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Implementation of Learning Cycle's Model Based on SCL (Student-Centered Learning) to Improve Students' Creative Thinking Ability in Learning Evaluation Subjects at Universitas Almuslim

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ABSTRACT

The main problems in conducting this research include 1) The ability of the students to analyze the question was less creative in answering; 2) the students learning activities were still low; 3) the students' interest and response were still low in the instruction. Those problems that had an impact on the instruction were not a success as individual and classical. Therefore, we need an innovative instruction model in enhancing the learning and teaching process, such as; SCL-based Learning Cycle model. This research was Classroom Action Research (CAR) which consisted of planning, acting, observing, and reflecting. This research was the students in the fifth semester in the Physics Education Department that consisted of 21 students. Based on the research results, it was concluded that the implementation of Learning Cycle 5E through SCL-based had improved students' creative thinking skills, lecturer's and students' activities in the teaching and learning process.

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I. Introduction

In improving the quality of education, teachers and schools have a significant role in determining the quality of education. Increasing the quality of education is generally seen from the success of teachers and schools in producing high-achieving graduates. In this case, the teacher has made many changes in schools' implementation, especially in designing learning based on the revised 2013 curriculum. Besides, teachers are active in improving work professionalism through various activities such as increasing teacher competence, certification, MGMP activities, workshops, and other activities to support their professionalism [1], [2]. This is following Government Regulation Number 19 of 2005, which mandates that instructors possess a high degree of competence in the four competencies of an educator, namely pedagogical, personal, professional, and social competencies [1]. However, these various efforts have not fully yielded maximum results.

At a lower level in maximizing teacher quality, universities must produce teacher candidates with qualified competencies to become competent and professional teachers in the work environment later [3]. In this case, lecturers are obliged to improve the competence of their students, one of which is through lecturing activities in class. Students can obtain the best possible course material in lectures to enhance their quality as competent teacher candidates.

Many children are challenged with challenges that require higher-order thinking skills (HOTS) to answer at a higher level of education than at the school level. Critical thinking skills, creative thinking skills, communication skills, and collaboration are HOTS [4]. In this case, many students have not used higher-order thinking skills in solving problems encountered in lectures. This is because students are still accustomed to solving problems given by the lecturer using only low thinking skills. These student habits cause students to be less creative in analyzing

questions and providing answers to the issues presented by the lecturer.

On the other hand, improper class management also causes students to be passive in lectures, resulting in low students' creative thinking skills. Lectures are conducted monotone and are still teacher-centered. Students tend to be more passive in learning in class management, resulting in low student interest and learning activities in education. For this reason, it is necessary to apply a classroom management method that can increase student learning activities so that students are more experienced in learning independently through teacher direction and guidance. Learning in question is learning that is student-centered learning (SCL).

According to Lee and Hannafin, student-centered learning (SCL) defines students as the proprietors of their learning [5]. Furthermore, Kaput explains that centered learning effectively increases student activity in learning. SCL effectively creates a learning environment where students feel ownership of their learning [6]. Student-centered learning provides students with more learning opportunities and reconstructs the information dynamically [5].

In this study, researchers tried to apply the 5E Learning Cycle model based on Student-Centered Learning (SCL) to develop more innovative learning. The Student-Centered Learning (SCL) 5E Learning Cycle model can provide opportunities for students to build knowledge independently with teacher guidance and direction through several stages such as engagement, exploration, explanation, elaboration, and evaluation [7], [8]. This activity hopes that it can solve developing education in a better direction to improve the quality of Indonesian education in general.

II. Theory

Learning Cycle

The Learning Cycle Model is a set of phases designed to support students in mastering their skills. The first three aspects of the learning cycle are exploration, introduction, and application of concepts. Before the exploration stage, the engagement stage is introduced. At the end of the cycle, the evaluation phase is introduced [9]. In this model, explaining and elaborating are called the stage of concept introduction and concept application. Therefore, the 5-phase learning cycle is often called the 5E learning cycle for engagement, exploration, explanation, elaboration, and evaluation [7]–[11]. The engagement stage aims to prepare students to take the next step by exploring their actual knowledge and ideas and discovering potential misunderstandings in prior learning.

