



Students' critical thinking ability in implementing the physics learning module with inquiry strategies based on blended learning

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ABSTRACT

The revised 2013 curriculum demands that teachers at all types and levels of schools are expected to be able to apply various approaches and learning models. The problem is the need for learning approaches, models, and assessment instruments for the National Examination or School Examination. This study aimed to describe the difference in the average critical thinking ability of students who used a scientific approach learning module with an inquiry strategy based on blended learning and conventional books used in one of the public high schools in Bandar Lampung. After carrying out the learning process using these modules in the experimental class and the learning process using conventional books in the control class, an analysis of gathering information through discussion forums and planning, instrument testing, difficulty level, discriminating power, N-gain, and Independent Sample T-test is carried out. Test. The final results of the research can be concluded that learning modules using a scientific approach with inquiry strategies based on blended learning can improve the critical thinking skills of high school students in Bandar Lampung for the 2020/2021 academic year.

Keywords: blended learning, critical thinking, inquiry strategies.

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INTRODUCTION

In current learning activities, the teacher is required to be able to present the subject matter to the maximum. Therefore, creativity and new ideas are needed to develop ways of presenting subject matter in schools, according to the demands of the revised 2013 curriculum (Kemendikbud, 2013). Creativity is the teacher's ability to choose suitable methods, approaches, and media in presenting subject matter (Windschitl, 2008). The reality on the ground shows that until now, many teachers are still using monotonous media in learning. Hence, students must still be directed to understand the physics concepts being studied (Maria

& Furtak, 2010). The media used has yet to be able to develop students' cognitive (reasoning), psychomotor (skills), and affective (attitude) abilities (Sanjaya, 2013), but they tend to memorize the physics concepts they learn. This tendency results in students' mastery of physics concepts needing to be improved. In addition, teachers as information providers tend to dominate learning activities in class.

In order to realize the objectives of learning physics, students' critical thinking skills are necessary. Critical thinking is a type of convergent thinking, which is towards a central point of knowledge. The ability to think critically is essential for life at work. Critical thinking skills are needed in learning. Critical thinking is an effort to process knowledge to identify relationships between disciplines and find creative solutions to solve certain problems (Abidin, 2016).

Critical thinking indicators, according to Ennis in Aryati (2009), are grouped into the big five activities as follows:

1. Provide a simple explanation that contains the:
 - a. Focusing questions
 - b. Analyze questions
 - c. Answer questions about an explanation or question
2. Provide basic skills, which consist of:
 - a. Consider whether the source can be trusted or not
 - b. Observe and consider a report on the results of observations
3. Summing up, which consists of activities:
 - a. Deduce or consider the results of the deduction
 - b. Inducing or considering induction results
 - c. Create and determine the value of the consideration
4. Provide a further explanation, which consists of activities:
 - a. Identify terms and definitions of considerations and dimensions
 - b. Identify assumptions
5. Manage strategies and techniques, which consist of:
 - a. Emphasize action
 - b. Interact with others

According to Ennis, indicators of critical thinking ability can be rubricated by scoring 1 to 4. Score 1 is the lowest, and score 4 is the highest. The critical thinking rubric is divided into three primary activities: giving simple explanations, giving further explanations, and setting strategies that emphasize actions and techniques for interacting with others. This rubric is used as a reference for evaluating the description questions being tested.

Inquiry learning in its implementation is the teacher guiding students. Sanjaya (2013), states that inquiry learning is an inquiry learning model in which the teacher provides broad guidance or instructions to students. The teacher does most of the planning, and students do not formulate problems or problems. In inquiry learning, the activities carried out by students are still guided by the teacher. Sanjaya (2013) says that inquiry learning follows the steps including orientation, formulating problems, formulating hypotheses, collecting data, testing hypotheses, and formulating conclusions.

