

Enhancing Students' Creative Thinking through Nearpod Integrated 5E Learning Model

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Abstract

The development of Science, Technology, and Society (IPTEKS) shows that the world is currently undergoing a very rapid transformation. Therefore, improving the quality of human resources, especially the quality of education, is an important key. Quality education produces skilled human resources, the ability to think creatively, and the readiness to face global competition. In 21st-century learning, several abilities must be developed, one of which is the ability to think creatively. Technology integration in the learning cycle 5E is needed with educational games, namely Nearpod. This study aims to explain the influence of the nearpod-based 5E learning cycle learning model on students' creative thinking abilities. The method used is an experiment with a quasi-experimental research design and a non-randomised control group pretest-posttest design. The population in this study was all students at SMA Negeri 7 Bengkulu City, with a research sample consisting of two (2) classes, namely the experimental and control classes, with a total sample of 74 students. Sampling was carried out using the purposive sampling technique. Data collection was carried out through a written test to measure students' creative thinking abilities in the form of five (5) essay questions. The data analysis technique uses a hypothesis test (t-test) with a significance level of 5% (0.05). Based on the results of the hypothesis test (t-test) on the post-test value of creative thinking ability, the value obtained is $0.000 < 0.05$, so there is an influence of the nearpod-based 5E learning cycle learning model on students' creative thinking abilities. This demonstrates the novelty and potential of integrating the learning cycle 5E model with digital interactive media as an effective strategy to foster creativity in modern learning environments.

Keywords: creative thinking abilities, 5e learning, nearpod, mutation material

INTRODUCTION

21st-century learning determines the progress of a nation because it requires students to be actively involved in learning that is critical and creative, collaborative and communicative, digital literacy, and life abilities (Maullidah *et al.*, 2024). So in 21st-century learning, schools are required to change their learning approach from teacher-centred to student-centred, namely learning that places students at the centre of the learning process (Satriaman *et al.*, 2019). With this approach, students are encouraged to be more active, critical, and creative throughout the learning process, while teachers take on the role of facilitators who guide, support, and direct students' exploration, inquiry, and construction of understanding in a more meaningful way. This shift in roles allows students to develop autonomy in their learning, engage in deeper analysis, and generate original ideas based on the concepts they encounter. In the context of 21st-century learning, a variety of competencies must be cultivated to prepare students for increasingly complex global challenges, and one of the essential skills that must be developed is the ability to think creatively, as it enables students to design innovative solutions, adapt to change, and approach problems from multiple perspectives.

The ability to think creatively is the ability to create something new, or the ability to place and combine a number of objects in a different way that comes from human thought that is understandable, useful, and innovative, with various factors that can influence it (Mursidik *et al.*,

2015). Creative thinking abilities are utilized to formulate effective reasoning, think systematically, solve complex problems, and make well-considered judgments and decisions that are grounded in logical analysis and innovative perspectives. These abilities enable individuals to explore multiple solution pathways, evaluate alternatives, and integrate new ideas with existing knowledge, thereby supporting deeper understanding and more meaningful problem-solving processes in various learning and real-life contexts (Nasir, 2018). Creative thinking ability is a student's ability to find solutions that are unusual, unique, and have never been found by anyone else (Purwasih, 2019). Students who have creative thinking abilities tend to have a high level of curiosity, see a problem from various perspectives, and produce many new ideas (Nursofah et al., 2018).

Through creative thinking abilities, students are required to be able to understand, master, and solve the problems they are facing (Febrianingsih, 2022). With strong creative abilities, students are not only capable of generating new ideas and exploring new learning materials, but they are also able to apply these creative skills in various learning contexts to produce innovative solutions and alternative perspectives (Yuliarni *et al.*, 2024). Therefore, creative thinking abilities can be understood as students' capacity to construct, develop, and utilize new ideas in order to effectively address and overcome the problems they encounter, both in academic settings and in real-life situations.

