment* techniques global warming to measure and cultivate critical thinking skills consisting of written tests, performance, portfolios, projects, and attitudes. The developed assessment model meets content and constructs validity, and effectively improves students' critical thinking skills and has a high level of suitability, easiness, and usefulness well-being. The assessment techniques are used in global warming learning are performance assessment techniques, portfolios, projects, products, and attitude that together contribute to the improvement of critical thinking skills on 97,4% of global warming learning.

Keyword: authentic assessment, critical thinking, global warming, scientific approach.

1. Introduction

Authentic assessment paradigmatically requires the realization of authentic instruction and authentic learning. It is assumed that authentic assessment can to provide learners' ability holistically and validity. Authentic assessment is an actual assessment with a measurement significantly of learners' outcomes for the sphere of attitude, skills, and knowledge. The reality in the field teachers has not done authentic assessment because teachers still have difficulty in making the authentic assessment. If the authentic assessment is to acquire the sort of legitimacy that the assessment practices of the measurement community have acquired, then we are as critics of these assessment

practices need to find ways and means of confronting the criticisms leveled at alternative assessment [1].

A scientific approach or a scientific-based approach can use some strategies such as contextual learning. The scientific approach is learning directly of learners to observe, ask, analyze, then process data or information, present data or information, followed by analyzing, reasoning, then concluding, and creating. Physics subjects are the subjects most disliked by students because it is always identic with the formulas. Global warming is a new material of subject matter in the class XI in the 2013 curriculum; basic competence in global warming materials has the goal to form students' critical thinking skills. In everyday life and every activity, people are always involved in making a decision, in the easy and difficult decisions. The process of decision making is always related to the process of critical thinking. Based on the previous research it has been done in research data, educational background of they do not affect the level of knowledge of global warming. In addition, teachers and students have little one. This condition is reasonable because they do not learn about it in their previous studies. Thus, it can be explained that teachers and students are required to learn about it in order to understand well about global warming. This situation means the government must increase global warming materials with the educational curriculum. With their knowledge, they are expected to behave pro environment. They always think twice to perform daily activities whether it can destroy or preserve the environment [2].

Critical thinking is a central and important topic in modern education. As an educator, is expected to be interested in teaching how to think critically to the learners. They should teach them "how to think" not "how to learn." The specific purpose of teaching critical thinking in science or other disciplines is to improve the skills in thinking and preparing learners to be more successful in the world. Therefore, teachers should have knowledge on how to improve critical thinking skills to support the students' decision-making process. In this manner, teachers will be in the best position to assess whether or not critical thinking is indeed taking place [3]. The analysis is supported by descriptions of pedagogical practices that have been used to motivate students to engage in the processes that characterize of critical thinking [4].

Based on the result of questionnaire analysis, the average of authentic assessment given to the teacher is 0,52 so that the value is < 1 , whereas based on the average questionnaire result analysis given to the students, it is obtained 0,7 so the value < 1 . Because the teachers and students value < 1 then the need for the development of the authentic assessment. Based on the results of questionnaire analysis given to teachers about the knowledge of global warming concept is only 32.31% of teachers who know it, while based on the results of questionnaire analysis given to students only 27.69% students who understand about the concept of global warming. By lack of the global warming knowledge so wild be done the authentic assessment to know the achievement the aims og global warming competence. Increased CO₂ emissions are one of the causes of global warming. The increased use of motor vehicles adds to the volume of it gas also increases. Humans do not realize if all that happens because of their lack of understanding about the impact of human activity itself. Global warming is caused by

the use of electricity from fossil fuel plants that can increase in CO₂ emissions so that by suppressing electricity consumption in homes can reduce the problem of global warming [5]. Global warming will cause epidemiological changes in infectious diseases. Global warming is increasing due to the increasing use of CO₂ gas and the impact of global warming, one of which will affect human health due to climate change [6].

Based on the background and the result of needs analysis on the concept of global warming, the problem in this research is how is the development of authentic assessment instrument that can measure critical thinking skill in global warming learning by scientific approach?

