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Characteristics of critical thinking skills test instruments about ecosystem

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Abstract. Critical thinking skill is one of the skills students need to have in realizing the demands of 21st- Century Skills. The objectives of this study were to know the characteristic of critical thinking skill test instrument and to know the early ability of critical thinking skill of junior high school students about the ecosystem. The samples of this study were 37 students of grade 7 in academic year 2016/2017 in one of State Junior High Schools in Tangerang District. The instrument used in this study was arranged in a multiple-choice test with reasons referring to the five indicators of Ennis' critical thinking skills. The test instrument was analyzed with Content Validity Ratio (CVR) and classical test analysis. The test instruments that have been arranged and analyzed were used to derive initial ability of the students' critical thinking skills. The results of this study indicate that the test instruments fall into the appropriate category and deserve to be used to measure students' thinking skills. The ecosystem theme needs to be learned by choosing appropriate strategies and learning methods in order to generate and improve students' critical thinking skills.

1. Introduction

Critical thinking skill is one of the 21st- Century Skills students need to have to face the challenges of education today [1]. This is in accordance with the formulation of graduate competency standards for primary and secondary education in which the students must possess graduate competencies including attitudes, knowledge, and skills [2]. Critical thinking is an intellectual process that involves conceptualizing, implementing, analyzing, synthesizing and evaluating, and skilfully gathered from, or generated by, observation, experience, reflection, reasoning, or communication as a guide to trust and action [3]. According to Ennis, critical thinking skill is a process which aims at making sensible decisions about what to believe and what to do [4]. Critical thinking can build the students' sensibility in keeping and preserving the environment for sustainable use [5]. One of the science materials that is closely related to the environment is ecosystem. The ecosystem materials can reveal the phenomena that are close to the students' environment. Through the environmental approach, students can improve their critical thinking skills [6].

Based on observations and interviews of science teachers at schools, it can be seen that the learning processes are still teacher-centred dominated with lecturing method. In the learning assessment, the teacher only provides concept mastery tests and has never provided critical thinking skills tests to students in learning processes.

Therefore, based on aforementioned explanation, it is necessary to conduct a study to know the description of critical thinking skills of junior high school students. The objective of this study was to

determine the characteristics of the test instrument and critical thinking skills of junior high school students about ecosystems.

2. Experimental Method

The method used in this study was a descriptive method. The samples of this study were 37 students of grade 7 in academic year 2016/2017 in one of State Junior High Schools in Tangerang, Banten. The samples were selected using purposive sampling techniques for the ecosystem themes studied in the 7th grade at the second semester. The critical thinking skill test used was 28 items in the multiple-choice test with reasons. The maximum score for each item was 2.

The distribution of question items on each indicator of critical thinking skills about the ecosystem is shown in Table 1.

Table 1. Distribution of critical thinking test items

Indicator	test item	Total
Elementary clarification	4,7,8,9,18,21,22	7
Basic support	1,2,12,19	4
Inference	11,14,15,17,20,25	6
Advanced clarification	3,5,6,10,13,23	6
Strategies and Tactics	16,24,26,27,28	5
Total test items		28

Table 1 shows the distribution of test items on the critical thinking skill indicator. There are five indicators and 12 sub-indicators of critical thinking skills. The indicators are: (1) elementary clarification, with its sub-indicators: focusing on a question, analysing argument, asking and answering question of clarification and challenge, (2) basic support, with its sub-indicators: judging the credibility of a source, observing and judging observation Reports, (3) inference, with sub-indicators: deducing and judging deductions, inducing and judging inductions, making and judgment judgments, (4) advanced clarification, with sub-indicators: defining terms and judging definitions, identifying assumptions, (5) strategies and tactics, with its indicators: deciding on an action, interacting with others [7].

The critical thinking skills test was constructed based on five indicators of Ennis' critical thinking skills, basic clarification, basic support, conclusions, advanced clarification, strategy & tactics. Before given to the subject of study, the test instrument was validated in advance by five experts (lecturers).

The next data was processed by using Content Validity Ratio (CVR) analysis with the following formula:

$$\text{CVR} = \frac{ne-(\frac{N}{2})}{N/2} \quad [8]$$

ne is the number of validators that declare a feasible item; N is the number of validators.

Furthermore, an instrument try-out was conducted which included the level of difficulty, discriminating power, and reliability test using anatest V4 software to obtain test instrument characteristics and the profile of students' critical thinking skills.

3. Result and Discussion

3.1. Characteristics of Critical Thinking Skills Test Instrument

The CVR test results based on five validators, value obtained is 0,6 with the percentage of 52,4% and 1 with the percentage of 47,6%. This means the test instrument is suitable to use [9]. There were several improvement suggestions given by the validators related to the choice of answers, and

improvements in the writing of questions or placements of critical thinking skill indicators which were in line with the question indicator.

The characteristics of students' critical thinking skills were obtained after a limited trial was conducted on a sample of 37students in the 7th grade in one of the State Junior High Schools in Tangerang. The whole analysis results of the test instrument showed the test reliability was 0.79 and the deviation standard was 8.55, meanwhile the average score was 23.11. From these results, it can be categorized that the test reliability was high.