The engagement phase is the initial phase. At this early stage, it allows students to be involved in learning tasks [8]. We can determine students' understanding of this engagement phase as their initial knowledge [12]. Students mentally focus on a problem, situation, or event. The activities of this phase must be linked to the learning activities of the previous and present meetings [11]. This phase can also be used to identify student misconceptions. This engagement phase can be shown in demonstrations, questions, graphics, events, or phenomena [12].

Second, students form small groups of 2-4 students during the exploration stage. They can work in small groups without learning directly from the teacher [8], [10]. Students are given direct experience through group learning before explaining the subject matter. This can be done by observing, questioning, investigating, testing predictions, hypothesizing, and communicating among group members [12]. Students can explore their understanding of the material being studied [11], [13]. This phase is an opportunity for students to test their hypotheses or predictions, discuss them with a group of friends, and make decisions [14].

The next stage is the explanation stage. Students must explain a concept with their sentences/thoughts [7], [12]. Teachers also asked for clarification on the evidence and explanations of students. Besides, at this stage, the teachers and students hear each other explain the concept being studied. With this discussion, the teacher offers a definition and explanation of the concepts discussed by the preceding students [9].

The elaboration phase is the fourth phase of the learning cycle model. In elaboration, students apply the concepts and skills learned in new situations or contexts. This stage can also be carried out through additional investigative activities such as giving practice questions to students [12]. As a result, pupils will learn more effectively by applying what they have learned in new settings. Student learning motivation can indeed stimulate increased student learning outcomes if the teacher correctly designs this stage [8], [12], [15].

The last stage is evaluation. At this stage, the teacher is tasked with observing students' knowledge and skills in applying concepts and changing students' thinking [8]. At this stage, too, the teacher can give tests to students in the form of homework, quizzes, exams, or assignments [12].

Student-Centered Learning (SCL)

Student-centered learning is one of the references for developing a learning approach in the classroom [14]. In this case, the lecturer is more of a guide and director. Students are allowed to study independently through lecturer guidance and guidance. SCL places students as active and independent subjects/learners, fully responsible for their learning. This student-centered learning process will make it possible for students, in turn, to gain a profound understanding and improve the quality of their knowledge [16].

Students should be encouraged to motivate themselves and work towards the desired competence under the SCL learning strategy. This can be done by increasing the time for discussion to be able and brave to express their opinions. The hope is that by implementing the SCL learning system, students can participate actively, have critical power, analyze, and solve problems [16].

The role of the teacher is not an instructor but a facilitator. Teachers help guide and manage students'

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activities and direct their learning [14]. Students become active participants in the learning project. Perry found that when they have high academic controls and take appropriate steps to prevent failures, they are most successful in college completion. This is because students are independently solve learning problems [5].

Creative Thinking Skills

Learning activities carried out are closely related to a person's thinking ability. Thinking is an activity that uses reason to consider and decide something. One type of thinking ability is thinking creatively, which is problem-solving activities that require someone's creativity. The ability to think creatively is one of the ability to build ideas based on fluency, flexibility, elaboration, sensitivity, and originality of the concept [17].

Guilford's theory, Torrance's theory, Amabile's theory, and others are some of the ideas that underpin the theory of creative thinking abilities. Guilford, in 1967, that creative thinking is linked to divergent thinking, which includes fluency, elaboration, flexibility, and originality [18]. The test proposed by Guilford emphasizes the various answers expressed by the research sample relating to one problem posed to the sample. The answers expressed by the research sample were assessed in terms of fluency, elaboration, flexibility, and originality [18], [19].

Torrance's theory of creative thinking ability is better known as the Torrance Tests of Creative Thinking (TTCT). In theory, Torrance relates creativity to moral commitment, self-confidence, the ability to see problems from different perspectives, and abilities to find different solutions [20]. The TTCT is a theory of the results of the adoption of Guilford's theory. In his theory, Torrance developed four aspects of creative thinking skills similar to Guilford's theory, namely fluency, originality, elaboration, and flexibility [21].

