Jurnal Penelitian dan Evaluasi Pendidikan
Volume 29, No. 1, June 2025 (13-25)
Online: http://journal.uny.ac.id/index.php/jpep

Creative thinking in elementary education: Reliable assessment instruments for science and social studies

Fitri Alfarisa[1*]; Andika Arisetyawan[1]; Farid Rizqi Maulana[1]; Nadhila Yanama Lathifah[1]; Sinta Afriani[1]; Mashudi[2]
[1]Universitas Pendidikan Indonesia, Indonesia
[2]Sekolah Indonesia Kuala Lumpur, Malaysia
[*]Corresponding Author. E-mail: alfarisa@upi.edu

ARTICLE INFO

Article History
Submitted:
26 November 2024
Revised:
28 February 2025
Accepted:
20 April 2025

Keywords
creative thinking skills; science and social studies; elementary school

Scan Me:

ABSTRACT

Creative Thinking Skills (CTS) are essential abilities that students must possess. CTS can be stimulated by teachers through the learning and assessment processes. The scarcity of specific CTS instruments, particularly in the subject of science and social studies, presents a gap that this research aims to address. The objectives of this study are to 1) develop a test instrument for measuring CTS in Science and Social Studies to enhance students' 21st-century competencies, 2) evaluate the quality of the developed CTS instrument, and 3) examine the CTS profile of fifth-grade elementary school students in Serang City. This research employs a development methodology based on Mardapi's instrument development model, which consists of nine steps, starting from constructing test specifications to interpreting test results. The developed instrument takes the form of an essay-based CTS test for fifth grade, consisting of 10 items. The CTS indicators include fluency, flexibility, originality, and elaboration. Content validity was established through expert judgment, with agreement levels assessed using Aiken's V index. Construct validity was tested using Confirmatory Factor Analysis, and reliability was measured with Cronbach's Alpha. Data analysis utilized the R program to assess the characteristics of the developed CTS instrument.

To cite this article (in APA style):
Alfarisa, F., Arisetyawan, A., Maulana, F. F., Lathifah, N. Y., Afriani, S., Mashudi, M. (2025). Creative thinking in elementary education: Reliable assessment instruments for science and social studies. *Jurnal Penelitian dan Evaluasi Pendidikan, 29(1)*, 13-25 doi: https://doi.org/10.21831/pep.v29i1.79429

INTRODUCTION

In the 21st Century, learning processes should not only emphasize knowledge but also skills. Skills play a crucial role and are highly needed in every aspect of life. The Partnership for 21st Century Learning (P21) highlights four essential skills for students in the 21st Century: communication, collaboration, critical thinking and problem-solving, and creative thinking (National Education Association, 2008). Furthermore, Almarzooq et al. (2020) emphasize that these four 21st-century skills are essential for all learners as they help them embrace differences, sharpen critical and creative thinking to solve problems, and connect concepts with theory and practical applications.

Creative thinking skills (CTS) are one of the crucial 21st-century skills that need to be developed. Creative thinking is the ability to come up with fresh, unique, and groundbreaking ideas that have not been explored before (Yasa et al., 2023). As a cognitive skill, creative thinking allows individuals to develop novel solutions to problems by generating ideas or creating something different from existing norms (Malik et al., 2019). Beyond being a mental activity, creative thinking involves the production and discovery of new, beautiful, and constructive concepts and ideas connected with intuitive and rational elements of thought (Dupri et al.,

10.21831/pep.v29i1.79429

2021). A person's quality can be seen in their creative thinking ability when solving various problems (Mutohhari et al., 2021).

In Indonesia, however, the level of creative thinking remains relatively low. According to the Global Creativity Index (GCI), in 2015, Indonesia ranked 115th out of 139 countries worldwide. Florida et al. (2015) revealed that Indonesia's creativity index score was only 0.202, indicating that the ability to express creativity among Indonesians is still relatively low. Research shows that many students struggle to generate new ideas, modify concepts, or find innovative solutions to problems. This is often due to learning approaches focused on rote memorization, which provides little room for exploration and creativity development (Henderson, 2008). A study by Nurjanah et al. (2023) found that while students demonstrate potential for creative thinking, the lack of support in student-centred learning activities hampers the development of these skills.

