Tadris: Jurnal Keguruan dan Ilmu Tarbiyah 9 (2): 391-402 (2024)
DOI: 10.24042/tadris.v9i2.23666

TADRIS: JURNAL KEGURUAN DAN ILMU TARBIYAH
(Tadris: Journal of Education and Teacher Training)
P-ISSN: 2301-7562 | E-ISSN: 2579-7964
ejournal.radenintan.ac.id/index.php/tadris/index

The Relationship Between Students' Critical and Creative Thinking Skills in Nutrition Concepts Within the Framework of Education for Sustainable Development

Tantri Liana[1]*, Parlindungan Sinaga[1], Lilit Rusyati[1], Ayu Lita Permata Airin[2]
[1]Department of Science Education, Universitas Pendidikan Indonesia, Indonesia
[2]Sekolah Menengah Pertama (SMP) Budi Bakti Utama Bandung, Indonesia

Article History:
Submitted: August 1st, 2024
Revised: August 7th, 2024
Accepted: September 14th, 2024
Published: December 29th, 2024

Keywords:
Creative thinking skills,
Critical thinking skills,
ESD,
Nutrition concepts

***Correspondence Address:**
tantri_liana@upi.edu

Abstract: In the context of the Fourth Industrial Revolution, equipping students with critical and creative thinking skills within the framework of Education for Sustainable Development is essential but remains insufficiently explored, particularly in relation to nutrition concepts. This study evaluates the critical and creative thinking skills of eighth-grade students at a private junior high school and examines the relationship between these skills in the context of Education for Sustainable Development and nutrition. A total of 62 students participated in the study, which employed a correlational design to analyze data from a written test comprising fifteen multiple-choice questions on critical thinking and eight essay questions on creative thinking. To minimize guessing, the critical thinking test included well-designed distractors. Descriptive analysis was followed by the application of the Spearman test to determine the correlation between critical and creative thinking skills. The results indicated low performance in both areas, with average scores of 31.61 for critical thinking and 43.34 for creative thinking. Furthermore, no significant correlation was found between the two skills, as the significance value of 0.126 exceeded the threshold of 0.05. The findings suggest that systematic planning and continuous learning are necessary to enhance these skills and improve academic performance. The study emphasizes the need for structured educational strategies to develop critical and creative thinking concurrently, thereby informing curriculum development to support Education for Sustainable Development goals and prepare students to address future sustainability challenges.

INTRODUCTION

In today's rapidly evolving industrial era, driven by the fourth industrial revolution, students must develop specific skills to navigate and compete with modern challenges. This revolution has highlighted the need for advanced learning and innovation skills across various sectors, including education. To thrive in this dynamic environment, students require abilities such as critical thinking, problem-solving, communication, collaboration, creativity, and innovation (Agustin & Pratama, 2021; Ayçiçek, 2021; Kardoyo et al., 2020). Among these, critical and creative thinking are particularly vital. Critical thinking enables students to analyse, evaluate, and synthesise information, making informed decisions in a fast-paced world. Creative thinking fosters the generation of novel ideas and solutions,

essential for innovation and adapting to new situations (Koivisto & Grassini, 2023a; Kuncel & Cities, 2015; Nasution et al., 2023; Sumarni & Kadarwati, 2020). Fostering these skills in modern education is crucial not only for students' academic success but also for their ability to address complex problems, drive progress, and transform traditional worldviews. By enhancing their understanding of the world, these skills empower students to act effectively and participate meaningfully in the 21st century (Gonzalez-Mohino et al., 2023; Sun et al., 2020a; Zaeske et al., 2022; Ramírez-Montoya & Portuguez-Castro, 2024).

Globally, the urgency to integrate critical and creative thinking skills into education is growing due to rapid technological advancements and the increasing complexity of societal challenges (Amran et al., 2019). Despite advancements in various sectors, including science and technology, Indonesia struggles with a workforce that is often low-skilled and poorly paid. This challenge impacts the educational sector, prompting efforts to improve educational outcomes and better prepare students for future challenges (Kemendikbudristek, 2023; Rusyati et al., 2020).

Efforts within the Education for Sustainable Development (ESD) framework, as noted by Weber et al. (2022), are essential because ESD equips students with the knowledge, skills, and values for sustainable development, with critical thinking being key to improving decision-making and increasing participation in public and political affairs (Gonzalez-Mohino et al., 2023; Weber et al., 2022). This framework provides an ideal context to explore the interaction between critical and creative thinking skills in understanding nutritional concepts (Nurhasan et al., 2021; World Health Organization & Unesco, 2021; World Health Organization (WHO), 2023; World Health Organization (WHO) & UNESCO, 2021).

