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Analysis of the Science Creative Thinking Ability Test Instrument at Elementary Level: Judging from its Validity and Reliability

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ABSTRACT

The aim of this research is to produce a valid and reliable Creative Thinking Ability Test Instrument that can be used in teaching and learning activities. Teachers are still at the stage of providing questions from student worksheets and have not yet developed instruments to assess students' creative thinking abilities. The research design uses Borg and Gall's research development which is reduced to the fifth stage including (1) potential and problems, (2) data collection, (3) product design, (4) design validation, (5) design revision. The data collection technique used is a validation sheet given to the validator. Data analysis for validity follows Aiken's V formula, while reliability is assessed using Borich's reliability coefficient formula. The research results show that the validity of the instrument in terms of content, construction and language falls into the categories of valid, valid and very valid, respectively. This shows that the critical thinking ability test instrument is suitable for use. The reliability of the instrument produces results of 78% which are categorized as reliable. This is the strength of this instrument so that it can be used to measure creative science thinking abilities at the elementary level. In line with this, the creative thinking skills test instrument that has been created can be used for research.

INTRODUCTION

Creative thinking is an imaginative process with original and valuable results (Robinson, 2021). Apart from that, creative thinking is a cognitive activity in finding solutions to solve a problem (Adams, 2020). Coughlan believes that creative thinking is not only useful for enriching and deepening learning experiences, but also for solving problems in everyday life and making decisions (Coughlan, 2019). Students mastering divergent thinking skills will make them able to make decisions as a form of convergent thinking. It is very important to develop creativity from the start because creativity is very influential in developing aspects of student development. In reality, children's creativity is not developed early, so students' intelligence abilities and fluency in thinking do not develop optimally (Dwikoranto et al, 2023). Creativity is a force that differentiates humans from other creatures and has helped advance human civilization over the centuries. Through examples of creativity in works of art, technology, literature, music and architecture, humans can see how important creativity is in various aspects of life. Creativity in education is very necessary as an effort to hone students' potential. Basically all students have creativity within themselves. This ability must be developed so that life becomes more enthusiastic and productive (Torrance, 2019). Students must be trained to have the ability to be more creative.

To determine the level of creativity, a creativity test instrument is needed. Science Creative Thinking Ability Test Instrument at Elementary Level is a tool for measuring student creativity by design (Torrance, 2019). A good instrument must meet the criteria for validity and reliability. Because it is thought that each student has different creativity, a Creativity instrument is needed. Errors in measuring creativity will occur during preparation, without considering the appropriate measurement instruments.

Considering that creativity is very diverse, it is necessary to focus this complexity on the human dimension as a form of creating trust through five indicators, namely: originality, flexibility, fluency, elaboration, redefinition (Guilford, 2019). The five indicators of creativity in the Creative Thinking Ability Instrument will be designed through the Validation, Construction and Application Criteria process. Creativity is one measure of learning success.

Creativity involves the production of something new or unusual that has value in life. Divergent thinking, creativity involves the production of new and unusual ideas, as well as thinking of unique solutions to solve problems. Creativity has four dimensions, namely the ability to generate a large number of ideas or solutions to problems (fluency), the number of different categories of relevant responses (flexibility), the ability to generate new and original ideas (originality), and provide detailed and detailed responses. systematic (elaboration) (Dwikoranto et al, 2021; Simonton, 2017) describes creativity as a creative process, creative person, creative product, and creative environment. Creativity is an important component for the kind of divergent thinking required for innovation. Expanding their creative capacity can make students more adept at forming original ideas, as well as training critical thinking skills (Torrance, 2019; Torrance, 2020).

This research examines how to make standardized creativity measurements according to procedures. This research is urgently carried out to produce a viable prototype instrument for measuring student creativity which will be useful in measuring student creativity to answer the need for creativity and accommodate one of the 21st century skills that is important to develop (Pramonoadi et al, 2020; Unesco, 2017).
By knowing students' creativity profiles correctly, teachers/lecturers can develop strategies, methods or learning models that are suitable for training and increasing their students' creativity as a form of optimizing SDGs quality education. Quality and lifelong education is in accordance with Ki Hajar Dewantoro's educational philosophy used by the Indonesian Ministry of Education and Culture in MBKM in he is (Unesco, 2017; Nizam, 2020).