In today's global era, Science and Social Studies is not just about imparting knowledge to students. The focus has shifted from memorizing content to emphasizing reasoning and thinking development among students. Developing reasoning and critical thinking enables students to enhance their creative reflexes. However, the reality is that CTS among elementary school students in Science and Social Studies lessons remains relatively low. Ucus (2018) identifies some reasons for the low CTS: (1) students are not accustomed to solving problems requiring multiple correct answers, and (2) teachers' limited ability to develop assessment instruments for creative thinking and the lack of specific assessment tools designed to cultivate CTS. Generally, elementary school students' creative thinking skills still require serious attention.

Another critical aspect of learning is assessment. Improving the quality of education can be achieved by developing effective assessment systems (Mardapi, 2017). Teachers must create assessments that continuously monitor students' thinking skills development from the beginning, through the process, to the end of learning. Assessments can be provided as peer feedback, teacher evaluations using prepared rubrics, or based on student's performance and products. Assessments can help students develop their thinking skills. Istiyono et al. (2014) affirm that assessments can be implemented to enhance students' higher-order thinking skills. High-order thinking questions deepen students' understanding of learning material (Barnett & Francis, 2012). It can be concluded that tests demanding high-level thinking skills can also stimulate students to develop such skills.

Although 21st-century education emphasizes creative thinking, implementing and evaluating the development of these skills still faces challenges, especially in designing appropriate instruments to measure CTS in elementary school students (Henderson, 2008). Various approaches, such as project-based learning and cross-curriculum integration, have proven effective in improving students' creativity. However, research indicates gaps in the availability of standardized evaluation tools. On the other hand, teachers find it challenging to integrate creativity into their classrooms (Patston et al., 2021). Teachers' limited references in creating critical thinking assessments also contribute to the underdevelopment of elementary students' CTS (Supriadi et al., 2023). For example, the instruments used often fail to reflect diverse characteristics of creativity, such as originality, flexibility, elaboration, and fluency. Based on the results of the study, it was found that the analysis of questions made by the teacher and had a stimulus for students' creative thinking skills was only 8% in the exam prepared by the social studies teacher (Özalp & Akpınar, 2021). This condition hinders optimal evaluation of students' CTS and fails to provide an accurate picture of their abilities..

In a learning environment built around ill-defined problems that can be solved in multiple ways and through multiple solutions, creative problem-solving becomes a necessity (Cropley & Cropley, 2009). Click or tap here to enter text. This presents a challenge for educators in objectively assessing the development of students' CTS, ultimately influencing systematic efforts to enhance competency-based learning. Based on the results of previous research and the needs

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

in the field, this study highlights the importance of developing creative thinking test instruments that are still rarely developed systematically at the primary school level, especially in Science and Social Studies subjects. This is because the development of creative thinking ability instruments that are more dominant in the field of mathematics has been widely produced (Keleş, 2022). In addition, this research focuses on analyzing students' creative thinking skills based on validated instruments to provide a more accurate picture of students' abilities. Thus, the results of this study can be a reference for educators in designing more effective evaluations to optimally improve students' creative thinking skills. The purpose of writing this research is to find out 1) the procedure for developing creative thinking test instruments; 2) the quality of the creative thinking test instruments that have been developed; and 3) a portrait of the creative thinking skills of Science and Social Studies elementary school students.

RESEARCH METHOD

This study employs a mixed-method approach oriented toward Research and Development (R&D). The approach begins with preliminary research, culminating in the formulation or development of a prototype designed based on relevant theories and supported by empirical data. The development procedure used in this study follows the nine steps of test development proposed by Mardapi (2017). The stages of creative thinking test development are based on the following steps in the development procedure: 1) Developing Test Specifications; 2) Writing Test Items; 3) Reviewing and Revising Test Items; 4) Conducting Trials; 5) Analyzing Test Items; 6) Revising the Test; 7) Assembling the Test; 8) Administering the Test; and 9) Interpreting Test Results.

