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Dominant Indicator of Creative Thinking: The Case of Geography Learning Outcomes

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ABSTRACT

Creative thinking were considered skills usually based on natural talent. It means that only those who were talented could become creative people. The reality, the students can create new ideas quickly and diversely. This article aimed to determine the dominant indicators of creative thinking between fluency, flexibility, originality, and elaboration. The subjects were 29 high school students in one class, and the learning process aimed to increase creativity. Measure creativity by using subjective questions, such as as as many as five questions. The learning outcome score was the final grade of the semester. Data analysis used multiple linear regression. The results showed that the flexibility indicator has a β value most distant from zero (0) (β = 4,030). The flexibility indicator was the most dominant and has the most significant influence compared to other indicators. Flexibility helped students deal with these obstacles by finding alternatives or changing strategies. Identifying major creative thinking indicators was a foundation for building unique evaluation methodologies. The contribution for methodologies can better assess students' creative ability and grasp of geographical ideas, resulting in a more comprehensive evaluation of student performance.

Keywords: *Creative Thinking, Geography Learning Outcomes, Flexibility*

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INTRODUCTION

In the evolving educational landscape of Indonesia, the need for creative thinking abilities among learners is more pressing than ever. As the nation navigates the complexities of the 21st century, characterized by rapid technological advancements, environmental challenges, and globalization, creative thinking becomes a crucial asset for students (Yasmin, 2023). Developing creative thinking abilities is essential for navigating the complexities of modern geography and addressing the unique challenges faced by the nation (Gustian et al., 2024). Creative thinking is not just a desirable skill but a necessary one to tackle the unique socio-economic and environmental issues facing the country (Odeyemi et al., 2024).

Geography, as a subject, provides an excellent platform for developing these skills. It requires students to analyze spatial data, understand environmental processes, and explore cultural dynamics. By fostering creative thinking in geography, educators can empower students to approach problems from multiple perspectives, devise

innovative solutions, and make informed decisions that benefit their communities and the nation at large (Foster, 2021; Treffinger et al., 2023; Ummah & Yuliati, 2020; Verganti et al., 2020).

Thinking is a mental activity experienced by a person when facing a problem. Ruggiero (2011) defines thinking as a mental activity to help solve a problem, decide, or fulfill a desire to understand. This opinion shows that when a person formulates a problem, solves a problem, and wants to understand something, he performs a thinking activity. Critical thinking and creative thinking are manifestations of higher-order thinking.

Previous finding stated that critical thinking is a metacognitive process that, through purposeful and reflective judgment, increases the likelihood of producing a logical conclusion to an argument or solution to a problem (Cáceres et al., 2020; Dwyer et al., 2014). For example, students can compare two or more pieces of information, comparing information received from outside with information owned. Questions or comments will arise that aim to get an explanation if there are differences or similarities. The process also applies to creative thinking. The difference is that creative thinking aims to generate many ideas. According to Solso et al. (2005), creative thinking is a cognitive activity that produces new ways of looking at a problem or situation. Creative thinking will provide many options to solve the problem at hand.

Three opinions were expressed about indicators of creative thinking. The first opinion is from Guilford (2010), the second from Torrance (2001), and the third from Munandar (2009). All three opinions mention the same thing about the characteristics of the ability to think creatively. The difference of opinion is seen in Guildford's opinion, which mentions sensitivity (problem of sensitivity) in the first point. The difference of opinion is only Guilford's. Guilford's first opinion states five indicators of creative thinking. These indicators are sensitivity, smoothness, flexibility, authenticity, and elaboration/detailing. Torrence's second opinion mentions only three characteristics of the ability to think creatively: fluency, originality, and elaboration. Munandar's third opinion mentions four aspects of creative thinking. These aspects are fluency, flexibility, originality, and elaboration. Torrence and Munandar do not use the sensitivity aspect. Sensitivity is the ability to recognize something. In the opinion of Guilford (2012), sensitivity is the ability to detect, recognize, understand, and respond to a statement, situation, or problem. Such a definition does not include sensitivity as an aspect of creative thinking. Creative thinking is oriented towards new things that are made. The definition of creative uses the word new idea or new thing so that the ability to respond to situations is not categorized into aspects of creative thinking.

Indicators of fluency or fluent thinking can be known when students can provide a large variety of ideas either verbally or in writing (Marcos et al., 2020). Torrence (1980) defines fluency as generating many ideas in various categories/fields. Similar to this opinion, according to Guilford (2012), fluency is the ability to generate many ideas. The characteristics of fluency skills are to trigger many ideas, answers, problem-solving, or questions; give many ways or suggestions for doing things; Always think of more than one answer (Acar et al., 2023; Handayani et al., 2021).

Flexibility is the ability to propose a variety of problem-solving. The ability to approach problems with different perspectives to produce different alternative ideas. According to Weiss & Wilhelm, (2022), flexibility has characteristics: The characteristics of flexible thinking skills (flexibility) are producing ideas, answers, or questions that vary; being able to look at a problem from different points of view; looking for many

alternatives or different directions; able to change the way of approach or way of thinking.

Originality is the ability to find ideas or thoughts initially or unusually. In this study, students can select, select, and evaluate from the many ideas produced to choose the best one with reasons that show authenticity. The characteristic of originality, according to Torrance, (2001), is having new ideas to solve problems. A more detailed view of Guilford (2012) is the ability to spark ideas in original ways that most people rarely mention. According to Munandar (2009), the characteristics of original thinking skills: The characteristics of original thinking skills (originality) are giving birth to new and unique expressions, thinking of unusual ways to express themselves, and making unusual combinations of parts or elements.

