



DEVELOPMENT OF CREATIVE THINKING SKILL INSTRUMENTS IN HIGHER EDUCATION

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ABSTRACT

This study aims to describe the item analysis of creative science thinking skills instruments in environmental education courses. The characteristics of creativity in the context of higher education are the benchmark for this study, namely fluency, originality, elaboration, and flexibility. The method of research was research and development. The validity study of the instrument was carried out by two experts, and the instrument was tested on 26 students. According to the First Expert, the instrument can be used with little revision and the Second Expert states that the instrument can be used without revision. Therefore, the researchers concluded that the instrument can be used with little revision. Based on the trial data on the 12 questions developed, it was found that 5 of the questions needed to be revised before data collection, 6 questions had to be corrected, and 1 question item was not used/discarded. The revision includes the affirmation of question sentences or commands for questions with a status of accepted but needing to be corrected. Indicators of creativity that concern this study are fluency, originality, elaboration, and flexibility. Therefore, from the 5 question items, one question was chosen for each that represented the four indicators of creativity.

Keywords: *Creative thinking, science, higher education*

1. INTRODUCTION

A creative Indonesia is one of the visions of the Ministry of Education and Culture. Creativity has been identified as an increasingly important graduate trait for employment in the 21st century (Georgiou et al., 2022). Creative performance attracted much research in its infancy in the Arab world (Alzghoul et al., 2023). Creativity is an important goal for higher education (Rae, 2023). Fostering creativity in higher education is concerned with improving students' professional competence and personal development (Catarino et al., 2019). Higher Education should also promote creative, and critical students (Vilarinho-Pereira & Fleith, 2021). Most educators and researchers would agree that creativity in higher education is relevant in terms of identifying the right problems (Jahnke & Liebscher, 2020). Creativity plays a role in human development (Sun et al., 2020).

The word creative is an adjective that means to have inventiveness or to (contain) inventiveness. The word creativity is a noun that means the ability to create, inventiveness, or about creating (Depdiknas, 2017). (Plucker & Makel, 2010) stated that the word creativity is the same as, *overlaps*, and is likely synonymous with the terms imagination, ingenuity, *innovation*, inspiration, *inventiveness*, *musings*, novelty, *originality*, serendipity, talent, and uniqueness. According to Peterson (1993), creativity is related to a person's ability to know the usefulness of new unusual, or original construct shapes. Many people do creative activities by combining them with other activities, one of which is intuition. Molefe and Brodie (2010) state that creativity and intuition are natural abilities that belief and understanding need not come from formal, deductive, or analytical proof.

Barron and Harrington (1981) state that the term creativity can have various meanings according to the existing context. We can say that a person can be said to be creative if he can create a product or good that is socially valuable. Creativity can also be viewed in terms of the skills needed to be creative, such as difficulties in understanding and solving problems. In addition, there is also a distinction between creativity as achievement, creativity as ability, and creativity as disposition or attitude. Someone who does creation or creativity will certainly do several stages in carrying out these activities. This stage is a well-structured process. Some experts have their own opinions about the process of creativity. According to Wallas (1993), the creative process has four stages, namely preparation, incubation, making something easier to understand (illumination), and verification. In addition, there are five steps in the creation process, namely: preparation,



incubation, understanding or ability to understand (insight), evaluation, and elaboration (Csikszentmihalyi, 1996).

In addition to the several stages of creativity mentioned above, several components need to be considered in creativity. According to Sharp (2004), there are several components related to the creative process including imagination; originality, namely the ability to produce new and uncommon ideas and products; productivity, which is the ability to generate different ideas through different ways of thinking; problem-solving, namely the application of knowledge and imagination into a given situation; and the ability to produce output in the form of value or something useful. The question that arises is whether the process of creativity or creativity can be taught by teachers to their students. The London-based National Advisory Committee on Creative and Cultural Education (NACCCE) argues that creativity can be taught to students. Teachers can be creative in classroom learning. They can also improve the creative abilities of their students. The role of the teacher is to recognize the creative abilities of his students and provide certain conditions for that creativity to emerge (NACCCE, 1999).

There are several types of creativity. First, creativity can be a form of problem-solving. If so, creativity may occur in conjunction with a goal or set of goals. Second, creativity may differ depending on who people focus on. For example, what people think creatively may not be the same as what someone thinks. Third, if we assume that creation is a process, is the final product part of creativity? If the final form is part of creativity, what criteria should be used to judge whether the product is creative? Novelty or authenticity is often considered an indicator of creativity. But if novelty is used as a criterion, it will leave a problem because a product can be said to be new in a different dimension and vice versa, and a product that has the same value in a dimension may not be perceived as a whole as creative. Fourth, is creativity according to scientists (art experts and others) the same as our idea of creativity? These things cause difficulties in defining the term creativity (Roskos-Ewoldson et al., 1993).