The content-validated instrument was then tested on 153 students who were selected based on a stratified random sampling technique. The test subjects came from three schools representing high, medium and low categories in Serang City. The selection of schools based on this category aims to ensure that the instrument can measure creative thinking skills comprehensively at various levels of student competence. The instrument to measure creative thinking skills developed in the form of a 10-item essay test question containing four indicators from (Ghaedi et al., 2014; Saptenno et al., 2019), namely fluency, flexibility, originality, and detail, as presented in Table 1. The use of essays was chosen because it can explore students' creative thinking skills in more depth than multiple-choice questions.

Table 1. Indicators of Creative Thinking Skills

No	Indicators	Description
1	Fluency	a. Fluent in generating various questions, answers, and problem-solving opportunities; b. Providing diverse methods or solutions to address different issues; c. Thinking of multiple answers or solutions in problem-solving.
2	Flexibility	a. Producing variations of answers, ideas, or questions b. Solving problems from various perspectives; c. Finding multiple diverse solutions to address problems; d. Ability to shift perspectives in addressing a problem.
3	Originality	a. Creating new ideas that differ from most people's thoughts; b. Thinking in unconventional ways; c. Combining elements in novel and unusual ways.
4.	Elaboration	a. Skilled at developing an idea or answer more deeply; b. Skilled at detailing objects or ideas to make them more appealing.

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Table 2. Blueprint of the Creative Thinking Skills test

Material	Learning Objectives	Creative Thinking Indicator	Test Item Indicator	Item Number
Cultural Heritage and Economic Activities	Students can analyze cultural heritage and economic activities in their local area.	Fluency	Presented with a statement, students can explain ways to preserve cultural heritage.	1
		Originality	Presented with a picture, students can identify differences between traditional markets and floating markets and explain the uniqueness of floating markets.	2
Struggle Against Colonial Powers	Students can determine the background of foreign nations' arrival and the colonial period.	Flexibility	Presented with a story, students can analyze ways to honor the efforts of national heroes.	3
		Originality	Presented with a picture, students can detail the struggles of Javanese people led by Prince Diponegoro against colonial powers.	4
Natural Disasters	Students can demonstrate the process and impact of natural disasters.	Originality	Presented with a picture of waste management, students can identify human activities that harm the environment.	5
		Fluency	Presented with a story, students can explain the impact of plastic on marine ecosystems.	6
		Elaboration	Presented with a picture of a plastic ban, students can describe the connection between plastic and natural disasters.	7
Characteristics of Indonesia's Regions	Students can identify the geographical conditions and natural features of Indonesia.	Flexibility	Presented with a picture and statement, students can propose solutions to prevent environmental damage.	8
		Elaboration	Presented with a picture and statement, students can explain differences in the characteristics of fauna from various regions.	9
		Elaboration	Presented with a picture, students can detail the activities being conducted.	10

The developed instrument underwent content validity testing by three experts in the field, who assessed each item based on relevance, clarity, and representativeness. The assessment results were then analyzed using Aiken's V index (Aiken, 1985) to determine the level of agreement among the experts. Furthermore, construct validity was confirmed through Confirmatory Factor Analysis (CFA) by testing model fit and factor loadings to ensure that the instrument actually measures the intended construct. The model fit category in CFA is evaluated based on several indicators, namely the Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) with values ≥ 0.90 indicating a good fit, while Standardized Root Mean Square Residual (SRMR) ≤ 0.08 and Root Mean Square Error of Approximation (RMSEA) ≤ 0.08 indicate a suitable model (Hair et al., 2019; Bentler, 1990). Reliability was estimated using Cronbach's

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Alpha, where coefficient values above 0.7 are considered acceptable for internal consistency. The analysis was facilitated by R software, which ensured precise statistical calculations and objective evaluation of item performance.

FINDINGS AND DISCUSSION

Developing the creative thinking skills (CTS) instrument for Science and Social Studies focuses on content taught during the odd semester, specifically Social Studies (IPS). Initial studies conducted in schools revealed that in the context of the Merdeka Curriculum, while Science and Social Studies are merged into a single subject, the teaching process remains separate. In practice, the subjects are divided across semesters: Social Studies content is taught during the odd semester, while Science content is covered in the even semester. However, this division does not alter the conceptual integration of the two subjects into Science and Social Studies. The test blueprint for the creative thinking skills instrument in Science and Social Studies is presented in Table 2.