Nutrition is critical for adolescents, influencing their physical growth, cognitive development, and overall health. A solid understanding of nutrition helps prevent issues such as malnutrition and obesity (J. Harris & Nissbett, 2020; Medina et al., 2020; Sharma et al., 2021; UNICEF, 2020; World Health Organization (WHO), 2023). Malnutrition whether undernutrition or overnutrition can disrupt immune function, impair growth, and increase susceptibility to infections. Proper nutritional strategies, including balanced diets rich in essential vitamins and minerals, are key to addressing these challenges, fostering optimal development and long-term well-being (Morales et al., 2024). Integrating nutrition education within the Education for Sustainable Development (ESD) framework links individual health to broader sustainability challenges, such as food security and environmental sustainability. While this integration is present in some educational settings, including science education (Fiel'ardh et al., 2023; McCormack et al., 2024; Patra et al., 2023). The relationship between critical and creative thinking skills and their impact on understanding nutrition in the ESD context remains underexplored. Monterrosa et al. (2020) highlight how socio-cultural factors influence food choices, underscoring the importance of considering these influences in nutrition education. However, research has not fully addressed how developing critical and creative thinking within an ESD framework can improve understanding and decision-making related to nutrition, indicating the need for more comprehensive studies in this area.

The novelty of this research lies in its integrative approach, examining critical and creative thinking skills together within the context of Education for Sustainable Development (ESD). By focusing on nutrition concepts, it links cognitive skills to real-world applications, addressing gaps in prior research and

aligning with global educational priorities. The findings benefit educators by providing insights into nurturing these skills, aiding curriculum design for critical and creative problem-solving, and contributing to sustainable education by integrating ESD into nutrition teaching, thus preparing students for a sustainable future (Fairuz et al., 2019; UNESCO, 2011, 2022; UNICEF, 2020).

Based on this context, this study aims to evaluate the student's critical and creative thinking skills of 8th-grade in a private junior high school and to explore the relationship between these skills within the context of Education for Sustainable Development (ESD) and nutrition concepts. The research seeks to contribute valuable knowledge to the field of educational research. The specific research questions are: 1) What are the levels of critical and creative thinking skills among these students? 2) Is there a significant correlation between these skills? The findings are anticipated to inform curriculum development and instructional practices, support ESD goals, and prepare students to tackle sustainability challenges.

METHOD

This study employed a correlational research design to investigate the relationship between critical thinking and creative thinking among eighth-grade students. Correlational research, as defined by Creswell (2018), examines the degree of relationship between variables without manipulation, indicating the strength and direction of the relationship (Creswell & Creswell, 2018; Devi et al., 2022). The participants were 62 students from grades VIII B and VIII C in a private junior high school in West Bandung Regency, selected through purposive sampling.

Critical thinking was assessed using a validated multiple-choice test consisting of 15 questions, which measured five key indicators: Basic Clarification, Basic for decision, Inference, Advanced Clarification, and Supposition and Integration (Ennis, 2011a). The test demonstrated acceptable reliability with a Cronbach's Alpha of 0.624. To minimize guessing, the questions were designed to assess higher-order thinking skills, with plausible distractors included. Each correct answer was scored as 1, while incorrect answers were scored as 0.

Creative thinking was evaluated through eight essay questions that assessed four indicators: Fluency, Flexibility, Originality, and Elaboration, within the context of nutrition and the Education for Sustainable Development (ESD) framework (Torrance, 1972). The rubric for scoring these indicators ranged from 1 to 3 points. The following is the rubric for each assessment indicator creative thinking, the rubric was applied as follows:

1. Fluency was assessed based on the number of relevant and correct answers students provided, with higher scores awarded for generating multiple ideas or solutions.
2. Flexibility was measured by the variety of approaches used in the answers, with higher scores for considering different perspectives.
3. Originality evaluated the uniqueness of the students' responses, with higher scores given for answers that were less common among their peers.
4. Elaboration focused on the level of detail in the students' answers, with higher scores for thorough explanations and well-developed ideas.