Elaboration is the ability to detail the main idea or ideas. In this study, students can determine the steps of the ideas that have been selected and put into operational details to be realized. According to Torrance (2001), elaboration is the ability to solve problems in detail. A slightly different opinion from Guilford, elaboration is the ability to add to the description of a situation or problem so that it becomes complete and details in which there are tables, graphs, pictures, models and words (Acar et al., 2023).

Elaboration skills can be seen when students provide a detailed idea description. Munandar (2009) calls it an effort to enrich an idea. The characteristic of elaboration skills is enriching and developing an idea or product, adding or detailing the details of an object, idea, or situation so that it becomes interesting.

Studies have shown that creative thinking skills like fluency, originality, flexibility, and elaboration are linked to improved learning outcomes in geography (Chumsukon, 2021; Rizal et al., 2022). However, there is always room for further research to explore new strategies for enhancing these skills and to understand their impact on learning outcomes more deeply. A thorough investigation into the indicators of creative thinking can guide curriculum developers in designing learning experiences that foster creativity (Albar & Southcott, 2021). Research findings can highlight which activities, projects, and types of content are most effective in promoting creative thinking. This can lead to the development of curricula that are more engaging and effective in nurturing students` creative abilities.

Creative thinking and creativity are considered skills based on natural talent. It means that only those who are gifted can be creative people. The reality is that certain people can create new ideas quickly and diversely. Everyone has their creative abilities. It is how people can release or actualize themselves by following the creative power and thinking patterns that have developed. If students cannot think creatively, then there is a tendency to experience difficulties in facing the challenges of life and employment (Saputri et al., 2020).

Creative thinking skills have an essential role in learning geography. The skills involve students' ability to identify and understand the relationships between geographical phenomena. This includes connecting physical, social, economic and cultural aspects in their analyses (Bladh, 2020). Students are encouraged to see the bigger picture and combine information from various sources to understand the complexity of geography. Creative thinking skills enable students to generate new ideas in solving problems or answering questions in the context of geography (Yli-Panula et al., 2019). Students are encouraged to think outside the box and develop innovative solutions to geography problems. Creative thinking skills exercise the ability to imagine, make new associations, and question existing concepts (Schoevers et al., 2019; Scoffham, 2003; Wojciehowski & Ernst, 2018).

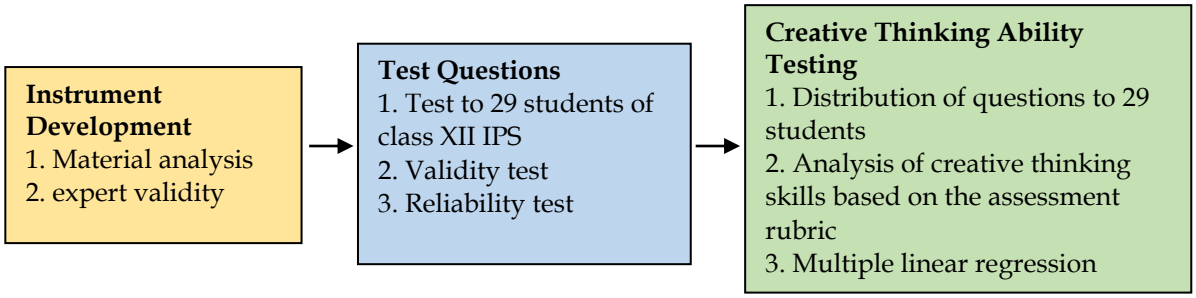
Creative thinking skills in geography also involve collaborating with classmates and participating in discussions encourage critical and creative thinking (Wojciehowski & Ernst, 2018). Students can exchange ideas, broaden their understanding, and see geography from different perspectives through collaboration. In geography learning, creative thinking skills help students see the world from multiple perspectives, make deep connections between geographic concepts, and develop innovative solutions to future problems (Yli-Panula et al., 2019). Creative thinking provides students with valuable skills in understanding and making decisions based on creative thinking.

In the dynamic landscape of education, the ability to think creatively is increasingly recognized as essential for student success, particularly in subjects that require complex problem-solving and critical analysis, such as geography (Pawson et al., 2013). For several reasons, understanding the dominant indicators of creative thinking in students' geography learning outcomes is crucial. Firstly, it enables educators to tailor their teaching strategies to foster an environment where creative thinking can flourish (Soh, 2017). Secondly, it helps identify and nurture students' potential, enhancing their engagement and performance (Barbot et al., 2018; Collard & Looney, 2014). Thirdly, cultivating creative thinkers is imperative for developing innovative solutions in a world facing multifaceted geographical challenges (Nijkamp & Kourtit, 2013). They were exploring the urgency of identifying these indicators, providing a foundation for improving educational practices and preparing students to address the pressing geographical issues of our time effectively. This research aims to determine the most dominant indicators in developing creative thinking based on the learning designed to increase creativity.

METHOD

This research is a correlational descriptive quantitative research. The research subjects were MAN 3 Malang students, totaling 29 students from one class. The independent variables in this study are Fluency (X1), Flexibility (X2), Originality (X3), and Ability to Detail (X4). The dependent variable is student learning outcomes (Y). Measurement of creative thinking ability using a creative thinking test instrument consists of 5 questions according to creative thinking indicators, namely: (1) fluency (i.e., quantity of answers), (2) flexibility (i.e. a number of categorically different ideas), (3) originality (i.e., quality of ideas), and (4) elaboration (amount of detail and elegance of answers) in expressing ideas or ideas. (Acar et al., 2023; Handayani et al., 2021; Torrance, 2001; Weiss & Wilhelm, 2022). The research steps are described in the following figure.