Table 2 is a test grid designed to measure students' creative thinking skills in various Science and Social Studies learning materials, including cultural heritage and economic activities, the struggle against colonizers, natural disasters, and the characteristics of Indonesia's territory. Each material has specific learning objectives, such as examining cultural heritage, determining the background of colonization, understanding the impact of natural disasters, and identifying Indonesia's geographical conditions. The developed CTS indicators contain Science and Social Studies learning materials in one semester that students have studied. This test measures four aspects of creative thinking, namely fluency (the ability to elaborate ideas clearly), originality (the ability to provide unique and different answers), flexibility (the ability to see a problem from various points of view), and detail (the ability to explain in detail). The questions in the test are presented in various forms, such as statements, pictures, and stories, which test students' ability to analyze, compare, explain, and identify a concept according to predetermined indicators. The developed CTS instrument is also accompanied by scoring guidelines and answer predictions, as presented in Table 3.

Table 3 above is an example of a CTS instrument that has been developed. Item number 3 of the CTS test was developed from the flexibility indicator on the material of the struggle against invaders (social group). In contrast, example number 7 is a CTS test item developed from the detailed indicator (science group). The differentiator between CTS and non-CTS questions is the stimulus seen in the question's stem in either a story or a picture. This stimulus is used as a trigger for students to think creatively (Sari et al., 2022). An inquiry-based teaching approach to students' scientific creativity by providing evaluation in the form of stimulus is efficacious in improving students' creative thinking skills in the context of science (Xu et al., 2021).

In the development of assessment instruments, the scoring of essay items is often divided into four categories to reduce subjectivity in scoring. This approach allows assessors to be more consistent in scoring, as each category clearly describes the scoring criteria. According to a study by Jönsson & Svingby (2007), the use of a structured scoring rubric can increase the reliability and validity of essay scoring, as raters have specific guidelines in evaluating student answers. In addition, a study by Brookhart (2013) showed that rubrics with clear scoring categories help reduce grading bias and ensure that grading is more objective and fair. Thus, implementing categorical scoring in essay assessment effectively improves quality and fairness in learning evaluation.

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Table 3. Blueprint of the Creative Thinking Skills test

Item No. 3 (Story Stimulus)		**Item No. 7 (Image Stimulus)**	
The struggle of the Indonesian nation against colonialism was long and arduous. Many of our national heroes sacrificed their lives in battles for independence. As students, we must strive to preserve the independence they fought for and honor the heroes who have fallen. Explain three efforts we can make to honor Indonesia's independence heroes! Answer: …… ……		Observe the following image!  Based on the image above, explain the connection between the ban on plastic bags and environmental damage! Answer: ……	
Scoring Guidelines	**Predicted Answer**	**Scoring Guidelines**	**Predicted Answer**
Students can analyze 4 efforts to honor the heroes of independence accurately and correctly (Score: 4)	Efforts to honor the heroes of independence include: 1. Praying for the heroes. 2. Studying diligently and achieving high performance. 3. Participating in flag ceremonies. 4. Taking part in Independence Day celebrations. 5. Visiting the graves of heroes. 6. Maintaining harmony. 7. Etc.	Providing a detailed answer with examples (Score: 4)	Plastic bags are made from non-renewable materials, which cause environmental pollution. For example, if plastic bags accumulate, they can clog drainage systems and lead to flooding.
Students can analyze 3 relevant and accurate efforts to honor the heroes of independence (Score: 3)		Providing a detailed answer without examples (Score: 3)	Plastic bags are made from non-renewable materials, which cause environmental pollution.
Students can analyze 2 accurate efforts to honor the heroes of independence (Score: 2)		Providing a general answer without detail (Score: 2)	Plastic bags are made from expensive materials.
Students can analyze 1 correct effort to honor the heroes of independence (Score: 1)		Providing an answer unrelated to the connection between the plastic bag ban and environmental damage (Score: 1)	Using plastic bags for food is unhealthy for human health.

