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Mapping Critical and Creative Thinking Skills: Evidence from Elementary School Students

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ABSTRACT

Objective: This study aims to map the profile of critical and creative thinking skills and analyze the relationship between the two. **Method:** The method used was quantitative descriptive correlational involving 112 students as a sample. Data was collected through test instruments that included various indicators of critical and creative thinking, then analyzed using the Spearman's rho correlation test. **Results:** The results showed that the critical thinking profile of students was in the medium category, with the highest achievement in the interpretation aspect but weak in strategy formulation. Meanwhile, the creative thinking profile showed high scores in the fluency aspect, but low in the flexibility and originality aspects. The results of the correlation test showed a significant positive relationship between critical and creative thinking skills. **Novelty:** This indicates that strengthening critical reasoning is an important foundation in producing innovative creative solutions. This research recommends the need for a learning model that challenges students' strategic abilities and originality.

INTRODUCTION

The 21st-century competencies are the main focus for improving human resources capacity in Indonesia (Amrina et al., 2024; Sunarni & Ibrahim, 2025). The 21st century educational paradigm places critical and creative thinking skills as fundamental components that students must master to face increasingly complex global challenges (Budiyanto et al., 2024; Kivunja, 2014; Tohani & Aulia, 2022). Thinking is an activity that involves the process of manipulating and changing information in memory (Nafiah & Suyanto, 2014). Critical thinking is defined as the cognitive ability to logically analyze information, validate the truth of facts, and make rational decisions (Harun Puling et al., 2024; Hitchcock, 2017; Preiss & Sternberg, 2010; Stanovich & Stanovich, 2010). On the other hand, creative thinking complements it with the ability to generate innovative solutions through flexible and original thinking (Chang et al., 2015; Gafour & Gafour, 2020). The synergy of these two skills is no longer just an instructional goal, but an existential need for elementary school students not to be trapped in the shallowness of thinking in the midst of a flood of information and cognitive impairment due to artificial intelligence (Chang et al., 2015).

The urgency of critical thinking skills in basic education has now shifted from just an instructional goal to an existential need for students (Kusuma et al., 2024; Mandernach, 2006; Mubarok et al., 2023; Thomas, 2009). In the midst of the phenomenon of information overload and cognitive disruption due to artificial intelligence, the ability to validate the truth of information is the main filter so that students do not get trapped in the shallowness of reason (Babys & Pramana, 2025; Sukmantara, 2024). Critical thinking is not just a high-level cognitive process, but a form of intellectual independence that allows elementary school students to not only become consumers of information, but also active thinkers (Ratri, 2025; Volkotrubova et al., 2025).

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In addition to analytical acuity, the aspect of creativity is a crucial variable that complements each other. Creative thinking skills allow students to generate new ideas, original solutions, and innovations through flexible thinking and the ability to associate diverse concepts (I. Lestari & Ilhami, 2022; S. P. Lestari et al., 2024; Ramadhan & Hindun, 2023). The synergy between critical information evaluation and creative innovative power is the main provision for students to become strong *problem solvers* (Manurung et al., 2023). In the context of basic education, creativity is not just a matter of aesthetics, but a cognitive process to identify knowledge gaps, formulate hypotheses, and test solutions continuously until optimal results are found (Alabbasi et al., 2022; Andriani et al., 2025; Pasri, 2025). In Indonesia, this urgency has been integrated into the Pancasila Student profile through the Independent Curriculum, which aims to build students' intellectual independence from an early age (Mainah, 2025; Putri Lestari et al., 2023; Waruwu et al., 2024).

The theoretical distinction between critical and creative thinking has historically been viewed through a dichotomy of convergent and divergent cognitive tracks. Convergent thinking, which underlies critical analysis, guides the cognitive apparatus toward a single, logically verified correct answer by filtering out extraneous data. In contrast, divergent thinking, the bedrock of creativity, expands the cognitive horizon to generate multiple, non-linear possibilities. However, contemporary educational psychology increasingly refutes this rigid separation, advocating for a unified higher-order thinking framework. In basic education, this integration is pivotal because elementary students do not experience problem-solving in isolated cognitive modes; they require analytical tools to evaluate what they creatively produce.