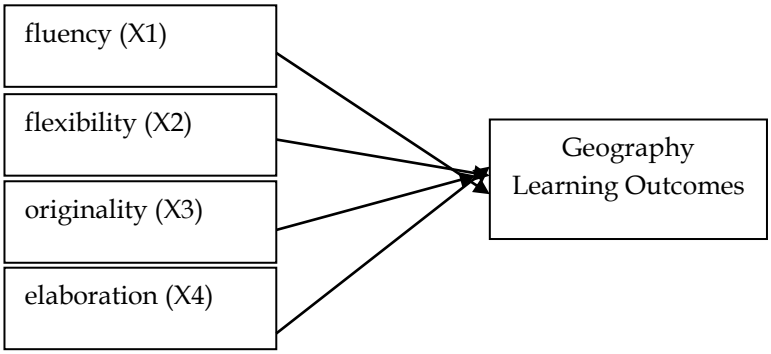
Figure 1. Research Phase



The analysis technique uses multiple linear regression tests with prerequisite classic assumption test (normality, multicollinearity, and heteroscedasticity tests) (Riadi, 2019; Yamin & Kurniawan, 2009). Classical assumption tests ensure that the

data to be analyzed is normally distributed (normality test), and the model does not contain multicollinearity and heteroscedasticity (Alita et al., 2021). Multiple linear regression tests aim to determine the effect of independent variables on the dependent variable both individually and together simultaneously (Sugiyono, 2013). Heteroscedasticity tests use diagnostic plots by residual vs. fitted value plots to inspect for patterns that might indicate heteroskedasticity visually (Osemeke et al., 2024; Raza et al., 2023). If no clear patterns are observed, this supports the assumption of homoskedasticity. The research design can be seen in the figure 2. Determination of the dominant variable is based on the significance value of P-value < 5% and β value. The β value closest to zero (0) is the most dominant (Riadi, 2019; Yamin & Kurniawan, 2009).

Figure 2. Multiple linear regression test design



RESULT AND DISCUSSION

The results of the calculation of creative thinking skills show that the fluency indicator has the highest percentage (80%), which is an excellent category. In comparison, the lowest indicator is detailing, with a percentage of 64%. The results of calculating the value of creative thinking skills based on indicators are presented in the following table.

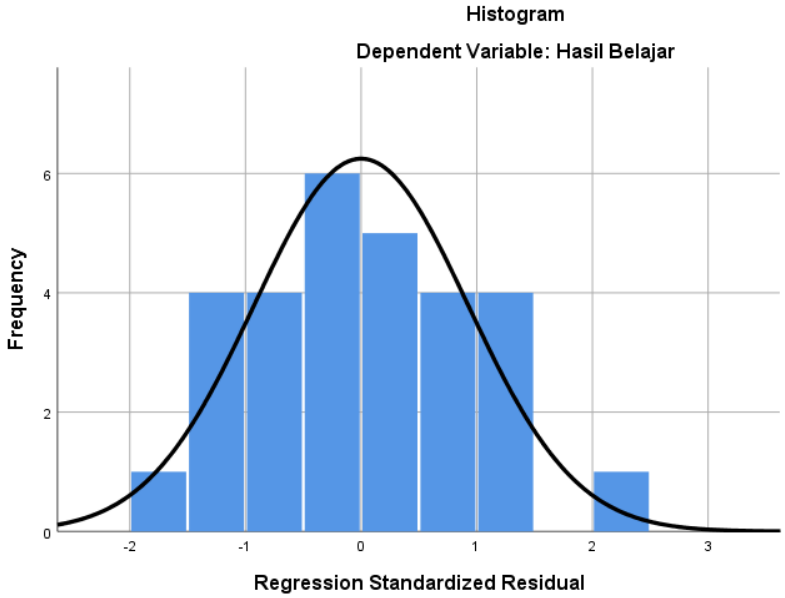
Table 1. Percentage of Creative Thinking Skills Based on Each Indicator.

Indicators	Percentage	Category
Fluency	80.17	Very good
Flexibility	78.45	Good
Originality	74.14	Good
Elaboration	64.66	Good

Source: Research Results

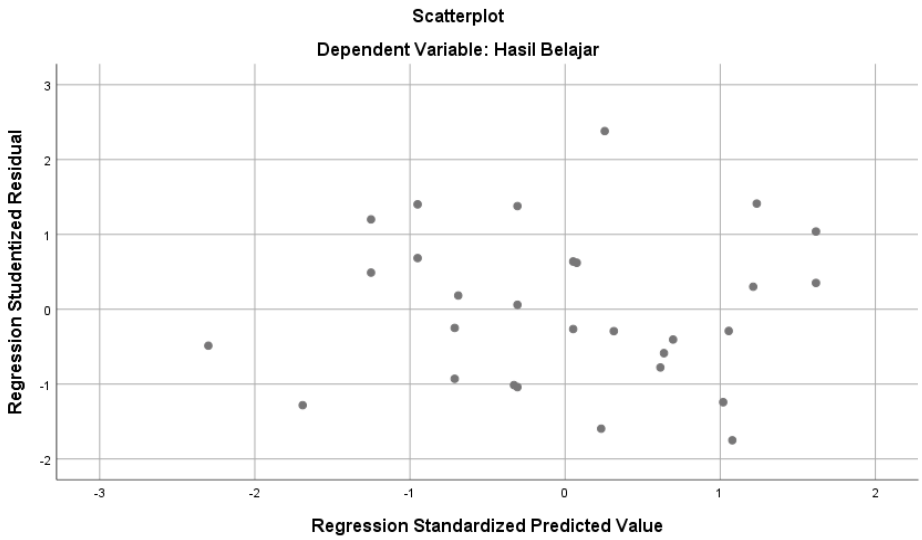
Multiple linear regression analysis determined the dominant indicators affecting learning outcomes. The prerequisite tests of the analysis are normality test, heteroscedasticity test, and multicollinearity test. The normality test results are based on the histogram test in the following figure.

