

Research trends of creative thinking skill in science education journals in Indonesia: Design analysis and data analysis techniques

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Abstract

Creative thinking as one of the 21st skills is not only beneficial but also essential, particularly in learning sciences. Creative thinking equips them with the cognitive flexibility to devise innovative solutions, consider multiple variables, and approach challenges from diverse angles, fosters critical reasoning and imagination, and enhances student motivation and engagement within science classrooms. This paper will focus on investigating the implementation of creative thinking in learning sciences based on the articles published in national accreditation journals in Indonesia. The content analysis approach was applied, leveraging the method of scanning published research journal documents as its research method. This study is distinctive from previous research on creative thinking skills in several ways covered on all educational articles published from 2015 to 2024 in all Indonesian science education journals. This study revealed that in the last three years, the number of publications focusing on creative thinking skills has increased. The most dominant research is quantitative research with quasi experiment as the research design. Meanwhile, junior high school students, and 'biology' with the subject material of 'environmental pollution' were consecutively the subjects, science fields of study, and topics most chosen by researchers. Project Based Learning (PjBL), test sheet, and N-gain were the most frequently used as treatments, instruments, and data analysis methods, respectively. The review highlights the need to increase the use of qualitative and mixed-method approaches, explore the integration of local wisdom and ethnoscience through R&D, and focus on developing instructional products to enhance students' low creative thinking abilities. Additionally, researchers are advised to clearly report their research instruments, including validity and reliability, and to select data analysis techniques that align with their research objectives and design.

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1. Introduction

Creative thinking skills are an essential part of the 21st century skills that are indispensable in science learning, as they play an important role in fostering problem solving, innovation, and the development of learners' scientific character (OECD, 2018; World Economic Forum, 2020). Various international studies emphasize that inquiry-based learning, STEM, and problem-based approaches can improve students' creative thinking skills (Sahin, Alpaslan & Top, 2015). However, although the importance of these skills is widely recognized, there is no systematic study that specifically maps the research trends of creative thinking skills in the context of science education in Indonesia. Studies such as Fauzi and Pradipta (2018) only examine general trends in science education publications, without focusing on aspects of creativity. This suggests a gap in the national literature regarding the mapping of topics, designs, instruments, and analysis techniques used in research on creative thinking skills. Therefore, this study aims to identify and analyze trends in creative thinking skills research in accredited Indonesian science education journals (SINTA) as a basis for developing more targeted and contextualized research.

Creative thinking skills refer to an individual's capacity to generate original ideas, explore novel possibilities, and develop innovative solutions or inventions. These skills involve producing outcomes that demonstrate originality and may take the form of either concrete or abstract concepts, such as forming new ideas, crafting analogies, or developing metaphors (Daud et al, 2012;). According to Gafour and Gafour (2020) creative thinking entails the deliberate use of basic cognitive operations to expand existing ideas or generate entirely new ones. Unlike critical thinking, which is centered on evaluating and analyzing information, creative thinking often involves producing ideas that challenge conventional logic. Nevertheless, it must be firmly rooted in one's prior experiences and existing knowledge. Through the manipulation of these internal resources,

individuals are able to view problems from multiple perspectives, ultimately leading to the creation of more effective and innovative solutions for decision-making and problem-solving.

As stated by Weisberg (2005) in the book *Creativity and Reasoning in Cognitive Development* (Kaufman & Baer, 2006), creative thinking is defined as the process of generating a creative product, which is a new (innovative) work derived from a goal-directed activity. This notion is further corroborated by the characteristics of creative thinking skills, namely, fluency, flexibility, originality, and elaboration (Nehe et al., 2017; Torrance, 1965). The significance of cultivating creative thinking skills in students has prompted numerous studies on the development of creative thinking skills in learning, particularly in the context of science education. There have been studies on creative thinking related to learning science, including comparative, relationship, casual and/or process-oriented. Some of them are presented in Table 1.