Furthermore, the internal mechanics of the Independent Curriculum demand a pedagogical shift toward this integrated cognitive model. The curriculum's emphasis on experiential learning through thematic projects implies that students must simultaneously exhibit critical acuity in assessing real-world constraints and creative innovation in designing functional solutions. Profiling these skills within a localized context provides more than just statistical baselines; it unveils how young learners navigate the tension between logical conformity and creative deviation. Consequently, exploring the empirical intersections of these cognitive tracks is essential for developing instructional materials that do not inadvertently sacrifice originality for the sake of analytical uniformity.

However, in reality, the mastery of these two abilities at the elementary school level still shows a worrying trend (Gavrysh & Dotsenko, 2021; Patras et al., 2024; Sabri, 2024). While several studies across various regions in Indonesia indicate a general decline in students' analytical skills, a localized empirical mapping is urgently required to understand the specific characteristics of other areas, including Purwakarta Regency. Previous studies have revealed that students still have significant difficulty in analyzing arguments, evaluating information independently, and finding alternative solutions to problems (Gavrysh & Dotsenko, 2021; Istiningsih et al., 2019). This low ability is often due to learning practices that still tend to be *teacher-centered*, thus limiting the space for students to explore, debate, and conduct in-depth inquiry (A. Rahayu et al., 2026; Aytaç & Kula, 2022; I Putu Rencanaguna et al., 2024). The debate over the development of these skills also has to do with the effectiveness of cognitive stimulation methods in the classroom (Birgili, 2015; Ensink et al., 2014). Some experts argue that creative thinking is a spontaneous process, while others emphasize that it is a disciplinary process that

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involves identifying problems, formulating hypotheses, and testing optimal solutions (Alabbasi et al., 2022; Dietrich, 2019; Samura, 2019). The uncertainty of the extent to which elementary school students are able to internalize this high-level thinking process is a challenge for educators, especially in designing classroom modules that are able to combine cognitive stimulation with real-world applications (Nur & Andriani, 2025).

Limited space for students to participate in inquiry-based activities, debate, and real exploration risks hindering their cognitive readiness at the next level of education. Without the right interventions, the target of building an adaptive student profile will be difficult to achieve. Therefore, educators and researchers need a comprehensive picture of the profile of students' thinking skills as an empirical foundation in designing effective pedagogical strategies. Based on this background, this study was conducted to describe the profile of critical and creative thinking skills of elementary school students in Purwakarta Regency. This mapping is crucial to identify local potentials and constraints to improve the quality of education in a sustainable manner.

Strengthening the ability to think creatively in the national education landscape is increasingly finding its urgency after the establishment of a new direction of the Independent Curriculum which consistently emphasizes the importance of the Eight Dimensions of the Graduate Profile, where creativity and critical reasoning are the main pillars. 21st century learning demands a radical transformation from procedural memorization models to multidimensional problem-solving. However, the biggest challenge in the field is to align regulatory demands with teacher instructional readiness. Curriculum flexibility is often mistaken for directionless freedom, so that substantial aspects such as the growth *of originality* and flexibility in students are often ignored in order to pursue external administrative targets. Therefore, mapping the profile of students' creative thinking in the implementation of this curriculum is crucial as a foundation for objective instructional evaluation.

Given the challenges faced in cultivating high-level thinking skills from an early age, educators and researchers need to get a comprehensive picture through mapping students' abilities. This study aims to map the level of critical and creative thinking skills of elementary school students in Purwakarta Regency and analyze the extent to which aspects such as interpretation, analysis, flexibility, and originality are interrelated in shaping student competencies**.** Mastering these skills opens up opportunities for faster cognitive development in children and significantly improves problem-solving skills. To address this urgency, this study specifically aims to answer the following research questions: (1) What is the profile of critical thinking skills among elementary school students in Purwakarta Regency across core indicators, including interpretation and analysis? (2) What is the profile of their creative thinking skills, specifically regarding flexibility and originality? and (3) How do these critical and creative thinking aspects interrelatedly shape student competencies? By answering these questions, this study objectives to map the baseline of higher-order thinking skills in Purwakarta Regency and provide empirical recommendations for educators to design effective cognitive learning frameworks.