The instrument that has been developed is then carried out content validation by expert judgment by checking the suitability of the items with the indicators and seeing the content suitability. Content validity was carried out by three experts, namely one expert lecturer in the field of social science and two people from practitioners/teachers. The results of the expert validation were subsequently analyzed using Aiken's V formula, with the details presented in Table 4. The content validity results show that the average Aiken's V index is 0.92, indicating high validity. This aligns with Aiken (1985) who stated that an agreement index below 0.4 indicates low validity, between 0.4 - 0.8 indicates moderate validity, and above 0.8 indicates high validity. The content validity analysis results show that the 10 developed items are valid and ready for instrument testing.

The CTS instrument was then tested on 153 fifth-grade elementary school students. The trial results were processed to prove construct validity using Confirmatory Factor Analysis (CFA). The Kaiser-Meyer-Olkin (KMO) analysis was performed to evaluate sample adequacy for factor analysis. The overall KMO value of 0.83 indicates that the data is highly suitable for factor analysis. According to Kaiser (1974), a KMO value above 0.50 is categorized as

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

"meritorious" or excellent. This suggests that the correlation between variables is strong enough to form latent factors. Individually, the MSA coefficients for all 10 developed items were greater than 0.50.

Table 4. Ineffective answer alternatives according to AnBuso, Iteman, and R applications

Item	Raters			S_1	S_2	S_3	$\sum s$	V	Description
	I	II	III						
Item_1	4	4	4	3	3	3	9	1.00	High
Item_2	3	4	3	2	3	2	7	0.78	Medium
Item_3	3	4	4	2	3	3	8	0.89	High
Item_4	3	4	4	2	3	3	8	0.89	High
Item_5	4	4	4	3	3	3	9	1.00	High
Item_6	4	4	4	3	3	3	9	1.00	High
Item_7	4	4	4	3	3	3	9	1.00	High
Item_8	3	4	3	2	3	2	7	0.78	Medium
Item_9	4	4	4	3	3	3	9	1.00	High
Item_10	3	4	4	2	3	3	8	0.89	High

Furthermore, the fit of the CFA model is seen based on the fit model fulfilment analysis results, namely CFI, TLI, RMSEA, and SRMR. Based on the CFA analysis, the developed creative thinking ability measurement model (CTS) perfectly fits the data. This can be seen from the results of the fit model fulfilment analysis, which includes several indicators, namely CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), RMSEA (Root Mean Square Error of Approximation), and SRMR (Standardized Root Mean Square Residual). CFI values of 0.962 and TLI of 0.942, which are greater than 0.90, indicate that the model has an excellent fit (Bentler, 1990). Values close to 1 indicate that the hypothesized model fits the data significantly. In addition, the RMSEA value of 0.059, which is below 0.08, indicates a good model fit (Hu & Bentler, 1999). Similarly, the SRMR value of 0.046, which is also below 0.08, indicates an excellent model fit (Hu & Bentler, 1999). This finding is in line with research by Hair et al. (2019), which states that CFI and TLI values above 0.90 and RMSEA and SRMR below 0.08 indicate a good and acceptable model. These results confirm that the model fits the data well, supporting the validity of the developed instrument.