Through physics learning modules with inquiry strategies (Arum, 2013) and students'

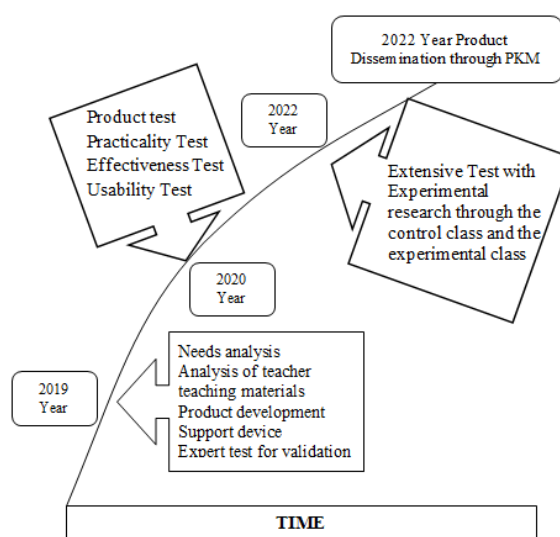
critical thinking skills (Techonly, 2010) based on blended learning, students are expected to improve their learning outcomes. To determine the effectiveness of implementing inquiry-based physics learning modules in students' critical thinking skills, a study titled "Students' Critical Thinking Ability in the Implementation of Physics Learning Modules with Inquiry Strategies Based on Blended Learning."

The formulation of the problem in this study is "Is there a difference in the average critical thinking ability of students in students who use learning module books through inquiry strategies with conventional books used in public high schools in Bandar Lampung?"

RESEARCH METHODS

This study uses a qualitative and quantitative research approach (Sugiyono, 2013) and is visualized in a flowchart as follows:

Figure 1. The flow of the research approach



In 2020 Experimental Research was carried out as a continuation of the Qualitative and Quantitative research steps (Sugiyono, 2013), and aimed to describe students' critical thinking skills with inquiry-based physics learning modules in high schools in Bandar Lampung City, Lampung Province.

The research was conducted at a high school (SMA) in Bandar Lampung City, Lampung Province. The selection of SMA will be carried out purposively, namely SMA that has implemented the revised 2013 curriculum, and these SMA certainly apply a scientific approach in learning activities, including inquiry-based physics learning.

The selection of SMA was carried out purposively, namely SMA that had implemented the revised 2013 curriculum, namely SMA Negeri 9 Bandar Lampung, and SMA had implemented a scientific approach in learning activities using the inquiry model. Research is declared successful if the assessment instrument product from the research results has values of effectiveness, efficiency, and usefulness.

The data will be analyzed qualitatively and quantitatively. Qualitative analysis to answer the research objectives, namely: To describe the average difference in students' critical thinking abilities to students who use learning module books through inquiry strategies with

conventional books used in public high schools in Bandar Lampung.

Before being used, a series of tests will be carried out, including (1) Validity; (2). Reliability; (3). Difficulty Level; (4). Discriminatory Power; (5) N-gains; (6) Normality Test; (7) Homogeneity Test; and (8) Independent Sample T-test (Ruseffendi,1998; Sudjana, 2007).

RESULTS AND DISCUSSION

Quantitative data from the pretest and posttest results obtained at the lesson's beginning and end are presented in the appendix. The average student pretest and post-test results are shown in table 1.

Table 1. Data on average student pretest and post-test results

No	Parameters	Experiment Class		Control Class	
		Pretest	Post-test	Pretest	Post-test
1	The number of students	36	36	36	36
2	The lowest score	2,5	35	5	40
3	The highest score	32,5	100	25	100
4	Maximum score	100	100	100	100
5	Average score	13,6	80,94	12,5	70,00

Then the test results were analyzed using the Anates V4 program, with 36 subjects and 20 multiple-choice questions, and five essay questions. The analysis results of these items are to find out about the sign correlation, level of difficulty, discriminating power, and deceptive quality.

Based on the processing results with Anates V4, there are 20 multiple-choice questions, three items in the medium category, nine in the high category, and three in the very high category. The essay questions, which consist of 5 items, are in the very high category.

The test results were analyzed with Anates V4, and the reliability test for multiple choice questions, namely points 1 to 20, was 0,96. The reliability value of this test is included in the category of very important questions. Furthermore, the description questions for items 16 to 20 were analyzed using the Anates V4 program. Number of Subjects = 36 and 5 items with a Reliability Test result = 0,89. The reliability value of this description test is in the excellent category.

