

Research Trends in Creative Thinking Skills in the Journal of Biology Education in Indonesia

Syamsurizal^{1*}, Yogi Valfa², Lufri¹

¹ Biology Education, Padang State University, Padang, Indonesia.

Received: May 8, 2023

Revised: July 14, 2023

Accepted: November 25, 2023

Published: November 30, 2023

Corresponding Author:

Syamsurizal

syamunp@fmipa.unp.ac.id

DOI: [10.29303/jppipa.v9i11.4048](https://doi.org/10.29303/jppipa.v9i11.4048)

© 2023 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: This research aims to conduct content analysis of various articles about creative thinking skills in Indonesian biology education journals. This research method is content analysis using the document scanning method which is used as a research method. In this research, the articles analyzed were downloaded from the Journal of Biology Education in Indonesia website. This study adheres to the principle of content analysis, which focuses on findings from various studies published in scientific journals in Indonesia. The results of this study reveal that in the last 5 years, the number of publications regarding creative thinking skills has increased. Among all the research obtained, quantitative research was the most dominant. Furthermore, class X high school students and environmental pollution materials are the subjects and materials most researched. The problem-based learning model is the treatment most often used as a treatment in looking at creative thinking skills. Test instruments and t-tests are the most commonly used instruments and data analysis methods. From the results of this study, it can be concluded that research on creative thinking skills in biology journals in Indonesia has increased.

Keywords: Creative thinking; Journal of biology education

Introduction

21st-century education is currently facing the global challenge of preparing a generation with quality human resources. This challenge certainly requires the education sector to produce graduates who have competence. Quality graduates must of course have the competencies needed in the 21st century. There are 4 competencies needed in 21st-century education today, namely 4C, communication, collaboration, critical thinking, and creativity (Akpur, 2020; Khairunnisa et al., 2022; Lavi et al., 2021; Nazifah & Asrizal, 2022; Ramdani et al., 2019; RESouRCE & GuidE, 2008)

Creativity, or what is known as the ability to think creatively (Nela & Supriatna, 2021), is an ability where students can create appropriate innovations based on data, information, and new elements or data that is already available (Elizabeth & Sigahitong, 2018). Creative thinking is an ability needed by students to become individuals who can solve problems and generate a new understanding of a problem (Tengku,

2022). Andrini (2016), Handayani et al. (2021), and Maharani et al. (2015) also said that creative thinking skills are needed by individuals to solve the problems they face. The importance of creative thinking skills in students requires various research regarding the development of creative thinking skills in learning, especially biology learning.

Based on this explanation, developing creative thinking skills in students is one of the important skills to develop (Ismunandar et al., 2020). The ability to think creatively makes it easier for students to apply their abilities to create ideas, questions, hypotheses, and conduct experiments with various alternatives to solve problems (Hwang et al., 2014). By having creative thinking skills, students can solve several complex problems (Birgili, 2015; Permata et al., 2022)

In contrast to the urgency of creative thinking skills, several studies report that Indonesian students have low creative thinking skills. A study from Tumurun et al. (2016) reports that students' ability to think creatively, especially in science learning in Sumedang Regency, is

How to Cite:

Syamsurizal, Valfa, Y., & Lufri. (2023). Research Trends in Creative Thinking Skills in the Journal of Biology Education in Indonesia. *Jurnal Penelitian Pendidikan IPA*, 9(11), 1094–1101. <https://doi.org/10.29303/jppipa.v9i11.4048>

less prominent. In line with this research, Lisliana et al. (2012) reported data on research conducted regarding students' creative thinking skills, the result was that only 19.23% had creative thinking skills, this problem was caused by the lack of creative thinking skills during the learning process trained. Furthermore, research reports (Astuti, 2017) state that the critical thinking skills of Kudus 1 High School students are still relatively low.