Data analysis involved converting the responses from both the multiple-choice and essay assessments into percentage scores using the formula:

$$Percentage\ score = \frac{Number\ of\ correct\ answers}{Total\ number\ of\ questions} x\ 100$$

Spearman's correlation formula was then used to determine the relationship between critical and creative thinking scores, with the analysis conducted using

SPSS Statistics 25 for Windows. Overall, the design and methodology of this study were intended to provide a comprehensive understanding of the interrelation between critical and creative thinking among students. A detailed flowchart illustrating the study's process is presented in Figure 1.

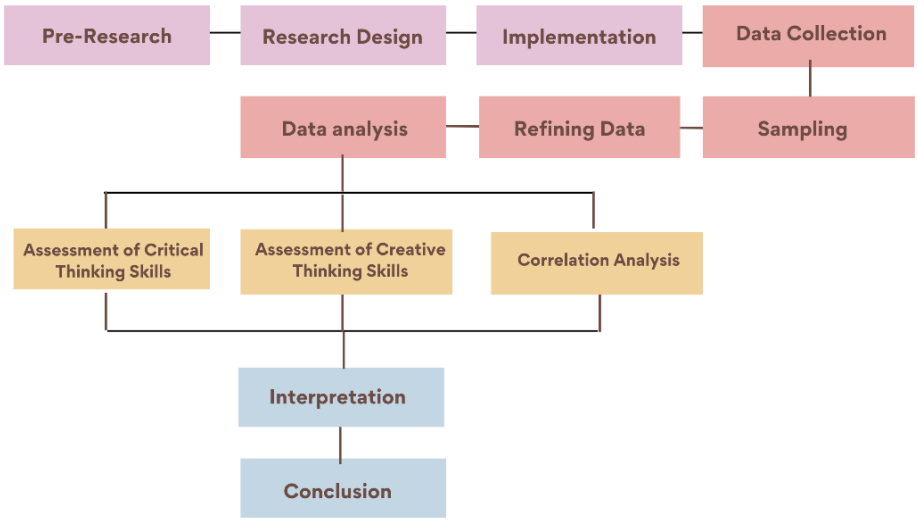


Figure 1. The Research Flow Diagram.

RESULT AND DISCUSSION

Description of Critical Thinking Skills

Data was collected based on the results of multiple-choice tests completed by students. After performing the calculations, the percentage data for each indicator of students' critical thinking skills are presented in Table 1 below.

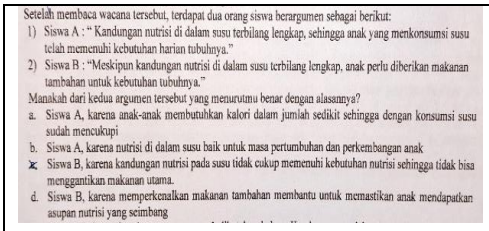
Table 1. Percentage of Critical Thinking Skills Indicators.

Indicator	Question Number	Percentage
Basic Clarification	1, 2, 3	32.26%
Basic for a Decision	4, 5, 6	48.39%
Inference	7, 8, 9, 10	35.08%
Advanced Clarification	11, 12	24.19%
Supposition and Integration	13, 14, 15	14.52%

Based on the data in Table 1, the highest achievement in critical thinking indicators is observed in the basic indicators for making decisions (Basis for Decision), with a score of 48.39%. In this indicator, students are asked to observe and evaluate a source or the results of an observation. They are required to examine a report on why we need food and additives, assess the credibility of the source, and consider its impact on life. Conversely, the lowest achievement in critical thinking indicators is found in the Supposition and Integration indicators, with a score of 14.52%. This is because students need to logically consider premises, reasons, assumptions, positions, and other proposals, as well as integrate other abilities and dispositions in making and maintaining decisions regarding a healthy diet, nutritional value information tables, and the function of the digestive system.

To ensure the validity of the multiple-choice results and reduce the likelihood of students guessing the correct answers, several strategies were implemented. High-quality distractors were included to challenge students' understanding, and their multiple-choice answers were cross-referenced with their essay responses on similar topics.

Additionally, some questions were designed to build on previous ones, requiring students to use their earlier answers to correctly answer subsequent questions (Figure 2). This approach helped determine whether students were critically engaging with the material or merely guessing.