Based on the results of observations and interviews with biology teachers at SMA Negeri 7 Kota Bengkulu, it was found that class XII learning in the school still uses the 2013 Curriculum (K13). In the learning process, there are still obstacles to developing students' creative abilities optimally. From student observation data on the Mid-Semester Exam (UTS) scores, 70% of students received incomplete scores, while 30% received complete scores. Students' creative thinking abilities are still classified as low. In addition, the learning model applied is still conventional without much innovation, so it has not been able to accommodate the development of today's student needs. This shows that students have not been fully able to utilize their creative thinking abilities and produce ideas in the learning process. This condition is thought to occur because the learning model applied is less able to stimulate student activity and involvement optimally, so an innovation in learning models is needed that is relevant to current developments in order to accommodate students' creative potential.

One of the efforts to address 21st-century challenges related to students' creative thinking abilities is the implementation of appropriate learning model innovations, as the learning model plays a vital role in directing and enhancing the learning process. A well-selected model can create learning conditions that stimulate exploration, inquiry, and the development of new ideas. One alternative model considered effective in facilitating creative thinking abilities is the 5E learning cycle, whose structured stages—engage, explore, explain, elaborate, and evaluate—provide students with opportunities to build understanding, generate creative ideas, and solve problems through meaningful and student-centered learning activities.

Learning cycle 5E is a cyclical learning process with five phases that are student-centered. The five phases in this learning are engagement, exploration, explanation, elaboration, and evaluation. In this learning model, students are able to improve their creative thinking abilities (Meidiyanti *et al.*, 2021). This 5E learning cycle model was developed to create effective and efficient learning activities in order to train students' creative thinking abilities (Siswadi *et al.*, 2023). In addition, the 5E learning cycle learning model presents cooperation and exchange of information so that students are able to understand concepts in depth through collaboration and can train their creative thinking abilities (Risidiana *et al.*, 2017). The characteristics of the 5E learning cycle can build current knowledge by

actively involving students in the learning process so that students are able to master the competencies that must be achieved in learning (Limbong *et al.*, 2019). This confirms that the 5E learning cycle is a student-centred learning model that is able to encourage cooperation and exchange of information so as to gain insight, where students can create their own ideas, which will then fulfill the competencies to be achieved.

Several previous studies have stated that the 5E learning cycle learning model is effective in enhancing students' creative thinking abilities. This finding is strengthened by the research of Risdiana *et al.* (2017) and Nada *et al.* (2021), which consistently demonstrate that the structured stages of the 5E learning cycle—engage, explore, explain, elaborate, and evaluate—provide meaningful learning experiences that stimulate students to think divergently and generate innovative ideas. The model encourages active participation, inquiry-based exploration, and reflective reasoning, enabling students to develop deeper conceptual understanding and broaden their cognitive flexibility. Therefore, the convergence of these research findings indicates that the 5E learning cycle serves as a comprehensive instructional approach that not only supports but significantly improves students' creative thinking abilities across various learning contexts.

Another technological innovation that is considered capable of improving students' creative thinking abilities is the integration of educational games into the learning process. One of the game-based applications that can be utilized effectively in this context is Nearpod. Nearpod is a web-based interactive learning platform equipped with a variety of engaging features—such as quizzes, collaborative boards, virtual reality experiences, and real-time feedback—that enable teachers to design dynamic lessons and facilitate active student participation. These features allow Nearpod to support interactive, student-centered, and effective learning activities, as it provides opportunities for students to explore concepts, express ideas creatively, and solve problems through engaging digital tasks. In addition, because Nearpod can be accessed anytime and anywhere, the learning process is not limited by space and time constraints, thereby offering greater flexibility and increasing students' motivation to learn (Oktaviani & Nurhamidah, 2023).

Based on the results of the literature review, the researcher identified that although studies related to the effectiveness of the 5E learning cycle model on students' creative thinking abilities have been conducted several times in previous research, none of the existing studies have attempted to integrate the 5E learning cycle with the Nearpod application, specifically within the context of biology learning in Indonesia. This indicates a clear gap in the literature, particularly regarding the utilization of digital learning platforms to enhance the implementation of inquiry-based learning models. Therefore, this study aims to provide a more comprehensive understanding by examining the influence of a Nearpod-based 5E learning cycle model on students' creative thinking abilities, with the expectation that the integration of these two approaches can create a more interactive, engaging, and effective learning environment that supports the development of higher-order thinking skills in biology education.

