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Creative Thinking Ability of MTs Students on the Topic of Renewable Energy: A Case Study in South OKU

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ABSTRACT

This study aims to analyse the creative thinking ability of MTs students in South OKU Regency on renewable energy material. The research sample totalled 109 ninth grade students from four MTs selected by purposive sampling. The research instrument was in the form of multiple choice questions based on TTCT (Torrance Tests of Creative Thinking) indicators consisting of fluency, flexibility, originality, and elaboration. The results showed that the average score in the range of 100 students' creative thinking ability was 41.56. The average score of each indicator is: fluency (60.54), elaboration (45.77), flexibility (32.03), and originality (22.52). The highest average score is on the fluency indicator and the lowest score is on the originality indicator. This shows that students do not have difficulty in generating many ideas, but still have difficulty in generating unique and innovative ideas. The results of this study provide a factual picture of the condition of the creative thinking skills of MTs.

1. INTRODUCTION

21st century education requires students to master various skills, one of which is the ability to think creatively which is an essential component in facing global challenges. Creative thinking ability is one of the high-level thinking abilities (Akhsan et al., 2020). Creative thinking is defined as the ability to produce new and useful work. Creative individuals have the ability to see problems from various perspectives, have extensive knowledge, and are motivated to explore new ideas (Strenberg, 1999).

According to Torrance (in Alabbasi et al., 2022), creative thinking ability consists of four main indicators, namely (1) Fluency: the ability to generate many ideas in a short time. (2) Flexibility: the ability to generate varied ideas in different categories. (3) Originality: the ability to create unique and different ideas. (4) Elaboration: the ability to enrich the details and development of an idea. With creative thinking skills, students can solve problems by creating unique, different, and logical ideas (Leasa et, a., 2021). Furthermore, students who have creative thinking skills are not only proficient in science, but also quite ready in the technological era (Fideli & Aliazas, 2022). Unfortunately, the level of creative thinking skills of Indonesian students is still low. The results of the Programme for International Student

Assessment (PISA) international study in 2022 showed that the average creative thinking score of Indonesian students reached 19 out of 60 points, which is much lower than the OECD average (OECD, 2022). This problem also occurs in South Ogan Komering Ulu (OKU) district, South Sumatera.

In South OKU, science learning in Madrasah Tsanawiyah (MTs) is still dominated by teacher-centred methods, such as lectures and practice questions. These methods tend to make students passive and less involved in critical or creative thinking processes (Asilevi et al., 2024). South OKU has varied geographical characteristics, ranging from lowlands to hills, with transport access still challenging in some areas. This condition affects the distribution of education quality, including in madrasahs in the region. In fact, science learning should be a vehicle for developing analytical thinking skills that enable students to solve complex problems (Bayani et al., 2025). According to the 2019 TIMSS (Trends in International Mathematics and Science Study) report, Indonesian students are ranked at the bottom in terms of critical and creative thinking skills in science subjects (Mullis et al., 2020).

Renewable energy is an important topic to be taught to students. The issue of climate change and the fossil energy crisis is increasingly urgent (Szeberényi et al., 2022), so students need to be invited to understand and solve problems related to renewable energy concepts. Learning about renewable energy not only provides knowledge about science and technology, but also trains students to think creatively in finding solutions to global problems (Ulazia et al., 2020). The importance of teaching students about renewable energy is to introduce environmentally friendly technology (Rabaia et al., 2021), as well as to reduce dependence on fossil energy sources that may be replaced in 2050 (Holechek et al., 2022). Research by Østergaard et al. (2022) also shows that learning about renewable energy can contribute to the achievement of the Sustainable Development Goals (SDGs), particularly in the aspects of quality education and climate action. South OKU district has natural potentials that support the development of renewable energy, such as large rivers that can be used for hydroelectric power plants (PLTA) and vast land suitable for solar energy development. However, the lack of students' awareness and understanding of the utilisation of this potential is one of the challenges in science learning in madrasah.