Setelah membaca wacana tersebut, terdapat dua orang siswa berargumen sebagai berikut:
1) Siswa A : " Kandungan nutrisi di dalam susu terbilang lengkap, sehingga anak yang menkonsumsi susu telah memenuhi kebutuhan harian tubuhnya."
2) Siswa B : "Meskipun kandungan nutrisi di dalam susu terbilang lengkap, anak perlu diberikan makanan tambahan untuk kebutuhan tubuhnya."
Manakah dari kedua argumen tersebut yang menurutmu benar dengan alasannya?
a. Siswa A, karena anak-anak membutuhkan kalori dalam jumlah sedikit sehingga dengan konsumsi susu sudah mencukupi
b. Siswa A, karena nutrisi di dalam susu baik untuk masa pertumbuhan dan perkembangan anak
x Siswa B, karena kandungan nutrisi pada susu tidak cukup memenuhi kebutuhan nutrisi sehingga tidak bisa menggantikan makanan utama.
d. Siswa B, karena memperkenalkan makanan tambahan membantu untuk memastikan anak mendapatkan asupan nutrisi yang seimbang

Question:
After reading the discourse, two students made the following arguments:
1. Student A: "The nutritional content in milk is fairly complete, so children who consume milk have met their daily nutritional needs."
2. Student B: "Although the nutritional content in milk is fairly complete, children still need to be given additional food to meet their nutritional needs."

Which of the two arguments do you think is correct, and why?
a. Student A, because children need calories in small amounts, so consuming milk is sufficient.
b. Student A, because the nutrients in milk are beneficial for children's growth and development.
c. Student B, because the nutritional content in milk is not sufficient to meet all nutritional needs and cannot replace main meals.
d. Student B, because introducing additional food helps ensure that children receive a balanced nutritional intake.

Student Answers:
Student B, because the nutritional content in milk is not sufficient to meet all nutritional needs and cannot replace main meals.

Figure 2. Critical Thinking Questions and Student Answers.

For instance, in the 'Basic Clarification' question indicator described above, students are evaluated not only on their ability to select the correct answer but also on their capacity to articulate reasons that align with the principles of balanced nutrition. This dual assessment approach emphasizes both accuracy and the depth of understanding. When students correctly identify the answer and support it with a well-reasoned explanation, they demonstrate their ability to critically evaluate information, consider various factors, and apply logical reasoning. These skills are fundamental components of critical thinking, showcasing the student's ability to make informed and thoughtful judgments."

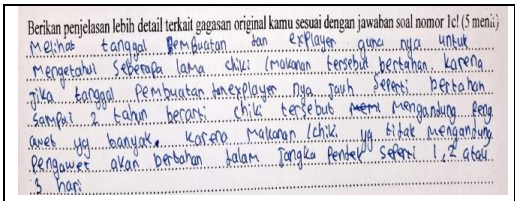
Description of Creative Thinking Skills

Creative thinking was assessed using essay questions that required students to generate ideas, explore different perspectives, and elaborate on their thoughts. Data was collected based on the results of essay tests completed by students. After performing the calculations, the percentage data for each indicator of students' creative thinking skills are presented in Table 2 below.

Table 2. Percentage of Creative Thinking Skills Indicators.

Indicator	Question Number	Percentage
Fluency	1a, 2a	67.47%
Flexibility	1b, 2b	43.82%
Originality	3a, 3b	30.91%
Elaboration	4a, 4b	30.91%

Based on Table 2, it is evident that there are differences in the percentages of students' achievement in creative thinking skills. The data reveal significant differences in students' creative thinking skills. The highest percentage was achieved in the fluency indicator (67.47%), which required students to generate numerous relevant statements or questions related to additives and healthy diets. The lowest percentages were observed in the originality and elaboration indicators, both at 30.91%. These indicators are challenging because students must develop unique and original ideas that differ from their peers' responses and provide more detailed descriptions. Implementing creative thinking in schools is challenging because critical thinking remains dominant, often due to disciplinary biases and non-creative habit patterns; this sidelines creative thinking and is compounded by teachers' limited conceptual mastery, which hinders their ability to connect and apply knowledge effectively (D. Harris et al., 2023).



Question:
Provide a more detailed explanation of your original idea based on your answer to question 1c.

Student Answer:
Checking the manufacturing date and expiration date is useful for determining how long a snack or food will last. If the expiration date is far off, such as up to 2 years, it suggests the food contains a lot of preservatives. In contrast, food without preservatives typically has a shorter shelf life, lasting only 1-3 days.

Figure 3. Creative Thinking Questions and Student Answers.

The answer shows a good understanding of the concept, with a detailed explanation of the relationship between the expiration date and preservatives. However, there are some misconceptions, and the lack of more detailed examples or further exploration of the topic means the answer is not fully comprehensive. Although the response is clear, there is still room for further development and elaboration. Therefore, the student's answer would likely score a 2 on this scale, as it demonstrates a reasonable level of elaboration but could benefit from deeper exploration and more thorough reasoning.