RESEARCH METHOD

The type of research used in this study is quasi-experimental research. The experimental design used is a non-randomised control group pretest-posttest design, which involves two classes consisting of the experimental class and the control class. The research design can be seen in Table 1.

Table 1. Quasi-Experimental Research Design

| Group | <i>Pre-Test</i> | Treatment | <i>Post-Test</i> |
|-------|-----------------|-----------|------------------|
|-------|-----------------|-----------|------------------|

| | | | |
|------------|----|---|----|
| Experiment | O1 | X | O2 |
| Control | O1 | - | O2 |

(Leedy & Ormrod, 2019)

Description:

O1: A pre-test is given to the experimental class and the control class.

O2: Post-test is given to the experimental class and the control class.

X: Learning using the nearpod-based 5e learning cycle learning model

This research was conducted at SMA Negeri 7 Bengkulu City, from January 2025 until completion. The target population in this study was all students of SMA Negeri 7 Bengkulu City, in class XII. The sample in this study consisted of two classes, namely class XII MIPA 3 as an experimental class of 37 students and class XII MIPA 7 as a control class of 37 students, so that the total sample was 74 students. This sample was selected using a purposive sampling technique, in which the researcher determined the sample based on specific considerations. The test used in this study was a written essay test. In addition, the instruments used included the Learning Implementation Plan (RPP), pre-test and post-test questions, and Student Worksheets (LKPD) developed by the author and documentation. Prior to implementation, all research instruments underwent validity and reliability testing. Content validity was carried out to ensure that the test items and LKPD were appropriate and aligned with the learning material and the indicators of creative thinking to be measured. The content validity process involved expert validators who assessed the relevance, clarity, and alignment of each test item with the curriculum and learning objectives, as well as the appropriateness of the LKPD structure, instructions, and activities. Revisions were made based on validator feedback to improve the quality of the instruments. Based on observations of students' Mid-Semester Exam (UTS) results, approximately 70% of learners had not yet achieved the minimum competency score, while only 30% met the required standard. This indicates that students' creative thinking skills remain relatively low.

In measuring students' creative thinking skills, this study employed four indicators: (1) Fluency, referring to students' ability to generate multiple relevant ideas or answers to a given problem; (2) Flexibility, referring to the ability to produce ideas from various perspectives or categories, demonstrating shifts in approaches when solving problems; (3) Originality, referring to students' ability to produce unique, uncommon, or novel ideas that differ from typical responses; and (4) Elaboration, referring to the ability to develop ideas in detail, including providing explanations, examples, or supporting reasoning to enrich the solution.

The data analysis technique used prerequisite tests, namely the normality test and the homogeneity test. Furthermore, a t-test was conducted to determine whether the proposed hypothesis was accepted or rejected.

RESULTS AND DISCUSSION

After conducting data analysis on the pre-test data, the next step is to conduct data analysis on the students' post-test data. Post-test data analysis was conducted to determine students' creative thinking abilities between the experimental class and the control class through descriptive analysis of post-test data, which can be seen in Table 2.

Table 2. Results of Post-test Descriptive Analysis

| Class | N | Lowest Value | The highest score | Mean |
|------------|----|--------------|-------------------|-------|
| Experiment | 37 | 60 | 95 | 77,70 |

| | | | | |
|---------|----|----|----|-------|
| Control | 37 | 50 | 85 | 66,08 |
|---------|----|----|----|-------|

Based on Table 2, it is known that the post-test results of students' creative thinking abilities in the experimental class have an average value of 77.70. With the highest value of 95 and the lowest of 60. While in the control class, the average value is 66.08, with the highest value of 85 and the lowest of 50. After conducting a descriptive analysis of the pre-test data, the data normality test was then carried out. The results of the pre-test data normality test can be seen in Table 3.