2. Research Methods

The development design is carried out with Borg & Gall (2003) development model, which is conducted out with seven stages: information gathering stage, planning stage, product development stage, product test stage, product revision stage, field test stage, and final product. The test subjects are two classes of XI (experiment and control class) and teacher in SMA Lampung Tengah by using purposive sampling technique. The data in this research is obtained through questionnaire and test method. The questionnaire method was taken by giving question sheet instrument to the expert test used to collect the data of available product, based on the suitability of the design and contents of the developed product and the user response questionnaire instrument to the Physics teacher in Lampung Tengah to collect data on the suitability, easiness, and usefulness of the product, And teacher's response to the product. Test method data obtained from the results of a question description with the form 10 questions of global warming and assignment with performance assessment techniques, portfolio, projects, and products obtained at the implementation stage, namely the results of student scores.

3. Results and Discussion

The contents of the developed global warming learning authentic assessment tool can be seen in Table 1 below.

Table 1. Contents of the Authentic Device Assessment

No	Assessment Competency	Assessment Technique	Instrument's Design
1	Attitude	Self-Assessment	Statement of Attitude
		Performance Assessment	Work Sheet
2	Psychomotor	Portfolio assessment	Assignment Sheet
		Assessment Project	Assignment Sheet
		Assessment Product	Assignment Sheet
3	Cognitive	Paper Test	Description

Development of the instrument based on the results of needs analysis can be seen as in Table 1 above; the assessments are the assessment of the affective, psychomotor, and knowledge. Based on the results of needs analysis conducted before the research both the need for authentic assessment instruments as well as understanding the concept of global warming.

Establishing an authentic assessment instrument based on Core Competence 4 and Basic Competency 3.9 Analyzing the symptoms of global warming, greenhouse effect, and climate change and their effect on life and the environment and basic competency 4.8 Presenting ideas/solutions to the problem of global warming symptoms and their impacts on life and the environment. Based on the analysis competence of global warming that has been done then compiled Authentic Assessment instrument on global warming learning by making instrument grille, instrument shape, rubric and scoring guidelines designed from instrument chart of Authentic Assessment instrument. Use of rubric for assessment was found to be very effective in determining a pathway for both the teachers and the students to look for and to get the desirable results [7]. Product design can be seen in Figure 1 following [8].