Table 1. Previous study on creative thinking skills in learning sciences based on the research types

N o	Type of research	Core focus	Year	References
1	Literature review	Efforts To Improve Creative Thinking Ability in Science Learning (Kiraga, 2023) The review method was chosen to obtain research journals with keywords in students' creative thinking abilities in science learning with Google Scholar reference sources. Twenty-five journals were reviewed based on author (year), research design, creative thinking skills, and findings.	2023	F. Kiraga, "Literature Review: Efforts to Improve Creative Thinking Ability in Science Learning", <i>In. Sci. Ed. J</i> , vol. 4, no. 2, pp. 77-83, May 2023.
2	Systematic review	Fostering Scientific Creativity in Teaching and Learning Science in Schools (Sidek et al., 2020) A systematic review of 30 studies was conducted to investigate effective interventions and variables that influence scientific creativity among students in school science classrooms.	2020	Sidek, et.al. "Fostering Scientific Creativity in Teaching and Learning Science in Schools: A systematic review", <i>JPPJ</i> , vol. 6, no. 1, pp. 13-35, May 2020.
3	Systematic review	Creative Thinking in Art and Design Education (Samaniego et al., 2024) A systematic literature review was conducted following the PRISMA protocol, utilizing the Scopus database, where 292 studies were retrieved through search strings. From these, 187 studies were selected for the final analysis.	2024	Samaniego, M.; Usca, N.; Salguero, J.; Quevedo, W. Creative Thinking in Art and Design Education: A Systematic Review. <i>Educ. Sci.</i> 2024, 14, 192. https://doi.org/10.3390/educsci14020192
4	A quasi- experimen tal	Investigation of effective strategies for developing creative science thinking The purpose of this study was to explore the effectiveness of the creative inquiry-based science teaching on students' creative science thinking and science inquiry performance. A quasi-experimental design consisting one experimental group ($N = 20$) and one comparison group ($N = 24$) with pretest and post-test was conducted.	2016	Yang, K. K., Lee, L., Hong, Z. R., & Lin, H. shyang. (2016). Investigation of effective strategies for developing creative science thinking. <i>International Journal of Science Education</i> , 38(13), 2133–2151. https://doi.org/10.1080/09500693.2016.1230685
5	A qualitative approach with content analysis method.	Creative Thinking Patterns in Students' Scientific Works This study aimed to explain creative thinking patterns, including imaginative thinking, divergent thinking, and lateral thinking of students in scientific work. The data source of this research was the writing of student scientific work. The data were collected through surveys, documentation studies, and interviews.	2019	Syahrin, A., Dawud, D., Suwignyo, H., Priyatni, E.T. (2019). Creative Thinking Patterns in Students' Scientific Works. <i>Eurasian Journal of Educational Research</i> 81,21-36. DOI: 10.14689/ejer.2019.81.2
6	Case study	The Learner's Creative Thinking Learning with Learning Innovation to Encourage Human Thinking (Sumalee et al., 2012) This study aimed to design and develop the learning innovation to encourage human thinking to support creative thinking. The target group was thirteen sixth-grade students studying during the first semester of 2006 at Nongpipittayacom School, Chumpae, Khon Kaen.	2012	Chaijareon, S., Samat, C., Kanjug, I., (2012). The Learner's Creative Thinking Learning with Learning Innovation to Encourage Human Thinking. <i>European Journal of Social Sciences</i> 28(2), 213-218

Comprehensive review of this study is focusing on meta-analysis type of research. Meta-analysis has become increasingly acknowledged as a rigorous and systematic methodology for synthesizing empirical research findings (Higgins, 2016; Whiston & Li, 2011; Cooper, Robinson, & Dorr, 2006). Its primary objective is to statistically integrate the results of multiple studies addressing a common research question, thereby offering a more precise estimate of effect sizes (Erford, Savin-Murphy, & Butler, 2010). Pigott and Polanin (2020) assert that meta-analysis enables researchers to draw conclusions about the current state of knowledge and identify gaps within a specific field by synthesizing quantitative data from multiple studies. This process involves statistically analyzing existing literature to integrate findings from prior research. It is worth to noting compared

to other type of research (Table 1) that meta-analysis offers several significant benefits to the research community. It enhances the accuracy of effect size estimates, particularly in the context of rare or infrequent events, and allows for the exploration of research questions that may not have been directly addressed in individual studies. Moreover, meta-analysis plays a critical role in generating new hypotheses, thereby guiding future research directions. By systematically synthesizing large volumes of empirical data, it contributes to the advancement of scientific knowledge and supports informed, evidence-based decision-making across various disciplines.