Table 3. Results of the Post-test Normality Test of Students' Creative Thinking Abilities

| Class | Statistic | Df | Sig. |
|-------------|-----------|----|-------|
| Exsperiment | 0,128 | 37 | 0,131 |
| Control | 0,113 | 37 | 0,200 |

Based on Table 3, it is known that the results of the normality test of the post-test value of students' creative thinking abilities in the experimental class obtained a value of 0.131, which means it is greater than the significance value of α (0.05). So it can be concluded that the post-test value of creative thinking abilities in the experimental class is normally distributed.

Based on Table 3, it is also known that the results of the normality test of the post-test value of students' creative thinking ability in the control class obtained a value of 0.200, which means it is greater than the significance value of α (0.05). So it can be concluded that the post-test value of students' critical thinking ability in the control class is normally distributed. After conducting the data normality test, the next step is to test the homogeneity of the post-test data. The results of the post-test data homogeneity test can be seen in Table 4.

Table 4. Results of the Homogeneity Test of Students' Creative Thinking Ability Post-test

| | Levene statistic | Df1 | Df2 | Sig. |
|--------------------------|------------------|-----|-----|-------|
| <i>Based on the mean</i> | 0,157 | 1 | 72 | 0,693 |

Based on the results of the variance test on the post-test data of students' creative thinking ability, a significance value of 0.693 was obtained, which means it is greater than the significance value of α (0.05). So it can be concluded that the post-test data of students' creative thinking ability has homogeneous variance.

After the normality and homogeneity tests of the post-test data, it can be concluded that the data are normal and homogeneous. Thus, a hypothesis test (t-test) can be carried out. The hypothesis test used is the independent sample test, with a significance level of 0.05. The criteria for the hypothesis test are based on the *sig* value. If the significance value < 0.05 , then the hypothesis is rejected; if the significance value > 0.05 , then the hypothesis is accepted. The results of the hypothesis test (t-test) can be seen in Table 5.

Table 5. Results of the Post-test Hypothesis Test of Creative Thinking Ability

| | F | Sig. | t | df | Sig. (2-tailed) |
|------------------------------------|-------|-------|-------|--------|-----------------|
| <i>Equal variances assumed</i> | 0,157 | | 4,919 | 72 | 0,000 |
| <i>Equal variances not assumed</i> | | 0,693 | 4,919 | 71,864 | 0.000 |

Based on Table 5, it is known that the t-test results obtained a value of 0.000, which is smaller than 0.05 (sig. 2-tailed $0.001 < 0.05$). So H_0 is rejected, and H_1 is accepted. This means that there is a significant difference between the post-test scores in the experimental class and the control class. So, it can be concluded that the 5E learning cycle learning model applied to the experimental class has an effect on improving students' creative thinking abilities.

Based on the results of the study, it can be stated that the 5E learning cycle learning model has a significant influence on improving creative thinking abilities, from the results of the t-test it is known that there is an influence between the 5E learning cycle learning model and students' creative thinking abilities, this is based on the results of the t-test obtained a significance value of 0.000 which is smaller than 0.05 (sig. 2-tailed $0.000 < 0.05$). So it can be concluded that there is an influence between the 5E learning cycle learning model and students' creative thinking abilities.

The syntax or steps of the 5E learning cycle can train students' creative thinking abilities because they are seen in stages such as engagement, exploration, explanation, elaboration, and evaluation. The five stages in the 5E learning cycle are able to facilitate students' creative thinking abilities. This is in line with research (Sihombing & Rahmatsyah, 2021), which reveals that the 5E learning cycle is able to encourage the emergence of creative attitudes in students. Based on the results of observations in the research process, it is known that at the engagement stage, students are interested in learning because they are enthusiastic about listening to the phenomena given regarding the mutation material through the Nearpod application, and students express their opinions about the material according to their imagination. Visual and interactive presentations through the application are able to arouse students' curiosity and create a pleasant learning atmosphere. This is in line with research by Yuliarni et al. (2024), which states that the engagement stage is the starting point of activities and fosters students' curiosity. At this engagement stage, the teacher does not immediately tell the correct answer, but rather appreciates all the ideas that emerge so as to foster a sense of security to think freely and fluently, the main characteristic of creative thinking. This is supported by the statement of Dharayanti et al (2022), which states that this engagement stage trains for fluency of thought by pouring out all the ideas that arise from one's mind.