Evans in 1991 suggests that creative thinking is a mental activity to make continuous (continuous) connections so that the "right" combination is found or until someone gives up [22]. Creativity occurs through the similarities of a concept or analogical thinking. Collection of ideas to form new ideas. In other words, creative thinking is a mental activity that requires someone to find a combination of ideas that did not exist before to create a new idea [17]. Meanwhile, Amabile in 1983 suggests, "Creativity can be considered as the quality of products or responses judged to be creative by appropriate observers" [23]. Amabile argues that identifying, definition, and problem-solving are essential aspects of creative thinking [24].

A person's success in creative thinking can be seen from the indicators of creative thinking aspects. According to Guilford and Torrance, there are four characteristics of creative thinking, namely 1) original thinking ability (originality); 2) the ability to think fluently (fluency); 3) ability to think flexibly (flexibility); and 4) the ability to think in detail (elaboration) [17], [21]. Evans in 1991 suggests that creative abilities can be seen from 5 kinds of creative behavior: fluency, flexibility, detail, sensitivity, and authenticity [25]. Fluency can be seen from the ability to develop many ideas, answers, problem-solving, or questions. Meanwhile, the ability to generate various ideas, answers, or questions, see problems from different points of view, look for many other alternatives, and change the approach can determine a person's flexibility in thinking.

Furthermore, detail is the ability to develop an idea, add or detail in detail an object, idea, or situation. The fourth aspect is sensitivity, as seen from a person's ability to capture and produce problems in response to a situation. Finally, authenticity, namely the ability to express one's own opinion in response to a situation at hand.

In previous research, researchers have measured students' creative thinking abilities with aspects that refer to Guilford and Torrance's theory [17]. In this study, researchers will examine students' creative thinking abilities with the number of indicators measured as many as five indicators, namely aspects of fluency, flexibility, elaboration, sensitivity, and authenticity, such as the theory presented by Evans in 1991.

III. Method

This research uses a qualitative approach because the researcher wants to obtain in-depth and natural data about students' steps in solving the questions. According to Moleong [26] states that "(1) humans as instruments, (2) data are analysed inductively, (3) descriptive research results, (4) problem boundaries and (5) special criteria for data validity". Qualitative research will produce descriptive data in written or spoken words and the observed behavior of a person.

This type of research is classroom action research conducted through research procedures based on John Elliot's principles [27]. In John Elliot's model, each cycle may consist of several actions, namely between 2-5 actions. Meanwhile, each action may consist of several steps, which are realized in teaching and learning activities. In practice, in the field, every subject usually cannot be completed in one step. Still, it will be resolved in several ways, which is why John Elliot developed a different model of CAR, which is schematically different from other models (see Figure 1).

This research was conducted at Universitas Almuslim in the fifth-semester Physics Education Study Program students who took the learning evaluation course, namely 21 students. The data collection instruments used in this study were lecture contracts, RPS, SAP, LKM, test questions, lecturer observation sheets, student observation sheets, and response questionnaires. Methods of data collection are done through tests, observation, and questionnaires. The data that has been collected is then analyzed using percentage statistics. For data on students' creative thinking abilities they were analyzed by looking at their level of completeness in learning. According to Trianto and Ibnu [28], determine student learning completeness (individually) can be calculated using the equation (1).

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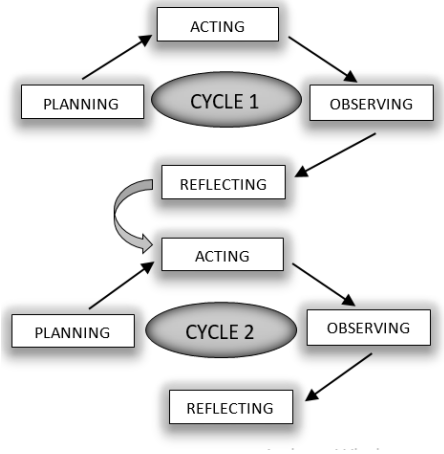

Figure 1. Classroom Action Research (CAR) design by John Elliot

Based on the instructions for implementing the teaching and learning process, a student can be complete to get 65%. At the same time, classical completeness is if the absorption reaches 85%. Equation (2) is used to analyze classical completeness [28]. Furthermore, the data on the activities of lecturers and students in each assessment component was analyzed using equation (3) [29]. Meanwhile, it was analyzed to find out student responses by presenting the answers to the questionnaire given to students using the percentage technique in equation (4) proposed by Sudijono [29].

