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# Analysis of Student Creativity Assessment Instruments: Supporting SDGs and MBKM in Higher Education

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**ABSTRACT**

**Objective:** This study aimed to produce a valid and reliable Creativity Assessment Instrument that can be used in learning. Students' low creative thinking ability and the unavailability of a Creativity Assessment Instrument to measure creativity in the science field of elementary school students are the background to this study. **Method:** The instrument was compiled through the following stages: potential and problems, data collection, product design, design validation, design revision, and valid and reliable final results. Data were collected using a validation sheet. Data from the validation results were then analyzed quantitatively descriptively and then compared with the validity criteria table that had been set. As a result, the creativity assessment instrument has been designed to measure creative thinking skills using descriptive questions. **Results:** Assessment of the material, construction, and language aspects showed high and reliable validity in the categories. This shows that the instrument can be used in the context of learning to measure student creativity effectively. There has been an increase in the development of creativity assessment instruments to measure students' creative thinking skills in elementary school science subjects, which were previously lacking but are now increasing due to this research. **Novelty:** For further development research, it is recommended that creativity assessment instruments have broader topics and are also equipped with Student Worksheets that can not only measure creative thinking skills but also measure the creative process and creative products.

## INTRODUCTION

Physics subjects are taught to students from elementary school to college. At the elementary school level, students study physics to develop curiosity and positive attitudes towards science, technology, and society and the process skills needed to investigate the environment, solve problems, make decisions, and investigate natural phenomena (Dwikoranto et al., 2024). Schools currently use the Independent Learning Curriculum, which is targeted to meet the needs of students to have skills in facing 21st-century global competition, which emphasizes aspects of communication skills, critical thinking, innovation, collaboration, and creativity. Here, creativity is the main emphasis and the ability to reflect on unique thoughts or ways about standards to find answers to problems experienced. Creativity with indicators can communicate thoughts or ideas, propose unique thoughts about standard perspectives in dealing with problems, produce thoughts based on their point of view, and describe thoughts in depth or entirely. Thinking creatively is part of creativity (Sari & Manurung, 2021; Bae et al., 2023).

Creative thinking skills are a characteristic of high-level thinking skills, where students can produce revolutionary ideas through the thinking process. This is urgent so that the Indonesian government in its curriculum accommodates creative thinking skills into classroom learning. In line with the National Education System, the goal is to help students explore their potential to become responsible individuals, obedient to God Almighty, have a noble character, healthy, knowledgeable, talented, creative, independent, and become democratic and responsible citizens (Fakhirah et al., 2023). Prospective educators and educators in schools are important in helping students become more creative thinkers (Dwikoranto et al., 2021).

In physics learning in schools, creative thinking skills still need to be explored further by educators due to the lack of tools to measure them in the field of science. Students are not used to thinking in various directions and considering potential solutions to problems because educators do not sufficiently stimulate creative thinking skills (Dwikoranto et al., 2018). Due to limited time allocation, students are not encouraged enough to improve their ability to think at a high level (Nurlaela, 2019). An important component of physics learning is creative thinking. Through physics, students can learn to think and understand natural phenomena, real-world problems, and the surrounding environment (Amelia et al., 2021; Anwar et al., 2023; Kadarisman et al., 2023; Kamila et al., 2024; Samadun & Dwikoranto, 2022). For students to think creatively, critically, and objectively, teachers must master physics learning materials and develop instruments to evaluate their learning outcomes. With an evaluation instrument to measure students' creative thinking skills, students can determine their actual condition. Students are still less encouraged to develop their true thinking potential because physics teaching activities are entirely carried out by educators when delivering materials. Therefore, to teach creative thinking skills, teachers must prepare the instruments. One of the instruments that can be prepared is a written test with indicators of fluency, flexibility, originality, decomposition, and reformulation (Dwikoranto et al., 2018).

The test instrument is suitable for measuring student learning outcomes in learning; this is by research conducted by Surya et al. (2023) and Dwikoranto et al. (2024). This study's imaginative thinking test instrument measures students' creative ability, including problem-solving and generating ideas. In line with Faresta et al.'s (2020) research, students' creative thinking abilities can be assessed using a creative thinking ability assessment instrument. This study introduces a new approach to creating creativity assessment instruments for physics material in elementary schools. Unlike previous studies, the creativity assessment instrument in this study combines five main aspects of creativity: fluency, originality, flexibility, decomposition, and reformulation (Ayaz et al., 2021). The emphasis on interdisciplinary integration allows students to apply their knowledge contextually by connecting science concepts with inventive solutions that can be applied in real life.