This study utilizes content analysis of several scientific science education journals published in Indonesia from 2015 to 2024. The objective of this study is to compile information regarding the array of research that addresses creative thinking skills in Indonesia. Specifically, the study seeks to address the following research questions: (1) What is the trend in the number of studies on creative thinking skills over the year?; (2) What types of research designs are used to investigate creative thinking skills in Indonesia?; (3) What topics are commonly explored to assess students' creative thinking skills?; (4) What learning model/method/strategy are researchers using to enhance students' creative thinking skills?; (5) What instruments are utilized by researchers to assess creative thinking skills?; (6) What data analysis techniques are employed by researchers to analyze creative thinking skills?; (7) What is the overview of the series of studies that have been conducted by researchers in investigating creative thinking skills? Based on this, the focus of this study is to provide a comprehensive overview of studies and suggests area of future research related to creative thinking in learning sciences.

2. Method

This research type is a scoping literature review with a content analysis approach, leveraging the method of scanning published research journal documents as its research method. This study is distinctive from previous research on creative thinking skills in several ways. Firstly, it was conducted on all educational articles published from 2015 to 2024 in all Indonesian science education journals, all of which are accredited by the Science and Technology Index (SINTA). Thirdly, a variety of parameters were used for content analysis. This approach aligns with the methodology employed by Fauzi and Pradipta (2018). The steps of a literature review include: creating a research problem, determining where to search for research in a database, selecting relevant research data, selecting relevant research, extracting information from primary research, synthesizing research, and presenting research (Moher et al., 2009) (Figure 1).

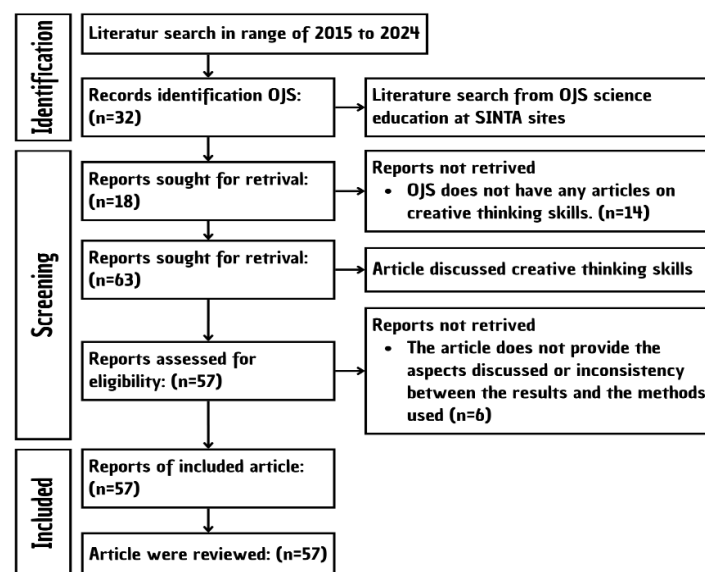


Figure 1. The literature flowchart adapted from (Moher et al., 2009)

In this study, a comprehensive download of articles was conducted from OJS science education sites in Indonesia registered in SINTA in January 2025. Based on the data obtained from SINTA through the journal search filter with the science education domain, 32 OJS were found. In addition, in each OJS, a filter is performed in the search column with the keyword "creative thinking skills" in the range of 2015 to 2024, thus obtaining data from 18 OJS with 57 articles that meet the criteria. All of the articles were downloaded and analyzed in this study.

The instrument utilized for this study was a content analysis guideline, which encompassed the pertinent aspects that were observed (see Table 2). The following aspects were considered in this study: (1) the number of publications per year; (2) the type of research; (3) the research subject; (4) the area of science chosen for

research; (5) learning model/method/strategy; (6) the data collection instrument; and (7) the data analysis method. It should be noted, however, that the categories in aspects (1), (4), and (5) were not decided from the beginning. This was due to the absence of previous research that could be referred to in order to determine what should be included in these categories. It was also due to the possibility of having too general categories that could appear when content analysis was carried out on several articles. In addition, the categories in aspects (2), (3), (6), and (7) were determined prior to data collection. The categories are delineated in Table 2, which was adapted and modified from Fauzi and Pradipta (2018).

