

# THE DEVELOPMENT OF CRITICAL AND CREATIVE THINKING ABILITY IN INTEGRATED SCIENCE LEARNING ON HUMAN EXCRESSION SYSTEM MATERIALS FOR JUNIOR HIGH SCHOOL STUDENTS

Oleh:

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## Abstrak

Penelitian ini bertujuan untuk menghasilkan perangkat pembelajaran berupa tes kemampuan berpikir kritis dan kreatif yang layak pada materi Sistem Ekskresi Manusia yang mengacu pembelajaran IPA Terpadu untuk siswa SMP. Adapun pengembangan perangkat merupakan modifikasi dari model Dick dan Carey yang diujicobakan pada siswa kelas VIII SMP semester genap tahun pelajaran 2018/2019 dan dilakukan pengulangan sebanyak 2 kali. Rancangan penelitian One-Group Pretest-Posttest Design. Data penelitian yang diukur adalah validitas, reliabilitas, dan sensitivitas dari perangkat tes kemampuan berpikir kritis dan kreatif serta dianalisis secara deskriptif kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa (a) dari 10 butir soal tes kemampuan berpikir kritis dan kreatif terdapat 2 butir soal yang dinyatakan tidak valid dengan nilai rata-rata masing-masing butir soal yang tidak valid 0,53, (b) reliabilitas perangkat tes kemampuan berpikir kritis dan kreatif sebesar 85% dengan kategori tinggi, (c) kedua butir soal yang tidak valid juga dinyatakan tidak sensitiv dan memiliki nilai sensitivitas masing-masing sebesar 0,03 dan 0,26, dan (d) hasil tes berpikir kritis dan kreatif siswa terdapat peningkatan, kemampuan berpikir kritis meningkat dari 12,73 (kurang kritis) menjadi 21,08 (sangat kritis) sehingga memperoleh N-Gain sebesar 0,70 (tinggi) dan kemampuan berpikir kreatif meningkat dari 10,05 (kurang kritis) menjadi 17,02 (kreatif) sehingga memperoleh N-Gain sebesar 0,54 (sedang). Simpulan perangkat tes kemampuan berpikir kritis dan kreatif dalam pembelajaran IPA Terpadu yang dikembangkan layak untuk digunakan.

**Kata Kunci:** IPA Terpadu, Sistem Ekskresi, Berpikir Kritis dan Kreatif

## 1. INTRODUCTION

In the 2013 curriculum, at the junior high school level the natural science learning was developed as an *integrative science* subject that has the meaning of integrating various fields of scientific study, so it is called Integrated Science learning. The field of natural science studies consisting of physics, chemistry, and biology is carried out in its entirety, becoming one unit and not separated anymore (*Blended*). Direct experience in learning can be obtained through Integrated Science, students can also add strength to receive, store, and apply the concepts they have learned so that they can train students to be able to discover for themselves various concepts learned holistically, actively, authentically, and meaningfully.

However, the process and method of evaluation of Integrated Science learning in schools shows that students have not been able to receive science lessons in an integrated manner and are still fixated on each field of science studies (assuming that the count material is Physics Science, living matter is Science Biology, and material reaction substances are Chemical IPA). Students also have not been able to associate abstract science material with experiences in daily life, students have

difficulty developing critical and creative thinking skills so that they tend to be passive and always depend on what is taught by the teacher (*Teacher Centered Learning*). Another problem caused by the lack of integration of the field of natural science studies in learning, when the teacher makes an evaluation of the daily assessment and final semester assessment, the item does not refer to the integration of science so that critical and creative thinking owned by students is less trained and influences academic achievement.

The design of the teacher in packaging learning and providing an assessment is very influential for students on the meaningful experience and determines the achievement of competencies in the 2013 curriculum. Assessment by educators is carried out by covering all aspects of competency, using a variety of assessment techniques and types of instruments. The assessment instrument was created with the aim of describing the mastery of student competencies, evaluating learning outcomes, finding learning difficulties, finding deficiencies during the learning process, and as a control for educators in advancing student development.