Recent research shows collaborative learning on renewable energy issues can develop students' critical and creative thinking skills (Ellianawati et al., 2025). Research by Bayani et al. (2025) highlights the importance of analytical thinking skills in science education and shows that innovative teaching strategies such as Problem-Based Learning (PBL) and Project-Based Learning (PjBL) are effective in developing these skills on renewable energy materials. This research emphasises the need for more interactive and participatory learning approaches to improve students' analytical thinking skills. Furthermore, the readiness of educational technology in supporting learning can strengthen the development of these skills (Fideli & Aliazas, 2022). Unfortunately, the implementation of this innovative strategy for MTs in South OKU is still very limited, influenced by the availability of facilities and teacher training.

As a region with geographical diversity and renewable energy potential that has not been optimally utilised in learning, South OKU serves as a representative case study to evaluate the actual condition of students' creative thinking skills within the context of renewable energy materials. The region also reflects broader educational challenges faced by areas with limited access to modern facilities and those still relying on traditional, teacher-centered learning systems. Given the global urgency to address climate change and transition toward sustainable energy sources, equipping students with creative problem-solving skills related to renewable energy is not only relevant but essential for future innovation and environmental sustainability.

This study aims to analyse the level of creative thinking ability of MTs students in South OKU when engaging with renewable energy topics. By focusing on this specific context, the research contributes to the growing body of knowledge on science education in underrepresented and geographically diverse regions of Indonesia. Moreover, it highlights the need for pedagogical reforms that prioritize higher-order thinking skills, especially in schools where conventional teaching methods still dominate.

The findings of this research provide an important picture of both the potential and existing challenges in developing students' creative thinking within the context of renewable energy learning. Specifically, they offer empirical insights into how students from rural and less technologically equipped environments perform in terms of fluency, flexibility, originality, and elaboration key components of creative thinking. These results can inform educators, curriculum developers, and policymakers about necessary interventions to enhance creativity through innovative teaching strategies, such as project-based or problem-based learning, particularly in resource-constrained settings.

2. METHODS

This study uses a quantitative descriptive approach to describe the creative thinking skills of MTs students on the topic of renewable energy. This approach was chosen because it aims to provide a clear and systematic description of the characteristics or conditions of the object of research through the collection and analysis of numerical data (Creswell, 2016). The population in this study were all students of grade IX MTs in South OKU. The selection of grade IX is based on the assumption that students in this grade have completed basic science materials, including the topic of renewable energy, so they have sufficient background knowledge to be evaluated. The research sample was selected by purposive sampling from four MTs in South OKU.

The data collection technique was a written test to measure students' creative thinking skills based on the Torrance Test Creative Thinking (TTCT) indicators totalling 20 questions. Instrument analysis continued with item quality analysis using the Rasch model to test the validity and reliability of the instrument. The validity test is the process of collecting relevant evidence to provide a scientific basis for score interpretation. Reliability test to measure the consistency of the research instrument. In this analysis, the question items are declared valid if they meet the criteria for the Outfit MNSQ and Infit MNSQ values to be in the range of 0.7-1.3. Then the Outfit ZSTD and Infit ZSTD values are in the range -2.0 to +2.0 (Boone et al., 2014). Of the 20 items, 2 items were declared misfit so that only 18 items were used as research instruments. To measure the reliability of the instrument, the Person Reliability coefficient was used which resulted in a value of 0.62, indicating that the instrument has a sufficient level of consistency.

3. RESULT AND DISCUSSION

The research sample came from 4 MTs in South OKU with all subjects totalling 109 ninth grade students. The sample consisted of 48 people (44%) male and 61 people (56%) female. This distribution shows that the respondent population is not completely homogeneous in terms of gender. Although females have a higher proportion, the difference between the two groups is not too large, so the distribution is relatively balanced. The questions given according to the TTCT (Torrance Tests of Creative Thinking) indicators with 4 indicators namely fluency, flexibility, originality and elaboration totalled 18 multiple choice questions. The distribution of students based on school origin is as follows.

Table 1. Distribution of sample MTs student respondents

Madrasah Name	Number of Students	Percentage
MTs N 1 South OKU	27	24,77 %
MTs N 2 South OKU	10	9,17 %
MTs N 3 South OKU	36	33,03 %
MTs Al Ittifaqiah South OKU	36	33,03 %

Using the SPSS application, data was analysed showing the distribution of creative thinking ability of the 109 respondents. This is to provide an in-depth insight into how creative thinking ability is spread among the population under study. The data analysis can be seen in Figure 1.