In Indonesia, many researchers have conducted studies on the level of students' creative thinking skills, especially in biology learning. Several studies focus on whether or not there is an influence of a learning model on students' creative thinking abilities (Sukmawijaya et al., 2019; Yuliani et al., 2017). There is also research that discusses creative thinking skills with learning outcomes (Manurung et al., 2020; Siang et al., 2020; Wahyuni & Kurniawan, 2018). Furthermore, there are researchers who conducted a meta-analysis of creative thinking skills (Amin et al., 2022; A. Handayani & Koeswanti, 2021; Yunita et al., 2021).

Based on the explanation above, this research aims to analyze the content of several biology education journals in Indonesia, published from 2014-2023. This research aims to present information about various studies that discuss students' creative thinking skills in biology subjects. In more detail, this research was conducted to answer the following questions: 1) what is the trend in the number of creative thinking skills from year to year? 2) What is the diversity of research designs used to research creative thinking skills in Indonesia? (3) What topics are most widely used to investigate students' creative thinking abilities? (4) What kind of treatment do researchers apply to develop students' creative thinking abilities? (5) What instruments do researchers use to measure students' creative thinking abilities? (6) What data analysis techniques do researchers use to analyze creative thinking skills? (7) What is the description of the series of research that researchers have carried out in studying creative thinking skills?

Method

This research is a content analysis using the document scanning method which is used as a research method. In this research, the articles analyzed were downloaded from the Indonesian Journal of Biology website. This study adheres to the principle of content analysis, which focuses on findings from various studies published in scientific journals in Indonesia. The research method used is similar to that used by (Fauzi & Pradipta, 2018).

Data Sources

Data was collected from the results of content analysis of Biology education articles. All articles are taken from Biology education journals registered with SINTA in April 2023. SINTA is a platform known for measuring developments in science and technology designed and developed by the Indonesian Ministry of Research, Technology, and Higher Education. In total, there are 21 biology education journals in the SINTA database. Henceforth, all articles discussing creative thinking skills were collected from each of these journals. The articles analyzed in this research were published online before April 2023. Of the hundreds of articles collected, 50 articles studied creative thinking. All articles were analyzed in this study.

Research Instrument

The instrument used for this research is a content analysis guide which contains related aspects observed (Table 1). There are seven main aspects studied for content analysis in this research. These aspects include 1) number of publications per year; 2) type of research; 3) research subject; 4) Biology topics selected for study; 5) treatment; 6) data collection instruments; and 7) data analysis methods. Exceptions, and categories in aspects (1), (4), and (5) were not determined initially due to the absence of previous research that could be referred to determine what should be included in the categories and the possibility of categories being too generalized. May appear when content analysis on some articles is performed. In addition, categories in aspects (2), (3), (6), and (7) were defined before data collection. These categories are shown in Table 2, which was adapted from (Fauzi & Pradipta, 2018). In addition, aspect (2) is divided into two sub-aspects that is (2a) general research types and (2b) quantitative research design.

Table 1. Reference Aspects and Categories in Conducting Analysis

| Aspect | Category |
|------------------------------------|---|
| Type of Research | A1) R and D A2) CAR |
| (2a) | A3) Qualitative Research A4) Quantitative Research |
| Quantitative type of research (2b) | B1) Observational Study (OS) B2) Correlation Research (CR) B3) Survey Research (SR) B4) Pre-Experimental Design (PED) B5) Experimental Design True(TED) B6) Quasi-Design Experimental(QED) |
| Research subjects | B7) Ex Post Facto Designs (EPFD) C1) VII class JHS students C2) Class VIII Middle School Students C3) IX class junior high school students |

| Aspect | Category |
|----------------------------|--------------------------------|
| | C4) X SHS class students |
| | C5) XI SHS class students |
| | C6) XII SHS class students |
| | C7) Undergraduate students |
| | C8) Postgraduate Students |
| | C9) junior high school teacher |
| | C10) high school teacher |
| | C11) lecturer |
| Instrument data collection | D1) questionnaire sheet |
| | D2) observation sheet |
| | D3) test sheet |
| | D4) interview sheet |
| | D5) not identified |
| Data analysis method | E1) mean |
| | E2) percentage |
| | E3) N-gain |
| | E4)-t-test |
| | E5) ANOVA |
| | E6) ANCOVA |
| | E7) Correlation |
| | E8) Unknown |
| | E9) Anacova |
| | E10) others |

Data Analysis

Each article is classified into a specific category based on certain aspects that meet the specified category. These decisions are based on information shared by the authors in the abstract, methods, and discussion sections. Next, the data that has been collected is presented in a bar chart.