The types of assessment instruments in integrated learning consist of tests (oral and written

tests including multiple choice tests or description tests) and non-tests (performance or behavior). When educators use assessment in the form of tests or specific assignments, they should not design assessments in a closed sense in the sense of having only one correct answer, but providing a variety of answers to creativity space to train students' critical power and creativity, and even the educator is expected to receive answers from students who are considered unusual. This form of test usually uses a description test. As stated by Ennis (1993; 1996) that to measure one's critical thinking skills can be done using multiple choice tests and description tests. Therefore, in this study the development of tests in the form of description was chosen to find out the increase in students' critical and creative thinking skills, especially in the material of the human Excretion System.

Actually there are many previous studies that examine the ability to think critically and or the ability to think creatively. To assess the ability of critical and creative thinking must use appropriate measurement tests. Ennis (1993) once developed a critical thinking ability test on free material. In addition there are several other related studies namely; Pradana (2017) developed a critical thinking ability test in the form of a description of the Geometry Optics material for students and Redhana and Sya'ban (2014) also developed a creative thinking ability test using three indicators derived from the *Torrance Test of Creative Verbal Thinking*.

## 2. REVIEW OF LITERATURE

The material of the Human Excretion System which has been determined in the Integrated Science learning is contextual and abstract and the excretion tool that will be discussed more focused is the kidney. According to the 2010 *Global Burden of Disease* results, chronic kidney disease (CKD) was the 27th leading cause of death in the world in 1990 and increased to 18th in 2010 (Infodatin, 2017). Because this material is contextual and abstract, it requires the ability to think high-level, deductive, inductive, analytical, synthesis, abstract, reflective, and problem solving. This is in accordance with the age of students in eight grade which ranges from 13-14 years and is at the stage of formal operational cognitive development (Piaget in Jufri, 2013).

To facilitate learning of science into contextual learning it is necessary to develop integrated science learning. The integrated concept implemented in the 2013 Curriculum is to integrate various competencies from various fields of study into various themes, with an emphasis on linkages, and a combination of basic competencies, learning materials, learning activities, and achievement indicators (Murfiah, 2017). This can be used to answer external challenges, science and technology

literacy, be able to think logically, critically, creatively, and be able to argue properly.

The assessment is designed primarily to support the process of critical and creative learning based on an analysis of the abilities needed by students. There are three types of assessment, namely pre-diagnostic assessment, formative assessment, and summative assessment conducted to determine the development of achievement of standard competencies by students. When educators use an assessment in the form of tests or specific assignments, they should not design a closed assessment in the sense of having only one correct answer, but providing a variety of creative spaces for answers to practice the students' critical and creative abilities.

Critical thinking and creative thinking should not be considered as cognitive processes that are comparable to problem solving and decision making. When we solve a problem or make a decision, we do it critically and creatively. Critical thinkers produce ways to test statements; creative thinkers generate new thoughts to assess their validity and usefulness. The difference is not of type but of degree and emphasis.

## 3. RESEARCH METHODS

This research was carried out in two stages: first, the stage of developing a critical and creative thinking ability test and its supporting tools with a modification of the Dick and Carey model. Besides this the first stage also includes identification of learning objectives, learning analysis (procedures and concepts), student analysis, and validation and revision. Content validation was carried out by 3 experts / lecturers majoring in Natural Sciences / Biology FMIPA Surabaya State University. Content validation includes (1) appropriateness of items with indicators, (2) material asked according to school level / level, (3) clear question and answer limits, (4) there are clear instructions on how to work on the problem, (5) formulation sentence questions demand answers to the description, (6) the formulation of questions does not lead to multiple interpretations, (7) the formulation of questions using simple and communicative language, (8) the formulation of questions contains knowledge / application of life / phenomena, (9) the formulation of questions contains the field of Integrated Science studies, (10) the formulation of the questions contains indicators of critical or creative thinking. The existence of the revision stage allows to be corrected if an error occurs and can immediately change it before the error affects the components afterwards (Dick and Carey, 2009).