Figure 3. Histogram of student learning outcomes



The histogram test results show an upward-curved line forming a mountain. If the line forms a mountain and looks perfect with symmetrical legs, it can be concluded that the data in the study is usually distributed (normally distributed) (Yamin & Kurniawan, 2009).

Figure 4. Scatterplot student learning outcomes



Heteroscedasticity value based on the scatterplot output (figure 4), it is known that the data points spread above and below or around the number 0. The spread of the points does not form a particular clear pattern. So, it can be concluded that there is no heteroscedasticity problem (Yamin & Kurniawan, 2009).

The tolerance value in Figure 5 has a value greater than 0.1. Meanwhile, when using VIF, the value of all variables is smaller than 10. The conclusion is that there is no solid correlation between each independent variable independent (there is no

multicollinearity). After the three prerequisite tests are fulfilled, the next step is the multiple linear regression test to determine the effect of the independent variables on the dependent variable. The results of multiple linear regression tests are presented in the following table.

Figure 5. Multiple linear regression calculation results

Regression

Table 2. Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.678[a]	.459	.369	4.712	1.523

a. Predictors: (Constant), Fluency, Flexibility, Originality, Elaboration
b. Dependent Variable: Learning Outcomes

Table 3. Anova[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	452.144	4	113.036	5.091	.004[b]
	Residual	532.822	24	22.201		
	Total	984.966	28			

a. Dependent Variable: Learning Outcomes
b. Predictors: (Constant), Fluency, Flexibility, Originality, Elaboration

Table 4. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	57.843	7.928		7.296	.000					
	Fluency	3.794	1.593	.396	2.382	.026	.517	.437	.358	.813	1.229
	Flexibility	4.030	1.512	.434	2.666	.014	.557	.478	.400	.849	1.178
	Originality	1.534	1.171	.201	1.310	.203	.062	.258	.197	.954	1.049
	Elaboration	-.092	1.438	-.010	-.064	.950	.025	-.013	-.010	.974	1.027

a. Dependent Variable: Learning Outcomes

Based on Figure 5, it can be seen that the fluency and flexibility variables have a significant effect because the P-value < 5%. The β value between fluency and flexibility variables that is the farthest from zero (0) is flexibility (β = 4.030). Thus, the most dominant variable is flexibility.

The flexibility indicator is associated with creative thinking skills by its analogy activities. Analog activities teach students to see things from unusual or different points of view to produce various alternative ideas from various approaches.

Flexibility is a person's ability to adjust themselves in their approach to a problem (Guilford, 2012). Flexibility is a necessary component of career and life skills. Flexibility trains students to solve problems in various ways (Saputri et al., 2020; Waluya & Suyitno, 2018). Flexibility arises due to the many concepts that students master (Saputri et al., 2020). When getting a problem, students will use the concepts they have to try to solve it. The concept can be a combination of several concepts or separate concepts. Flexible students tend to have more ideas (Mones & Massonnié, 2022).

DISCUSSION

The primary finding of this study highlights flexibility as the dominant indicator of creative thinking in student geography learning outcomes. Flexibility, the ability to approach problems from multiple perspectives and adapt to changing scenarios, significantly enhanced students' comprehension and engagement with geographical concepts (Acar et al., 2023; Handayani et al., 2021). This adaptability allows students to generate various solutions to spatial and environmental problems, facilitating a deeper and more nuanced understanding of the material (Pawson et al., 2013). The research demonstrates that students who exhibit high levels of flexibility are better equipped to integrate diverse information, think critically about complex issues, and apply their knowledge in novel contexts. Consequently, flexibility improves academic performance in geography and prepares students for real-world challenges by fostering innovative and versatile thinking skills (Catacutan et al., 2023; Javed, 2023).

Flexibility emphasizes its unique role in enhancing students' ability to view problems from multiple perspectives and adapt their thinking processes (Avcı, 2024; Handayani et al., 2021). This finding suggests that while originality and fluency remain essential, flexibility is crucial in geography education. Flexibility enables students to navigate the multifaceted nature of geographical problems, integrating diverse viewpoints and adapting to new information more effectively (Abulibdeh et al., 2024; Gube & Lajoie, 2020). This nuanced understanding underscores the importance of promoting flexible thinking skills to improve student outcomes in geography, suggesting a more dynamic and adaptable approach to teaching and learning within the discipline.