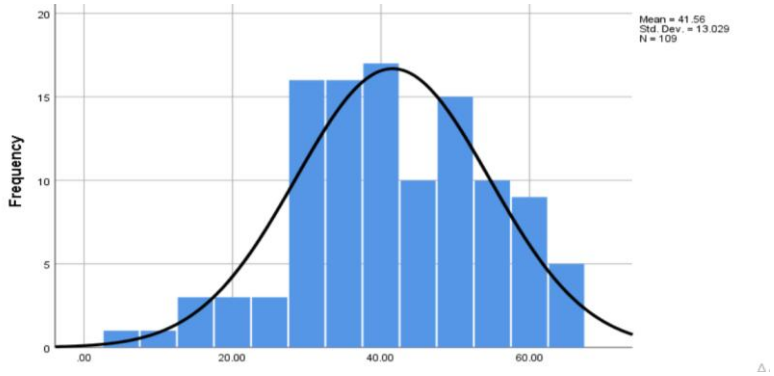

Figure 1. Histogram of data distribution of creative thinking ability test results of MTs students

Diagram 1 shows that the majority of respondents have creative thinking skills that are around the mean value. This is due to the highest frequencies being around the middle value. This indicates that there is a lack of creativity among the respondents, with many individuals having 'medium' skills. There were relatively few respondents with very high (above 60) or very low (below 20) scores. This is reflected in the lower frequencies in the two tail distributions. However, the presence of respondents with very high scores suggests that there are significant individual differences in creative thinking ability.

The results showed that the average score of creative thinking ability of Madrasah Tsanawiyah students in South OKU Regency in solving renewable energy problems was 41.56. This score illustrates that in general students have the basic ability to solve problems and generate new ideas, although it has not reached the optimal level. While the results of the analysis of the creative thinking ability of MTs students per indicator in the context of renewable energy topics can be seen in Diagram 2. Indicators of creative thinking include dimensions of fluency (richness of ideas), flexibility (adaptability of ideas), originality (creativity of ideas), and elaboration (development of ideas). Based on the results of data collection, the data obtained are as shown in Figure 2.

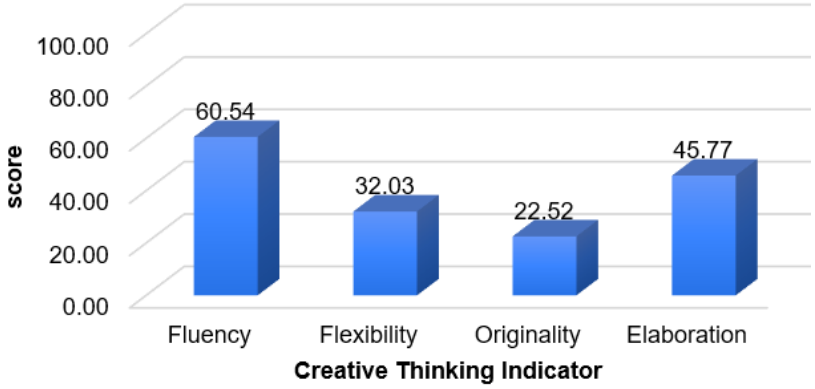

Figure 2. Creative thinking ability test results of MTs students

Based on Figure 1, the fluency indicator shows the highest score among the four indicators, with an average of 61.28. This indicates that MTs students in South OKU have a good ability to generate many ideas or solutions in a short time. This is in line with the findings of Leasa et al. (2021) who mentioned that students find it easier to generate many ideas than to generate unique or original ideas. However, this could also be influenced by the learning style that tends to reinforce speed and fluency of thinking, but places less emphasis on the quality of ideas.

In contrast, the originality indicator recorded the lowest score among the four indicators, at 22.52. This indicates that students have limitations in generating unique or innovative ideas. This result is in line with the PISA 2022 report which states that Indonesian students are still below the average of OECD countries in terms of creative thinking (OECD, 2019). Creativity of ideas is essential in creative thinking as it allows individuals to create new solutions that have never existed before.

The flexibility indicator shows a score of 32.61 which is lower than the fluency indicator. This indicates that students are not very flexible in adjusting their plans or strategies when the situation changes or when their initial ideas do not work. The ability to adapt ideas is essential for creative thinking as it allows one to see problems from different perspectives and find alternative solutions. The plus point is that some students have demonstrated the ability to adapt ideas, despite the fact that it may be relatively low. However, the average score given for this flexibility factor indicates that most students remain committed to one idea or approach without considering other options. This can be a useful tool for dealing with complex problems that require dynamic thinking.