This creativity test consolidates creativity in cooperative information, builds broad associations between scientific ideas, and measures students' ability to get used to reasoning extensively. The ability to measure and stimulate students' creative thinking skills in more depth makes the creative thinking test instrument superior to conventional test instruments that measure conceptual understanding (Masuwai et al., 2024). As a result, this instrument can help educators and researchers understand and improve students' abilities to solve complex problems and think creatively, which are very important abilities to answer the challenges of a complex and dynamic future (Alshammari et al., 2020). The importance of this study is that educators are still lacking

in designing learning more effectively to encourage and develop students' creative thinking skills, thanks to the availability of high-quality instruments. This is important because creativity is one of the most important skills for preparing the younger generation to face the challenges of the 21st century's future, which is full of global competition.

Preparing the creativity of students and students related to quality education initiated by the UN is an obligation in the world of education. SDGs (Sustainable Development Goals) are a series of goals the UN sets to achieve a better and more sustainable life for all. Indonesia is one of the countries committed to implementing SDGs. One of the goals of the fourth SDGs is quality education by the UBHI Renstra and as a Learning Innovation in PGSD. Organizing inclusive, quality, and equal education to be accessible to everyone and supporting lifelong learning opportunities is by the philosophy of Ki Hajar Dewantoro's Education used by the Ministry of Education and Culture (Nizam, 2020). *Merdeka Belajar Kampus Merdeka* (MBKM) provides opportunities for students to obtain quality education by increasing student creativity. One of the strengthening of MBKM refers to the statement of the Indonesian Minister of Education and Culture: "Giving the freedom and autonomy to educational institutions, and freedom from bureaucratization, lectures are freed from bureaucracy, and students are given the freedom to choose their preferred field—the concept of 8 off-campus learning activities in "Independent Campus" (Nizam, 2020).

This research will analyze the developed creativity assessment instrument that meets the criteria as a suitable assessment (valid and reliable) for measuring student creativity. With this instrument, which criteria do students' creativity profiles fall into so that teachers or prospective teachers still studying at universities can determine learning models, strategies, methods, and approaches to improve the quality of students' creativity? In this way, the quality of education can be improved.

## RESEARCH METHOD

The research used is development research adopted from Borg and Gall [24] reduced to the fifth stage, including (1) potential and problems, (2) data collection, (3) product design, (4) design validation, and (5) design revision. The stages of compiling the Creativity Assessment Instrument developed are presented in Figure 1.

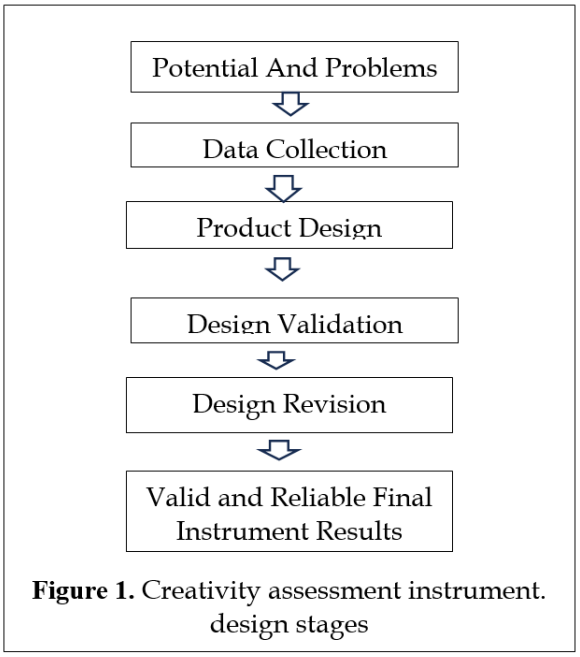


**Figure 1.** Creativity assessment instrument. design stages

The focus of this research's development stage is to demonstrate the developed instrument's theoretical validity and reliability; the dissemination stage will guide further research. The science creativity assessment instrument, which is in the form of descriptive test questions, is the subject of research. The instrument was prepared until the final stage of assessment by the validator was carried out at Bhinneka PGRI University. Material and curriculum experts tested the Creativity Assessment Instrument to ensure that each question covers important aspects of creative thinking and its appropriate indicators.