In the next stage, namely exploration, students learn in groups to solve problems in the LKPD together. When exploring problems in the LKPD, students provide open questions and mention various possible solutions or predictions, so that students will produce many ideas or possibilities, and fluency occurs. This is in line with research by Zufahmi & Zuraida (2019), which states that fluency is related to the ability to create as many ideas as possible. At the exploration stage, students can solve problems with various strategies, not just one way, so that it will train students' flexibility of thinking and uniqueness (originality) because students interpret and complete tasks in their own way. This is in line with research by Saputro et al. (2017), which states that the exploration phase can train students' flexibility of thinking through solving problems from various perspectives. Then, students are also able to complete tasks in LKPD in detail together with their group members to train the elaboration phase in students. Thus, the exploration phase can improve students' creative thinking abilities through fluency of thinking, training flexibility in thinking, designing problem-solving steps in detail (elaboration), and uniqueness (originality) (Risdiana *et al.*, 2017).

In the third stage, namely explanation, students are seen to be able to explain the results of finding answers to previous problems. In the explanation phase, students are seen to be making direct observations of the phenomenon so that each student sees, records, and understands individually, so the results of their observations are personal and unique (originality). This is supported by research

by Siswadi *et al* (2023), which states that in the explanation stage, students express concepts that are understood, justify logical thinking, and produce new ideas, thus further strengthening the aspect of originality in creative thinking.

Then, in the elaboration stage, students are seen to be able to link the concepts that the teacher gives with what they learned in the previous stage. At this stage, students learn to add details, organize ideas systematically, and relate them to the real world. This is in line with research by Moningka *et al.* (2024), which states that at this stage, students are able to expand and apply the knowledge they have acquired in different but similar situations. This process strengthens students' ability to process and refine initial ideas into something useful and profound. At this stage, the elaboration aspect is trained, namely, students add ideas by detailing or adding an idea (Firdaus *et al.*, 2021).

Next, the final stage in the 5E learning cycle learning model is evaluation. At this stage, students are able to complete five multiple-choice questions presented through the Nearpod application to measure their creative thinking abilities related to mutation material. The assessment is carried out with a fun approach through the educational game Time to Climb. Students appear enthusiastic and motivated to answer each question quickly and accurately. Because the quiz activities are presented in an enjoyable and interactive format, students tend to be more motivated and less anxious, which creates a positive learning environment that supports creative risk-taking. The instant feedback feature helps students refine their ideas in real time, allowing them to evaluate and adjust their responses during the learning process. This continuous cycle of idea generation, feedback, and revision strengthens deeper cognitive engagement, which ultimately enhances creative thinking. Thus, the quiz-based interaction in Nearpod not only increases student participation but also actively stimulates the components of creativity in a structured yet enjoyable manner. Through this game, students not only test their understanding but also hone their creativity and thinking abilities in a competitive but fun atmosphere. This shows that evaluation does not always have to be conventional, but can be carried out in an innovative and interactive manner to provide a more meaningful learning experience (Vestia *et al.*, 2022).

The advantage of the 5E learning cycle learning model is its opportunities for students to develop their own experiences and knowledge by being actively involved in the teaching and learning process. This is in line with research by Tanfiziyah *et al.* (2021), which states that the 5E learning cycle makes it easier for students to understand a concept taught and to be more active in the learning process. So the 5E learning cycle learning model is one of the right models to use to develop students' creative thinking abilities, with the advantages of the 5E learning cycle and the creative thinking indicators also in line with the 5E learning cycle, so that they can improve the creative thinking abilities possessed by students. This is supported by the opinion of Ilmi *et al* (2019), which states that the 5E learning cycle learning model is able to encourage students to recognise phenomena, investigate them through a series of phases, and systematically compile problem-solving steps. These activities greatly assist students in developing creative thinking abilities.