Theoretically, creativity is seen as a multicomponent process involving cognitive aspects as well as affective, motivational, and other characteristics that must transfer and apply concepts to solve problems related to discussions on additives and healthy diets. Overall, data processing is conducted to evaluate students' abilities. Descriptive statistical results of students' critical and creative thinking about nutrition concepts are presented in Table 3.

Table 3. Descriptive Statistics.

	Critical Thinking	Creative Thinking	Valid N (Listwise)
Minimum	7	8	62
Maximum	53	88	
Sum	1960	2687	
Mean	31.61	43.34	
Std. Deviation	12.413	19.920	
Variance	154.077	396.818	

(Primary Data, SPSS)

Based on Table 3, on average, students scored higher in Creative Thinking (43.34) than in Critical Thinking (31.61). However, it can be concluded that both critical and creative thinking skills are still in the low category and quite similar on average. This is consistent with research findings that suggest there is still a lack of basic critical and creative thinking skills (Dalila et al., 2022; Febriana & Sinaga, 2021; Hidayati & Sinaga, 2019; Qodari et al., 2022). The standard deviation indicates that there is more variability in Creative Thinking scores (19.920) compared to Critical Thinking scores (12.413). A higher standard deviation means that the scores are more spread out from the mean.

Abrahami et al. (2008). Educators should integrate critical thinking into academic content and teach it as a standalone skill. Schafersman (1991) suggests that one easier, quicker, and cheaper method involves adjusting teaching and testing approaches. He also notes that critical thinking is enhanced through hands-on lab activities and quantitative exercises (Sinaga et al., 2022).

Correlation between Critical Thinking Skills and Creative Thinking

Before hypothesis testing, the normality of the data for critical and creative thinking skills was assessed using the Kolmogorov-Smirnov test. The results indicated that the data for critical thinking skills were not normally distributed, while the data for creative thinking skills were normally distributed. This was determined by significance values, with the critical thinking significance at 0.005 and the creative thinking significance at 0.083 (values less than 0.05 indicate a non-normal distribution). Due to the non-normal distribution of some data, the Spearman correlation test was used to test the research hypothesis. The hypotheses for this study are:

H_0: There is no relationship between students' critical thinking and creative thinking on nutrition concepts.
H_1: There is a relationship between students' critical thinking and creative thinking on nutrition concepts.

Table 4. Spearman Correlation.

			Critical Thinking	Creative Thinking
Spearman's rho	Critical Thinking	Correlation Coefficient	1,000	,196
		Sig. (2-tailed)	.	.126
		N	62	62
	Creative Thinking	Correlation Coefficient	,196	1,000
		Sig. (2-tailed)	.126	.
		N	62	62

(Primary Data, SPSS)

Based on Table 4, the significance of Spearman's correlation between students' critical thinking and creative thinking skills is 0.126, with a correlation coefficient of 0.196. Since the significance value is 0.126, which is greater than 0.05, the null hypothesis (H0) is accepted. Thus, it can be concluded that, in general, there is no significant relationship between students' critical thinking skills and their creative thinking skills concerning nutrition concepts in general. This correlation indicates that a higher critical thinking score for a student does not necessarily correspond to a higher creative thinking score. Students' critical thinking abilities are not dependent on their levels of creative thinking, whether high, medium, or low. Further research

was conducted to analyse the correlation of each indicator with each student's thinking ability, as presented in Table 5 below.

Table 5. Spearman Correlation for each Indicator.

			Fluency	Flexibility	Originality	Elaboration
Spearman's rho	Basic Clarification	Correlation Coefficient	-0.073	0.217	.265*	.311*
		Sig. (2-tailed)	0.575	0.090	0.037	0.014
		N	62	62	62	62
	Basic for a Decisions	Correlation Coefficient	0.025	0.115	0.142	0.084
		Sig. (2-tailed)	0.847	0.373	0.270	0.517
		N	62	62	62	62
	Inference	Correlation Coefficient	0.025	0.061	0.037	0.073
		Sig. (2-tailed)	0.847	0.636	0.775	0.574
		N	62	62	62	62
	Advanced Clarification	Correlation Coefficient	0.086	0.010	0.213	0.125
		Sig. (2-tailed)	0.506	0.941	0.097	0.332
		N	62	62	62	62
	Supposition and Integration	Correlation Coefficient	0.180	0.007	-0.055	-0.135
		Sig. (2-tailed)	0.161	0.958	0.673	0.295
		N	62	62	62	62