Table 2. The aspects and categories that were utilized for content analysis in the present study

Aspects	Categories			
Research Approach	A.1-Qualitative	A.3-R&D		
	A.2-Quantitative	A.4-Mix Method		
Research Design	B.1-Case Study	B.7-Corelation Research	B.13-4D	
	B.2-Descriptive Research	B.8-Survey Research	B.14-ADDIE	
	B.3-Classroom Action Research	B.9-Ex Post Facto Research	B.15-Borg & Gall	
	B.4-Phenomenological Research	B.10-Pre-Experiment	B.16-Dick & Carey	
	B.5-Ethnographic Research	B.11-True Experiment	B.17-Tessmer	
	B.6-Comparative	B.12-Quasi Experiment	B.18-Sequential Explanatory	
Research Subject	C.1-Elementary Students	C.4-Pre-Service Teacher		
	C.2-Junior High School Students	C.5-Teachers		
	C.3-Senior High School Students	C.6-Lecturers		
Data Collection	D.1-Questionnaire Sheet	D.3-Test Sheet		
Instruments	D.2-Observation Sheet	D.4-Interview Sheet		
Data Analysis	E.1-Mean	E.5-ANOVA	E.8-MANCOVA	
Methods	E.2-Percentage	E.6-ANCOVA	E.9-Triangulation	
	E.3-T-Test	E.7-MANOVA	E.10-Descriptive	
	E.4-N-Gain			

3. Results and Discussion

The articles were classified into specific categories based on predetermined criteria. The determination of the category is based on the information conveyed in the abstract and methods section. Furthermore, the data that has been collected is presented in the form of bar charts.

3.1. Total Number of Publication

The number of published articles in a given time period, as demonstrated in Figure 2. A notable upward trend is evident in articles pertaining to creative thinking skills from 2015 to 2024, though a considerable decline is observed in 2019. This decline could be attributed to the impact of changes in the education system during the pandemic. However, since 2022 there has been an upward trend in the number of publications, as depicted in Figure 2.

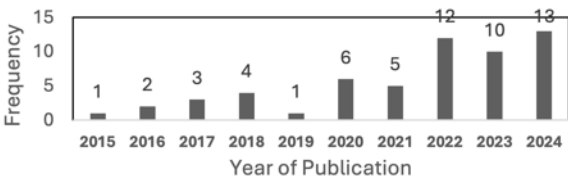


Figure 2. Graphical representation of the number of educational studies that have focused on creative thinking skills in Indonesia over the past decade

This may be due to the acceleration of digital transformation as a result of the pandemic, which is forcing many individuals and organizations to adapt in new ways, according to the research of Arlinda et al., (2022). In addition, curriculum changes that emphasize creativity as a core 21st-century skill also underlie the increase in research on creative thinking skills, such as that conducted by Qadafi et al., (2022). This indicates a notable increase in the number of researchers dedicated to exploring creative thinking skills.

The majority of research in this field is initiated by researchers' sensitivity to issues that frequently emerge in their respective contexts. A pervasive challenge that has garnered significant attention is the apparent dearth of creative thinking skills among Indonesian students. Through research, researchers can assess students' initial creative thinking skills or ascertain the most effective learning design and learning media that can optimally foster students' creative thinking skills. This is evidenced by the existence of various studies aimed at improving creative thinking skills through the development of media or learning models, such as the one carried out by Millen & Supahar (2023). The influence of research on educational practice is multifaceted, as it can serve as: (1) a reliable source of information that can be implemented by teachers; (2) a foundational basis for educational

decision-making at various levels, including national, local, and institutional; and (3) a catalyst for change in teachers' thinking (Susetyarini & Fauzi, 2020).

3.2. Type of Research Approach and Design

The approach and research design determine the focus of the research. As illustrated in Figure 3, quantitative research is the most prevalent approach employed by researchers to investigate creative thinking skills.