Table 1. The Indicators of Critical and Creative Thinking Ability and Item Details

No	The Indicators of Critical and Creative Thinking Ability	Question item	The field of cohesiveness
Critical Thinking			
1	Deduction	1	Biology
2	Summarize	2	Bio-Chemistry
3	Determine action	4	Biologi
4	Giving explanation	5	Bio-Physics
5	Develop basic skill	6	Bio-Physics
6	Set up a strategy and tactics	7	Biology
Creative Thinking			
7	Flexible	3	Bio-Chemistry
8	Originality	8	Biology
9	Fluency	9	Bio-Physics
10	Detail	10	Bio-Physics

The second stage is the trial or implementation of Integrated Science learning in class with 4 meetings on the subject matter of the Human Excretion System, focusing on the kidneys. The research design uses a *One-Group Pretest-Posttest Design* research design (Arifin, 2012) with the aim of obtaining input in the form of notes about the abilities and levels of students' critical and creative thinking at the beginning and at the end of learning. This research was conducted at Surabaya 45 Junior High School in the even semester of 2018-2019 for 10 students of class VIII B and was repeated twice in classes VIII C and VIII E. The research process from the beginning to the end of data collection was carried out in January to by April 2019.

The research instruments used in this study include: validation sheets and Test sheets. The validation sheet is used to obtain validity data on critical and creative thinking skills and tools that support it, filled in by 3 validators. Test Sheets are used to measure students' abilities according to indicators of critical and creative thinking in Integrated Natural Science learning material in the Human Excretion System. The test form is in the form of an essay test that refers to indicators of critical and creative thinking that have been determined and packaged in the form of an integrated science assessment instrument.

#### 4. RESULTS AND DISCUSSIONS

When someone solves a problem or makes a decision, then that person will do it critically and creatively. The ability to think critically is needed in the process of problem solving. Students who are accustomed to critical thinking will have the ability to solve problems properly. While the creative process of communicating continuously, it can be through internal actions in making decisions and reaching conclusions and external actions that must have results (output). To teach creativity, student

learning outcomes must be the main criteria (Perkins, 1984).

The results of validation by 3 validators were analyzed through the criteria aspects assessed, each criterion consisted of 6 items of critical thinking tests and 4 items of creative thinking tests. The ability to think critically with 5 indicators, namely: (1) deducing, (2) developing basic skills, (3) making conclusions, (4) explaining further, and (5) making strategic and tactic rules (Ennis, 1985 in Marzano, 1988 ). The ability to think creatively with 4 indicators, namely: (1) *Fluency*. (2) *Flexibility*. (3) *Originality*, and (4) *Elaboration* (Anwar et al, 2012). While the validation of items includes 10 kinds of aspects for each item of critical thinking and creative thinking items, as described in the research method.

Table 2. The results of Validation Test of critical and creative thinking skills

No	Question item	Value aspects										Average	Category
		1	2	3	4	5	6	7	8	9	10		
<b>Critical thinking question</b>													
1	1	0,67	1	0,33	1	0	0,33	0,67	0,67	0,33	0,33	0,53	Low valid
2	2	1	1	1	1	1	0,67	1	1	1	1	0,96	High valid
3	4	0,67	1	0,67	1	0,67	1	1	0,67	1	1	0,86	High valid
4	5	1	1	1	1	1	1	0,33	1	1	1	0,93	High valid
5	6	1	1	1	1	1	1	0,67	1	1	1	0,96	High valid
6	7	1	1	1	1	1	1	1	1	1	1	1	High valid
Average		0,89	1	0,83	1	0,77	0,83	0,77	0,89	0,88	0,88	-	-
Category		High valid	High valid	High valid	High valid	valid	High valid	valid	High valid	High valid	High valid	-	-
Reliabilities		80%	100%	80%	100%	80%	80%	80%	80%	90%	80%	-	-
<b>Creative thinking question</b>													
7	3	1	0,67	1	1	1	0,33	0,33	1	1	1	0,83	High valid
8	8	0,33	0,67	0,33	1	0,67	0,33	0,33	0,67	0,33	0,67	0,53	Low valid
9	9	1	1	0,67	1	1	0,67	0,67	1	1	1	0,90	High valid
10	10	1	1	1	1	1	1	0,67	1	1	1	0,96	High valid
Average		0,83	0,83	0,75	1	0,91	0,58	0,50	0,91	0,83	0,91	-	-
Category		High valid	High valid	valid	High valid	High valid	Low valid	Low valid	High valid	High valid	High valid	-	-
Reliabilities		85%	85%	80%	100%	85%	80%	80%	85%	85%	85%	-	-