The validation process then continues to construct validity, which involves statistical testing to ensure that the test instrument can measure creative thinking skills accurately. Important points assessed on the validation sheet include (1) material on the suitability of learning achievements with material and objectives, questions with indicators, material, and creativity indicators. (2) construction consisting of clarity of work instructions, intent, possibility of completion, clear and firm formulation, does not provide clues to answers, free from double negatives, graphs, tables, diagrams, and images in the questions have functions and are clear and (3) language includes: conformity to Indonesian language rules, communicative, and uses official language. Each statement in each aspect on the validation sheet has a score range of 1-5. Then, the score results given by the validator are calculated as an average for each aspect. Furthermore, the final step is calculating the average assessment of all aspects. The calculation results are then matched with the validity criteria in Table 1.

**Table 1.** Instrument validity category.

| Score | Category |
|---|---|
| $\bar{x} > 4.20$ | Very valid |
| $3.40 < \bar{x} \leq 4.20$ | Valid |
| $2.60 < \bar{x} \leq 3.40$ | Quite valid |
| $1.80 < \bar{x} \leq 2.60$ | Less valid |
| $\bar{x} < 1.80$ | Not valid |

If there are invalid and less valid test questions, revisions are made according to the suggestions of the Creativity Assessment Instrument validators. Furthermore, the revision results become an instrument suitable for use, using Cronbach's alpha (α) to determine the reliability of the developed instrument (Yuliarto, 2021).

## RESULTS AND DISCUSSION

### *Results*

### Potential and Problems

The definition stage, by conducting problem analysis, involves interviews with elementary school teachers from different schools in Tulungagung and UBHI students of the PGSD study program. It is known that teachers have never assessed students' creative thinking skills through test questions or other instruments. Students have been given test questions that refer to a collection of exercises from the Student Worksheet, which only contains multiple-choice questions, short answers, and essays. Worksheet test questions have never assessed students' creative thinking skills at the cognitive level C1-C3 or Lower Order Thinking Skills (LOTs). The cognitive analysis of elementary school students is based on Piaget's theory of the stage of mental development that occurs at this age in the concrete operational stage (Piaget, 1963). At

this stage, students can carry out more complex mental activities such as classifying objects based on many attributes, sorting, and grouping based on size or other characteristics. They also begin to understand more complex abstract concepts, although their abilities remain limited to concrete and authentic contexts. At the same time, students are already in the formal operational stage. A test or other assessment form can be used to observe how well students develop their cognitive competencies.

**Analysis Grid and Independent Curriculum**

Analysis of the independent curriculum on Learning Outcomes, described as learning objectives, is then used as a reference for compiling question indicators on renewable energy material. Learning objectives refer to methods for communicating instructions to students, existing structures, and academics. In addition to content and complexity, learning objectives must include professional practices, program instructions, and individual instructions to communicate with academic institutions' content and knowledge areas. Mapping learning objectives and teaching materials ensures effectiveness and learning planning, supports coherent learning experiences, and encourages accountability in achieving learning outcomes. Analysis of Learning Outcomes and Learning Objectives is presented in Table 2.

**Table 2.** Analysis of learning outcomes and learning objectives.

| Learning Outcomes | Learning Objectives | Material |
|---|---|---|
| Students identify the process of renewable energy and its types in everyday life. | Renewable energy | 1. Recognizing renewable energy and its characteristics.<br>2. Learning the characteristics of renewable energy.<br>3. Finding out how renewable energy occurs |

The grid of questions that have been compiled is presented in Table 3. Using five indicators from Guilford: fluency, flexibility, originality, elaboration, and redefinition.