Figure 3. Distribution of creative thinking skills research as the main concern based on research approach

This is consistent with prior studies that reported researchers' preference for quantitative research approaches in conducting research in education, as opposed to qualitative research (Uzunboyulu & Aşıksoy, 2014). Creswell (2018) posits that the preference for quantitative research in education stems from its capacity to facilitate objective measurement and robust statistical analysis. The necessity of quantitative methods in cultivating competencies in data-driven decision-making and strategic planning is underscored (Zhang, 2024). However, despite the prevalence of quantitative methods in education, many students, particularly those majoring in social sciences, demonstrate a preference for qualitative methods due to a perceived lack of confidence in their statistical skills (Dani & Al Quraan, 2023).

Nevertheless, there has been an increasing inclination toward qualitative approaches in recent studies (Shakouri, 2014). This tendency has been observed in various fields, including social research and educational issues (Mohajan, 2018). The qualitative approach offers distinct advantages, such as its ability to define a phenomenon in detail and comprehensively. Consequently, the paucity of existing qualitative research signifies a valuable opportunity for future researchers to utilize qualitative approaches and prioritize research focusing on creative thinking skills.

This phenomenon is also evident in the context of the Mix Method research approach. Mixed methods research has evolved into a set of procedures that proposal developers and study designers can use in planning a mixed methods study. Mixed methods is chosen because of its strength of drawing on both qualitative and quantitative research and minimizing the limitations of both approaches (Creswell & Creswell, 2018). This approach offers a valuable opportunity for future researchers to engage with the Mix Method design and direct their research toward the exploration of creative thinking skills.

The R&D research approach is distinct from the qualitative and mixed methods research approaches. A significant increase in the number of research publications in the field of science education has been observed, particularly from 2017 onwards (Muchson et al., 2024). The nine R&D studies analyzed still emphasize the development of media, models, teaching materials and assessment instruments based on a specific framework. This orientation presents a significant challenge for future researchers, who must strive to integrate development more comprehensively, including "local wisdom" and "ethnoscience". To address this challenge, researchers must adopt R&D design methodologies and prioritize the cultivation of creative thinking skills.

In addition to the type of research approach, the objective of this study is to reveal the distribution of research designs most frequently selected by researchers. As illustrated in Figure 4, the quasi-experimental design is the most widely used experimental research design in studies on creative thinking skills. Quasi-experimental designs have become increasingly prominent in educational research over the past few decades, driven by the need for rigorous causal inference in the social sciences (Gopalan et al., 2020). The use of quasi-experimental designs continues to grow, with researchers increasingly adopting these methods to address complex educational questions. The integration of interdisciplinary techniques and the development of new quasi-experimental methods are expected to further enhance the rigor and applicability of educational research (Chow, 2024). Quasi-experiments are well suited for use in studies of creative thinking skills, as they maintain the validity of the experiment under natural conditions without disrupting the existing educational system. This is evident from the fact that the focus of the research is to measure the effectiveness of learning using pre-test and post-test instruments. As the data were collected from 23 quasi-experiments, 21 of them used pre-test and post-test. Each of these methodologies offers unique insights and contributes to the broader understanding of educational practices and outcomes. By selecting the appropriate methodology, researchers can effectively address their specific research questions and objectives.

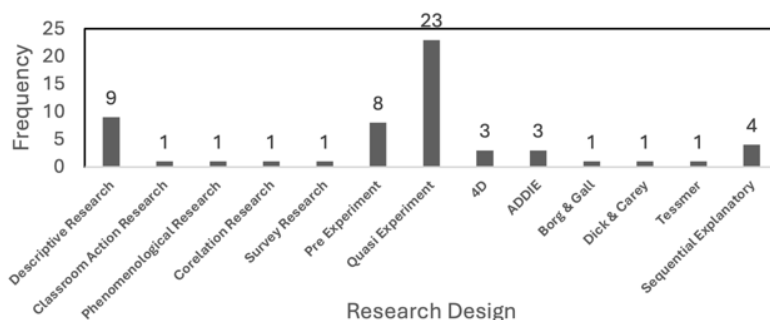


Figure 4. Distribution of creative thinking skills research as the main concern based on research design

3.3. Subject of Research

The objective of enhancing creative thinking skills encompasses diverse research subjects. In the context of conducting research, researchers require research subjects to evaluate their hypotheses. As illustrated in Figure 5, the most frequently selected research subjects are junior high school students, followed by senior high school students, then pre-service teachers and elementary school students. Conversely, teachers are rarely chosen as research subjects, with only a single publication addressing this topic. Notably, the subject of teachers was not observed in any publications concerning creative thinking skills. This finding aligns with the research conducted by Yudistira and Suparman (2023), who examined the content of all research on creative thinking skills from SINTA-accredited Mathematics Education Journals published in Indonesia from 2016 to 2023.