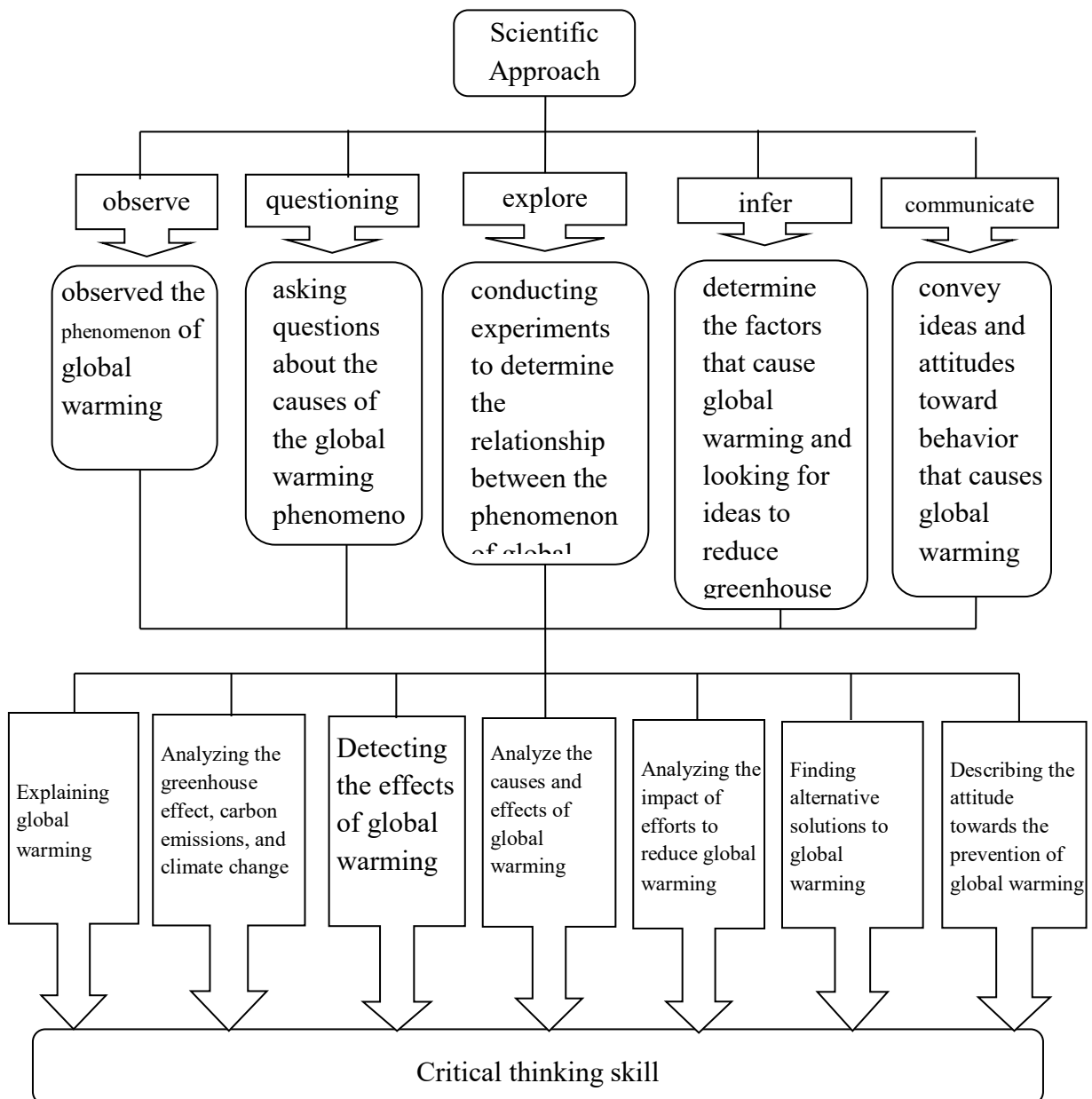


Figure 1. Authentic Assessment Chart for Critical Thinking Skills on Global Warming Learning with the Scientific Approach

(Source of: Suyatna A.& Rosidin U, 2016)

The development stage of the authentic assessment of global warming is based on product design. Then entered the stage of product test performed by the validators of construction products, experts substance, and linguists. The results of the validation recapitulation can be seen in Figure 2.below.

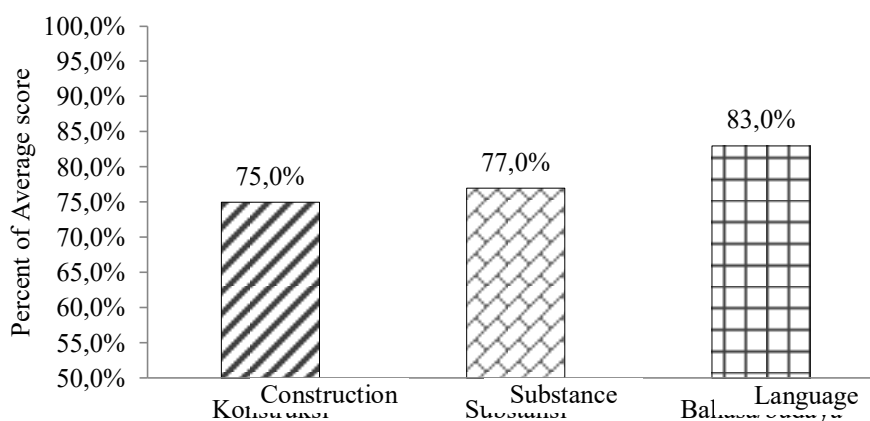


Figure 2. Validation Recapitulation

One-on-one test results for product easiness, suitability, and usefulness were done to three physics teachers from different schools with consecutive scores of 2.83 suit categories, 2.67 easy categories, and 2.67 useful categories. The revisions are then made to test the product in the field.

The experiment was conducted in class XI MIPA 2 as an experimental class. Field trials are divided into two sections, they are the effectiveness test to describe the effectiveness of authentic assessment instruments of global warming learning and teacher questionnaires to take the data on suitability, easiness, and usefulness on global warming learning tested in the experimental class as a product user.

The experiment effectiveness of authentic assessment instrument to improve students' critical thinking skill using quasi experimental design method using nonequivalent control group design research. The use of this research procedure is done by separating treatment groups and control groups to then be tested through pretest and posttest.