**Table 3.** Grid of creativity assessment questions.

| No. | Guilford Creativity Indicator | Question Indicator | Question Number | Bloom's Taxonomy |
|---|---|---|---|---|
| **1** | *Fluency*: The ability to produce many ideas. | Students compare non-renewable energy and renewable energy. | 1 | C4 |
| | | Given a picture, students can analyze the characteristics of each renewable energy. | 2 | C4 |
| **2** | *Flexibility:* The ability to propose a variety of approaches/paths to problem-solving. | Presented with phenomena about energy, students can find solutions to problems related to these phenomena. | 3 | C5 |
| **3** | *Originality*: The ability to produce original | Students can compile steps to create products that utilize renewable energy.<br>Given a story, students can provide creative | 4 | C6 |

| No. | Guilford Creativity Indicator | Question Indicator | Question Number | Bloom's Taxonomy |
|---|---|---|---|---|
| | ideas as a result of one's thinking and not as clichés. | ideas based on existing phenomena. | 5 | C6 |
| **4** | *Elaboration*: The ability to describe something in detail. | Students can detail the sequence of the process of producing renewable energy based on existing phenomena. | 6,7 | C4 |
| | | Students can describe the types of renewable energy with diagrams. | 8 | C4 |
| **5** | *Redefinition*: The ability to examine/re-examine a problem through different methods and perspectives than what is common. | Presented with experimental data, students are able to draw conclusions based on the data, | 9 | C5 |
| | | Presented with an event, students can analyze the causes of the event. | 10 | C4 |

**Validation and Reliability**

Table 4 shows the results of expert validation. The validation aspects are viewed from the material, construction, and language perspectives.

**Table 4.** Results of validator assessment of creativity assessment.

| Aspect | | Assessment Point | The average score of 3 validators | Average per Aspect | Reliable (%) | Validity category |
|---|---|---|---|---|---|---|
| **A.** | Material | 1. Learning Outcomes are by Renewable Energy material. | 4.67 | 4.53 | 90 | Very valid |
| | | 2. Learning Objectives are based on Learning Outcomes and Renewable Energy material. | 3.67 | | 89 | |
| | | 3. Question Indicators arrange test questions. | 5.00 | | 100 | |
| | | 4. Creative thinking indicators can be measured by the questions created. | 4.34 | | 90 | |
| | | 5. Questions are by Renewable Energy Material. | 5.00 | | 100 | |
| **B.** | Construction | 1. There are clear instructions for working on the questions. | 5,00 | | 100 | |
| | | 2. The purpose of the questions is clearly | 4.67 | | 93 | |

| Aspect | | Assessment Point | The average score of 3 validators | Average per Aspect | Reliable (%) | Validity category |
|---|---|---|---|---|---|---|
| | | explained. | | 4.61 | | Very valid |
| | | 3. The questions can be solved | 4.67 | | 93 | |
| | | 4. The formulation of the questions is clear and firm | 3.67 | | 93 | |
| | | 5. Does not provide clues to the answer key in the questions. | 4.67 | | 93 | |
| | | 6. Free from double negative statements. | 5.00 | | 100 | |
| | | 7. The questions' graphs, tables, diagrams, and images are clear and functional. | 4.67 | | 94 | |
| C | Language | 1. Language conformity with Indonesian language rules. | 4.67 | | 94 | |
| | | 2. The language used is communicative. | 4.34 | 4.67 | 92 | Very valid |
| | | 3. Using official language. | 5.00 | | 100 | |

*Discussion*

**Potential and Problem**

Concept analysis is carried out by identifying critical ideas from renewable energy materials. The main concepts of renewable energy include the definition of renewable energy, characteristics of renewable energy, examples of renewable energy, and conversion of renewable energy into other forms of energy. Concepts are part of learning in students' cognitive development. Concept analysis aims to better understand a concept by analyzing, defining, developing, and evaluating it. Instruments in the form of questions to test students' ability to think creatively are compiled based on the concept and adjusted to the demands of the independent curriculum in learning. The design stage is carried out by compiling a grid of questions adjusted to Guilford's learning objectives and creative thinking indicators. The grid matrix containing the criteria for compiling quality exam questions must meet several requirements, including: (1) can describe the representation of curriculum content, (2) grid components must be clear, specific, and easy to understand, and (3) question items can be written on each indicator.

**Validity and Reliability**

Table 3 shows that the Creativity Assessment designed to measure students' creative thinking abilities is at the cognitive levels of Bloom's taxonomy C4, C5, and C6, with percentages of 60%, 20%, and 20%, respectively. Test questions at levels C4 to C6 also represent students' high-level thinking skills because creative thinking is one of the indicators. A Creativity Assessment is suitable for measuring if it meets the construction criteria. The goal is that the results of the Assessment Instrument obtained

with the measuring tool can accurately describe the actual condition of the object being measured, especially its creative thinking capacity (Yuliarto, 2021). The design of the answer key and scoring guidelines follow the preparation of the question grid. The quality of the answers for each test question is used to adjust the maximum score. With the scoring guidelines, it will be easier for teachers to carry out assessments, and students will also understand the assessment criteria given so that they will be motivated to make maximum efforts to achieve the highest score (Tangkin, 2019; Dwikoranto, 2019). The development stage is carried out by compiling the planned design. After all the designs are compiled, the designated experts validate the product. Validity is the most important factor in developing research instrumentation (Masuwai et al., 2024). The items in the instructions must be interpreted because they will be compared with the attributes to be evaluated (Roebianto et al., 2023).