The next step in the analysis activity is to determine each item's difficulty level. The level of difficulty of the items can be seen in table 2. The differential power of the items from the results of this trial showed that each item had great discriminatory power. The results of the multiple choice test in this study obtained the quality of the distractors in the range of 0,03 – 0,53. This means that the quality of the distractor on this test is in the good or functioning category.

Table 2. Difficulty level recapitulation

No	Question Form	Difficulty Level	Percentage
1	Multiple choice	Easy	10,00%
		Medium	73,33%
		Difficult	16,67%
2	Essay	Easy	10,00%
		Medium	60,00%
		Difficult	10,00%

1. The effectiveness of Physics learning instruments with a scientific approach through inquiry strategies based in blended learning

The results of the ability assessment are taken through tests, both at the beginning and after students have finished learning; then, students are given evaluation questions to determine the level of students' understanding of Elasticity and Hooke's Law material. Of 36 students in class XI IPA 4 (experimental class), 31 scored above the KKM, and five scored below the KKM. In class XI IPA 4 (experimental), the average ability before applying learning with a scientific approach based on blended learning was only 13,60; after being given treatment, the student's ability increased to 80,94. There was an average increase in students' ability of 67,34 after applying learning with a scientific approach through an inquiry strategy based on blended learning.

Based on these data, 83,33% of class XI IPA 4 (experimental) has been completed. Arikunto (2012) states that if 75% of students who study do a due diligence test above the KKM score, then the product of the test instrument is said to be effective and suitable for use as a test instrument. Thus, the instrument through an inquiry strategy learning Physics with a scientific approach through a blended development-based inquiry strategy is feasible and effective as a test instrument.

2. Efficiency of the suitability of Physics learning objectives through inquiry strategies based on blended learning with assessment

First, the main objective of this research is to produce a scientific approach assessment instrument through inquiry strategies in learning physics with an inquiry strategy based on feasible and effective blended learning. The material described relates to students' real-world situations or contexts to increase students' understanding of the material. Examples of questions and evaluation questions are provided to measure students' abilities on Elasticity and Hooke's Law material.

Second, the assessment instrument with a scientific approach through inquiry strategies in physics learning based on blended learning on Elasticity and Hooke's Law material has undergone several stages, one of which is a formative evaluation process. Formative evaluation includes material expert tests, design expert tests, and one-on-one tests from the previous year.

All three have been passed, and there are suggestions for improvement for assessing the scientific approach through inquiry strategies in physics learning based on blended learning material Elasticity and Hooke's Law, as explained in the development research stages previously described. The assessment through inquiry strategies in learning physics with a

scientific approach based on blended learning was revised according to the recommendations, so an assessment instrument was obtained that was ready to use in accordance with the revised 2013 Curriculum standards that were achieved. The resulting product can be used as an assessment instrument through inquiry strategies in learning physics with a scientific approach based on blended learning for SMA.

Assessment through inquiry strategies in learning physics with a scientific approach based on blended learning of the material Elasticity and Hooke's Law that has been developed has several advantages, namely:

- a. Presentation of assessments through inquiry strategies in learning physics with a scientific approach based on blended learning is based on an inquiry approach which includes orientation, formulating problems, initial hypotheses, testing hypotheses, analyzing, and evaluating so that it makes it easier for students to evaluate them.
- b. The concepts of Elasticity and Hooke's Law in everyday life are visualized excitingly through pictures and a series of experimental questions contained in assessments through inquiry strategies in learning physics with a scientific approach based on blended learning material Elasticity and Hooke's Law.
- c. Assessment through inquiry strategies in physics learning with a scientific approach based on blended learning Elasticity and Hooke's Law material is arranged systematically, making it easier for students to assess inquiry strategy in physics learning with a scientific approach based on blended learning Elasticity and Hooke's Law material.
- d. Products from the implementation of assessments through inquiry strategies in learning physics with a scientific approach based on blended learning can be used as assessment instruments through inquiry strategies in learning physics with a scientific approach based on blended learning.