Another opinion regarding the characteristics of creativity comes from the European University Association. According to the European University Association (2007), there are four characteristics of creativity in the context of further education, namely originality, appropriateness, future-oriented, and problem-solving ability. Creativity is not about reproduction but requires new development and requires a breakthrough in ideas and concepts. In addition, not every new one is creative but creativity indicates a new approach that suits the problem at the time. Creativity is also not a setback but focuses on what happens in the future. Creativity is related to problem-solving ability is related to the ability to identify new solutions. It is about the ability to think outside the box, see things from a new point of view, and speculate and be ready for failure.

Creativity in the field of science, especially the field of biology will be developed in this study. Most instruments used to measure creativity are the same from primary to higher education. Not every new thing is creative, but something must match the problem at hand. Fluency, originality, elaboration, and flexibility are the main characteristics developed in this research report. The preparation of instruments will be better if done through development research. The research and development process was carried out to see if the instrument was valid and whether it needed to be revised after the trial.

2. METHODS

The main product of research is the instrument of creative thinking skills. To get quality instruments, these instruments will be developed through the curriculum product development process. The first step is to analyze the initial activity, then conduct a formative evaluation many times aimed at improving the quality of the unfinished product, and continue with a summative evaluation at the end of the process which aims to assess the effectiveness of the final product. This research and development procedure uses the Four-D Model (4D Model), which includes the stages of Define, Design, Develop, and Disseminate (Thiagarajan, Semmel, & Semmel, 1974).

This research was carried out in February 2024 and the research place was carried out at the Makassar State University Postgraduate Program and the Biology Education Study Program, Faculty of Teacher Training and Education, Khairun University. Expert Validators come from Makassar State University and the



subjects of the research are biology education students. The subjects of the research trial amounted to 26 students.

The instrument to determine the validity of question items is the validation sheet. This validation sheet is used to assess the quality of critical thinking skills instruments covering aspects of material, construction, and language. Data on the quality of critical thinking skills instruments obtained with instruments in the form of checklists on the *Likert* scale are then analyzed into quantitative data. The data will be analyzed with descriptive statistics. Descriptive analysis is done only to obtain a score about the quality of the critical thinking skills instrument. Furthermore, it is classified based on the following Table 1.

Table 1. Critical Thinking Skills Instrument Quality Criteria

Skor (X)	Criterion
$3,25 < X$	Excellent
$2,50 < X \leq 3,25$	Good
$1,75 < X \leq 2,50$	Average
$X \leq 1,75$	Poor

3. RESULT & DISCUSSION

The Creative Thinking Skills Instrument will be used to determine the ability of creative thinking skills of biology education students. Indicators or characteristics of students' creative skills are determined to consist of fluency, originality, elaboration, and flexibility from environmental education courses. In the early stages of development, researchers make one question each on each creative indicator.

After the initial creative thinking skills instrument has been developed, the next stage is to ask for expert responses to the instrument. The members who evaluated the number of 2 experts. The assessment includes the suitability of the question items according to the indicators; The boundaries of the questions and expected answers are clear; The content of the material is in accordance with the purpose; The material asked is according to the level; The content of the material is precisely measuring one of the indicators of creative thinking; The content of the material is in accordance with the problem-based; The formulation of sentences in the form of question sentences or commands that demand an unraveled answer; There are clear instructions on how to do/complete; There are scoring guidelines; Meaningful case (clearly the description or has something to do with the problem in question); The question item does not depend on the previous question item; Formulation of communicative sentences; Sentences use good and correct language; The formulation of sentences does not give rise to double interpretation or misunderstanding; Use a common language/word (not the local language); The formulation of the question does not contain words that can offend students; and Between grains are independent of each other. Based on the assessment of these aspects, data on the assessment results from two experts were obtained which are shown in Table 2.

Table 2. Results of Expert Assessment of Critical Thinking Instruments

	Average	Criterion	Notes
First Expert	3,06	Good	Worth using with minor revisions
Second Expert	4,00	Excellent	Worth using without revision
Total	3,53	Excellent	

Based on Table 2, it can be seen that according to the First Expert, the instrument can be used with little revision and the Second Expert states that the instrument can be used without revision. Therefore, the researchers concluded that the instrument can be used with little revision. Revision of the focus of the material, namely environmental issues, conservation, and environmental health, and the addition of question items, namely each creative indicator made three questions based on the three materials in the environmental education course.



After the revision of the instrument, the instrument was tested. The trial was carried out on 4th semester students and 6th semester students. The selection of semester 4th students and semester 6th students as instrument test subjects is based on the assumption that semester 4th students and semester 6th students have received environmental education course materials. The number of students who participated in this trial was 26 students. The results of the analysis of the level of difficulty and difference using Excel are shown in Table 3.