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Based on the Spearman correlation results for each indicator of students' critical and creative thinking skills, only a small number of significant correlations were found. These include the relationships between the basic clarification indicators of critical thinking and the originality and elaboration indicators of creative thinking. The basic clarification indicators of critical thinking are assessed in questions 1, 2, and 3. In these questions, students are asked to focus on the question, identify or formulate the question, determine possible criteria for evaluating an answer, and recall the relevant question and context from the reading text about the importance of checking nutrition in milk (Ennis, 2011b). According to Munandar (1999), the originality indicator of creative thinking (questions 1c and 2c) involves providing new ideas for solving problems or answering questions about additives and adolescent diets in unique ways, as well as creating novel combinations of various elements. The elaboration indicator of creative thinking (questions 1c and 2c) involves developing or enriching others' ideas, adding details, organising, or refining an idea to improve its quality.

Several studies have demonstrated a relationship between creative (divergent) thinking and critical (convergent) thinking. Creative thinking is divergent, while critical thinking is convergent, and the two are not entirely separate but are closely integrated. Paul (2006) states that creative and critical thinking are closely related to imaging skills. Creative thinking generates unconventional ideas, while critical thinking evaluates them rationally.

Effective creativity combines both, with divergent thinking producing ideas and convergent thinking refining them. Modern views see these as a continuum, emphasizing their interplay in achieving innovative outcomes (Eymann et al., 2024). Individuals with a rich semantic knowledge structure are more likely to activate and associate remote ideas, leading to more original combinations compared to those with strictly hierarchical structures (Koivisto & Grassini, 2023b). However, the lack of a significant correlation between critical thinking skills and creativity indicates that reasoning is not always directly proportional to creativity, possibly due to the differing nature of critical (closed) versus creative (open) thinking questions. Therefore, learning plans must focus on training students' divergent and convergent thinking abilities. Teachers can use open-ended questions to encourage flexible responses. The combination of divergent and convergent thinking helps students elaborate on ideas (Nurdiana et al., 2020).

CONCLUSION

The findings of this study reveal that students' critical thinking and creative thinking abilities remain relatively low, with average scores of 31.61 and 43.34, respectively. Furthermore, the correlation analysis shows no significant relationship between these two skills, as evidenced by a significance value of 0.126 ($p > 0.05$). These results underscore the need for a well-structured and continuous learning process aimed at fostering critical and creative thinking skills, which are essential for improving academic performance.

REFERENCES

Agustin, M., & Pratama, Y. (2021). *Keterampilan berpikir dalam konteks pembelajaran abad ke-21* (N. Atif, Ed.; Vol. 1). PT Refika Aditama.

Amran, A., Perkasa, M., Satriawan, M., Jasin, I., & Irwansyah, M. (2019). Assessing students 21st century attitude and environmental awareness: Promoting education for sustainable development through science education. *Journal of Physics: Conference Series*, *1157*(2). https://doi.org/10.1088/1742-6596/1157/2/022025

Ayçiçek, B. (2021). Integration of critical thinking into curriculum: Perspectives of prospective teachers. *Thinking Skills and Creativity*, *41*. https://doi.org/10.1016/j.tsc.2021.100895

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches - John W. Creswell, J. David Creswell - Google Books. In *SAGE Publications, Inc.*

Dalila, A. A., Sinaga, P., Liliawati, W., Setiawan, A., Sa'Diyah, L. H., Komalasari, K., & Umar, F. A. (2022). Inventory of high school students' critical thinking skills in online learning during the Covid-19 Pandemic on momentum and impulse material in Subang Regency. *AIP Conference Proceedings*, *2468*. https://doi.org/10.1063/5.0102517

Devi, B., Devi, R., Pradhan, S., Giri, D., Lepcha, N., & Basnet, S. (2022). Application of correlational research design in nursing and medical research Ranjita Devi. *Journal of Xi'an Shiyou University*, *65*(11), 60–69.

Ennis, R. (2011a). Critical thinking: Reflection and perspective part I. *Inquiry: Critical Thinking Across the Disciplines*, *26*(1), 4–18.

Ennis, R. (2011b). Critical thinking: Reflection and perspective Part I.

Inquiry: Critical Thinking Across the Disciplines, *26*(1), 4–18.