The last aspect, elaboration, recorded a score of 45.77 which is higher than flexibility and originality, but lower than fluency. This indicator shows that students have the ability to develop their ideas in more detail and depth. Idea development is very important because it ensures that the ideas generated are not just rough ideas, but also have concrete and practical details. The high proportion of elaboration shows that students have the ability to develop their ideas in more depth, which is an important step in the creative thinking process. However, although better than flexibility and originality, this average score still shows that most students have not been able to fully develop their ideas optimally.

From the results of the student creative thinking ability test, the fluency indicator has the highest score and the originality score is the lowest. This shows that students are able to generate many ideas, but still have difficulty in creating unique and innovative ideas. This result is in line with the research of Ellianawati et al. (2021) which shows that Indonesian students tend to be better at generating many ideas (fluency) than originality (creating original solutions). Csikszentmihalyi (1997) states that originality in creative thinking ability is very rarely found in student answers. However, it is different from Larraz's research (2021) which states that originality ability is usually higher from distant places or remote areas.

By research of Fideli & Aliazas (2022), which found that technological readiness in the learning environment can increase student creativity, this study shows that technological readiness in MTs South OKU is still limited, so it has not had a significant positive impact on student creativity. The main difference lies in the context of the learning environment and the availability of supporting facilities, such as digital devices, the internet, and teacher training in innovative learning strategies. In urban areas or technology-based schools, students are more often exposed to extensive information and collaborative activities that encourage creative thinking.

The low level of students' creative thinking skills is influenced by several factors is:

1. Teacher-centred learning methods. Most of the science learning at MTs in South OKU still uses the lecture method and practice questions, so students are not accustomed to exploring or developing their own ideas. In line with the results of research by Lestari & Jingga (2024) that students inability to think creatively is hampered by the education system's continued reliance on conventional teaching methods and teacher dominance in the learning process.
2. Parenting and learning culture. According to research by Gryazeva et al. (2025), environmental factors such as education, culture, and social experiences, contribute to the development of one's creativity.
3. Focus on standard competencies where the curriculum emphasises the achievement of academic standards rather than the development of higher order thinking skills such as creativity (Isabirye et al., 2025).
4. Lack of teacher training to implement learning methods that encourage creativity (Isabirye et al., 2025).

5. Lack of technology integration, even though technology can be a powerful tool to enhance student creativity (Isabirye et al., 2025).

The findings also show that MTs students in South OKU have the potential to develop their creative thinking skills, particularly in generating many ideas (fluency) and developing these ideas in detail (elaboration). However, the biggest challenge lies in the aspects of originality and flexibility, which are the core components of true creative thinking. In this pattern, where fluency and elaboration scores are relatively higher while originality and flexibility remain low is consistent with previous studies conducted in various regions of Indonesia. For instance, Leasa et al. (2021) found similar results among elementary school students in Maluku, where students could generate numerous ideas but struggled to produce unique or unconventional solutions. Likewise, the PISA 2022 report highlighted that Indonesian students, on average, scored significantly lower in creative thinking compared to the OECD average, particularly in tasks requiring originality and innovative problem-solving (OECD, 2023).

The low performance in originality may be attributed to several factors identified in this study, including teacher-centered learning methods, limited exposure to open-ended problems, and minimal integration of technology in teaching. These findings align with research by Lestari & Lingga (2024), which emphasized how conventional teaching practices hinder students' ability to think divergently and creatively. Additionally, the lack of emphasis on creativity in curriculum design and assessment systems further reinforces a learning culture that prioritizes rote memorization over idea generation (Isabirye et al., 2025). In rural areas like South OKU, where access to digital resources and teacher training is limited, these challenges are even more pronounced.

Responding to these challenges, Wiyono et al. (2024) proposed a STEM-based instructional prototype that integrates real-world challenges and design-based activities to foster creative thinking. Their findings suggest that such materials can guide students through the process of identifying problems, brainstorming solutions, and refining ideas—skills that directly support originality and flexibility. Implementing similar STEM-based resources in MTs schools could serve as a strategic intervention to improve creative thinking performance, particularly in under-resourced regions like South OKU.