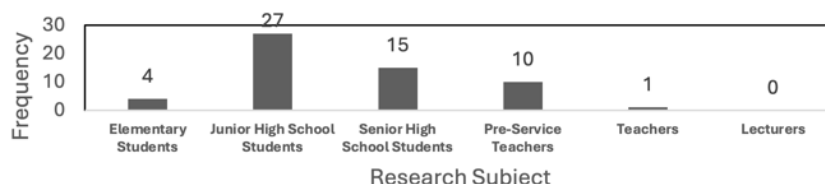


Figure 5. Distribution of research on creative thinking skills as the main concern based on research subjects

In contrast to the research conducted by Syamsurizal (2023), which was based on the results of a content analysis of research articles published in the Journal of Biology Education, the present study reveals that researchers most frequently select senior high school students as research subjects, followed by junior high school students. Pre-service teachers are the least frequently selected research subjects by researchers. This variation can be attributed to several fundamental factors, including differences in the scope of the selected journals, variations in research focus, differences in the time span of data collection, and discrepancies in the amount of data collected.

A review of the extant research on the subject indicates that researchers most frequently selected junior high school students in the first or second position. The selection of junior high school students in the study of creative thinking skills was based on considerations of cognitive development, curriculum, flexibility of learning, accessibility, and educational relevance. This is consistent with the research conducted by Nofida and Arif (2020) on the effectiveness of problem-based learning (PBL) model based on audio-visual media. Conversely, researchers selected elementary school students and teachers with the least frequency. This information is of significant value, as it provides a basis for further research on creative thinking skills in determining subjects that are infrequently selected for new research.

3.4. Commonly Selected Science Subjects

Science, as a scientific discipline, can be subdivided into several fields of study and associated topics. This study will examine the distribution of science fields of study selected by researchers and the topics that are most frequently encountered in journal article publications. As illustrated in Figure 6, the field of study that researchers have expressed the most interest in is biology. Biology was chosen as a subject for research into creative thinking skills because of the relevance of the material, the flexibility of learning methods, the availability of facilities, the need to develop assessment tools and the focus on improving the quality of learning. In the remaining six articles, the researchers did not specifically explain the scientific field they studied.

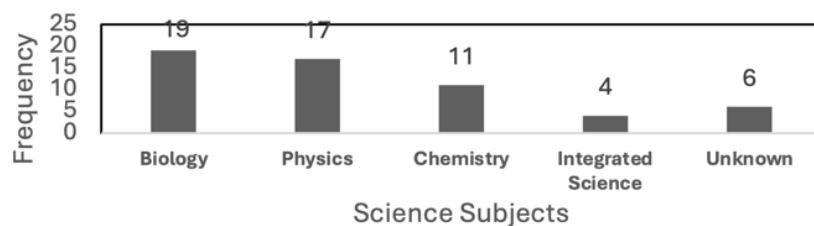


Figure 6. Distribution of research on creative thinking skills as the main concern by science field of study

A close examination of the publications revealed that a subset of them focused on a single specific topic, while others encompassed a broader range of subjects. The most frequently selected topics by researchers who emphasized creative thinking skills are outlined in Figure 7. The analysis reveals that the topic of environmental pollution emerged as the most prevalent subject of research in 13 publications focused on creative thinking skills. In 11 articles, the science topic was unknown because the researchers did not include it.