The results of validation tests of critical and creative thinking skills by 3 validators based on each aspect assessed in Table 2 show that the average validation score in terms of items contained 5 items of critical thinking tests obtaining very valid categories (numbers 2, 4, 5, 6, and 7) and 1 item that only gets an average number of 0.53 with less valid categories (number 1). Whereas in terms of item aspects there are 8 aspects of getting a very valid category (aspects 1, 2, 3, 4, 6, 8, 9, and 10) and 2 aspects of getting a valid category (aspects 5 and 7). For the average validation score in terms of the items there are 3 items of creative thinking obtaining a very valid category (numbers 3, 9, and 10) and 1 item only obtains an average number of 0.53 with less valid categories (number 8 ). Whereas in terms of item aspects there are 9

aspects that get a very valid category and only 1 aspect that gets a valid category (number 3) (Ratumanan and Laurens, 2011).

These results indicate that based on the validation in terms of the items, there are 1 item in the critical thinking test and 1 item in the creative thinking test is not feasible to use. However, when viewed from the aspect of the questions, it shows that the 10 aspects of the items developed in the critical and creative thinking ability are appropriate to be used by the teacher in the learning process with a slight revision according to the validator's suggestion. Suggestions for detailed items are shown in Table 3.

Table 3. The Suggestion from Item Validation Results for Critical and Creative Thinking Problems

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1	<ul style="list-style-type: none"> <li>The boundary between question and answer must be clear</li> <li>The question formulation must lead to the answer to the description</li> <li>The formulation of the questions does not lead to a double interpretation</li> <li>Problem formulation refers to Integrated Science</li> <li>Problem formulation must refer to clear indicators of critical thinking</li> </ul>
8	<ul style="list-style-type: none"> <li>Questions must match indicators</li> <li>The boundary between question and answer must be clear</li> <li>The formulation of the questions does not lead to a double interpretation</li> <li>Problem formulation must use communicative language</li> <li>Problem formulation refers to Integrated Science</li> <li>Problem formulation must refer to clear indicators of creative thinking</li> </ul>

The students' critical thinking ability test validated by 3 validators had an average of 6 aspects matching with a score of 85%, while the results of the validation of the students' creative thinking ability test of the 3 validators had an average match on 4 aspects that were valued at 85%. The instrument that has been developed can only be used if the compatibility percentage is ≥ 75% (Borich, 1994).

In general, critical thinking is seen as evaluative thinking and creative thinking is considered as generative thinking. But the two types of thinking are not contradictory, they are complementary (Paul and Bailin in Marzano, 1988). The ability to think critically here is a translation of the 5 indicators by Ennis (1985), namely the ability to ask questions, develop basic skills, make conclusions, explain further, and manage strategies possessed by students. Pretest value is used to determine the extent of students' ability to think critically and creatively. While the posttest value is used to determine students' critical and creative thinking skills after participating in the learning process with Integrated Science learning.