RESEARCH METHOD

The research design to produce the Science Creative Thinking Ability Test Instrument at Elementary Level uses Borg and Gall development research (R&D) which is reduced to the fifth stage including (1) potential and problems, (2) data collection, (3) product design, (4) design validation, (5) design revision. Data collection uses a validity sheet. On the validation sheet, a score is given between 1 and 5 for each statement regarding

each aspect (Dwikoranto et al, 2021). The data was analyzed descriptively qualitatively and quantitatively by calculating the average validity value using the following Aiken's V measurement (Aiken, 1985; Istiyono, 2020).

$$V= (\sum s)/([N(c-1)])$$

Where:
N = Number of Experts
S = r-lo
r = Number Given by Validators
lo = Lowest Validity Assessment Score
c = Highest Validity Number

The results of the creative thinking ability test instrument assessment obtained by material experts, evaluation experts, and GSD Ministry of Education and Culture certified science teachers were used to describe the achievements of the research criteria. There are 5 assessment categories from 3 validators used in this research. Based on the guidelines set by Aiken's V, the basic standard in this study is 0.80 with a possible error of 0.04 (Aiken, 1985). To determine the validity criteria for the instrument, validation testing was carried out by calculating the Aiken's V statistic and then changing it to a scale of one to five. Table 1 presents five scale feasibility criteria calculated using Aiken's V.

Table 1 Aiken's V Validity Criteria (Dwikoranto et al, 2020)

No	Interval Score	Validity Results	Criteria Validity	Description
1	4.20 < P ≤ 5.00	0.80 < V ≤ 1.00	Very valid	Can be used without revision
2	3.40 < P ≤ 4.20	0.60 < V ≤ 0.80	Valid	Can be used with slight revision
3	1.80 < P ≤ 2.60	0.20 < V ≤ 0.40	Less Valid	Can be used with many revisions
4	1.00 ≤ P ≤ 1.80	0.00 < V ≤ 0.20	Invalid	Not yet usable and requires consultation

Assuming that the calculation results for the creative thinking ability test instrument have a value of V above the basic value of V, then the test instrument is important and suitable for use.

The next investigation is, plan dependability checking to determine the consistency of the test instrument. Borich formula analysis is a reliability analysis used in this research. The R value is the level of understanding between validators (consistency between validators) on an instrument. Based on the Borich formula, the following formula is used to determine reliability (Permana et al, 2023).

R = (1-(A-B)/(A+B)) x 100%
R = Reliability Coefficient (Percentage of Agreement)
A = Highest Score Given by Validator
B = Lowest Score Given by Validator

The creative thinking ability test instrument is said to be reliable if the level of understanding is more than or equal to 75%. According to Borich (Borich, 1994) if the results are less than 75%, then the clarity and agreement between validators must be checked.

RESULTS AND DISCUSSION

The Science Creative Thinking Ability Test Instrument at the Basic Level uses science material: Seeing in view of Light, Seeing as a result of Light, Suitability of the Environment, Hearing the Effects of Sound. The instrument is planned to focus on this material to create a quality instrument (Kafii et al, 2023). The question grid functions as a guide for creating creative thinking test questions and is presented in Table 2.

Table 2. Science Creative Thinking Ability Test Instrument Grid

Chapter	Guilford's Creativity Indicators	Question Indicator	QN	LC
Seeing as a result of Light, Seeing in view of Light, Hearing due to Sound	Fluency	Presented with a picture, students are able to analyse the properties of of light based on the picture presented	1	C4
	Redefinition, elaboration	Students are able to describe how rainbows are formed	2	C4
	Flexibility	Given a picture, students are able to relate the role of light with human vision human vision	3	C5
	Redefinition, originality	Presented with a picture, students can compare the two images of different kinds of mirrors	4	C4
	Elaboration	Presented with a picture, students are able to mention the part of the eye that are visible based on the picture presented	5	C4
		Presented with a table, students are able to display the function of each part of the eye that visible	6	C5
	Originality	Given a picture, students are able to complete the scheme disorders of the hearing organ	15	C6
Congruity in Environ-ments	Fluency, elaboration	Presented with a picture, students are able to describe the differences between producers, tier 1 consumers tier 2 consumers, tier 3 consumers and decomposers. and decomposers.	1	C4
	Redefinition	Students are able to make a chart or drawing of the Food chain	2	C6