The criteria for assessing the activities of teachers, lecturers and students as well as student responses to the use of the SCL-based 5E Learning Cycle model are: Very good for 90% < P ≤ 100%, Good for 80% < P ≤ 90%, Sufficient for 70% < P ≤ 80%, Less for 60% < P ≤ 70%, and Very less for 0% < P ≤ 60% [29].

$$\text{Completeness of study} = \frac{\text{the number of scores obtained}}{\text{total score}} x100\% \quad (1)$$

$$\text{Absorption} = \frac{\text{the number of students who completed}}{\text{the total number of students}} x100\% \quad (2)$$

$$P = \frac{\text{Score Obtained}}{\text{Total Score}} x100\% \quad (3)$$

$$P = \frac{f}{N} x100\% \quad (4)$$

IV. Results and Discussion

Analysis of Students' Creative Thinking Ability

Based on data analysis, the changes in students' creative thinking abilities in each cycle can be seen. The change in creative thinking skills shows an increase in lectures with the SCL-based Learning Cycle learning model. The difference in students' creative thinking abilities in the first and second cycles can be seen in Table 1.

Table 1. Increasing creative thinking skills in each cycle

No.	Cycle	Complete	Not Complete	Complete Percentage
1	I	11	10	52%
2	II	19	2	90%

Based on Table 1, it can be seen that the implementation of lectures by applying the SCL-based Learning Cycle learning model can improve students' creative thinking skills. However, there were only 11 students who completed the study in the first cycle, and the remaining ten students did not complete the study. These data show that lectures by applying the SCL-based Learning Cycle model have been able to complete students in lectures individually. Still, classically, it has not been successful. In this case, there are still many obstacles to make improvements in the next cycle.

In the second cycle, the level of individual learning completeness has increased with the number of students who complete as many as 19 students and only two who do not. Classical completeness is the completeness seen from the number of students who have completed learning in a class. A class is classically complete if more than 85% of students complete the study in the class. For example, students' creative thinking skills in the second cycle showed that 19 completed their studies. In contrast, only two had not finished their creative thinking skills. So, it can be said that the implementation of learning by applying the SCL-based Learning Cycle learning model has been successful both individually and classically.

From the analysis of the test results per indicator of creative thinking ability, it was found that classically, students' creative thinking ability had increased from cycle I to cycle II. More clearly, the percentage level of student learning completeness per indicator of creative thinking ability can be seen in Table 2.

Table 2 shows that in cycle I individually, students have completed learning in each indicator. Still, classically it cannot be considered complete. Furthermore, based on cycle II data, it was found that the level of student learning completeness increased in each indicator of the ability to think creatively. This can be seen from the high percentage of students who complete learning on each indicator of creative thinking abilities. The percentage obtained by the

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indicator is ≥ 85%. Thus, students' creative thinking skills are complete, both individually and classically.

Table 2. Percentage of completeness level of learning per indicator of creative thinking skills

No.	Indicator of Creative thinking skills	Cycle I (%)	Cycle II (%)	Enhancement (%)
1	Fluency	57	95	38
2	Flexibility	52	90	38
3	Elaboration	38	86	48
4	Sensitivity	42	86	44
5	Originality	42	90	48

Analysis of Lecturer and Student Activities

In addition to the ability to think creatively, the activities of lecturers and students during lectures by applying the SCL-based Learning Cycle 5E learning model also increased. So that the lecture process runs as expected, which can increase teaching and learning activities. The increase in the activities of lecturers and students in lectures can be seen in Table 3.

Based on the data analysis in Table 3, it can be seen that lecturer activity at each meeting from the first cycle to the second cycle has increased. For example, for action I in the first cycle, lecturer lecture activity was only 61%, then increased to 73% at action II. For the first action in the implementation of the second cycle, lecturer activity reached 86%, then increased to 96% at the second action. So, the increase in lecturer activity from cycle I to cycle II is 35%.