Learning cycle 5E is a problem-based learning model because students directly face the problems, and then they will look for information or data to solve the problems they face, thus students will think critically and creatively so that existing problems can be solved. This is supported by by Juheti *et al.*, (2019), which states that there is a relationship between problem-solving and creative thinking abilities. As a result, through the creative thinking process, students find various innovative and relevant solution strategies directly in the learning process. Learning the 5E learning cycle is closely related to students' ability to think creatively. Student creativity can be seen in how students predict

the phenomena that will be proven at the exploration stage. Starting from asking, giving ideas, having a deep curiosity, being brave and free to express opinions (Nada *et al.*, 2021). The 5E learning cycle learning model can help students develop their creative thinking abilities by being trained to think at a high level in solving problems. Likewise, in the control class, which also guides students in solving problems, the problems used are less able to develop students' thinking abilities, so that students become accustomed to receiving information from teachers, while students who are accustomed will be less confident in making the right decisions.

CONCLUSION

Based on the results of the study, it can be concluded that the Nearpod-based 5E learning cycle model is effective in improving students' creative abilities. This effectiveness is reflected in the significant increase in students' creative thinking scores after the implementation of the learning model, as well as the higher level of student engagement and participation throughout the learning process. The integration of Nearpod features, such as interactive quizzes, collaborative activities, and multimedia content, supports each phase of the 5E learning cycle (Engage, Explore, Explain, Elaborate, and Evaluate), enabling students to express ideas more freely, generate multiple solutions, and develop originality in their creative products. Thus, the combination of technology-enhanced learning and the 5E approach contributes positively to fostering students' creativity in a more meaningful and student-centered learning environment. These findings also carry important implications for teachers, serving as a basis for understanding the significance of applying the 5E learning cycle to enhance learning quality and inspire the development of innovative, adaptive instructional programs aligned with 21st-century student needs. Future research is recommended to expand the implementation of the Nearpod-based 5E model to other biology topics or different subject areas to determine its broader effectiveness. Additionally, employing mixed-methods approaches—combining quantitative measures with qualitative data such as student interviews, observations, or learning portfolios—could provide deeper insights into how students experience and develop creative thinking skills through this model. This will strengthen the generalizability and depth of understanding regarding the model's impact in diverse educational contexts. This study has some limitations. It was limited to two classes and a single topic, which may affect the generalizability of the results. The short duration of the study and the sample characteristics—students from the same school and grade—also limit the broader applicability of the findings. Additionally, the instruments used may not capture all aspects of students' creative thinking.

BIBLIOGRAPHY

- Dharayanti, Y. P., Sumantri, M., & Widiana, I. (2022). Pengaruh Model Pembelajaran Learning Cycle 5E Berbasis Brainstorming Terhadap Kemampuan Berpikir. *Mimbar PGSD Undiksha*, 1(1). <https://ejournal.undiksha.ac.id/index.php/JJPGSD/index>
- Febrianingsih, F. (2022). Kemampuan Berpikir Kreatif Siswa dalam Memecahkan Masalah Matematis. *Mosharafa: Jurnal Pendidikan Matematika*, 11(1), 119–130. <https://doi.org/https://doi.org/10.31980/mosharafa.v11i1.692>
- Firdaus, A., Asikin, M., & Agoestanto, A. (2021). Kemampuan Berpikir Kreatif pada Model Learning Cycle 5E Ditinjau dari Metakognisi Siswa. *AKSIOMA: Jurnal Matematika Dan Pendidikan Matematika*, 12(3), 382–398. <https://doi.org/https://doi.org/10.26877/aks.v12i3.8462>
- Ilmi, N., Salempa, P., & Side, S. (2019). Penerapan Model Pembelajaran Learning Cycle 5E yang Terintegrasi dengan Metode Problem Solving. *Sainsmat : Jurnal Ilmiah Ilmu Pengetahuan Alam*, 8(2), 36. <https://doi.org/10.35580/sainsmat82107182019>