	Elaboration, originality	Given a picture, students are able to construct an explanation about food chains in marine ecosystems	3	C6
		Given a picture, students are able to assemble a food chain on the chart or food web picture provided	4	C6
	Elaboration	Students analyse the relationships between living things in an ecosystem in the form of food web	5	C4
	Flexibility	Presented with an event, students are able to analyse the case of energy transfer between plants, animals and humans	15	C4

Note: QN= Question Number LC= Level Cognitive

An overview of the Science Creativity Ability Test Instrument at Basic Level based on this grid, for example:

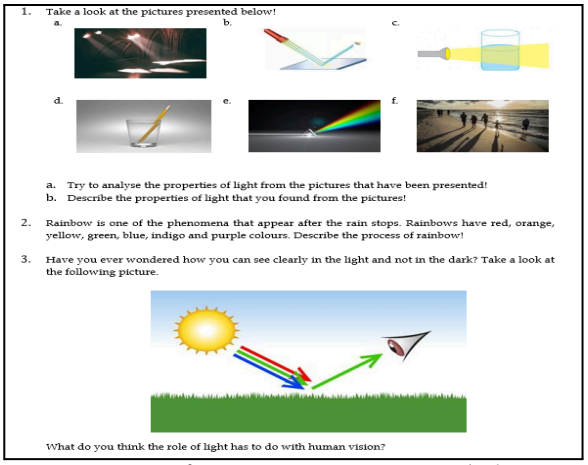

Figure 1. Form of science creativity ability test

The validity of the substance of the Science Creative Thinking Ability Test Instrument at the Basic Level can be seen from the results of the validators' assessments. The fairness of these things is surveyed by validators from the material, construction and language aspects. The Aiken item index is then calculated by analyzing the assessment results using the Aiken's V formula (Setiani et al, 2017). A summary of the validation results can be seen in Table 3 below.

Table 3. Recapitulation of Validation Results and Reliability

Question No.	Aspect						Reliability
	Material		Construction		Language		
	V	Note	V	Note	V	Note	
Chapter: Seeing as a result of Light Seeing in view of Light, Hearing due to Sound							
1	0.83	Very valid	0.91	Very valid	0.91	Very valid	0.78
2	0.75	Valid	0.83	Very valid	0.83	Very valid	0.79

3	0.67	Valid	0.67	Valid	0.75	Valid	0.79
4	0.75	Valid	0.75	Valid	0.75	Valid	0.77
5	0.75	Valid	0.67	Valid	0.67	Valid	0.77
6	0.83	Very valid	0.83	Very valid	0.83	Very valid	0.78
7	1.00	Very valid	0.91	Very valid	0.91	Very valid	0.79
8	0.91	Very valid	0.91	Very valid	0.91	Very valid	0.77
9	0.67	Valid	0.67	Valid	0.67	Valid	0.76
10	0.91	Very valid	0.91	Very valid	1.00	Very valid	0.80
11	0.83	Very valid	0.83	Very valid	1.00	Very valid	0.78
12	0.67	Valid	0.67	Valid	0.67	Valid	0.78
13	1.00	Very valid	1.00	Very valid	1.00	Very valid	0.78
14	0.75	Valid	0.75	Valid	0.75	Valid	0.79
15	0.75	Valid	0.75	Valid	0.75	Valid	0.77
Average	**0.80**	**Valid**	**0.80**	**Valid**	**0.83**	**Very valid**	**0.78**
Chapter: Congruity in Environments							
1	0.83	Very valid	0.83	Very valid	0.83	Very valid	0.79
2	0.67	Valid	0.67	Valid	0.67	Valid	0.77
3	0.67	Valid	0.67	Valid	0.91	Very valid	0.78
4	0.67	Valid	0.75	Valid	0.83	Very valid	0.77
5	1.00	Very valid	1.00	Very valid	1.00	Very valid	0.79
6	0.91	Very valid	0.91	Very valid	1.00	Very valid	0.79
7	0.67	Valid	0.67	Valid	0.75	Valid	0.79
8	0.75	Valid	0.75	Valid	0.91	Very valid	0.77
9	0.83	Very valid	0.83	Very valid	0.91	Very valid	0.77
10	0.67	Valid	0.75	Valid	0.75	Valid	0.78
11	0.67	Valid	0.67	Valid	0.83	Very valid	0.78
12	0.75	Valid	0.75	Valid	0.75	Valid	0.78
13	0.83	Very valid	0.83	Very valid	0.83	Very valid	0.79
14	0.75	Valid	0.83	Very valid	0.83	Very valid	0.77
15	0.67	Valid	0.75	Valid	0.83	Very valid	0.78
Average	**0.76**	**Valid**	**0.77**	**Valid**	**0.84**	**Very valid**	**0.78**