Like lecturer activities, student activities during lectures by applying the SCL-based Learning Cycle model have also increased. For the first action in the first cycle, student activity in lectures was only 57%, then increased to 77% at the second action. For the first action in the second cycle, student activity reached 84%, then increased to 96% at the second action. So, the increase in student activity from the first cycle to the second cycle was 39%.

Student Response Analysis

In addition to increasing the ability to think creatively and the activities of lecturers and students, the application of SCL-based Learning Cycle learning in lectures can provide positive student responses to Lectures. This can be seen from the number of students who stated that they were very happy and happy with each of the questions on the student response sheet. Student responses to the implementation of lectures by applying the SCL-based Learning Cycle model were analyzed using descriptive statistics. Retrieval of student response data to the SCL-based Learning Cycle model using student response questionnaires. The general description of student responses by applying the SCL-based Learning Cycle model is summarised in Figure 2.

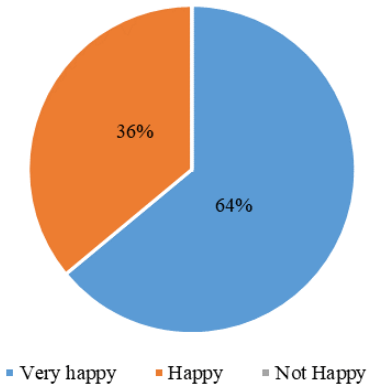

Figure 2. Diagram of the percentage of student responses to SCL-based learning cycle

The diagram in Figure 2 shows that student responses to lectures with the SCL-based Learning Cycle model obtained a positive response. This can be seen from the number of students who gave positive responses to each of the statements in the student response questionnaire. Among other things, 64% of students said they were very happy implementing the SCL-based Learning Cycle model. The rest, 36% of the total number of students who said they were happy with the conducted lectures. Thus, it can be ignored that implementing learning using the SCL-based Learning Cycle learning model can increase student interest and motivation to learn. Besides that, the learning atmosphere becomes more enjoyable.

This research was conducted to determine students' creative thinking skills, lecturer and student activities, and responses after applying the SCL-based Learning Cycle model in learning evaluation courses. If there are still obstacles during lecture activities, the researcher must improve the next cycle [28]. If lectures using the SCL-based Learning Cycle model can improve student learning outcomes, the learning has been successfully carried out. The increase in students' creative thinking abilities in lectures proves that using the SCL-based Learning Cycle model is very effective.

Table 3. Percentage of lecturer and student activities in lectures

Activities	Cycle I		Cycle II		Enhancement
	Action I	Action II	Action I	Action II	
Lecturer	61%	73 %	86 %	96 %	35 %
Students	57 %	77 %	84 %	96 %	39 %

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Learning activities carried out from the first cycle to the second cycle also increased. This can be seen both from lecturer activities and from student activities, namely in Table 3. In this case, using SCL-based learning methods can improve student learning activities. This is because in lectures with the SCL-based Learning Cycle 5E model, students are more active in the lecture process. In contrast, lecturers' lecturers' duties guide and educate, not just teaching material or concepts to students. This is in line with the research results from Putra *et al.* [8], which showed an increase in learning activities in terms of lecturers and students in each cycle compared to the initial conditions when implementing the Learning Cycle in learning. Besides, in student-centered learning (SCL), students will be more critical in shaping their knowledge through various learning activities to shape their knowledge [5].

The vital point of student-centered learning is that students become wiser in carrying out learning activities. Therefore, every activity or activity carried out by students is used to form knowledge [6]. In this case, knowledge is formed following the 5E Learning Cycle learning flow. One of the essential stages in the learning cycle is where students are taught to assess the work of themselves and their peers by asking constructive critical questions, namely, through the explain stage [8]. In addition, the theoretical and practical skills that will be learned and implemented are given numerous opportunities [6].