RESEARCH METHOD

This study uses a quantitative approach with a correlational descriptive design. Correlation design is used to measure the degree of association between two or more

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variables using statistical procedures of correlational analysis (Creswell & Báez, 2020). This study aims to map the profile of students' critical and creative thinking skills and analyze the relationship between the two variables. The research subjects involved 112 students who were selected as samples. The selection of elementary schools within Purwakarta Regency followed a purposive sampling approach to ensure a balanced representation of diverse institutional characteristics. The target population was strictly mapped to include schools currently implementing the Independent Curriculum (*Kurikulum Merdeka*) for at least two academic cycles. This criterion was essential to ensure that the participating students had already been exposed to the collaborative and project-based learning ecosystems mandated by the national educational reforms, thereby providing a valid baseline profile for critical and creative thinking skill assessmentsData were collected using validated essay tests that specifically measure students' critical and creative thinking skills, including specific indicators as detailed in Table 1.

Table 1. Critical and Creative Thinking Instrument Grid

Variabel	Key Indicators
Critical Thinking Creative Thinking	Interpretation, Analysis, Inferences, Evaluation, Strategy, Fluency, Flexibility, Originality, Elaboration

Data analysis is carried out in two main stages. First, descriptive analysis is used to calculate the average score on each indicator to determine the category of students' abilities based on the criteria in Table 2. Second, an inferential analysis was performed using the Spearman's rho correlation test with the help of SPSS software to test the direction and significance of the relationship between critical thinking skills and creative thinking.

Table 2. Criteria for Student Ability Categories

Score Range	Category
3,26 – 4,00	Very high
2,51 – 3,25	Height
1,76 – 2.50	Medium
1,00 – 1,75	Low

RESULTS AND DISCUSSION

Result

Based on the results of data analysis, the mapping of critical thinking skills: evidence from elementary school students in Purwakarta, as shown in Figure 1.

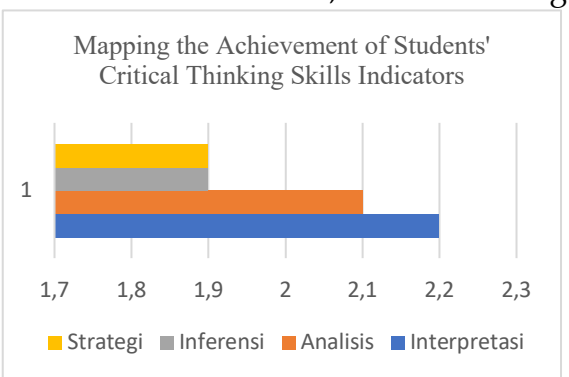

Figure 1. Mapping the Achievement of Students' Critical Thinking Skills Indicators

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Based on the mapping results in Figure 1, it can be seen that the average critical thinking skills of 112 students are spread in the range of 1.9 to 2.2. The highest achievement was in the Interpretation indicator (2,2), which indicates that students have sufficient initial ability to understand and identify problems. However, the Inferences and Strategy indicators had the lowest score of 1.9. This indicates that students still have difficulty in drawing logical conclusions and determining structured problem-solving steps. Overall, the critical thinking profile of students is in the Medium category, which indicates the need for further stimulation in the learning process. Furthermore, for the results of data analysis, the mapping of creative thinking skills: evidence from elementary school students in Purwakarta, as shown in Figure 2.