Based on the results of the analysis of the increase score (*N-gain*) of students' critical thinking

skills in Table 4 shows that the average value of increase (*N-gain*) classically for class B samples reached 0.68 (obtained from an increase in scores of 13.45 to 21, 2) in the medium category, class C reached 0.72 (obtained from an increase in scores of 12.35 to 21.3) with a high category, and class E reached 0.71 (obtained from an increase in scores of 12.40 to 20.75) with high category. Students will experience the ability to think critically if they get an increase in the average value (*N-Gain*) classically by sebesar 0.70 (high category). This means that increasing the average value from low to medium and high shows that learning that refers to Integrated Science can train students' critical thinking skills well in classes C and E, but can still train students' critical thinking skills quite well in class B. Although thus, if the recapitulated results of the average total pretest score in 3 sample classes can reach 12.73 with the category of Less Critical (KK) and the average posttest score of 21.08 gets the Very Critical (SK) category.

Table 4 The Recapitulation of Improvement Scores (*N-Gain*) Students' Critical Thinking Ability

Name of class	Pretest average score	Criteria	Posttest average score	Criteria	Average <i>N-Gain</i>	Category
B	13,45	Low Critical	21,2	High Critical	0,68	Average
C	12,35	Low Critical	21,3	High Critical	0,72	High
E	12,40	Low Critical	20,75	High Critical	0,71	High
Average score	12,73	Low Critical	21,08	High Critical	0,70	High

In Ennis's (1985) analysis, thinking is reasonable when thinkers try to analyze opinions carefully, look for valid evidence, and reach conclusions that make sense. The aim of teaching students to think critically is to develop students who think fairly, objectively, and are committed to clarity and accuracy.

Creative thinking as well as critical thinking. Halpern (1984) in Marzano (1988) states that creativity is the ability to form a combination of new ideas while meeting needs. Baron (1969) also states that the creative process embodies continuous communication between integration and effusion, convergence and divergence, thesis and antithesis, which can be done by combining ideas of critical thinking.

In measuring the ability of creative thinking students use the same instrument to measure critical thinking skills, namely using summative test questions that refer to Integrated Science learning. But the ability to think creatively is measured based on 4 indicators which include the ability to provide many ideas or ideas, use various approaches to solve problems, express original ideas (original), and explain ideas in detail by students. The results of compilation of creative thinking test questions were also tested on students at the beginning before learning trial 1 was conducted as a pretest and after

learning trial 1 ended as a posttest. The initial ability of students to think creatively before learning using the developed device can be known by providing pretest questions. The ability of students to think creatively after taking the learning process by using a developed device can be known by giving a posttest question.

The results of the analysis of the improvement of students' creative thinking in Table 5 show that the average value of the increase (*N-gain*) in the classical for the class B sample reached 0.53 (obtained from an increase in score of 10.1 to 18.3) with the medium category, class C reached 0.41 (obtained from an increase in scores 11 to 17) with a moderate category, and class E reached 0.68 (obtained from an increase in the score of 9.05 to 17.56) with a high category. If students succeed in obtaining a test score that contains an indicator of creative thinking ,2 61.2% then the student is said to be creative (Khanafiyah, 2010). This means that the increase in the ability to think creatively obtained by analyzing test scores that contain indicators of students' creative thinking before and after Integrated Science learning in 3 sample classes is already quite creative.

Table 5 The Recapitulation of Improvement Scores (*N-Gain*) Creative Thinking Ability of Students

Name of class	Pretest average score	Criteria	Posttest average score	Criteria	Average N-Gain	Category
B	10,1	Low Kreatif	18,3	High Creative	0,53	Average
C	11	Average Kreatif	17	Creative	0,41	Average
E	9,05	Low Kreatif	17,56	Creative	0,68	Average
Average Score	10,05	Low Kreatif	17,62	Creative	0,54	Average

The students' critical and creative thinking skills as measured by written summative tests using critical and creative thinking tests are made in the form of essay question items. This is intended when practicing critical and creative thinking skills, students need to be given a variety of answers to creativity space, even teachers are expected to receive answers from students who are considered unusual (Trianto, 2007). The test questions of critical and creative thinking skills that have been prepared will be analyzed the sensitivity of the item in order to find out the positive differences between before and after learning takes place. The item sensitivity category is based on 4 kinds of score ranges that are very true, correct, quite correct, and not quite correct.