Eymann, V., Beck, A. K., Lachmann, T., Jaarsveld, S., & Czernochowski, D. (2024). Reconsidering divergent and convergent thinking in creativity–a neurophysiological index for the convergence-divergence continuum. *Creativity Research Journal*, *00*(00), 1–8. https://doi.org/10.1080/10400419.2024.2419751

Fairuz, T., Kaniawati, I., & Sinaga, P. (2019). Integrated science teaching materials oriented on critical thinking skills and information literacy. *Journal of Physics: Conference Series*, *1157*(2). https://doi.org/10.1088/1742-6596/1157/2/022037

Febriana, R., & Sinaga, P. (2021). Evaluation of critical thinking skills of class x high school students on the material of Newton's laws. *Journal of Physics: Conference Series*, *1806*(1). https://doi.org/10.1088/1742-6596/1806/1/012012

Fiel'ardh, K., Fardhani, I., & Fujii, H. (2023). Integrating perspectives from education for sustainable development to foster plant awareness among trainee science teachers: A mixed methods study. *Sustainability (Switzerland)*, *15*(9). https://doi.org/10.3390/su15097395

Gonzalez-Mohino, M., Rodriguez-Domenech, M. Á., Callejas-Albiñana, A. I., & Castillo-Canalejo, A. (2023). Empowering critical thinking: The role of digital tools in citizen participation. *Journal of New Approaches in Educational Research*, *12*(2), 258–275. https://doi.org/10.7821/naer.2023.7.1385

Harris, D., Coleman, K., & Cook, P. J. (2023). Radical rubrics: implementing the critical and creative thinking general capability through an ecological approach. *Australian Educational Researcher*, *50*(3), 729–745. https://doi.org/10.1007/s13384-022-00521-8

Harris, J., & Nissbett, N. (2020). *Global nutrition report : Action on equity to end malnutrition*. Global Nutrition Report.

Hidayati, Y., & Sinaga, P. (2019). The profile of critical thinking skills students on science learning. *Journal of Physics: Conference Series*, *1402*(4). https://doi.org/10.1088/1742-6596/1402/4/044075

Kardoyo, Nurkhin, A., & Pramusinto, H. (2020). Problem-based learning strategy: Its Impact on Students' Critical and Creative Thinking Skills. *European Journal of Educational Research*, *9*(3).

Kemendikbudristek. (2023). PISA 2022 dan pemulihan pembelajaran di Indonesia. In *Laporan Pisa Kemendikbudristek*.

Koivisto, M., & Grassini, S. (2023a). Best humans still outperform artificial intelligence in a creative divergent thinking task. *Scientific Reports*, *13*(1). https://doi.org/10.1038/s41598-023-40858-3

Koivisto, M., & Grassini, S. (2023b). Best humans still outperform artificial intelligence in a creative divergent thinking task. *Scientific Reports*, *13*(1). https://doi.org/10.1038/s41598-023-40858-3

Kuncel, N. R., & Cities, T. (2015). Yes, colleges do teach critical-thinking skills, study finds. *The Chronicle of Higher Education*.

McCormack, J., Noble, C., Rutherford, S., Ross, L. J., & Bialocerkowski, A. (2024). Integrating the sustainable development goals into health professions' curricula: using the nominal group technique to guide their contextualisation. *BMC*

Medical Education, *24*(1). https://doi.org/10.1186/s12909-024-05968-0

Medina, C. R., Urbano, M. B., De Jesús Espinosa, A., & López, Á. T. (2020). Eating habits associated with nutrition-related knowledge among university students enrolled in academic programs related to nutrition and culinary arts in puerto rico. *Nutrients*, *12*(5). https://doi.org/10.3390/nu12051408

Morales, F., Montserrat-de la Paz, S., Leon, M. J., & Rivero-Pino, F. (2024). Effects of malnutrition on the immune system and infection and the role of nutritional strategies regarding improvements in children's health status: A literature review. *Nutrients*, *16*(1), 1–16. https://doi.org/10.3390/nu16010001

Nasution, N. E. A., Al Muhdhar, M. H. I., Sari, M. S., & Balqis. (2023). Relationship between critical and creative thinking skills and learning achievement in Biology with reference to educational level and gender. *Journal of Turkish Science Education*, *20*(1). https://doi.org/10.36681/tused.2023.005

Nurdiana, H., Sajidan, & Maridi. (2020). Creative thinking skills profile of junior high school students in science learning. *Journal of Physics: Conference Series*, *1567*(2). https://doi.org/10.1088/1742-6596/1567/2/022049