3. The usefulness of assessment through an inquiry strategy with a scientific approach based on blended learning in learning Physics

At the end of implementing the assessment through inquiry strategies in learning physics with a scientific approach based on blended learning. In terms of the characteristics of the test instrument it is determined by taking into account the characteristic indicators of the items used in the test, namely validity, reliability, discriminating power, level of difficulty, and deceptive quality.

a. Validity Test

The results of the validity test that has been carried out from the material, construction, and language aspects are illustrated with a graph, as shown in the figure 2.

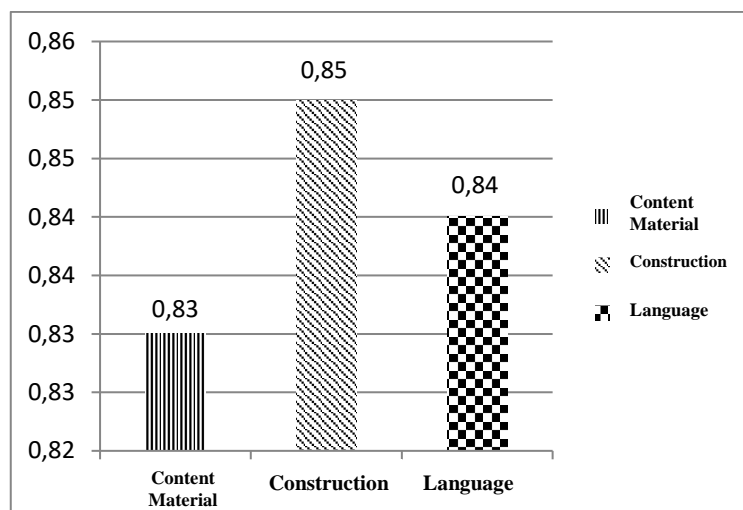


Figure 2. Graph of validation results

Assessment validation scores through inquiry strategies from each aspect, material aspects with a score of 4,16 or 83%, construction aspects with a score of 4,23 or 85%, and language aspects with a score of 4,22 or 84%. This score shows qualitatively that the instrument is in the excellent category. In line with Khabibah (2006), scores in the interval $4 \leq VR \leq 5$ are very valid categories.

b. Reliability

The measurement results obtained Reliability Test = 0,96. Determination of the degree of reliability of multiple-choice items using the criteria proposed by Sugiono (2013). The reliability value in the $0,81 < r \leq 1,00$ is very high. The reliability value of this test is in the very significant category of questions, which is in line with Guilford's opinion in Kartowagiran (2012), which says that a measuring instrument with a reliability coefficient of 0,8 is good..

Furthermore, the reliability of essay questions using the AnatesV4 program. Number of Subjects = 36 and 5 items with Reliability Test results = 0,81. The reliability value of this description test is in a suitable category. This value is in line with Nunnally's opinion in Kartowagiran (2012), that essay questions have a reliability coefficient of 0,6 – 0,7, and multiple choice questions have a reliability coefficient of 0,75 – 0,90 can be said to be good. The same thing was explained by Feldt and Brehmman in Kartowagiran (2012), that an instrument that has a reliability coefficient $\leq 0,7$ is said to be reliable.

A reliable instrument is one that, when used several times to measure the same object, will produce the same data. A test is highly reliable if it provides consistent results even though it is given at different times to the same respondent. The test results are fixed, or if they change, the change is not significant, so the test is said to be reliable. Therefore reliability is often referred to as the instrument's trustworthiness, dependability, stability, consistency, and stability. Reliability concerns the problem of the accuracy of measuring instruments. An instrument is considered reliable if the instrument can be trusted as a measuring tool for research data.

c. Difficulty Level

Judging from the difficulty level of the questions, the number of questions is proportional, with the details of most of the questions in the medium category as much as

75%, as much as 15% difficult, and as much as 10% easy to describe with graphics such as figure 3.