Result and Discussion

Number of Publications

Based on the graph shown in Figure 1, articles reviewing creative thinking skills can be found since 2014. Referring to Figure 1, the number of publications since 2018 has increased higher than in previous years. This shows that the trend of increasing the number of publications regarding creative thinking skills is increasing significantly.

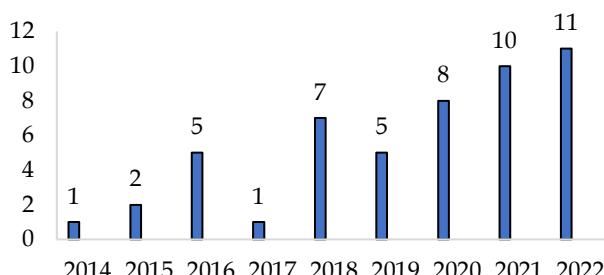


Figure 1. Number of article publications on creative thinking abilities in each year

Types of research

The type of research is an aspect that determines the focus of research. The data obtained regarding various articles about creative thinking skills in biology education journals are as follows.

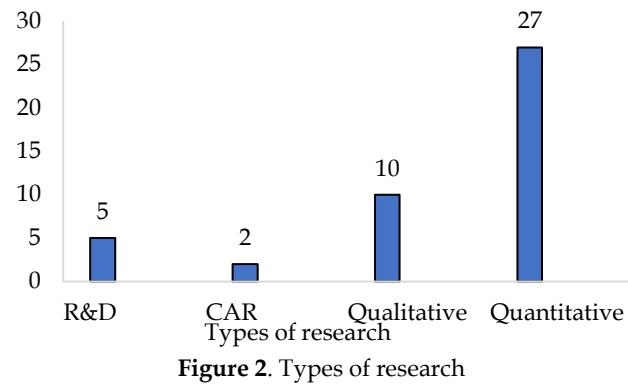


Figure 2. Types of research

Based on Figure 2, the type of quantitative research is the dominant design used by researchers in studying creative thinking skills. According to (Sugiyono, 2013) quantitative research is a type of research that has a wide scope, quantitative methods can be used for various research backgrounds, can involve large numbers of research subjects, and have a high level of accuracy for analyzing data.

Apart from the type of research, researchers also identify which types of various types of quantitative research are chosen to conduct research. The following is Figure 3, which illustrates the type of quantitative research.

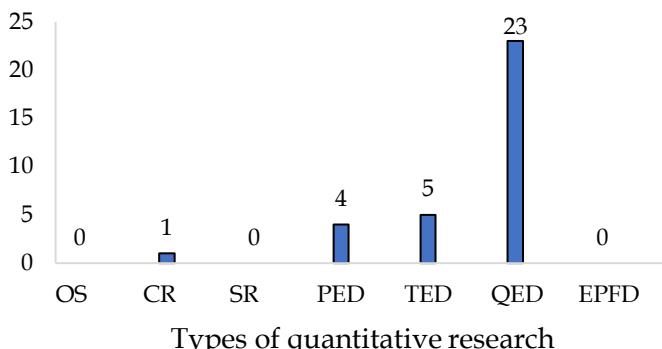


Figure 3. Types of quantitative research

Based on the data in Figure 3, quasi-experimental design is the experimental research most widely used by researchers in researching creative thinking abilities. Quasi-experiment is an experiment in which the assignment of the smallest experimental units into experimental and control groups is not carried out randomly (Hastjarjo, 2019). The smallest unit in an educational experiment is usually an individual or a person, for example, a student and a teacher. Research conducted by Zulkarnaen et al. (2022) on improving

students' creative thinking abilities in physics subjects also used a quasi-experimental design. Another research was conducted by Liu et al. (2020) who used a quasi-experimental design to improve the creative thinking abilities of nursing students in Taiwan.