Table 4. The Item Sensitivity Analysis of Problems to Improve Students' Critical and Creative Thinking Abilities

No	Question Item	∑ Right Pretest	∑ Right Posttest	Sensitivity	Category
<b>Critical Thinking</b>					
1	1	29	30	0,03	Not sensitive
2	2	18	28	0,33	Sensitive
3	4	7	30	0,76	Sensitive

4	5	11	22	0,50	Sensitive
5	6	13	25	0,40	Sensitive
6	7	10	22	0,40	Sensitive
<b>Creative Thinking</b>					
3	3	12	28	0,53	Sensitive
8	8	5	13	0,26	Not sensitive
9	9	2	23	0,70	Sensitive
10	10	13	23	0,33	Sensitive

The results of the sensitivity analysis of the items in Table 4 show that from the 6 items of critical thinking there are five items that were declared sensitive and there were one item that was declared not sensitive because it only got a value of 0.03 namely item number 1. One item which is stated as not sensitive is due to the formulation of questions that should require students' answers to the description but in the case of no, the results of students' answers are only in the form of one-word and definite answers, so that no variations of answers such as the criterion of answers to essays are found.

While of the 4 items of creative thinking there are three items that are declared sensitive and there is one item that is declared not sensitive namely item number 8 because in that question only gets a figure of 0.26. The invalidity of item 8 is because the pre-learning teacher has briefly explained the learning process that will be carried out by students so students can predict the answer to question number 8 when doing a pretest. This causes no increase in scores on item number 8 during the posttest and automatically does not form the original creativity of students. The sensitivity of the questions ranges from 0 to 1. The item is said to be good if it meets the criteria  $\geq 0.30$ . This means that one item of critical thinking with the acquisition of the number 0.03 and one item of creative thinking with the acquisition of the number 0.26 is included in the non-sensitive category, the item is declared unusable because it has a sensitivity value  $\leq 0.30$ . The sensitivity of these items is very influential on the increase (*N-gain*) of student learning outcomes because the acquisition of scores at pretest and posttest on non-sensitive items does not change for the better or the results remain in accordance with the results of the study.

From the results of the analysis of the research data above, it can be seen that there is a relationship between validation and item sensitivity on the results of tests of students' critical and creative thinking skills. In the validation stage in terms of the items, there is one item of critical thinking that is declared invalid, namely item number 1 and there is one item of creative thinking that is declared invalid, namely number 8. The invalid item has received a revised suggestion containing several aspects of the validator. After testing 1, the results show that there is one sample class that has not been able to achieve a good

critical thinking score, namely class B (0.68 in the medium category). Although the other two classes, namely classes C and E, have received results in the very critical category, but there has not been a significant increase in scores (0.72 and 0.71 in the high category). For the results of the ability to think creatively, of the three sample classes both obtained results in the medium category and also there was no significant increase in scores.

According to Susiawan (2013), in order to be able to obtain positive student response results and good learning outcomes, learning tools in the form of ability tests aimed at students should have a validity of the test items with a minimal category, test reliability has a very high category and has item sensitivity good / sensitive test. Therefore, to follow up on the results of the second trial, this research needs to be revised to invalid and non-sensitive items in order to obtain good student learning test results in accordance with the objectives of increasing students' ability to think critically and creatively.