The use of concepts at certain times is considered to be able to influence student learning outcomes. Creative thinking skills are the ability of individuals to use the mind to generate new ideas, new possibilities, and discoveries based on originality in its production (Daud et al., 2012). It can be in the form of natural or abstract ideas, creating new ideas, and making analogies and metaphors (Daud et al., 2012; Gube & Lajoie, 2020). Creative thinking has a significant correlation with cognitive learning outcomes. This is in line with the results of research (Fatmawati et al., 2019; Lin & Wu, 2016; Siburian et al., 2019; Yusnaeni et al., 2016) which states that there is a positive correlation between creative thinking skills and cognitive learning outcomes. More simply, creative thinking can improve students' academic achievement.

Flexibility indicators are considered to stimulate students' ability to generate various ideas and solutions (Daud et al., 2012; Nugroho et al., 2020). Flexibility helps overcome limitations in thinking that are too fixed on one idea. With flexibility, students can develop diverse alternatives and explore various creative possibilities (Wojciehowski & Ernst, 2018). In the creative thinking process, students often face obstacles and uncertainties. Flexibility helps students deal with these obstacles by finding alternatives or changing strategies. This trains students to remain open to change and always find creative solutions (Ritter et al., 2020).

Flexibility also facilitates students' personal development by developing an open attitude towards learning. Flexible students continuously improve their creative skills and seek opportunities to learn more. Students explore and try new things to improve their thinking ability (Nugroho et al., 2020; Wojciehowski & Ernst, 2018). Identifying flexibility as the dominant indicator of creative thinking in student geography learning outcomes is multifaceted, impacting educational practices and curriculum development. In Teaching Strategies, Educators should incorporate teaching methods that foster flexibility in thinking. It could include problem-based learning, where students are encouraged to approach problems from various angles and consider multiple solutions (Pawson et al., 2013; Ummah & Yuliati, 2020). Activities such as debates, role-playing, and simulations as part of their study can help students practice adapting their thinking to different scenarios. Traditional assessments might need to be revised to measure flexibility effectively. Instead of relying solely on multiple-choice tests, educators could use open-ended questions, projects, and real-world problem-solving tasks that require students to demonstrate their ability to think flexibly.

Emphasizing the learning process rather than just the final product can help develop flexible thinking. Encouraging students to reflect on their problem-solving processes, discuss alternative approaches, and understand the rationale behind different solutions can be beneficial. By fostering flexibility, educators can enhance overall critical thinking skills (Lorencová et al., 2019). Students learn to evaluate information critically, consider various perspectives, and make informed decisions, valuable skills in academic and real-life contexts. Developing flexibility in thinking encourages a mindset of lifelong learning (Tseng et al., 2020). Students become more open to new ideas and better equipped to adapt to changes, which is crucial in an ever-evolving global landscape.

The emphasis on flexibility might be particularly relevant to geography but not necessarily to other subjects. Creative thinking in disciplines such as mathematics or literature might involve different dominant indicators, limiting the broader applicability of the findings. Assessing flexibility can be inherently subjective. Different educators might have varying interpretations of what constitutes flexible thinking, leading to inconsistencies in the evaluation and potential biases (Weiss & Wilhelm, 2022). While flexibility is crucial, focusing predominantly on this single aspect might overshadow other essential components of creative thinking, such as originality and fluency. A more balanced approach considering multiple indicators could provide a more comprehensive understanding. Integrating flexibility into teaching practices and assessments can be challenging. Teachers may need additional training and resources, and there may be resistance to changing established educational methods. This could slow down the adoption of strategies designed to enhance flexibility.

The methods used to measure flexibility and creative thinking might have limitations. Self-reported measures can be subjective, and performance-based assessments might not fully capture the complexity of flexible thinking (Handayani et al., 2021; Weiss & Wilhelm, 2022). The reliability and validity of these tools need careful consideration. Emphasizing flexibility might inadvertently lead to neglecting other essential skills in geography education, such as factual knowledge and technical skills. A well-rounded approach is necessary to ensure comprehensive student development. The long-term impact of prioritizing flexibility over other aspects of creative thinking is uncertain (Saeed et al., 2022). More longitudinal studies are needed to understand how this focus influences students' academic and professional success in the long run (Atkins et al., 2020)

Several areas warrant further research and expansion to build on the findings that flexibility is the dominant indicator of creative thinking in student geography learning outcomes (Tzachrista et al., 2023; Wagino et al., 2024). Conduct long-term studies to track the development of flexibility and its impact on geography learning outcomes over several years. This can help understand the sustained effects of flexibility-focused education. Compare the role of flexibility in creative thinking across different subjects. Investigating whether flexibility is equally essential in disciplines like mathematics, science, or literature can provide a broader understanding of its significance in education.

However, no single indicator has an absolute advantage over other indicators in students' creative thinking ability. Each indicator has its role and importance. Creative thinking involves a variety of complementary indicators: fluency, originality, and detailing (Weiss & Wilhelm, 2022). Flexibility is a critical aspect of students' creative thinking ability, but it must also be accompanied by the courage to experiment, develop ideas, and develop critical thinking skills (Setiawan et al., 2018; Zulyusri et al., 2023).

The developing support systems that help students build flexibility (Ruesch & Sarvary, 2024). This could include mentorship programs, peer collaboration opportunities, and resources encouraging independent exploration and critical thinking. Study the application of flexibility-focused education in real-world settings, such as internships, community projects, and extracurricular activities. Understanding how flexibility translates into practical skills can provide valuable insights for educators and employers (Gelles et al., 2020). By addressing these areas, researchers and educators can deepen their understanding of flexibility as a critical component of creative thinking and develop more effective strategies to enhance student learning outcomes in geography and beyond.