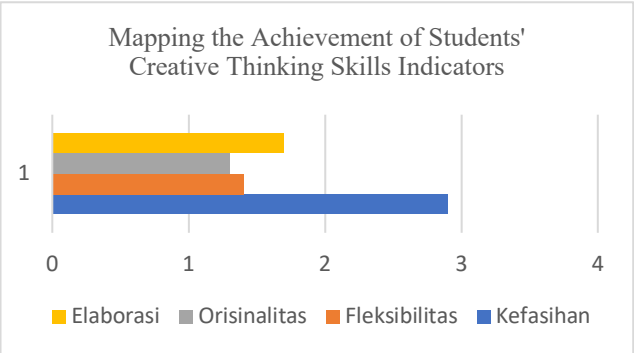

Figure 2. Mapping the Achievement of Students' Creative Thinking Skills Indicators

Based on Figure 2, the creative thinking profiles of 112 students showed a very contrasting distribution of scores. The Fluency Indicator has the highest score of 2.9. This means that students have good abilities in coming up with many ideas or answers. However, these abilities are not followed by diversity and uniqueness of ideas. This can be seen from the low scores on the indicators of Flexibility (1.4) and Originality (1.3). This data indicates that although students are able to answer quickly (fluently), the ideas generated tend to be similar to each other and less original. Meanwhile, students' ability to detail ideas (elaboration) is also still in the low category with a score of 1.7. To find out the mapping of Critical and Creative Thinking Skills: Evidence from Elementary School Students, it is necessary to conduct a correlation test (Figure 3)

Correlations

			Kritis	Kreatif
Spearman's rho	Kritis	Correlation Coefficient	1.000	.324**
		Sig. (2-tailed)	.	<,001
		N	112	112
	Kreatif	Correlation Coefficient	.324**	1.000
		Sig. (2-tailed)	<,001	.
		N	112	112

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

Figure 3. Mapping of Critical and Creative Thinking Skills: Evidence from Elementary School Students

Based on the Spearman's rho *correlation test*, the correlation coefficient value of 0.324 with a significance value of $p < 0.001$ was obtained. This shows that there is a significant positive relationship between the level of Critical thinking skills and Creative thinking skills. This relationship falls into the category of weak but sure, which means that the higher a person's critical level, the higher their creative level.

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To provide a deeper understanding of how students generate these ideas during the learning process, a detailed document analysis of the students' task worksheets was conducted. The specific patterns of students' creative thinking are categorized and presented in Table 3.

Table 3. Categorization of Students' Creative Thinking Patterns Based on Document Analysis

Student Response Category	Typical Problem-Solving Pattern	Fulfilled Indicators	Percentage
Category A (Procedural)	Using standard formulas, only changing numerical variables based on teacher's previous examples.	High Fluency, Low Originality	75%
Category B (Explorative)	Attempting alternative methods and basic modifications outside the teacher's examples.	High Fluency, Moderate Originality	20%
Category C (Innovative)	Discovering unique, novel conceptual approaches, and highly distinct solutions.	High Fluency, High Originality	5%

The imbalance between high fluency and low originality as clearly detailed in Table 3 reveals a significant cognitive gap in students' reasoning processes. Based on the empirical evidence gathered from the document analysis of students' test worksheets, the high fluency score indicates that the initial instructional stimulus successfully triggered short-term memory recall. Students were capable of producing multiple linear answers rapidly. However, when progressed to originality and elaboration demands, their performance dropped significantly. Instructional reflection notes indicate that when faced with open-ended problems, a cognitive conformity mental block occurs. Students tend to feel secure by remaining within uniform, conventional solving paths shared by their peers, rather than exploring novel perspectives.