To improve these abilities, a shift in the learning paradigm is essential from a knowledge-transfer model to a student-centered approach that encourages exploration, inquiry, and innovation. Strategies such as Problem-Based Learning (PBL) and Project-Based Learning (PjBL) have been shown to effectively foster creative thinking, especially when contextualized in real-world issues such as renewable energy and sustainability (Zulkarnain et al., 2022; Nurfa & Nana, 2020; Setyarini et al., 2020; Leasa et al., 2023; Putri et al., 2021). These strategies not only promote active learning but also allow students to practice flexibility and originality by engaging with complex, multidisciplinary problems. Recent studies in Indonesian science education also support this finding. For instance, a bibliometric analysis by Permadi et al. (2025) highlights the growing application of PjBL in science classrooms across Indonesia, showing its positive impact on student engagement and higher-order thinking skills. Moreover, Adriani et al. (2025) demonstrated that integrating augmented reality into PjBL significantly enhances students' creativity, particularly in abstract topics such as the solar system. This suggests that combining PjBL with technology-enhanced tools can be a promising approach for improving creative thinking indicators like originality and flexibility in rural settings like South OKU.

The other research, Ellianawati et al. (2025) demonstrated that STEAM-based collaborative learning on renewable energy topics significantly improved both critical and creative thinking skills among middle school students. STEM-based e-learning has proven effective in promoting creative problem-solving and collaboration (Wiyono et al, 2022). Similarly, Ulazia & Ibarra-Berastegi (2020) showed that project-based activities involving renewable energy technologies helped university students develop a deeper understanding of scientific concepts while enhancing their creative capacities. Therefore, implementing such approaches in MTs schools in South OKU could serve as an effective

intervention to bridge the gap in creative thinking skills, particularly in the domains of originality and flexibility.

In conclusion, the current findings highlight the need for pedagogical reforms that integrate creative learning strategies into science education, especially in under-resourced and geographically isolated regions. By leveraging contextual themes such as renewable energy and employing student-centered methodologies, educators can better nurture the creative potential of students and prepare them for future challenges in science, technology, and sustainable development.

4. CONCLUSION

Based on the research results, it can be concluded that:

1. The average score of creative thinking ability of MTs students in South OKU is 41.56.
2. The fluency indicator has the highest score and the originality score is the lowest. This shows that students are able to generate many ideas, but still have difficulty in creating unique and innovative ideas.
3. The creative thinking ability scores on each indicator are as follows:
   a. The highest average score is achieved in the fluency indicator (60.54), which shows that students have a good ability to generate many ideas or solutions related to renewable energy problems.
   b. Flexibility recorded a score of 32.03, which indicates that students are still less flexible in adapting their ideas when the situation changes.
   c. Originality recorded the lowest score of 22.52, indicating that students have limitations in generating unique or innovative ideas.
   d. Elaboration recorded a score of 45.77, which is higher than flexibility and originality, but still shows that students are not fully able to develop their ideas optimally.

These findings highlight the urgent need to reform pedagogical practices in MTs schools, particularly through the integration of student-centered learning models such as Problem Based Learning (PBL) and Project Based Learning (PjBL), which have been shown to effectively stimulate creative thinking in science education.

The results of this study provide a solid foundation for future research aimed at enhancing creative thinking in rural educational settings. Future research could focus on the implementation of innovative teaching strategies such as Problem-Based Learning (PBL), Project-Based Learning (PjBL), or STEAM-based learning in South OKU to assess their effectiveness in improving students' creative thinking skills, particularly in the areas of originality and flexibility, which were found to be most deficient in this study. Investigating the impact of professional development programs for teachers could also provide valuable insights into how training educators in creativity-fostering strategies can lead to sustainable improvements in science classroom practices. In addition, future studies might explore the integration of technology in low-resource environments and how digital tools can be used to enhance student engagement and idea generation. Conducting longitudinal assessments would further help determine the long-term effects of these interventions on students' creative thinking abilities, especially in the context of renewable energy and sustainability education. Expanding this research to other regions in Indonesia with different geographical and socio-cultural contexts could also contribute to a broader understanding of creative thinking patterns across diverse educational settings.

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