Research subject

The development of critical thinking skills is aimed at students as research subjects. The following are research subjects used in research on creative thinking skills in biology education journals in Indonesia.

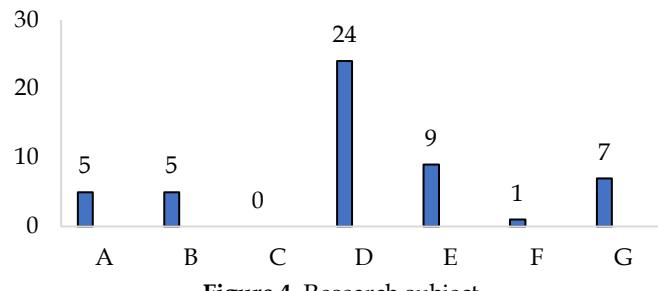


Figure 4. Research subject

Information:

A= VII JHS
 B= VIII JHS
 C= IX JHS
 D= X SHS
 E= XI SHS
 F= XII SHS
 G=Undergraduate

Looking at Figure 4, the most frequently used research subjects are high school students. Followed by college students and junior high school students. This finding is in line with research conducted by (Fauzi & Pradipta, 2018) which analyzed the content of all biology education studies in Indonesia published in 2017. Apart from displaying information regarding the comparison of junior high, high school, and tertiary levels, Figure 4 also shows that The higher the class level in the educational unit, the less often that class is chosen as a research subject. For example, students in class X SMA are often chosen as research subjects, but students in class this is due to several factors, for example, the busy schedule for preparing for school exams, national exams, etc.

Biology Topics

Based on Table 2, several topics were chosen by researchers to be used as topics for researching students' creative thinking abilities. Environmental pollution is the topic most often chosen by researchers, followed by the topic of ecosystems and the digestive system.

Table 2. Biology Topics

| Topics | Number of articles |
|-------------------------|--------------------|
| Environmental pollution | 7 |
| Ecosystem | 3 |
| digestive system | 2 |

Environmental pollution is a material listed in the competency standards, so this material must be mastered by students. On the topic of environmental pollution, there are various problems faced by students, such as various human activities that influence environmental pollution and analyzing types of recycled waste. Through this environmental pollution material, it is hoped that students will have high creative thinking skills (Astuti, 2017). Furthermore, according to Fatimah et al. (2022) in terms of environmental pollution, there are human activities that can reduce environmental quality. In this material, students are required to be able to think creatively in solving these problems. Research conducted by Permata et al. (2022) also used environmental pollution material to examine students' creative thinking abilities.

Treatments

Based on Table 3, Problem-based learning (PBL), Inquiry-based learning (IBL), Project-based learning (PJBL) are the treatments most commonly used in research on creative thinking abilities. 9 publications are using PBL, and 4 publications using IBL and PJBL.

Table 3. Treatment

| Treatments/independent variables | Number of articles |
|----------------------------------|--------------------|
| Problem-based learning | 9 |
| Inquiry-based learning | 4 |
| Project-based learning | 4 |

The Project Based Learning (PBL) learning model is an innovative learning model and emphasizes contextual learning through various complex activities (Khairani & Aloysius, 2023; Dewi et al., 2023; Evendi & Verawati, 2021). PBL is also a learning model that focuses on problem-solving, thinking creatively, interacting with others, and using new knowledge. Thus, this PBL model is a learning model that directly demands students' creative thinking skills in problem-solving. Apart from that, according to Ramdoniati et al. (2019) students are skilled at evaluating through the application of PBL-based teaching materials, this is because they are required to assess the results of the analysis according to theory by making conclusions after they have carried out investigations. Research conducted by Wijayati et al. (2019) also proves that the PBL model can improve students' creative thinking abilities. Other research conducted by Khoiriyah et al. (2018) shows that the PBL model can improve creative thinking skills, problem-solving skills and learning outcomes. Furthermore, research conducted by Kardoyo et al. (2020) also shows that PBL can improve creative thinking abilities. Furthermore, research was conducted Hidayat et al. (2022) where the PBL model was able to

improve students' creative thinking in learning mathematics.