Discussion

The results of the mapping of the critical and creative thinking skills profile of 112 students showed an interrelated picture but required special attention to certain indicators. In the critical thinking variable, students showed fairly good ability on the *Interpretation* indicator (2,2), which indicates that students have adequate initial ability to understand and identify problems. This is crucial because understanding the problem is the main foundation in the cognitive process. However, the lowest achievement on the *Inferences* and *Strategy* indicators (1,9) showed that students still had difficulty in drawing logical conclusions and determining the steps to solve problems in a structured manner. These findings are in line with several previous studies that explain that the ability to evaluate arguments and strategize is a high-level level of thinking that requires intensive stimulation (Dinsmore & Fryer, 2023; Dwyer et al., 2012; Sucipto, 2017). This phenomenon is confirmed through the analysis of student work documents (answer sheets). It was found that although students were able to write down up to 4 alternative solutions (*high fluency*), all variations of the answers showed identical completion patterns and were based on the algorithms that had been exemplified earlier. This proves that the high number of ideas does not reflect the flexibility or originality of thinking, as students tend to replicate procedures without exploring new points of view.

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A similar condition was found in the creative thinking profile of students. There is a very contrasting distribution of scores, where *the Fluency* indicator achieves the highest score (2.9), but *Flexibility* (1.4) and *Originality* (1.3) are in the very low category. This data shows that although students are able to generate many ideas quickly, they tend to be homogeneous (uniform) and less unique. This phenomenon confirms the view of experts that the quantity of ideas (*fluency*) is not always directly proportional to the quality of creativity if it is not accompanied by the flexibility of thinking (Teresia & Sulistyani, 2023; Weiss & Wilhelm, 2022). Low *Originality* scores are thought to be closely related to low *scores on Strategy* in critical thinking; without a well-rounded problem-solving strategy, students tend to use commonly known conventional methods.

The relationship between these two variables is proven through the *Spearman's rho* correlation test which produces a coefficient of 0.324 with significance. These results show a significant positive relationship between the levels of critical thinking and creative thinking. Despite being in the weak category, this relationship is definite, which means any improvement in students' critical abilities will make a real contribution to their creative abilities.

This weak correlation coefficient is particularly common and justifiable within elementary school cohorts. From a developmental psychology perspective, children in this concrete operational stage are still transitioning toward abstract reasoning. Critical and creative thinking skills at this age often develop asynchronously or in a fragmented manner, primarily due to the ongoing maturation of executive functions in the prefrontal cortex. While elementary students can generate abundant spontaneous ideas (the generative/creative process), they frequently lack the advanced cognitive control required to simultaneously evaluate, filter, and strategize (the evaluative/critical process). Consequently, the interplay between critical reasoning and creative imagination is not as tightly integrated as it is in adolescent or adult cohorts. This phenomenon of a weak yet significant correlation aligns with findings by Runco (2014) and Ward (2020), which suggest that children's creative potential often manifests ahead of their critical thinking maturity.

Critical thinking acts as a "filter" or evaluative control, while creative thinking plays a role in "generative process" solutions. This relationship reinforces the theory that critical and creative thinking are two mental processes that are inseparable in effective problem-solving (Ampartzaki, 2023; Wechsler et al., 2018)

The implications of this study show that to increase students' creativity, educators cannot only focus on imagination techniques, but must also strengthen students' critical reasoning in analyzing information. The low originality and problem-solving strategies in these findings signal that the learning process needs to integrate more problem-based learning models that challenge students to think *outside the box* but still be based on strong logic.

This study has limitations in terms of the number of samples that are limited to one particular environment. Therefore, further research is recommended to use a broader sample size and apply specific learning intervention models (such as *Problem-Based Learning* or *Steam-based Learning*) to experimentally test the extent to which increased critical thinking can accelerate students' *Originality* and *Flexibility* abilities in the future.

The empirical mapping reveals that critical thinking and creative thinking do not operate in cognitive silos; rather, they form a symbiotic framework in elementary

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student development. Critical thinking acts as a cognitive filter, enabling students to evaluate the boundary constraints of a problem, while creative thinking serves as the generative engine that drives innovative output. In the context of the Independent Curriculum, which prioritizes holistic problem-solving, this interrelatedness becomes highly visible. Students who demonstrate high analytical skills tend to have a more structured approach when facing open-ended problems, preventing their fluency from devolving into irrelevant brainstorming.