Learning of global warming materials using an instrument of authentic assessment in the experimental class is done by group learning at each meeting. Grouping is done with the aim to occur more intensive communication between students and students more active. Communication is needed for mutual understanding and discussion to solve problems. Students in the experimental class of 30 students were divided into six groups, each group consisting of 5 students. Grouping is done by observing students' early critical thinking skills. The grouping is conducted after the students' pretest. Each group consists of students with high, medium, and low critical thinking skill level by giving ten description questions based on critical thinking skill indicators. Grouping based on initial test results in students' critical thinking skills.

The result of the hypothesis test of mean difference of result data of posttest of the control class and experiment class shows that there is a difference which is significant between the average values of critical thinking of experiment class student with the average value of critical thinking skill of student of the control class. The improvement of students' critical thinking skills can be seen after learning in the experimental class, and control class is done a comparison of the average of N-gain of the class. The

average N-gain grade of the experimental and a control class was presented in Table 2 below.

Table 2. Average N-gain of Critical Thinking Skills of Experiment and Control Class Students

Component	Class	
	Experiment	Control
Average of N-gain	0,532	0,284
Criteria	Medium	Low

The result of data analysis of index gain obtained by data which can be seen in Table.3 shows that the mean of N-gain there is a significant difference of critical thinking skill of experiment class student in medium category and control class is in the low category. But the average value of critical thinking skills of the experimental class is higher that is equal to 0,532 compared to control class that is 0,284. Authentic assessment project-based with a scientific approach developed can improve the skills of scientific thinking effectively. Every aspect of students' scientific thinking skills has been improved [9]. The result of research and development of physics-based electronic module of the mutual material of global warming showed that the application of electronic physics module in learning could improve student learning achievement [10].

The process of global warming learning uses a scientific approach at each meeting that is with students' activities is observing, questioning, exploring, associating, and communicating. Learning activities with a scientific approach making students more active so that the learning is centered on students. The learning plan based on a scientific approach through the PBL learning model has successfully motivated and instilled an internal attitude to the learners. Stages of a scientific approach can improve the learner's ability to observe, question, reason, try and communicate his findings, thereby positively impacting his or her soft skill abilities. Portfolio-based assessments are perceived to be more objective and authentic assessing the performance of learners [11]. The plan for implementing growth material learning that applies in a scientific approach, character planting, and conservation. The application of this approach positively affects the cognitive, affective and psychomotor learning outcomes and has achieved a classical mastery [12].

Global warming learning was conducted in four meetings, each time a process assessment is evaluated using different assessment techniques. The results of multiple linear regression tests for the assessment made during the global warming learning process of critical thinking skills can be seen in Table 3 and Table 4 below.

Table 3. Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,987 ^a	,974	,969	1,001

- a. Predictors: (Constant), Affective, Product, Project, Performance, Portfolio
- R = Koe Fisi en corellas = 0,987
 - **R Square** = Koe Fisi en determinant = 0,974 Meaning the contribution of performance assessment, portfolio, project, product, and affective toward critical thinking skill is 97,4%, while the rest 2,6% is caused by other factors.

Table 4. Coeffisients^a

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	5,235	2,572		2,035	,053
Performance	,153	,057	,174	2,678	,013
Portfolio	,262	,065	,295	4,021	,000
Project	,109	,048	,138	2,242	,034
Product	,103	,048	,112	2,138	,043
Attitude	,315	,071	,358	4,416	,000

a. Dependent Variable: Critical thinking skill

Table 3 Shows a significance of 0.00 and R^2 of 0.974 with the equation $Y = 5,235 + 0,153X_1 + 0,262X_2 + 0,109X_3 + 0,103X_4 + 0,315X_5$, meaning if the assessment of performance, portfolio, project, product, and attitude = 0, then critical thinking skills = 5,235. Code Y shows the dependent variables of critical thinking skills, X_1 performance, X_2 portfolio, X_3 project, X_4 product, and X_5 attitude. The parametric condition test results indicate that the data is normally distributed and homogeneous.

Regression equations with the significant of 0.00 and R^2 0.974 which means that the application of authentic assessment on global warming learning, in general, affects critical thinking skills. Overall assessment of performance, portfolio, projects, products, and attitude contributed to critical thinking skills of 97.4%. Application of assessment instruments affects the learning outcomes [13]. Student mindset has embedded a pattern of behavior that can ultimately implement it in the daily life is a pattern of behavior choices that do not contribute to the growing development of global warming symptoms in the environment around life [14].