Data Collection Instrument

Instruments are tools used by researchers to collect data in a study. Students' creative thinking abilities can be measured through various instruments that have been developed by previous researchers. Based on Figure 5, the test instrument is an instrument that is often used to collect data on creative thinking skills.

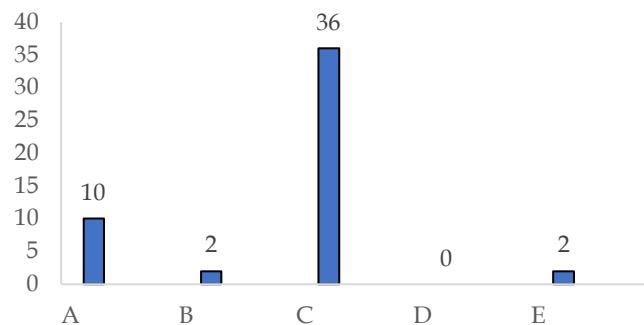


Figure 5. Data collection instrument

Information:

A = Questionnaire
C = Test-sheet
E = Unidentified

B = Observation
D = Interview

A test instrument is a tool for obtaining information about the characteristics of an object. The objects in question can be about students' thinking abilities, interest in learning, attitudes, and motivation. Test instruments are most often used by researchers in collecting research data because with these test instruments assessment activities can be carried out comprehensively, both in the cognitive, affective, and psychomotor domains. According to Rofiah et al. (2013) test instruments are one of the instruments often used to measure students' cognitive abilities.

Data Analysis Method

Based on Figure 6, the t-test is a data analysis method that is often used by researchers. 18 studies used the t-test in the creative thinking ability journals studied.

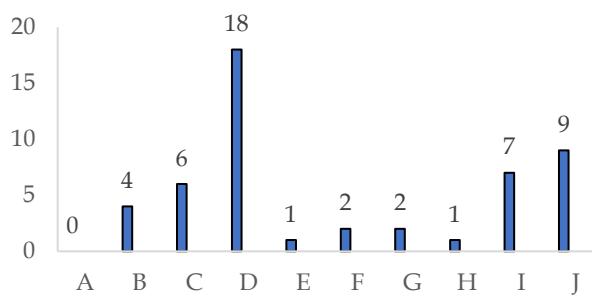


Figure 6. Data analysis method

Information:

A = Mean
C = N-gain
E = Anova
G = Anacova
I = Unidentified

B = Percentage
D = T-test
F = Ancova
H = Correlation
J = Others

Conclusion

Creative thinking skills are skills that are needed at this time. Various studies have studied the level of student's creative thinking skills, especially in biology education journals in Indonesia. In this research, the results showed that there was an increasing trend in research on students' creative thinking skills over the last 5 years. In the content analysis of all the research obtained, quantitative research was the most dominant. In addition, Class X high school students and environmental pollution materials are the most studied objects and materials. The problem-based learning model is the treatment most often used as a treatment in looking at creative thinking skills. Test instruments and t-tests are the most commonly used instruments and data analysis methods.

Author Contributions

All authors contributed to writing this article.

Funding

No external funding.

Conflicts of Interest

No conflict interest.

References

Akpur, U. (2020). Critical, Reflective, Creative Thinking and Their Reflections on Academic Achievement. *Thinking Skills and Creativity*, 37(August). <https://doi.org/10.1016/j.tsc.2020.100683>

Amin, M., Ibrahim, M., & Alkusaeri, A. (2022). Meta analisis: Keefektifan stem terhadap kemampuan berpikir kreatif siswa. *Journal of Authentic Research on Mathematics Education (JARME)*, 4(2), 248–262. <https://doi.org/10.37058/jarme.v4i2.4844>

Andrini, V. S. (2016). The Effectiveness of Inquiry Learning Method to Enhance Students' Learning Outcome: A Theoretical and Empirical Review. *Journal of Education and Practice*, 7(3), 38–42. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1089825.pdf>

Astuti, P. (2017). Peningkatan Motivasi dan Kemampuan Berpikir Kreatif Siswa pada Materi Pencemaran Lingkungan melalui Media Fotonovela. *Refleksi Edukatika: Jurnal Ilmiah*

Kependidikan, 8(1).
<https://doi.org/10.24176/re.v8i1.1783>

Birgili, B. (2015). Creative and critical thinking skills in problem-based learning environments. *Journal of Gifted Education and Creativity*, 2(2), 71-80.
<https://doi.org/10.18200/JGEDC.2015214253>.