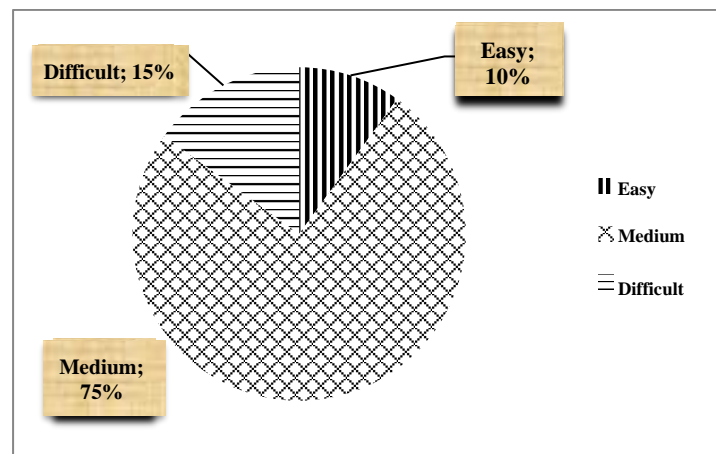


Figure 3. Graph of the proportion of difficulty levels of questions

d. Discriminating Power

The discriminating power in this study ranged from (0,44 – 1,00), indicating that the discriminating power was very good. The index used in distinguishing high-ability test takers from low-ability test takers is the discriminating power index. This index shows the suitability between the question function and the test function. Thus, this question is the same as the item's discriminatory power, which discriminates between high-ability and low-ability test takers.

e. Distracting Quality

The form multiple choice questions is a question whose answer must be chosen from several possible answers that have been provided. Each multiple-choice question consists of a subject matter and answers choices. The answer choices consist of an answer key and a distractor.

The distractor is an incorrect answer but allows students to be tricked into choosing it if students do not master the subject matter well. The results of the instrument try-out selected at least 6% of the test takers. This means that the distractor in the questions is functioning correctly. In line with Kartowagiran (2012), the cheater is said to be good if at least 2% of all test takers choose it. Meanwhile, Nitko (2012) said the distractor functions when at least one test taker was selected from the low group. Voters from the lower group should be more than the upper group. The distractor can also function when the test takers from the upper group can distinguish between the distractor and the answer key so that more answer keys are chosen than the distractor.

Based on the description above, the instrument parameters in the trial activity in the form of a multiple choice test with five answer choices and description questions have a high level of stability. This is also supported by the high-reliability estimate of 0,96 at the trial stage, which indicates that this instrument's measurement results are reliable. In line with Suryabrata (2000), a test that has a reliability coefficient of at least 0,80. The results of measurements with tests with this reliability coefficient can be used to make decisions about individuals.

CONCLUSION

This study concluded that the results of the effectiveness test on class XI IPA 4 students at SMAN 9 Bandar Lampung had been carried out. The results showed that the implementation of assessment through inquiry strategies in physics learning with a scientific approach based on blended learning was developed effectively, with the acquisition of learning outcomes of 83,33% of students passed the KKM, and with the highest score of 97,5. The efficiency suitability of Physics learning objectives through a scientific approach based on blended learning with assessment through inquiry strategies is very efficient when viewed from evaluation, which makes it easier for students to do it; visualization displayed in interesting everyday life can be through pictures and a series of trial questions; systematic, making it easier for students to work on; Products from the implementation of assessments through inquiry strategies in learning physics are very efficient to use. The usefulness of assessment through an inquiry strategy through a scientific approach based on blended learning in learning physics in terms of (a) 83% content validity, 85% construction, and 84% language; (b) Reliability has met the requirements, even including high with a reliability coefficient of more than 0,80; (c) the level of difficulty is good, ranging from 0,28 to 0,78; and (d) very good differential power, in the range of 0,44 to 1,00.

Suggestions in this study include assessment instruments through inquiry strategies in learning physics with a scientific approach based on blended learning. They are tested on large-scale groups so that effective results are truly tested. The assessment instrument through inquiry strategies in learning physics with a scientific approach based on blended learning can be used according to the needs of educators in assessing the competence of students' abilities in learning physics. Assessment instruments through inquiry strategies in learning physics with a scientific approach based on blended learning can be made as an analogy for material other than Elasticity and Hooke's Law. It is necessary to develop instruments through inquiry strategies in learning physics with a scientific approach based on blended learning on different basic physics competencies due to researchers' limited ability.

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