Posttest results of students' answers that demonstrate critical thinking skills can be seen in Figure 3 below.

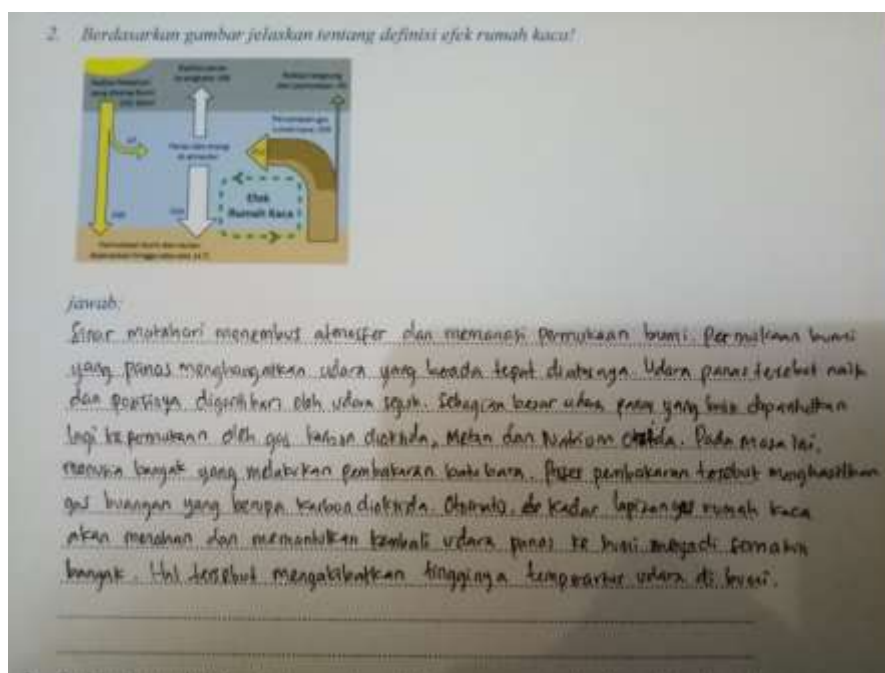


Figure 3. Student's Answers on the Greenhouse Effect Concept

Greenhouse Effect Concept. Based on students' answers to the question of the greenhouse effect, students can explain that the greenhouse gas layer are Carbon dioxide, Methane and Sodium oxide gas that will hold and reflect back the hot air to Earth, causing the earth temperature to increase. Students can explain the concept of greenhouse effect based on the picture.

The suitability, easiness, and usefulness and the result of data processing conducted on ten physics teachers that obtained the result with an average score of 3.38 or 84.58% by highest criteria for suitability test, an average score of 3.30 or 82,50% with very high criteria for easiness test, and average score 3,35 or 83,75% for benefit test by highest criteria. Based on the results of the device authentic assessment for critical thinking skills on learning global warming with scientific approaches are very suitability, easiness, and useful to use. The application of authentic assessment to lectures gives students an opportunity to perform authentic tasks that are interesting, useful, and relevant to student life [9]. Learning using learning model based on virtual lab based project based on global warming material that is student's knowledge competence increased significantly [15].

4. Conclusion

The result of the N-gain test obtained the average value of the experimental class of 0.532 with the medium category means the authentic assessment instrument of global warming learning effective for use. The degree of suitability, easiness, and usefulness of the use of authentic assessment instruments for critical thinking skills on global warming learning with a consecutive scientific approach is very high (84.58%), very high (82.30%), and very high (83.75%).

The resulting authentic assessment instrument has a written test assessment technique with a description form that consists of 10 global warming questions to measure critical thinking skills. Procedures for the use of authentic assessment are divided into four meetings with each meeting conducted the assessment of global warming learning process with different assessment techniques at each meeting, the learning process is done by a scientific approach that is observing, asking, trying, associating, and communicating. The assessment techniques are used in global warming learning are performance assessment techniques, portfolios, projects, products, and attitude that together contribute to the improvement of critical thinking skills on 97.4% of global warming learning.

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