- Juheti, J., Nur, S. H., & Hindriana, A. F. (2019). Model Pembelajaran Siklus Belajar 5E Untuk Meningkatkan Literasi Sains dan Kreativitas Siswa dalam Memecahkan Masalah. *Edubiologica Jurnal Penelitian Ilmu Dan Pendidikan Biologi*, 6(1), 20. <https://doi.org/10.25134/edubiologica.v6i1.2359>
- Leedy, P. D., & Ormrod, J. E. (2019). *Practical Research : Planning and Design* (12th ed.). Pearson Education.
- Limbong, C., Rohadi, N., & Hamdani, D. (2019). Meningkatkan Motivasi Belajar Dan Penguasaan Konsep Dengan Model Pembelajaran Siklus Belajar Tipe 5E Di Kelas X Ipa 3 Sman 9 Kota Bengkulu. *Jurnal Kumparan Fisika*, 2(1), 33–40. <https://doi.org/10.33369/jkf.2.1.33-40>
- Maullidah, S. N., Madani, M. A., Nabilah, N., Muhammad Ridho Ramadhan Ali, Ikmawati Ikmawati, & Zainuddin Untu. (2024). Analisis Peran Guru dalam Pembelajaran Abad 21 pada Siswa Sekolah Dasar di Kurikulum Merdeka. *Populer: Jurnal Penelitian Mahasiswa*, 3(2), 31–42. <https://doi.org/10.58192/populer.v3i2.2116>
- Meidiyanti, S., Damayanti, E., Syamsudduha, S., & Jamilah, J. (2021). Pengaruh Kemampuan Berpikir Kreatif Peserta Didik Melalui Pembelajaran Model Learning Cycle Engagement Exploration Elaboration Dan Evaluation Disertai Mind Mapping. *Jurnal Pendidikan Biologi*, 12(1), 16. <https://doi.org/10.17977/um052v12i1p16-21>
- Moningka, Y., Aprilia, N., & Isnaeni, B. (2024). *Elaboration of learning cycle 5E model and PJBL based on creative products and fun entrepreneurship through shutterstock application*. 9(3), 6–12. <https://doi.org/https://doi.org/10.29210/023865jppi0005>
- Mursidik, E. M., Samsiyah, N., & Rudyanto, H. E. (2015). Kemampuan Berpikir Kreatif Dalam Memecahkan Masalah Matematika Open-Ended Ditinjau Dari Tingkat Kemampuan Matematika Pada Siswa Sekolah Dasar. *PEDAGOGIA: Journal of Education*, 4(1), 23–33.
- Nada, H. N., Koes, S., & Nida, S. (2021). Pengembangan paket ipa terpadu berbasis learning cycle (LC) 5e untuk meningkatkan kemampuan berpikir kreatif siswa SMP/MTs kelas VII tema pemanasan global. *Jurnal MIPA Dan Pembelajarannya*, 1(3), 231–238. <https://doi.org/10.17977/um067v1i3p231-238>
- Nasir, M. (2018). Influence of Project-Based Learning Model that Aided Matrix Laboratory toward Creative Thinking Skills Viewed from College Student's Science Generic Skills. *Indonesian Journal of Science and Education*, 2(2), 161. <https://doi.org/10.31002/ijose.v2i2.779>
- Nursofah, N., Komala, R., & Rusdi, R. (2018). The Effect of Research Based Learning Model and Creative Thinking Ability on Students Learning Outcomes. *Indonesian Journal of Science and Education*, 2(2), 168. <https://doi.org/10.31002/ijose.v2i2.584>
- Oktaviani, R., & Nurhamidah, D. (2023). Efektivitas Penggunaan Media Pembelajaran Interaktif Nearpod pada Mata Pelajaran Bahasa Indonesia. *Jurnal Didaktika Pendidikan Dasar*, 7(2), 717–726. <https://doi.org/10.26811/didaktika.v7i2.1121>
- Purwasih, R. (2019). Kemampuan Berpikir Kreatif Matematis Siswa Smp Dalam Menyelesaikan Soal Pemecahan Masalah Di Tinjau Dari Adversity Quotient Tipe Climber. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 8(2), 323. <https://doi.org/10.24127/ajpm.v8i2.2118>
- Risdiana, H., Suyatno, S., & Poedjiastuti, S. (2017). Implementasi Model 5E Learning Cycle Untuk Meningkatkan Penguasaan Konsep Dan Kemampuan Berpikir Kreatif Siswa Sma. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 3(2), 367. <https://doi.org/10.26740/jpps.v3n2.p367-375>
- Saputro, E. H., Rahayu, Y. S., & Hidayat, M. T. (2017). Pengembangan Perangkat Pembelajaran Ipa Berbasis 5E Learning Cycle Untuk Melatih Kemampuan Berpikir Kreatif Siswa Smp. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 5(2), 1001. <https://doi.org/10.26740/jpps.v5n2.p1001-1008>
- Satriaman, K. T., Pujani, N. M., & Sarini, P. (2019). Implementasi Pendekatan Student Centered Learning Dalam Pembelajaran Ipa Dan Relevansinya Dengan Hasil Belajar Siswa Kelas Viii