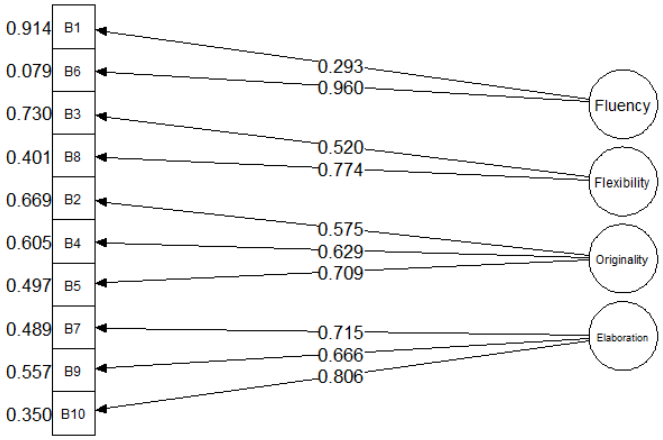

Figure 1. CFA Fit Model

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Based on the diagram in Figure 1, the CFA model of creative thinking ability consists of four indicators, namely fluency, flexibility, originality, and detail. Each indicator is elaborated through question items as follows: fluency is measured through items B1 and B6, flexibility is measured through items B3 and B8, originality is measured through items B2, B4, and B5, and detail is measured through items B7, B9, and B10. Furthermore, the reliability estimation using Cronbach's Alpha showed a value of 0.813. This value indicates that the CTS test instrument developed has high internal reliability. According to Nunnally and Bernstein (1994), Alpha values above 0.70 are considered reasonable and sufficient for exploratory research, while values above 0.80, as in this case, indicate excellent internal consistency. The items in the scale tend to measure the same thing consistently, so this instrument can be relied upon to measure creative thinking ability. This finding is reinforced by research Taber (2018), which states that a Cronbach's Alpha value above 0.80 indicates a reliable and consistent instrument for measuring the construct in question.

This finding is also supported by Storme et al. (2017) and Barbot et al. (2011), who showed that instruments that measure creativity with indicators such as fluency, flexibility, and originality have high validity and reliability so that they can be widely used in educational contexts. In addition, the importance of using instruments that are standardized and have high internal consistency to measure creative thinking skills is quite important, especially in the context of learning in schools (Barbot et al., 2011; Long et al., 2022). Thus, this finding strengthens the validity and reliability of the developed CTS instrument so that it can be used as a reliable measurement tool in further research. In addition, the resulting CFA model also provides a clear picture of the factor structure and the relationship between indicators that build the creative thinking ability construct. The data portrait of the creative thinking ability of grade V students in Science and Social Studies learning made in four categories is reflected in Figure 2.

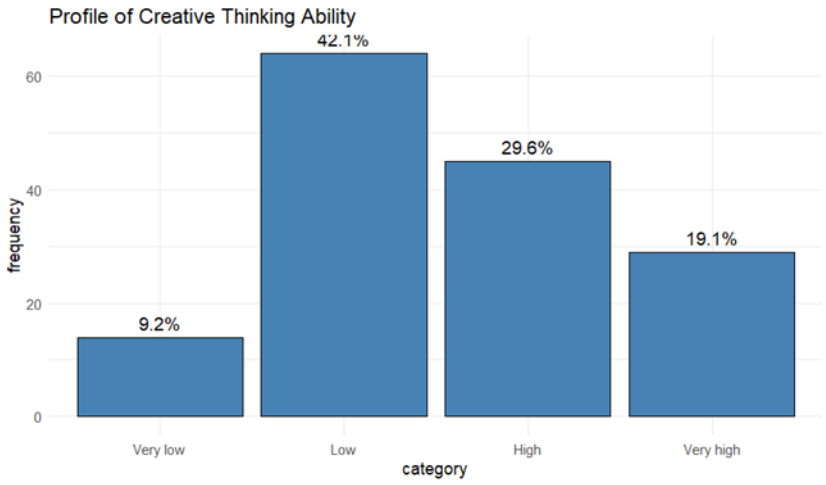

Figure 2. Profile of Creative Thinking Skills (CTS) of Fifth-Grade Students in Serang City

Based on Figure 2, most students are in the low category (42.1% or 64 students), indicating that students' creative thinking skills tend to be not optimal. The high category (29.6% or 45 students) is the next category with a significant number, indicating that some students have shown good creative thinking skills. Although the majority of students are in the low category, the presence of students in the high and very high categories indicates the potential that can be further developed with the right approach. This finding is in line with several previous studies that explored creative thinking skills in elementary schools. For example,

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Fowler (2012) found that a learning environment that supports exploration and experimentation can improve students' creative thinking skills. Furthermore, research by Davies et al. (2013) showed that the integration of arts and technology in the curriculum can facilitate students' creative thinking development. Furthermore, research Hui (2015) highlighted the role of collaboration and social interaction in developing students' creative thinking skills. These findings indicate that although students' creative thinking skills are currently not optimal, there are various strategies and approaches that can be applied to develop this potential.