Table 3. Analysis Results of Mathematical Discovery Ability Test

Question No.	Difficulty Level			Discriminatory Power	
	Index	Category		Index	Category
1	0,46	Moderate	0,35	Accepted But Needs to Be Fixed	
2	0,48	Moderate	0,35	Accepted But Needs to Be Fixed	
3	0,42	Moderate	0,33	Accepted But Needs to Be Fixed	
4	0,48	Moderate	0,14	Not Worn/ Discarded	
5	0,59	Moderate	0,28	Fixed	
6	0,38	Moderate	0,28	Fixed	
7	0,47	Moderate	0,34	Accepted But Needs to Be Fixed	
8	0,38	Moderate	0,27	Fixed	
9	0,29	Difficult	0,21	Fixed	
10	0,34	Moderate	0,22	Fixed	
11	0,58	Moderate	0,26	Fixed	
12	0,40	Moderate	0,36	Accepted But Needs to Be Fixed	

The table above shows that 5 questions need to be revised before data collection is carried out, 6 questions must be corrected, and 1 question item is not used/discarded. The revision includes the affirmation of question sentences or commands for questions with a status of accepted but needing to be corrected. Indicators of creativity that concern this study are fluency, originality, elaboration, and flexibility. Therefore, from the 5 question items, one question was chosen for each that represented the four indicators of creativity.

Question point number 1 is used to measure the fluency indicator and has a difficulty level of 0.46, so it can be classified as medium and has a difference power index of 0.35, so this question item is categorized as an acceptable question but needs to be improved. This problem will be corrected for data collection in further research. Question point number 2 is used to measure the originality indicator and has a difficulty level of 0.48, so it can be classified as medium and has a difference power index of 0.35, so this question item is categorized as an acceptable question but needs improvement. Similar to question number 1, this question will be corrected for data collection in further research. Question point number 3 is used to measure the flexibility indicator and has a difficulty level of 0.42, so it can be classified as medium and has a difference power index of 0.33, so this question item is categorized as an acceptable question but needs to be improved. This problem will be corrected for data collection in further research. Question point number 4 is used to measure the flexibility indicator and has a difficulty level of 0.48, so it can be classified as medium and has a difference power index of 0.14, so this question item is categorized as a question that needs improvement. This question will not be used for data collection in further research.

Question point number 5 is used to measure fluency elaboration and has a difficulty level of 0.59, so it can be classified as medium and has a difference power index of 0.28, so this question item is categorized as a question that needs improvement. This question will not be used for data collection in further research. Question point number 6 is used to measure the originality indicator and has a difficulty level of 0.38, so it can be classified as medium and has a difference power index of 0.28, so this question item is categorized as a question that needs improvement. This question will not be used for data collection in further research. Question point number 7 is used to measure the elaboration indicator and has a difficulty level of 0.47, so it



can be classified as medium and has a difference power index of 0.34, so this question item is categorized as an acceptable question but needs improvement. This problem will be corrected for data collection in further research. Question point number 8 is used to measure the flexibility indicator and has a difficulty level of 0.38, so it can be classified as medium and has a power difference index of 0.27, so this question item is categorized as a question that needs improvement. This question will not be used for data collection in further research.

Question point number 9 is used to measure the fluency indicator and has a difficulty level of 0.29, so it can be classified as difficult and has a difference power index of 0.21, so this question item is categorized as a question that needs improvement. This question will not be used for data collection in further research. Question point number 10 is used to measure the originality indicator and has a difficulty level of 0.34, so it can be classified as difficult and has a difference power index of 0.22, so this question item is categorized as a question that needs improvement. This question will not be used for data collection in further research. Question point number 11 is used to measure the elaboration indicator and has a difficulty level of 0.58, so it can be classified as difficult and has a power difference index of 0.26, so this question item is categorized as a question that needs improvement. This question will not be used for data collection in further research. Question point number 12 is used to measure the flexibility indicator and has a difficulty level of 0.40, so it can be classified as medium and has a difference power index of 0.36, so this question item is categorized as an acceptable question but needs to be improved. This problem will be corrected for data collection in further research.

4. CONCLUSION

The development of instruments to measure the creative thinking skills of this research aims to obtain viable instruments through the research and development stages. The main characteristics of creativity that are the focus of research are fluency, originality, elaboration, and flexibility. Based on the assessment of experts, data is obtained that the instrument developed is included in the criteria of very good with a note that the instrument requires a little improvement. After revision, a trial was carried out. Based on the trial data on the 12 questions developed, it was found that 5 of the questions needed to be revised before data collection, 6 questions had to be corrected, and 1 question item was not used/discarded. The revision includes the affirmation of question sentences or commands for questions with a status of accepted but needing to be corrected. Indicators of creativity that concern this study are fluency, originality, elaboration, and flexibility. Therefore, from the 5 question items, one question was chosen for each that represented the four indicators of creativity.

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