Dewi, W. S., Siregar, R., Putra, A., & Hidayati, H. (2023). Effect of Problem-Based Learning Model on Students' Physics Problem Solving Ability: A Meta-Analysis. *Jurnal Penelitian Pendidikan IPA*, 9(4), 2103-2109.
<https://doi.org/10.29303/jppipa.v9i4.3291>

Elizabeth, A., & Sigahitong, M. M. (2018). Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kreatif Peserta Didik SMA. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, 6(2), 66-76. <https://doi.org/10.33394/j-ps.v6i2.1044>

Evendi, E., & Verawati, N. N. S. P. (2021). Evaluation of Student Learning Outcomes in Problem-Based Learning: Study of Its Implementation and Reflection of Successful Factors. *Jurnal Penelitian Pendidikan IPA*, 7(SpecialIssue), 69-76.
<https://doi.org/10.29303/jppipa.v7ispecialissue.1099>

Fatimah, S., & Rohani, R. (2022). Development of Student Worksheets Based on Discovery Learning for Class X Students of Environmental Pollution Materials. *Jurnal Penelitian Pendidikan IPA*, 8(4), 2101-2108.
<https://doi.org/10.29303/jppipa.v8i4.2093>

Fauzi, A., & Pradipta, I. W. (2018). Research methods and data analysis techniques in education articles published by Indonesian biology educational journals. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 4(2), 123-134.
<https://doi.org/10.22219/jpbi.v4i2.5889>

Handayani, A., & Koeswanti, H. D. (2021). Meta-analisis model pembelajaran problem based learning (pbl) untuk meningkatkan kemampuan berpikir kreatif. *Jurnal Basicedu*, 5(3), 1349-1355.
<https://doi.org/10.31004/basicedu.v5i3.924>

Handayani, S. A., Rahayu, Y. S., & Agustini, R. (2021). Students' creative thinking skills in biology learning: Fluency, flexibility, originality, and elaboration. *Journal of Physics: Conference Series*, 1747(1). <https://doi.org/10.1088/1742-6596/1747/1/012040>

Hastjarjo, T. D. (2019). Rancangan eksperimen-kuasi. *Buletin Psikologi*, 27(2), 187-203.
<https://doi.org/10.22146/buletinpsikologi.38619>

Hidayat, R., & Evendi, E. (2022). The Intervention of Mathematical Problem-Solving Model on the Systems of Linear Equation Material: Analysing its Impact on Increasing Students' Creative Thinking. *International Journal of Essential Competencies in Education*, 1(2), 61-68.
<https://doi.org/10.36312/ijece.v1i2.1069>

Hwang, G.-J., Kuo, F.-R., Chen, N.-S., & Ho, H.-J. (2014). Effects of an integrated concept mapping and web-based problem-solving approach on students' learning achievements, perceptions and cognitive loads. *Computers & Education*, 71, 77-86.
<http://dx.doi.org/10.1016/j.compedu.2013.09.013>

Ismunandar, D., Gunadi, F., Taufan, M., Mulyana, D., & Runisah. (2020). Creative thinking skills of students through realistic mathematics education approach. *Journal of Physics: Conference Series*, 1657(1). <https://doi.org/10.1088/1742-6596/1657/1/012054>

Kardoyo, Nurkin, A., Muhsin, & Pramusinto, H. (2020). Problem-based learning strategy: Its impact on students' critical and creative thinking skills. *European Journal of Educational Research*, 9(3), 1141-1150. <https://doi.org/10.12973/EU-JER.9.3.1141>