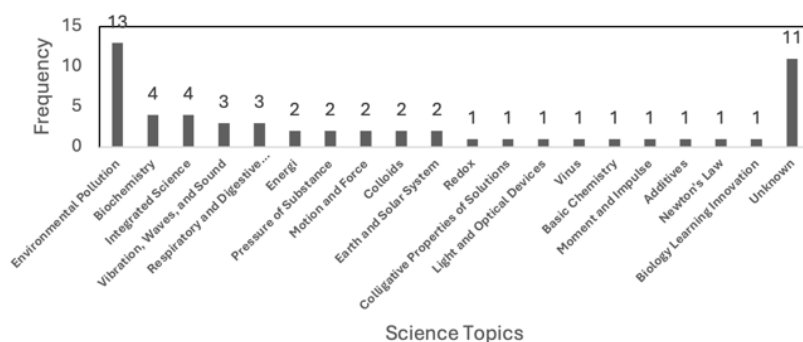


Figure 7. Distribution of research on creative thinking skills as the main concern by science topics

Furthermore, a survey of articles on the subject of environmental pollution reveals that many fail to thoroughly explicate the underlying factual conditions and the necessity of fostering creative thinking skills in students. Two notable studies—those by Indriani (2022) and Apriliana (2023)—offer a compelling rationale for the selection of this particular topic. The selection of this topic is consistent with the theory of cognitive learning by Jean Piaget, which posits that an individual's cognitive development is influenced by age and the chosen research subject. In this case, the selected research subject is junior high school students, with the objective of enhancing their creative thinking skills. This suggests that Indonesian researchers possess considerable potential in identifying solutions to assist students in becoming creative thinkers and adept problem solvers within their environment.

3.5. Learning Model/Method/Strategy

The provision of treatment is intended to test the researcher's hypothesis or to identify the difference or significance of certain conditions on the parameters under study. As shown in Figure 8, Project Based Learning (PjBL) and Problem Based Learning (PBL) with STEM are the most commonly used in research on creative thinking skills. This is based on the learning model/method/strategy's proven effectiveness, alignment with contemporary educational goals and ability to actively engage students in meaningful and interdisciplinary learning experiences.

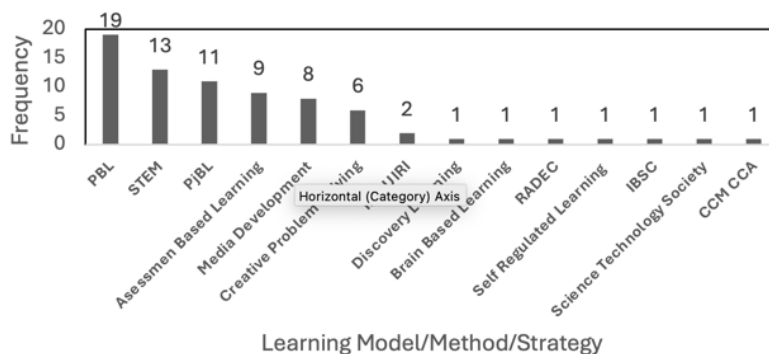


Figure 8. Distribution of research on creative thinking skills as the main concern by learning model/method/strategy

The amount of data in the graph is greater than the number of articles because an article may sometimes be a combination of models that are integrated with a particular learning strategy or approach. The findings from this study indicate a predominant tendency among researchers to employ a specific instructional design as the treatment or independent variable in their research. Conversely, there is a limited presence of evaluation research, which is research that focuses on assessing the effectiveness of programs, methods, or curricula in education (Scriven, 1981). This includes evaluating the effectiveness of an independent variable or the impact of a program on a dependent variable. Furthermore, research in educational psychology that examines psychological factors influencing learning, such as motivation, intelligence, and emotions (Dweck, 2006), remains limited. For instance, the relationship between psychological factors and specific dependent variables requires further exploration. Consequently, research in evaluation and educational psychology concerning students' creative thinking skills requires enhancement.

3.6. Data Collection Instruments

Students' creative thinking skills can be assessed through various instruments developed by preceding researchers. As depicted in Figure 9, tests are the most prevalent instrument for collecting data on creative thinking skills. In accordance with Guilford and Torrance, the cognitive dimensions of creativity (fluency, flexibility, originality, and elaboration) become consistent and stable when using the Torrance Tests of Creative Thinking (TTCT) in assessing creative thinking skills. Almeida (2008), further asserts that the TTCT is the most well-known and widely used test to measure creativity, and it includes figural and verbal subtests.