- Smp Negeri 4 Singaraja. *Jurnal Pendidikan Dan Pembelajaran Sains Indonesia (JPPSI)*, 1(1), 12. <https://doi.org/10.23887/jppsi.v1i1.21912>
- Sihombing, E. S. U., & Rahmatsyah, R. (2021). Pengaruh Model Pembelajaran Learning Cycle 5E Dengan Pendekatan Stem (Science, Technology, Engineering, and Mathematic) Terhadap Kemampuan Berpikir Kreatif Siswa Pada Materi Fluida Statis Di Sma Methodist-8 Medan. *Jurnal Ikatan Alumni Fisika*, 7(2), 1. <https://doi.org/10.24114/jiaf.v7i2.15330>
- Siswadi, S., Fuadi, A., & Dharin, A. (2023). Development of Learning Cycle-Based Science Learning Devices to Improve Elementary School Students' Creative Thinking Ability. *Jurnal Penelitian Pendidikan IPA*, 9(4), 2118–2124. <https://doi.org/10.29303/jppipa.v9i4.3335>
- Tanfiziyah, R., Khasanah, M., Riandi, R., & Supriatno, B. (2021). Inovasi Pembelajaran Berbasis Teknologi Informasi: Model Learning Cycle 5E Menggunakan Gather Town pada Materi Protista. *Biodik*, 7(3), 1–10. <https://doi.org/10.22437/bio.v7i3.13096>
- Vestia, E., Djanah, M., Fahmi, F., Handayani, S., & Fazalani, R. (2022). Mengembangkan Kreativitas dan Keaktifan Peserta Didik di Sekolah Melalui Model Pembelajaran Learning Cycle 5E. *Sustainable Jurnal Kajian Mutu Pendidikan*, 5(1), 176–181. <https://doi.org/10.32923/kjmp.v5i1.3043>
- Yuliarni, Machrizal, R., & Harahap, H. S. (2024). Analisis Kemampuan Berpikir Kreatif Dalam Pembelajaran Biologi Pada Siswa Kelas XI SMA Negeri 1 Kampung Rakyat. 12(1), 1273–1284. <https://doi.org/https://e-journal.undikma.ac.id/index.php/bioscientist> 1275
- Zufahmi, & Zuraida. (2019). Pengembangan Perangkat Pembelajaran Ipa Model Learning Cycle 5E Untuk Melatihkan Kemampuan Berpikir Kreatif Siswa Smp Negeri 2 Kembang Tanjong. *Jurnal Sains Riset*, 9(2), 39–48. <https://doi.org/10.47647/jsr.v9i2.113>