Invalid and non-sensitive test items on the development of devices in this study are in item number 1 and 8. Item number 1 and 8 are items included in the field of Natural Sciences-Biology studies. For other number items containing the fields of Natural Sciences Physics and Natural Sciences Chemistry have been declared valid and sensitive. The following are items number 1 and 8 before being revised:

Num ber of questi on	Question Indicator	Question Item	Qu esti on for m	Cogni tive aspec t	Ans wer key	Sc or e
1	Describe the location of one excretion organ according to the description of the sentence in the problem. (3. Detailing - critical thinking)	The organ excretion or expenditure of metabolic waste in humans there are 4 kinds of kidneys, skin, lungs, and liver. Each of these organs has a different structure, function, and secrete metabolic waste. One of the human excretion organs is shaped like a kidney bean seed, whose length ranges from 10-12 cm, serves to filter blood and excrete waste products in the form of urine. The organs referred to based on the description above are ....	Ess ay	C2	Kid ney	3
8	Designing the delivery of writing to the community through writing. (3. Authenticity / Originality)	When Andi was 10 years old and was still in elementary school grade IV, he often found his father complaining of pain in the waist, a weak body due to decreased appetite. Andi's mother is only a housewife with an elementary school graduate so there is very little	Ess ay	C6	Ma ke a broc hure or artic le abo ut how to mai ntai n.	4

Num ber of questi on	Question Indicator	Question Item	Qu esti on for m	Cogni tive aspec t	Ans wer key	Sc or e
	y - creative thinking)	knowledge she has in dealing with illnesses that are complained about like Andi's father. One day when Andi's father was examined by a doctor, it was stated that Andi's father had suffered from chronic kidney failure. Andi's father had to experience dialysis with intensity 4 times a week and 6 months later died. Andi is now 14 years old and has become a grade VIII junior high school student. At school, Andi receives lessons on the material Human Excretion System. He realized how important it is to maintain kidney health as an organ of human excretion.			prev ent, and treat diso rder s / dise ases of the kid neys	

In question item number 1, the problem indicators and critical thinking indicators are not appropriate because they are based on the cognitive domain only at the C2 level, while for the cognitive domain critical thinking skills must be C4, C5, or C6. In addition, the answer does not refer to the description of the description because it is only a short answer and must be correct. So in this item students do not have the opportunity to develop answers. Therefore obtain advice from the validator which includes: the boundary between the question and the answer must be clear, the formulation of the problem must lead to the description of the description, does not lead to multiple interpretations, refers to the Integrated Science, and must refer to clear critical thinking indicators.

In question item 8, item indicator is not in accordance with the question formulation. In addition, the boundary between questions and answers is unclear, the language used in the question is less communicative and gives rise to a double interpretation. Therefore, obtaining advice from the validator which includes: questions must be in accordance with indicators, the boundary between questions and answers must be clear, do not cause multiple interpretations, must use communicative language, refer to Integrated Science, and refer to clear creative thinking indicators.

There are non-sensitive items because there is no increase in the number of correct answers between the pretest and posttest results on the item. The influencing factors are the invalid items, the weight of the questions is too easy, and students have previous experience with the problems so that it affects the student learning outcomes. When

invalid and non-sensitive items are corrected / revised, students are expected to be able to achieve the learning objectives.

## 5. CONCLUSION

Based on the results of research and data analysis, it can be seen that from 6 items of critical thinking ability test there are 1 item that was declared invalid and from 4 items of creative thinking ability test there are also 1 item that is invalid. The two items that were invalid were also declared not sensitive because they only had sensitivity values of 0.03 and 0.26. While the five items of the critical thinking ability test items and the three items of the creative thinking abilities test which were declared valid had a reliability of 85% with a high category so that these items could be used to measure students' critical and creative thinking skills in Integrated Science learning.

The results of tests of students' critical and creative thinking skills have not significantly improved. The average score of students' critical thinking pretest was 12.73 for the less critical category and the posttest score of 21.08 in the very critical category, so that they obtained an *N-gain* of 0.70 with a high category but the value was the same as the minimum limit of the provisions. While the average score of students' pretest creative thinking is 10.05 less critical categories and posttest scores 17.02 creative categories, so as to obtain an *N-Gain* of 0.54 in the medium category. This can show that the students' critical thinking skills are good but the students' creative thinking abilities are still quite good.

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