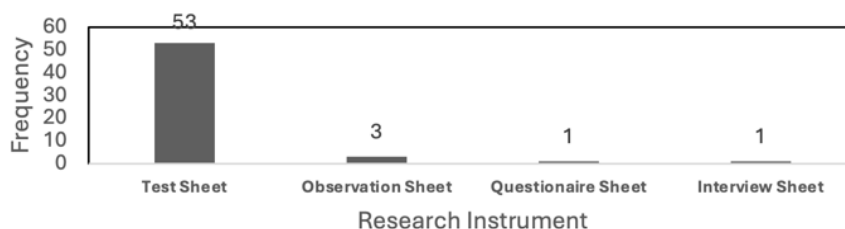


Figure 9. Distribution of research on creative thinking skills as the main concern based on data collection instruments

However, certain researchers did not explicitly indicate the utilization of TTCT as their data collection instrument, and some researchers who employed tests as the primary data collection technique merely delineated the test form, for instance, a test with a description answer form. Furthermore, some researchers did not conspicuously inform the audience that the instruments employed had undergone prior validation and reliability testing. Valid and reliable instruments ensure that the data collected accurately reflect the variables being studied, which is crucial for drawing valid conclusions (Souza et al., 2017). Researchers must rigorously test and validate their instruments to support sound educational practices and policies.

In addition to the administration of tests, some researchers elected to utilize alternative instruments. Specifically, one publication employed a combination of tests and interviews. With this combination, the amount of data is more than 57, according to the number of articles that were analyzed. However, it is widely accepted that data collection through tests is considered more objective than questionnaires and observations.

3.7. Data Analysis Techniques

The accuracy of the selection of methods for data analysis is a critical factor in determining the validity of a study. The distribution of data analysis techniques in Figure 10 was determined through one-on-one calculation for studies that employed more than one data analysis technique in conjunction. Furthermore, Figure 10 demonstrates that N-Gain and t-test were the most frequently used data analysis methods.

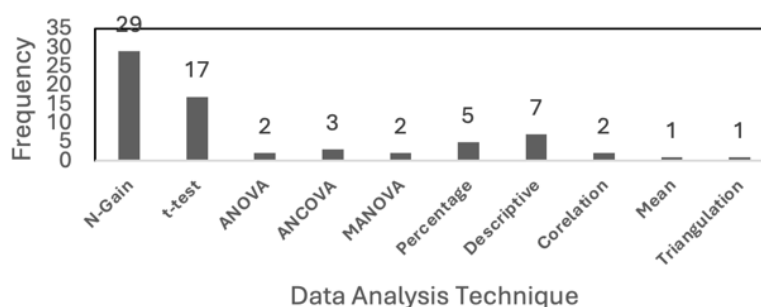


Figure 10. Distribution of research on creative thinking skills as the main concern based on data analysis technique

In this study, it was observed that research titles employing the N-Gain and t-test methods typically involved the utilization of experimental groups and control classes. N-gains and t-tests are preferred because they effectively quantify learning gains and test for statistical significance of improvements in creative thinking skills. They provide reliable evidence to determine whether educational interventions actually improve students' creativity. The insights derived from this study could serve as a reference point for future researchers, enabling them to select data analysis techniques tailored to the objectives of their research, research hypotheses, and research design.

4. Conclusions

This study reviewed articles emphasizing creative thinking skills that were published in science education journals across Indonesia from 2015 to 2024. The analysis revealed a trend of increasing publications emphasizing creative thinking skills, particularly in the last three years. The majority of these publications were quantitative studies. The study identified a preference for research subjects among junior high school students, with the field of study Biology being the most prevalent, and environmental pollution as the most prevalent topic. The study further noted the predominance of Problem-Based Learning (PjBL) as the most commonly applied treatment, followed by the utilization of tests as the primary data collection instrument and the selection of N-Gain as the predominant data analysis approach. Addressing the findings of this study, several recommendations have been prepared for further research. Firstly, there is a necessity to augment the frequency with which qualitative and mixed-method research is conducted to investigate the development of creative thinking skills. Secondly, the topic of local wisdom and ethnosience presents an opportunity to develop R&D research with a focus on creative thinking skills. Thirdly, R&D that aims to develop instructional products should be targeted to improve students' low creative thinking skills. Fourthly, researchers should clearly inform about their research instruments, along with the validity and reliability of the instruments. Finally, in conducting research, it is recommended that researchers choose the most appropriate data analysis technique for the research objectives or hypotheses and research design.

Author Contributions

All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

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