Learning using a suitable method can increase the effectiveness of the learning system itself. Automatically, learning becomes more meaningful and enjoyable for students. This can be seen from the student's response to learning using the SCL-based Learning Cycle 5E learning model. Student response to SCL-based Learning Cycle 5E is very good. This can be seen in Figure 2, which shows the percentage of student responses to the statements in the student response questionnaire.

Furthermore, a good form of student response can also be seen during the lecture process. This can be seen from the high interest and motivation to learn during the lecture. Besides, students also seemed very enthusiastic in expressing their opinions during the presentation and the accountability of group performance. Data from the research results of Astrodjojo [11] also show the same thing. In their research, about 50% of students stated that they strongly agreed with the learning Cycle model's implementation, 49% answered agreed. Only 1% answered "disagreed" with some of the question items in the response questionnaire.

V. Conclusion

Based on the analysis and discussion results stated previously, it can be generally concluded: (1) The implementation of the SCL-based Learning Cycle model can improve students' creative thinking skills. This can be seen from the increase in students' creative thinking abilities from 52% in the first cycle to 90% in the second cycle. (2) The implementation of the SCL-based Learning Cycle model can increase the activities of lecturers and students in lectures. This can be seen from the increase in the activities of lecturers and students in each cycle. For example, the rise in lecturer and student activities reached 96% at the second meeting of the second cycle, namely an increase of 35% for lecturer activities and 39% for student activities. (3) Implementing the SCL-based Learning Cycle model can describe a positive response from students to the ongoing lectures. In this case, 64% of students said they were very happy with their learning.

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References

[1] N. S. Permana, "Peningkatan Mutu Tenaga Pendidik dengan Kompetensi dan Sertifikasi Guru [Improving the Quality of Educators with Teacher Competence and Certification]," *Stud. Didakt.*, vol. 11, no. 01, pp. 1-8., 2017.

[2] S. Makhmudah, "Upaya Memperbaiki Kualitas Guru dengan Memaksimalkan Terpenuhinya Kompetensi Kepribadian dan Profesionalisme Guru [Efforts to Improve Teacher Quality by Maximizing the Fulfillment of Personal Competence and Teacher Professionalism]," *J. Stud. Islam*, vol. 11, no. 1, pp. 80–103, 2016.

[3] L. Leonard, "Kompetensi Tenaga Pendidik di Indonesia: Analisis Dampak Rendahnya Kualitas SDM Guru dan Solusi Perbaikannya [The Competence of Educators in Indonesia: Analysis of the Impact of the Low Quality of Teacher Human Resources and Solutions for Its Improvement]," *Form. J. Ilm. Pendidik. MIPA*, vol. 5, no. 3, pp. 192–201, Feb. 2016, doi: 10.30998/formatif.v5i3.643.

[4] S. R. Yuliati and I. Lestari, "Higher-Order Thinking Skills (HOTS) Analysis of Students in Solving HOTS Question in Higher Education," *Perspekt. Ilmu Pendidik.*, vol. 32, no. 2, pp. 181–188, Oct. 2018, doi: 10.21009/PIP.322.10.

[5] E. Lee and M. J. Hannafin, "A Design Framework for Enhancing Engagement in Student-Centered Learning: Own It, Learn It, and Share It," *Educ. Technol. Res. Dev.*, vol. 64, no. 4, pp. 707–734, Aug. 2016, doi: 10.1007/s11423-015-9422-5.

[6] K. Kaput, "Evidence for Student-Centered Learning." education evolving, 2018, [Online]. Available: https://files.eric.ed.gov/fulltext/ED581111.pdf.

[7] D. Astriani and N. N. Istiqomah, "Model Pembelajaran Learning Cycle 5E: Mengaktifkan Siswa pada Materi Suhu dan Perubahannya [Learning Cycle 5E Model: Enabling Students on Material Temperature and Its Changes]," *J. Penelit. Pendidik. IPA*, vol. 1, no. 2, pp. 71–75, Nov. 2017, doi: 10.26740/jppipa.v1n2.p71-75.