CONCLUSION

The flexibility indicator is the most dominant and has the most significant influence compared to other indicators. This is evidenced by the β value, which is the furthest away from zero (0) (β = 4.030). The expression of more ideas shows that students' basic concepts of knowledge are also more. Learning with a learning model to provoke creative thinking activities helps increase students' resilience in producing ideas. Students often face obstacles and uncertainties, and flexibility helps them deal with these obstacles by finding alternatives or changing strategies. This trains students to remain open to change and always find creative solutions. comparing the role of flexibility in creative thinking across different subjects can clarify and add to the accuracy of the measurement.

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AUTHOR CONTRIBUTION STATEMENT

FAS: Research design and data analysis. AMR: statistical data analysis. ST: Discussing results and providing ideas. MAJ: Proofreading and revision of materials.

REFERENCES

Abulibdeh, A., Zaidan, E., & Abulibdeh, R. (2024). Navigating the confluence of artificial intelligence and education for sustainable development in the era of industry 4.0: Challenges, opportunities, and ethical dimensions. *Journal of Cleaner Production*, 140527. https://doi.org/10.1016/j.jclepro.2023.140527

Acar, S., Berthiaume, K., Grajzel, K., Dumas, D., Flemister, C. "Tedd," & Organisciak, P. (2023). Applying automated originality scoring to the verbal form of Torrance tests of creative thinking. *Gifted Child Quarterly*, *67*(1), 3–17. https://doi.org/10.1177/00169862211061874

Albar, S. B., & Southcott, J. E. (2021). Problem and project-based learning through an investigation lesson: Significant gains in creative thinking behaviour within the Australian foundation (preparatory) classroom. *Thinking Skills and Creativity*, *41*, 100853. https://doi.org/10.1016/j.tsc.2021.100853

Alita, D., Putra, A. D., & Darwis, D. (2021). Analysis of classic assumption test and multiple linear regression coefficient test for employee structural office recommendation. *IJCCS (Indonesian Journal of Computing and Cybernetics Systems)*, *15*(3), 295–306. https://doi.org/10.22146/ijccs.65586

Atkins, K., Dougan, B. M., Dromgold-Sermen, M. S., Potter, H., Sathy, V., & Panter, A. T. (2020). "Looking at Myself in the Future": how mentoring shapes scientific identity for STEM students from underrepresented groups. *International Journal of STEM Education*, *7*, 1–15. https://doi.org/10.1186/s40594-020-00242-3

Avcı, Ü. (2024). The effect of cognitive flexibility on students' spatial visualization abilities and computational thinking skills in a three-dimensional design and coding training. *Research in Science & Technological Education*, 1–27. https://doi.org/10.1080/02635143.2024.2355199

Barbot, B., Besançon, M., & Lubart, T. (2018). Creative potential in educational settings: Its nature, measure, and nurture. *Creativity and Creative Pedagogies in the Early and Primary Years*, 12–22. https://doi.org/10.4324/9781315617305-3

Bladh, G. (2020). GeoCapabilities, Didaktical analysis and curriculum thinking–furthering the dialogue between Didaktik and curriculum. *International Research in Geographical and Environmental Education*, *29*(3), 206–220. https://doi.org/10.1080/10382046.2020.1749766

Cáceres, M., Nussbaum, M., & Ortiz, J. (2020). Integrating critical thinking into the classroom: A teacher's perspective. *Thinking Skills and Creativity*, *37*, 100674. https://doi.org/10.1016/j.tsc.2020.100674

Catacutan, A., Kilag, O. K., Diano Jr, F., Tiongzon, B., Malbas, M., & Abendan, C. F. (2023). Competence-Based Curriculum Development in a Globalized Education Landscape. *Excellencia: International Multi-Disciplinary Journal of Education (2994-9521)*, *1*(4), 270–282.

Chumsukon, M. (2021). Developing Geography Curriculum Framework for Promoting Pre-Service Teachers' Creative Thinking through Instructional Media Production. *Journal of Education and Learning*, *10*(5), 197–210. https://doi.org/10.5539/jel.v10n5p197

Collard, P., & Looney, J. (2014). Nurturing creativity in education. *European Journal of Education*, *49*(3), 348–364. https://doi.org/10.1111/ejed.12090

Daud, A. M., Omar, J., Turiman, P., & Osman, K. (2012). Creativity in Science Education. UKM Teaching and Learning Congress 2011 (pp. 467-474). *Procedia Social and Behavioral Science*. https://doi.org/10.1016/j.sbspro.2012.09.302

Dwyer, C. P., Hogan, M. J., & Stewart, I. (2014). An integrated critical thinking

framework for the 21st century. *Thinking Skills and Creativity*, *12*, 43–52. https://doi.org/10.1016/j.tsc.2013.12.004

Fatmawati, A., Zubaidah, S., & Mahanal, S. (2019). Critical thinking, creative thinking, and learning achievement: How they are related. *Journal of Physics: Conference Series*, *1417*(1), 12070. https://doi.org/10.1088/1742-6596/1417/1/012070

Foster, M. K. (2021). Design thinking: A creative approach to problem solving. *Management Teaching Review*, *6*(2), 123–140. https://doi.org/10.1177/2379298119871468

Gelles, L. A., Lord, S. M., Hoople, G. D., Chen, D. A., & Mejia, J. A. (2020). Compassionate flexibility and self-discipline: Student adaptation to emergency remote teaching in an integrated engineering energy course during COVID-19. *Education Sciences*, *10*(11), 304. https://doi.org/10.3390/educsci10110304