Nurhasan, M., Samsudin, Y., Mccarthy, J., Napitupulu, L., Dewi, R., Hadihardjono, D., Rouw, A., Melati, K., Belloti, W., Tanoto, R., Campbell, J. S., Ariesta, D., Setiawan, H., Khomsan, A., & Ickowitz, A. (2021). Linking food, nutrition and the environment in Indonesia: A perspective on sustainable food systems. In *Linking food, nutrition and the environment in Indonesia: A perspective on sustainable food systems*. Center for International Forestry Research (CIFOR). https://doi.org/10.17528/cifor/008070

Patra, E., Kokkinopoulou, A., & Pagkalos, I. (2023). Focus of sustainable healthy diets interventions in primary school-aged children: A systematic review. *Nutrients*, *15*(11). https://doi.org/10.3390/nu15112460

Qodari, N. N., Sinaga, P., & Suhendi, E. (2022). Analysis of creative thinking skills of high school students in dynamic fluid materials as the impact of distance learning during the Covid-19 Pandemic. *AIP Conference Proceedings*, *2468*. https://doi.org/10.1063/5.0103684

Ramírez-Montoya, M. S., & Portuguez-Castro, M. (2024). Expanding horizons for the future with an open educational model for complex thinking: external and internal validation. *On the Horizon*, *32*(1), 32–48. https://doi.org/10.1108/OTH-12-2023-0042

Rusyati, L., Rochintaniawati, D., Agustin, R. R., Sanjaya, Y., & Deandra, I. G. (2020). Gender differences in the attribution of creative thinking: experimental evidence using STEM-based e-module. *Proceedings of the 7th Mathematics, Science, and Computer Science Education International Seminar, MSCEIS 2019*. https://doi.org/10.4108/eai.12-10-2019.2296391

Sharma, D. M., Kupka, R., Tyler, V., & Aguayo, V. (2021). *Nutrition in Middle Childhood and Adolescence*.

Sinaga, P., Setiawan, W., & liana, M. (2022). The impact of electronic interactive teaching materials (EITMs) in e-learning on junior high school students' critical thinking skills. *Thinking Skills and*

Creativity, *46*. https://doi.org/10.1016/j.tsc.2022.101066

Sumarni, W., & Kadarwati, S. (2020). Ethno-stem project-based learning: Its impact to critical and creative thinking skills. *Jurnal Pendidikan IPA Indonesia*, *9*(1). https://doi.org/10.15294/jpii.v9i1.21754

Sun, M., Wang, M., & Wegerif, R. (2020a). Effects of divergent thinking training on students' scientific creativity: The impact of individual creative potential and domain knowledge. *Thinking Skills and Creativity*, *37*(July), 1–10. https://doi.org/10.1016/j.tsc.2020.100682

Sun, M., Wang, M., & Wegerif, R. (2020b). Effects of divergent thinking training on students' scientific creativity: The impact of individual creative potential and domain knowledge. *Thinking Skills and Creativity*, *37*(November 2021). https://doi.org/10.1016/j.tsc.2020.100682

Torrance, E. P. (1972). Predictive Validity of the torrance tests of creative thinking. *The Journal of Creative Behavior*, *6*(4), 236–262. https://doi.org/10.1002/j.2162-6057.1972.tb00936.x

UNESCO. (2011). *Education for sustainable development for changing the climate of teacher education to address sustainability*. www.unesco.org/jakarta

UNESCO. (2022). *sustainability starts with teachers programme*. www.sustainabilityteachers.org

UNICEF. (2020). *FOOD AND ME How adolescents experience nutrition across the world*. https://doi.org/10.26183/26f6-ec12

Weber, A., Linkemeyer, L., Szczepanski, L., & Fiebelkorn, F. (2022). "Vegan teachers make students feel really bad": Is teaching sustainable nutrition indoctrinating? *Foods*, *11*(6). https://doi.org/10.3390/foods11060887

World Health Organization, & Unesco. (2021). *WHO guideline on school health services*. mncah@who.int

World Health Organization (WHO). (2023). *Why is nutrition important for learners' health and well-being?* 1–8.

World Health Organization (WHO), & UNESCO. (2021). *Making every school a health-promoting school: Implementation guidance*.

Zaeske, L. M., Harris, T. P., Williams, A., Long, H., Kerr, B. A., & Birdnow, M. (2022). Adolescent technology-use and creative activities during COVID-19: A qualitative study. *Thinking Skills and Creativity*, *November*. https://doi.org/https://doi.org/10.1016/j.tsc.2022.101190