Conversely, a lack of creative stimulation hampers critical acuity. When classrooms overemphasize procedural correctness, students' capacity for original thought is suppressed, which in turn diminishes their ability to critically evaluate alternative perspectives. This study strongly argues that to achieve the ideal graduate profile envisioned by modern educational reforms, instructional designs must deliberately pair analytical tasks with creative exploration. Nurturing one dimension while neglecting the other only results in an incomplete cognitive profile, leaving students ill-prepared for complex global challenges.

CONCLUSION

Fundamental Finding: This study revealed that students' critical thinking profiles were predominantly categorized within the medium level, showing the highest achievement in the basic interpretation aspect but remaining significantly weak in strategic formulation. This cognitive condition was found to be positively correlated with a high creative thinking profile specifically in the fluency aspect, yet conversely low in flexibility and originality, indicating a structural imbalance in higher-order reasoning.
Implication: Based on the empirical findings of the research on the profile of students' creative and critical thinking skills, this study provides real, urgent practical implications for the sustainable development of the teaching profession. The Teacher Working Group (KKG) and the Subject Teacher Meeting (MGMP) of IPAS should no longer focus primarily on routine learning administration, but must actively shift their strategic focus toward operational, collaborative instructional actions in the classroom. Therefore, three tactical steps are recommended for the KKG/MGMP framework to effectively follow up on these empirical findings:

1. **Preparation of Open-Ended Problems-Based Question Banks:** KKG/MGMP needs to hold intensive, periodic professional workshops to design valid open-ended problem-based assessment instruments that are directly integrated with the Independent Curriculum Teaching Modules (*Modul Ajar*). This structural intervention aims to ensure that elementary teachers have concrete, standardized pedagogical references in triggering critical strategy indicators and fostering student cognitive flexibility and originality.
2. **Implementation of Peer-Teaching and Open Reflection:** The monthly agenda of this professional organization must continuously facilitate structural peer-teaching simulations among members. The core operational focus of these simulations should be centered on how the classroom teacher dynamically stimulates and non-judgmentally responds to diverse student answers, eliminating cognitive conformity without limiting their natural creative pathways.
3. **Standardization of the Creativity Assessment Rubric:** KKG/MGMP must collectively formulate a uniform, comprehensive creative thinking assessment guide (covering distinct operational aspects of fluency, flexibility, originality, and

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elaboration). This unified framework will ensure that the ongoing evaluation of students' creative products or experiential projects within the Independent Curriculum ecosystem becomes highly objective, transparent, and structurally measurable.

Limitation: However, this structural study demonstrates that although higher-order thinking skills have been formally introduced, their actual qualitative execution is not yet optimal, especially regarding the indicators of strategy formulation, cognitive flexibility, and genuine originality. Furthermore, the empirical findings are methodologically limited by a relatively constrained sample size drawn from one specific educational environment in Purwakarta Regency, which naturally restricts its direct generalizability to other regions. To provide more comprehensive, actionable guidance for regional scaling, subsequent studies must address the current layout by expanding the participant sample size. This should be achieved by establishing collaborative research networks across multiple school districts, ensuring the inclusion of highly diverse urban, suburban, and rural educational contexts that reflect varying teacher readiness levels. Additionally, this study remains limited to baseline profiling without the long-term empirical intervention of specific innovative learning models. **Future Research:** Therefore, further research endeavors need to be systematically focused on executing large-scale, nationwide regional assessments—potentially by actively utilizing and empowering local teacher working groups (KKG/MGMP) to standardize empirical data collection methods across broader regional layouts. Future scholastic initiatives should also prioritize the structural development, rigorous testing, and longitudinal implementation of innovative, inquiry-based learning models alongside the targeted provision of supportive digital facilities. These future frameworks must be designed to integrate the strengthening of critical strategies and creative originality simultaneously, providing a robust academic solution to global challenges that demand both disciplined logical reasoning and innovative problem-solving outputs.

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framework, ultimately ensuring the successful milestone completion of this research project.

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