Gube, M., & Lajoie, S. (2020). Adaptive expertise and creative thinking: A synthetic review and implications for practice. *Thinking Skills and Creativity*, *35*, 100630. https://doi.org/10.1016/j.tsc.2020.100630

Guilford, J. P. (2012). Creativity: Yesterday, today and tomorrow. *The Journal of Creative Behavior*, *1*(1), 3–14. https://doi.org/10.1002/j.2162-6057.1967.tb00002.x

Guilford, J. P. (2010). A sixty-year perspective on psychological I measurement. *Applied Psychological Measurement*, *9*(4), 341–349. https://doi.org/10.1177/014662168500900401

Gustian, D., Marzuki, M., Nukman, N., Purnama, Y., & Abdurrahman, D. (2024). Synergies In Education: Integrating Character, Literacy, And Technology For Enhanced Outcomes: Current Perspectives From Global Education Experts. *International Journal Of Teaching And Learning*, *2*(2), 498–512.

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), 12040. https://doi.org/10.1088/1742-6596/1747/1/012040

Javed, M. (2023). The Effectiveness of Different Teaching Methods in Education: A Comprehensive Review. *Journal of Social Signs Review*, *1*(1), 17–24.

Lin, C.-S., & Wu, R. Y.-W. (2016). Effects of web-based creative thinking teaching on students' creativity and learning outcome. *Eurasia Journal of Mathematics, Science and Technology Education*, *12*(6), 1675–1684. https://doi.org/10.12973/eurasia.2016.1558a

Lorencová, H., Jarošová, E., Avgitidou, S., & Dimitriadou, C. (2019). Critical thinking practices in teacher education programmes: A systematic review. *Studies in Higher Education*, *44*(5), 844–859. https://doi.org/10.1080/03075079.2019.1586331

Marcos, R. I. S., Fernández, V. L., González, M. T. D., & Phillips-Silver, J. (2020). Promoting children's creative thinking through reading and writing in a cooperative learning classroom. *Thinking Skills and Creativity*, *36*, 100663. https://doi.org/10.1016/j.tsc.2020.100663

Mones, P., & Massonnié, J. (2022). What can you do with a bottle and a hanger? Students with high cognitive flexibility give more ideas in the presence of ambient noise. *Thinking Skills and Creativity*, *46*, 101116. https://doi.org/10.1016/j.tsc.2022.101116

Munandar, U. (2009). Kreativitas dan Keberbakatan. *Jakarta: PT Gramedia Pustaka Utama*.

Nijkamp, P., & Kourtit, K. (2013). The "new urban Europe": Global challenges and local responses in the urban century. *European Planning Studies*, *21*(3), 291–315.

https://doi.org/10.1080/09654313.2012.716243

Nugroho, A. A., Nizaruddin, N., Dwijayanti, I., & Tristianti, A. (2020). Exploring Students' Creative Thinking in the Use of Representations in Solving Mathematical Problems Based on Cognitive Style. *Journal of Research and Advances in Mathematics Education*, *5*(2), 202–217. https://doi.org/10.23917/jramathedu.v5i2.9983

Odeyemi, O., Oyewole, A. T., Adeoye, O. B., Ofodile, O. C., Addy, W. A., Okoye, C. C., & Ololade, Y. J. (2024). Entrepreneurship in Africa: a review of growth and challenges. *International Journal of Management & Entrepreneurship Research*, *6*(3), 608–622. https://doi.org/10.51594/ijmer.v6i3.874

Osemeke, R. F., Igabari, J. N., & Christian, N. D. (2024). Detection and correction of violations of linear model assumptions by means of residuals. *Journal of Science Innovation and Technology Research*.

Pawson, E., Fournier, E., Haigh, M., Muniz, O., Trafford, J., & Vajoczki, S. (2013). Problem-based learning in geography: Towards a critical assessment of its purposes, benefits and risks. In *Active Learning and Student Engagement* (pp. 58–71). Routledge.

Raza, M., Ahmed, M., Razzaque, S., & Hina, H. (2023). Testing for Heteroskedasticity in The Presence of Outliers. *Journal of Education and Social Studies*, *4*(2), 313–329.

Riadi, E. (2019). *Statistika penelitian (analisis manual dan IBM SPSS)*. https://doi.org/10.52223/jess.2023.4209

Ritter, S. M., Gu, X., Crijns, M., & Biekens, P. (2020). Fostering students' creative thinking skills by means of a one-year creativity training program. *PloS One*, *15*(3), e0229773. https://doi.org/10.1371/journal.pone.0229773

Rizal, S., Putra, A. K., Suharto, Y., & Wirahayu, Y. A. (2022). Creative thinking and process science skill: Self-organized learning environment on watershed conservation material. *Jurnal Pendidikan IPA Indonesia*, *11*(4), 578–587. https://doi.org/10.15294/jpii.v11i4.39571

Ruesch, J. M., & Sarvary, M. A. (2024). Structure and flexibility: systemic and explicit assignment extensions foster an inclusive learning environment. *Frontiers in Education*, *9*, 1324506. https://doi.org/10.3389/feduc.2024.1324506

Ruggiero, V. R. (2011). *The art of thinking: A guide to critical and creative thought*. Pearson Higher Ed.