Khairani, R., & Aloysius, S. (2023). How does PBL Brainwriting Method Supplemented with Concept Mapping Effective to Improve Critical Thinking and Problem-Solving Ability? *Jurnal Penelitian Pendidikan IPA*, 9(3), 1030-1038.
<https://doi.org/10.29303/jppipa.v9i3.3212>

Khairunnisa, Abdullah, Kharil, Hasanuddin, & Rahmatan, H. (2022). The Influence of Problem Based Learning Models combined with Flashcard Media on Creative Thinking Skills of Students. *Jurnal Penelitian Pendidikan IPA*, 8(1), 247-251.
<https://doi.org/10.29303/jppipa.v8i1.1154>

Khoiriyah, A. J., & Husamah, H. (2018). Problem-based learning: Creative thinking skills, problem-solving skills, and learning outcome of seventh grade students. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 4(2), 151-160.
<https://doi.org/10.22219/jpbi.v4i2.5804>

Kuspriyanto, B., & Siagian, S. (2013). Strategi pembelajaran dan kemampuan berpikir kreatif terhadap hasil belajar fisika. *Jurnal Teknologi Pendidikan*, 6(1), 134-258. Retrieved from <http://digilib.unimed.ac.id/975/>

Lavi, R., Tal, M., & Dori, Y. J. (2021). Perceptions of STEM alumni and students on developing 21st century skills through methods of teaching and learning. *Studies in Educational Evaluation*, 70, 101002.
<https://doi.org/10.1016/j.stueduc.2021.101002>

Lisliana, L., Hartoyo, A., & Bistari, B. (2012). Analisis Kemampuan Berpikir Kreatif Siswa dalam Menyelesaikan Masalah pada Materi Segitiga di SMP.

Tanjungpura University.

Liu, H. Y., Wang, I. T., Chen, N. H., & Chao, C. Y. (2020). Effect of creativity training on teaching for creativity for nursing faculty in Taiwan: A quasi-experimental study. *Nurse Education Today*, 85, 104231. <https://doi.org/10.1016/j.nedt.2019.104231>

Maharani, H. R., & Waluya, S. B. Sugianto.(2015). Humanistic Mathematics Learning with creative problem solving assisted Interactive Compact Disk to improve creative thinking ability. *International journal of Education and research*, 3(1), 207-216. Retrieved from <https://www.ijern.com/journal/2015/January-2015/17.pdf>

Manurung, A. S., Halim, A., & Rosyid, A. (2020). Pengaruh Kemampuan Berpikir Kreatif untuk meningkatkan Hasil Belajar Matematika di Sekolah Dasar. *Jurnal Basicedu*, 4(4), 1274-1290. <https://doi.org/10.31004/basicedu.v4i4.544>

Nazifah, N., & Asrizal, A. (2022). Development of STEM Integrated Physics E-Modules to Improve 21st Century Skills of Students. *Jurnal Penelitian Pendidikan IPA*, 8(4), 2078-2084. <https://doi.org/10.29303/jppipa.v8i4.1820>

Nela, E., & Supriatna, N. (2021). Creative Learning Through Google Classroom in History Learning During the Covid-19 Pandemic. *Proceedings of the 6th International Conference on Education & Social Sciences (ICESS 2021)*, 578(Icess), 83-91. <https://doi.org/10.2991/assehr.k.210918.017>

Permata, S. A. I., Sunarno, W., & Harlita, H. (2022). Effect of the Problem Based Learning and Double Loop Problem Solving Learning Models on Problem Solving Ability in Term of Creative Thinking on Environmental Pollution Material. *Jurnal Penelitian Pendidikan IPA*, 8(6), 2647-2653. <https://doi.org/10.29303/jppipa.v8i6.1996>

Ramdani, A., Jufri, A. W., Gunawan, G., Hadisaputra, S., & Zulkifli, L. (2019). Pengembangan Alat Evaluasi Pembelajaran Ipa Yang Mendukung Keterampilan Abad 21. *Jurnal Penelitian Pendidikan IPA*, 5(1). <https://doi.org/10.29303/jppipa.v5i1.221>

Ramdoniati, N., Muntari, M., & Hadisaputra, S. (2019). Pengembangan bahan ajar kimia berbasis problem based learning untuk meningkatkan keterampilan metakognisi. *Jurnal Penelitian Pendidikan IPA*, 5(1). <https://doi.org/https://doi.org/10.29303/jppipa.v5i1.148>

RESouRCE, A., & GuidE, P. (2008). 21st Century Skills, Education & Competitiveness. *Partnership for 21st Century Skills*.