The relevance of these findings is reinforced by the research of Xu et al. (2021), who examined the relationship between authenticity, openness to experience, openness to change, and creativity. The study found that authenticity has a positive relationship with creativity, and openness to experience and change act as full mediators in this relationship. These results suggest that developing self-authenticity and increasing openness to new experiences and change can stimulate creativity Xu et al. (2021). In the context of elementary school students, approaches that encourage students to develop self-authenticity (e.g., through free self-expression and support for unique ideas) and increase openness to new experiences (e.g., through the integration of arts, technology, or experimental learning methods) may be key to optimizing their creative thinking abilities.

The condition of students' creative thinking skills that are still not optimal can also be stimulated by using Project-Based Learning (PjBL) or Problem-Based Learning (PBL) methods that involve exploration, problem-solving, and collaborative work in the learning process. This strategy can help students develop creative thinking skills through real, challenging situations. This is in line with Kokotsaki et al. (2016) and Condliffe et al. (2017), who showed that PjBL is effective in improving students' creative thinking skills because it involves a deep exploration and collaboration process. Maximize the potential of CTS in the high and very high categories by providing additional challenges such as in-depth exploration tasks, innovation competitions, or technology-based creative projects. Giving students responsibility and autonomy in learning increases intrinsic motivation and creativity, which is in line with the principles of the Self-Determination Theory. Furthermore, from an educator's perspective, it is important to train teachers to understand and apply creative learning techniques, such as the use of open-ended questions, brainstorming, or design thinking methods. Teachers trained in creative learning methods can be more effective in encouraging students to think creatively and innovatively (Saptenno et al., 2019; Henriksen et al., 2020).

In addition, creating a learning environment that encourages creativity, such as providing innovative tools, space for exploration, and a learning atmosphere that supports freedom of expression. Davies et al. (2013) also emphasized that a supportive physical and social environment, including access to creative resources, plays an important role in enhancing students' creativity. By implementing some of these recommendations, it is expected that students' creative thinking skills can develop optimally, both for students who are in the low category and those who have shown high potential. This approach not only supports students in achieving their creative potential but also creates an inclusive learning environment that encourages innovation.

CONCLUSION

This study highlights the importance of developing creative thinking skills (CTS) among elementary school students, particularly in Science and Social Studies within the Merdeka Curriculum. The findings reveal that creative thinking among students remains relatively low, emphasizing the need for effective assessment tools. A CTS test instrument was systematically developed and validated through expert judgment, Confirmatory Factor Analysis (CFA), and reliability testing to address this. The instrument demonstrated high validity and reliability,

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

confirming its effectiveness in measuring fluency, flexibility, originality, and elaboration. This is evidenced by the content validity score with Aiken's V averaging 0.92 and its fit to the CFA model based on CFI, TLI, RMSEA, and SRMR values.

Furthermore, the CTS profile of students in Serang City, which served as the sample, falls into the low (42.1%) and high (29%) categories. Although the majority of students are in the low category, the presence of students in the high and very high categories indicates potential that can be further developed with appropriate approaches. Therefore, it is crucial to implement targeted strategies to enhance CTS, such as Project-Based Learning, differentiated instruction, and technology-driven creative activities. By refining teaching methods and assessment tools, educators can foster a learning environment that nurtures creativity, ultimately preparing students for the challenges of the 21st century. Future research should focus on further refining these instruments and exploring innovative pedagogical approaches to enhance creativity in elementary education.

Conflict of interests

There are no known conflicts of interest associated with this publication.

REFERENCES

Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement, 45*(1), 131–142. https://doi.org/10.1177/0013164485451012

Almarzooq, Z. I., Lopes, M., & Kochar, A. (2020). Virtual learning during the COVID-19 pandemic: A disruptive technology in graduate medical education. *Journal of the American College of Cardiology, 75*(20), 2635–2638. https://doi.org/10.1016/j.jacc.2020.04.015

Barbot, B., Besançon, M., & Lubart, T. I. (2011). Assessing creativity in the classroom. *The Open Education Journal, 4*, 58–66. https://doi.org/10.2174/1874920801104010058

Barnett, J. E., & Francis, A. L. (2011). Using higher order thinking questions to foster critical thinking: A classroom study. *Educational Psychology, 32*(2), 201–211. https://doi.org/10.1080/01443410.2011.638619

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–246. https://doi.org/10.1037/0033-2909.107.2.238

Brookhart, S. M. (2013). How to create and use rubrics for formative assessment and grading. *In Analytical Biochemistry* (Vol. 11, Issue 1).