Saeed, M. A., Tabassum, H., Zahid, M. M., Jiao, Y., & Nauman, S. (2022). Organizational flexibility and project portfolio performance: The roles of environmental uncertainty and innovation capability. *Engineering Management Journal*, *34*(2), 249–264. https://doi.org/10.1080/10429247.2021.1884450

Saputri, M. D., Pramudya, I., & Slamet, I. (2020). The Flexibility of Students' Mathematical Creative Thinking in Solving Mathematical Problems. *1st International Multidisciplinary Conference on Education, Technology, and Engineering (IMCETE 2019)*, 121–125. https://doi.org/10.2991/assehr.k.200303.030

Schoevers, E. M., Leseman, P. P. M., Slot, E. M., Bakker, A., Keijzer, R., & Kroesbergen, E. H. (2019). Promoting pupils' creative thinking in primary school mathematics: A case study. *Thinking Skills and Creativity*, *31*, 323–334. https://doi.org/10.1016/j.tsc.2019.02.003

Scoffham, S. (2003). Thinking creatively. *Primary Geographer*, *50*, 4–6.

Setiawan, A., Malik, A., Suhandi, A., & Permanasari, A. (2018). Effect of higher order thinking laboratory on the improvement of critical and creative thinking skills. *IOP Conference Series: Materials Science and Engineering*, *306*(1), 12008.

https://doi.org/10.1088/1757-899X/306/1/012008
Siburian, J., Corebima, A. D., & Saptasari, M. (2019). The correlation between critical and creative thinking skills on cognitive learning results. *Eurasian Journal of Educational Research*, *19*(81), 99–114. https://doi.org/10.14689/ejer.2019.81.6
Soh, K. (2017). Fostering student creativity through teacher behaviors. *Thinking Skills and Creativity*, *23*, 58–66. https://doi.org/10.1016/j.tsc.2016.11.002
Solso, R. L., MacLin, M. K., & MacLin, O. H. (2005). *Cognitive psychology*. Pearson Education New Zealand.
Sugiyono, D. (2013). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D*.
Torrance, E. P. (2001). Creativity and Futurism in Education: Retooling. *Education*, *100*(4).
Treffinger, D. J., Isaksen, S. G., & Stead-Dorval, K. B. (2023). *Creative problem solving: An introduction*. Routledge. https://doi.org/10.4324/9781003419327-1
Tseng, H., Kuo, Y.-C., & Walsh, E. J. (2020). Exploring first-time online undergraduate and graduate students' growth mindsets and flexible thinking and their relations to online learning engagement. *Educational Technology Research and Development*, *68*, 2285–2303. https://doi.org/10.1007/s11423-020-09774-5
Tzachrista, M., Gkintoni, E., & Halkiopoulos, C. (2023). Neurocognitive Profile of Creativity in Improving Academic Performance—A Scoping Review. *Education Sciences*, *13*(11), 1127. https://doi.org/10.3390/educsci13111127
Ummah, I. K., & Yuliati, N. (2020). The Effect of Jumping Task Based on Creative Problem Solving on Students' Problem Solving Ability. *International Journal of Instruction*, *13*(1), 387–406. https://doi.org/10.29333/iji.2020.13126a
Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and design in the age of artificial intelligence. *Journal of Product Innovation Management*, *37*(3), 212–227. https://doi.org/10.1111/jpim.12523
Wagino, W., Maksum, H., Purwanto, W., Simatupang, W., Lapisa, R., & Indrawan, E. (2024). Enhancing Learning Outcomes and Student Engagement: Integrating E-Learning Innovations into Problem-Based Higher Education. *International Journal of Interactive Mobile Technologies*, *18*(10). https://doi.org/10.3991/ijim.v18i10.47649
Waluya, S. B., & Suyitno, H. (2018). Assimilation and accommodation processes in improving mathematical creative thinking with scaffolding according to learning style. *Journal of Physics: Conference Series*, *1097*(1), 12156. https://doi.org/10.1088/1742-6596/1097/1/012156
Weiss, S., & Wilhelm, O. (2022). Is Flexibility More than Fluency and Originality? In *Journal of Intelligence* (Vol. 10, Issue 4). https://doi.org/10.3390/jintelligence10040096
Wojciehowski, M., & Ernst, J. (2018). Creative by Nature: Investigating the Impact of Nature Preschools on Young Children's Creative Thinking. *International Journal of Early Childhood Environmental Education*, *6*(1), 3–20.
Yamin, S., & Kurniawan, H. (2009). SPSS complete: Teknik analisis statistik terlengkap dengan software SPSS. *Jakarta: Salemba Infotek*, *328*.
Yasmin, T. (2023). The role of arts and humanities in preparing students for the 21st century workplace. *Al-Behishat Research Archive*, *1*(02), 107–113.
Yli-Panula, E., Jeronen, E., & Lemmetty, P. (2019). Teaching and learning methods in geography promoting sustainability. *Education Sciences*, *10*(1), 5. https://doi.org/10.3390/educsci10010005

Yusnaeni, H. S., Corebima, A. D., & Zubaidah, S. (2016). Hubungan Kemampuan Berpikir Kreatif dan Hasil Belajar Kognitif pada Pembelajaran Search Solve Create and Solve di SMA. *Prosiding Seminar Nasional Biologi*.

Zulyusri, Z., Elfira, I., Lufri, L., & Santosa, T. A. (2023). Literature Study: Utilization of the PjBL Model in Science Education to Improve Creativity and Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, *9*(1), 133–143. https://doi.org/10.29303/jppipa.v9i1.2555