Rofiah, E., Aminah, N. S., & Ekawati, E. Y. (2013). Penyusunan Instrumen tes kemampuan berpikir tingkat tinggi fisika pada siswa SMP. *Jurnal Pendidikan Fisika*, 1(2).

Siang, J. L., Sukardjo, M., Salenussa, B. J. M., Sudrajat, Y., & Khasanah, U. (2020). Pengaruh model pembelajaran dan kemampuan berpikir kreatif terhadap hasil belajar IPA siswa SMP. *JTP-Jurnal Teknologi Pendidikan*, 22(1), 40-52. <https://doi.org/https://doi.org/10.21009/jtp.v2i1.15329>

Sugiyono. (2013). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

Sukmawijaya, Y., Suhendar, S., & Juhanda, A. (2019). Pengaruh model pembelajaran stem-pjbl terhadap kemampuan berpikir kreatif siswa pada materi pencemaran lingkungan. *Jurnal BIOEDUIN: Program Studi Pendidikan Biologi*, 9(2), 28-43. <https://doi.org/https://doi.org/10.15575/bioed.uin.v9i2.5893>

Tengku, I. (2022). Critical and Creative Thinking Skills of Pekanbaru High School Students in Biology Learning. *Jurnal Penelitian Pendidikan IPA*, 8(5), 2430-2436. <https://doi.org/10.29303/jppipa.v8i5.1737>

Tumurun, S. W., Gusrayani, D., & Jayadinata, A. K. (2016). Pengaruh model pembelajaran discovery learning terhadap keterampilan berpikir kreatif siswa pada materi sifat-sifat cahaya. *Jurnal Pena Ilmiah*, 1(1). Retrieved from <https://ejournal.upi.edu/index.php/penailmiah/article/viewFile/2936/1964>

Wahyuni, A., & Kurniawan, P. (2018). Hubungan kemampuan berpikir kreatif terhadap hasil belajar mahasiswa. *Matematika: Jurnal Teori Dan Terapan Matematika*, 17(2). <https://doi.org/10.29313/jmtm.v17i2.4114>

Wijayati, N., Sumarni, W., & Supanti, S. (2019). Improving Student Creative Thinking Skills Through Project Based Learning. *KnE Social Sciences*, 2019, 408-421. <https://doi.org/10.18502/kss.v3i18.4732>

Yuliani, H., Mariati, M., Yulianti, R., & Herianto, C. (2017). Keterampilan Berpikir Kreatif Pada Siswa Sekolah Menengah Di Palangka Raya Menggunakan Pendekatan Saintifik. *Jurnal Pendidikan Fisika Dan Keilmuan (JPKF)*, 3(1), 48-56. <http://doi.org/10.25273/jpkf.v3i1.1134>

Yunita, Y., Juandi, D., Hasanah, A., & Tamur, M. (2021). Studi Meta-Analisis: Efektivitas Model Project-Based Learning Terhadap Kemampuan Berpikir Kreatif Matematis Siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 10(3), 1382-1395. <http://dx.doi.org/10.24127/ajpm.v10i3.3705>

Zulkarnaen, Z., Suhirman, S., Hidayat, S., Prayogi, S.,

Sarnita, F., Widia, W., Fathurrahmaniah, F., Fauzi, A., Ramdhani, L., & Verawati, N. N. S. P. (2022). Effect of Problem Based Learning Model on Students' Creative Thinking Ability. *Jurnal Penelitian Pendidikan IPA*, 8(1), 379-382. <https://doi.org/10.29303/jppipa.v8i1.1307>