As can be seen in Table 3, the results of the validation of the creative thinking ability test instrument for science material calculated using the Aiken's V formula, the averages for

the material, construction and language aspects respectively show the valid, valid and very valid categories. The validity of the instrument can be said to be good as shown by Aiken if Aiken's criteria are more prominent or equal to 0.75 (Aiken, 1985). The Aiken Price List V is a list of appraisers regarding the fairness of an instrument with markers that must be estimated using the list. The closer the Aiken value is to 1, the better the instrument because the more important the marker is (Retnawati, 2016).

Chapter: Seeing as a result of Light Seeing in view of Light, Hearing due to Sound. In questions number 1, 6, 7, 8, 10, 11, and 13 in the material aspect are included in the very valid category, while questions number 2, 3, 4, 5, 9, 12, 14, and 15 are included in the very valid category. included in the valid category. construction aspect, questions number 1, 2, 6, 7, 8, 10, 11, and 13 are categorized as very valid; 3, 4, 5, 9, 12, 14, and 15 are in the valid category. The linguistic aspects of questions 3, 4, 5, 12, 14, 15 are included in the valid category and the rest are very valid as shown in Table 3. The lowest validation results for each aspect with a value of 0.67 are found in questions 9 and 12. In this question, the validator gave suggestions to the researcher for revision, namely replacing the C2 level questions in numbers 9 and 12 with the cognitive level in Bloom's Taxonomy to C4-C6.

Chapter: Congruity in Environments questions number 1, 5, 6, 9, 13 material aspects are very valid; 2, 3, 4, 7, 8, 10, 11, 12, 14, and 15 are valid categories. Construction aspects, questions number 1, 5, 6, 9, 13, and 14 are very valid; 2, 3, 4, 7, 8, 10, 11, 12, and 15 are valid categories. Meanwhile, in the linguistic aspect, questions number 7, 10, 12 are in the valid category and the rest are very valid.

Overall, the creative thinking ability test instrument in both chapters shows high validity of the test instrument because the average Aiken's V validity test results for material, construction and linguistic aspects, the Aiken's V scale value above 0.80 is included in the high validity criteria and is suitable for use in testing (Dwikoranto et al, 2021; Akbar, 2013).

The reliability coefficient is calculated based on the results of the validator assessment. Based on the results of calculations according to formula (Borich, 1994), the reliability coefficient R of the creative thinking ability test instrument at the Elementary Level is 0.78. This shows that the test instrument is reliable (Pramonoadi et al, 2020). In line with research led by (Setiani et al, 2017; Utama et al, 2022) shows that the validity of the creative thinking ability instrument from the reliability test is in the high classification (Syaifudin, 2021). This shows that the critical thinking ability test instrument is suitable for use. In line with this, the creative thinking skills test questions that have been prepared can be used for research (Pramonoadi et al, 2020; Siregar, 2020).

CONCLUSION

The validation results of the Science Creative Thinking Ability Test Instrument at Basic Level on the topics Seeing as a result of Light, seeing in view of Light, hearing due to Sound and the topic of Environmental Suitability in the material, development and language sections were closed to be valid and solid with a few change. Validator assessments generally provide a decent picture of the nature of the instrument. The

Creative Thinking Ability Test Instrument is also reliable. This is the strength of this instrument so that it can be used to measure science creative thinking abilities at the elementary level, especially in these two chapters.

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