[8] F. Putra, I. Y. N. Kholifah, B. Subali, and A. Rusilowati, "5E-Learning Cycle Strategy: Increasing Conceptual Understanding and Learning Motivation," *J. Ilm. Pendidik. Fis. Al-Biruni*, vol. 7, no. 2, pp. 171–181, Oct. 2018, doi: 10.24042/jipfalbiruni.v7i2.2898.

[9] D. F. Susilaningrum, S. Santosa, and J. Ariyanto, "Comparative Study Between the Application of Learning

p-ISSN: 2621-3761
e-ISSN: 2621-2889

Cycle 5E and Discovery Learning Models to the Science Process Skill and Cognitive Outcomes in Student Class X SMA Negeri 3 Boyolali," *Proceeding Biol. Educ. Conf.*, vol. 14, no. 1, pp. 331–339, 2017.
[10] R. Runisah, T. Herman, and J. A. Dahlan, "Using the 5E Learning Cycle with Metacognitive Technique to Enhance Students' Mathematical Critical Thinking Skills," *Int. J. Emerg. Math. Educ.*, vol. 1, no. 1, pp. 87–98, Feb. 2017, doi: 10.12928/ijeme.v1i1.5698.
[11] D. R. Astrodjojo, "The Development of Teaching Materials Using Learning Cycle 5E to Increase Critical Thinking Skills and Student's Learning Outcome of High School Students on the Subject of Reaction Rate," *JPPS (Jurnal Penelit. Pendidik. Sains)*, vol. 8, no. 1, pp. 1564–1569, 2018, doi: 10.26740/jpps.v8n1.p%25p.
[12] D. Muliyati, Herga Marizka, and F. Bakri, "E-Learning Using Wordpress on Physics Materials with the 5E Learning Cycle Strategy," *J. Penelit. Pengemb. Pendidik. Fis.*, vol. 5, no. 2, pp. 101–112, Oct. 2019, doi: 10.21009/1.05205.
[13] M. Wena, *Strategi Pembelajaran Inovatif Kontemporer Suatu Tinjauan Konseptual Operasional [Contemporary Innovative Learning Strategies An Operational Conceptual Review]*. Jakarta: Bumi Aksara, 2009.
[14] I. Emaliana, "Teacher-centered or Student-centered Learning Approach to Promote Learning?," *J. Sos. Hum.*, vol. 10, no. 2, pp. 59–70, Nov. 2017, doi: 10.12962/j24433527.v10i2.2161.
[15] R. Ms., T. Herman, and J. A. Dahlan, "The Enhancement of Students' Critical Thinking Skills in Mathematics through The 5E Learning Cycle with Metacognitive Technique," 2017, doi: 10.2991/icmsed-16.2017.23.
[16] A. Ardian and S. Munadi, "Pengaruh Strategi Pembelajaran Student-Centered Learning dan Kemampuan Spasial terhadap Kreativitas Mahasiswa [Effect of Student-Centered Learning Strategy and Spatial Ability on Student Creativity]," *J. Pendidik. Teknol. dan Kejuru.*, vol. 22, no. 4, pp. 454–466, Jan. 2015, doi: 10.21831/jptk.v22i4.7843.
[17] Fatimah, "Upaya Meningkatkan Kemampuan Berpikir Kreatif Siswa SMA Negeri 2 Bireuen pada Materi Kalor melalui Penerapan Model Pembelajaran Open-Ended Problem (Masalah Terbuka) [Efforts to Improve Creative Thinking Skills for Students of SMA Negeri 2 Bireuen on Heat Materials through the Application of the Open-Ended Problem Learning Model]," *J. Pendidik. Almuslim*, vol. 5, no. 2, pp. 85–90, 2017.
[18] M. M. Trianggono, "Analisis Kausalitas Pemahaman Konsep dengan Kemampuan Berpikir Kreatif Siswa pada Pemecahan Masalah Fisika [Causality Analysis of Concept Understanding with Students' Creative Thinking Ability in Physics Problem Solving]," *J. Pendidik. Fis. dan Keilmuan*, vol. 3, no. 1, pp. 1–12, Apr. 2017, doi: 10.25273/jpfk.v3i1.874.