The difficulty level of this instrument fell into the moderate category. The analysis results of the difficulty level of each test items can be seen in Table 2.

Table 2. The Level of Difficulty Item Test.

Category	Item test	Total item
Easy	-	0
Moderate	1,3,4,5,6,7,8,9,10,11,14,15,16,18,19,20,21,22,25,26,27,28	22
Difficult	12,17,23,24	4
Very Difficult	2,13	2

Table 2 shows that 78.6% of the test items are in the moderate category, 14.3% test items are in the difficult category, and 2% test items are in the very difficult category. The test items in the easy category are 0%. This indicates that the difficulty level of this test instrument falls into the moderate category.

The analysis results of the discriminating power of each item can be seen in Table 3.

Table 3. Discriminating Power Item Test.

Category	Item test	Total item
Bad ($\leq$ 0,00)	8	1
Ugly (0,00<x$\leq$ 0,20)	4,13,16,23	4
Moderate (0,20<x$\leq$ 0,40)	1,2,3,5,7,11,12,14,17,18	10
Good (0,40<x$\leq$ 0,70)	6,9,10,15,19,20,21,22,24,25,26,27,28	13
Very Good (>0,70)	-	0

Table 3 shows that test items included, good, enough, and bad discriminating power. Test items in a good category were 46.4%, the test items in enough category were 35.7%, and the test items in a bad category were 14.3%, the test items in a very bad category were 3.6%. The test items that had good and enough discriminating power can be used; the test items in bad category can be revised; the items in a very bad category should be discarded.

3.2. Trial Results of Test Instrument

The achievement of students' critical thinking skill can be seen in each indicator presented in Figure 1.

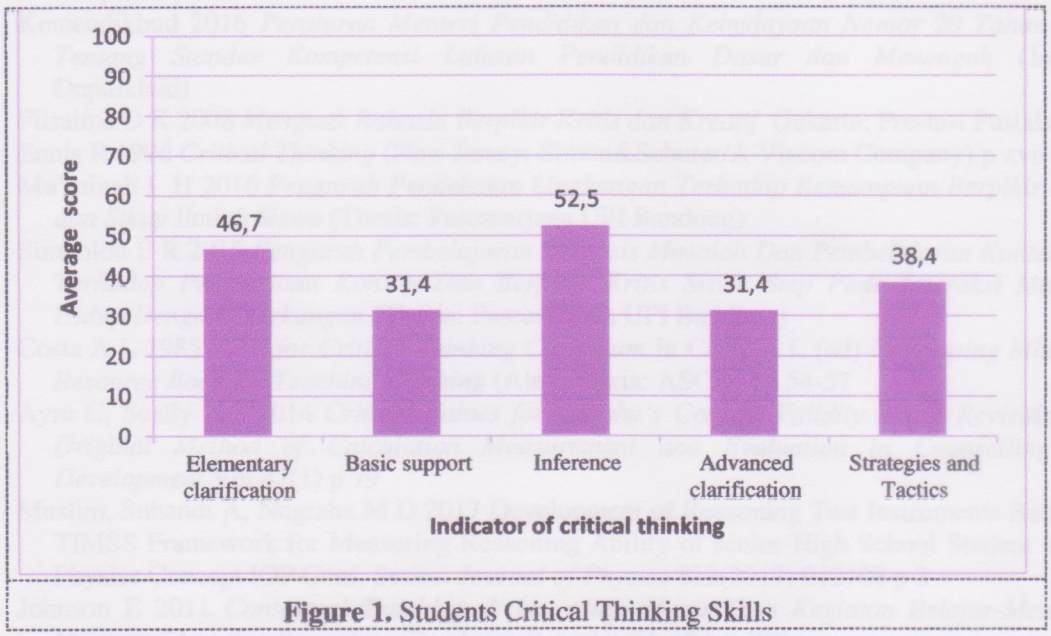

Figure 1. Students Critical Thinking Skills

Figure 1 shows the average achievement scores of students' critical thinking skills in each indicator. The indicator that got the lowest average was basic support consisting of sub-indicators such as observing, assessing observation results, and considering credibility. The highest average achieved was merely 52.5. This shows that students' critical thinking skills are still low and students still have difficulty in mastering critical thinking skills.

The basic support indicator got the lowest average score, i.e. 31.4. This shows the students' ability to observe and give a reason is still very low. The lack of students' critical thinking skills is due to students have not been familiarized and trained in critical thinking skills while learning, and at the time of assessment, students are poorly trained to express the reasons for answering the questions.

The students' critical thinking skills can be improved through the training process to be a habit [10]. Both academic and non-academic experience can influence the change of students' critical thinking skills [11]. In the materials related to the ecosystem, many phenomena occurring in the surrounding environments that can be explored by students through observation or experiment. The selection of appropriate strategies and methods on science learning for the materials related to the ecosystem is expected to train and bring up the critical thinking skills in students.

4. Conclusion

The characteristics of the test instrument had good quality and feasible to be used to measure the skills of junior high school students about the ecosystem. This test of critical thinking skills can explore students' critical thinking skills on all aspects developed by Ennis. From the results of the study, it can be concluded that the materials of science subject about ecosystem need to be delivered in the proper strategies and methods in order to generate and improve students' critical thinking skills.

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