Table 4 shows that the Creativity Assessment Instrument in the form of essay questions on students' creative thinking skills developed on renewable energy material is in the very valid and reliable category—Cronbach's alpha (α) to determine the reliability of learning tools. This validation is important to check the suitability of the relationship between the questions and the objectives of the Assessment (Can & Burakgazi, 2022). Validity is reviewed from three aspects, namely material, construction, and language. The material, construction, and language aspects each consist of several statements assessed by the validator. Validators are experts who are actively involved in the development of scientific disciplines (Syaiful, 2020). The average score of the three validators in each aspect is 4.53, 4.61, and 4.67, included in the very valid criteria. Content validity determines whether the content is relevant to the quality evaluation criteria. The purpose of the expert panel review is to display items that are unclear, irrelevant, and unrelated to the instructions (El-sehrawy, 2020). The validation of the Creativity Assessment is in line with existing literature that emphasizes the importance of measuring scientific creativity in learning (Dwikoranto et al., 2024; Guilford, 2019). This also means that this Creativity Assessment Instrument is now suitable for learning and can accurately measure all indicators of creative thinking ability from Guilford. This is based on research findings, which show that a measurement has high validity if it accurately produces data that reflects the variables being measured by the purpose of the measurement. A measurement has low validity if it produces data that does not match the purpose of the measurement. So, the instruments tested for validity can be used in learning (Lukman, 2023; Arikunto, 2018).

A valid instrument that measures students' creative thinking in the context of science not only allows for accurate assessment of students' understanding and application of scientific concepts but also encourages students to develop creative thinking skills such as adaptability, originality, and the ability to relate information to real-world situations (Elangovan & Sundaravel, 2021). An assessment tool in the form of an open-ended question instrument that requires creative answers is one of the assessment tools that can measure students' creative thinking skills (Damanik, 2022; Dawana & Dwikoranto, 2024). With this instrument, educators can more effectively design challenging learning and encourage students to innovate, which is the objective of the Independent Curriculum to produce graduates who are skilled in critical and creative thinking. Collaboration is needed between teachers and students to develop creative thinking skills (Ernaningsih, 2019; Darfler & Kalantari, 2022). This study provides a solid foundation for the development of relevant and effective evaluation instruments in supporting science learning that is centered on students' experiences and the

application of knowledge in their daily lives in the context of modern education, which increasingly emphasizes student creativity as an important component of the Merdeka curriculum (Siti & Dwikoranto, 2021). This study is limited to only examining part of the science material in elementary schools, namely renewable energy. In the context of the Merdeka curriculum, research on science creativity assessment instruments in elementary schools has significant implications, encouraging the integration of learning strategies that encourage creativity into every aspect of the curriculum by measuring students' creativity in understanding science concepts (Nursiwan & Hanri, 2023). This is important because the Merdeka curriculum emphasizes advancing critical and creative thinking skills. By ensuring that the evaluation instrument measures verifiable information and the capacity to produce imaginative arrangements, this assessment upholds the vision of SDGs by planning teachers who can inspire students to effectively take part in creating answers to existing difficulties through creative methods in learning and supporting MBKM.

## CONCLUSION

**Fundamental Finding:** The Science Creativity Assessment Instrument in the independent curriculum on renewable energy material in the form of essay questions has met the validity test with very valid and reliable criteria. By providing a tool that can help measure and develop students' creative thinking skills in the context of science, this study makes a significant contribution to improving education. **Implication:** This appropriate and relevant instrument will provide new opportunities to design more engaging, interactive learning and encourage the development of students' creativity since elementary school. **Limitation:** Research subjects must be expanded and supplemented using digital platforms. **Further research**: It is recommended to increase the number of creativity assessment questions so that there are more choices of questions to measure students' creative thinking skills, which are carried out in other innovative learning models.

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