[19] M. Nuswowati, E. Susilaningsih, R. Ramlawati, and S. Kadarwati, "Implementation of Problem-Based Learning with Green Chemistry Vision to Improve Creative Thinking Skill and Students' Creative Actions," *J. Pendidik. IPA Indones.*, vol. 6, no. 2, pp. 221–228, Oct. 2017, doi: 10.15294/jpii.v6i2.9467.
[20] S. Ndiung, N. Dantes, I. M. Ardana, and A. A. I. N. Marhaeni, "Treffinger Creative Learning Model with RME Principles on Creative Thinking Skill by Considering Numerical Ability," *Int. J. Instr.*, vol. 12, no. 3, pp. 731–744, Jul. 2019, doi: 10.29333/iji.2019.12344a.
[21] W. M. Bart, B. Hokanson, and I. Can, "An Investigation of the Factor Structure of the Torrance Tests of Creative Thinking," *Educ. Sci. Theory Pract.*, vol. 17, no. 2, pp. 515–528, 2017, doi: 10.12738/estp.2017.2.0051.
[22] P. R. Nasution, E. Surya, and E. Syahputra, "Perbedaan Peningkatan Kemampuan Berpikir Kreatif Matematis dan Kemandirian Belajar Siswa pada Pembelajaran Berbasis Masalah dan Pembelajaran Konvensional di SMPN 4 Padangsidimpuan [Differences in Improving Mathematical Creative Thinking Ability and Independent Learning of Students in Problem-Based Learning and Conventional Learning at SMPN 4 Padangsidimpuan]." *Parad. J. Pendidik. Mat.*, vol. 9, no. 1, p. 106, 2016, doi: 10.24114/paradikma.v8i3.3360.
[23] W. O. L. Arisanti, W. Sopandi, and A. Widodo, "Analisis Penguasaan Konsep dan Keterampilan Berpikir Kreatif Siswa SD Melalui Project Based Learning [Analysis of Concept Mastery and Creative Thinking Skills of Elementary School Students Through Project Based Learning]," *EduHumaniora | J. Pendidik. Dasar Kampus Cibiru*, vol. 8, no. 1, pp. 82–95, Feb. 2017, doi: 10.17509/eh.v8i1.5125.
[24] S. Mahanal and S. Zubaidah, "Model Pembelajaran RICOSRE yang Berpotensi Memberdayakan Keterampilan Berpikir Kreatif [RICOSRE Learning Model Potentially Empowering Creative Thinking Skills]," *J. Pendidik. Teor. Penelitian, dan Pengemb.*, vol. 2, no. 5, pp. 676–685, 2017, doi: 10.17977/jptpp.v2i5.9180.
[25] N. Ratnaningsih, "The Analysis of Mathematical Creative Thinking Skills and Self-Efficacy of High Students Built Through Implementation of Problem Based Learning and Discovery Learning," *JPMI (Jurnal Pendidik. Mat. Indones.*, vol. 2, no. 2, pp. 42–45, Oct. 2017, doi: 10.26737/jpmi.v2i2.219.
[26] L. J. Moleong, *Metodologi Penelitian Kualitatif [Qualitative Research Methodology]*, Ed. Revisi. Bandung: Remaja Rosdakarya, 2007.
[27] A. Suharsimi, *Prosedur Penelitian: Suatu Pendekatan Praktik [Research Procedure: A Practical Approach]*, Ed. Revisi. Jakarta: Rineka Cipta, 2006.
[28] I. B. Trianto and B. Ibnu, *Mendesain Model Pembelajaran Inovatif, Progresif, dan Kontekstual [Designing Innovative, Progressive, and Contextual Learning Models]*. Jakarta: Prenadamedia Group, 2014.
[29] E. Kusumawati and R. A. Irwanto, "Penerapan Metode Pembelajaran Drill untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa Kelas VIII SMP [Application of Drill Learning Method to Improve Mathematical Problem Solving Ability of Class VIII Junior High School Students]," *EDU-MAT J. Pendidik. Mat.*, vol. 4, no. 1, pp. 49–57, Apr. 2016, doi: 10.20527/edumat.v4i1.2289.

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