Condliffe, B., Quint, J., Visher, M. G., Bangser, M. R., Drohojowska, S., Saco, L., & Nelson, E. (2017). *Project-based learning: A literature review* (Working Paper No. ED578933). MDRC.

Cropley, A. J., & Cropley, D. (2009). *Fostering creativity: A diagnostic approach for higher education and organisations*. Hampton Press.

Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P., & Howe, A. (2013). Creative learning environments in education—A systematic literature review. *Thinking Skills and Creativity, 8*(1), 80–91. https://doi.org/10.1016/j.tsc.2012.07.004

Dishon, G., & Gilead, T. (2021). Adaptability and its discontents: 21st-century skills and the preparation for an unpredictable future. *British Journal of Educational Studies, 69*(4), 393–413. https://doi.org/10.1080/00071005.2020.1829545

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Dupri, D., Nazirun, N., & Candra, O. (2021). Creative thinking learning of physical education: Can be enhanced using discovery learning model? *Journal Sport Area, 6*(1), 29–36. https://doi.org/10.25299/sportarea.2021.vol6(1).5690

Florida, R., Mellander, C., & King, K. (2015). The Global Creativity Index 2015. Retrieved from Martin Prosperity Institute website: https://urn.kb.se/resolve?urn=urn:nbn:se:hj:diva-28304.

Fowler, Z. (2012). Creativity and education futures: Learning in a digital age. *British Educational Research Journal,* 38(2). https://doi.org/10.1080/01411926.2011.605110

Ghaedi, Y., Fomani, F. K., & Mahdian, M. (2014). Identifying dimensions of creative thinking in preschool children during implementation of Philosophy for Children (P4C) program: Targeted content analysis. *Review of the Nigerian Journal of Business and Management*, *2*(11), 30–37. https://doi.org/10.12816/0011638

Hair, J. F., Jr., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.

Henderson, J. (2008). Developing students' creative skills for 21st century success. *Educational Leadership, 50*(12). https://www.ascd.org/el/articles/developing-students-creative-skills-for-21st-century-success

Henriksen, D., Richardson, C., & Shack, K. (2020). Mindfulness and creativity: Implications for thinking and learning. *Thinking Skills and Creativity, 37*, 100689. https://doi.org/10.1016/j.tsc.2020.100689

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hui, A. N. N. (2015). Commentary on *The psychology of creativity: A critical reading. Creativity. Theories – Research – Applications, 2*(1), 56–63. https://doi.org/10.1515/ctra-2015-0008

Istiyono, E., Mardapi, D., & Suparno, S. (2014). Pengembangan tes kemampuan berpikir tingkat tinggi fisika (PysTHOTS) peserta didik SMA. *Jurnal Penelitian dan Evaluasi Pendidikan, 18*(1), 1–12. https://doi.org/10.21831/pep.v18i1.2120

Jönsson, A., & Svingby, G. (2007). The use of scoring rubrics: Reliability, validity and educational consequences. *Educational Research Review, 2*(2), 130–144. https://doi.org/10.1016/j.edurev.2007.05.002

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31–36. https://doi.org/10.1007/BF02291575

Keleş, T. (2022). Investigation of high school students' creative problem-solving attributes. *Journal of Pedagogical Research, 6*(4), 66–83. https://doi.org/10.33902/JPR.202215433

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. *Improving Schools, 19*(3), 267–277. https://doi.org/10.1177/1365480216659733

Long, H., Kerr, B. A., Emler, T. E., & Birdnow, M. (2022). A critical review of assessments of creativity in education. *Review of Research in Education, 46*(1), 288–323. https://doi.org/10.3102/0091732X221084326

Malik, A., Nuraeni, Y., Samsudin, A., & Sutarno, S. (2019). Creative Thinking Skills of Students on Harmonic Vibration using Model Student Facilitator and Explaining (SFAE). Jurnal Ilmiah Pendidikan Fisika Al-Biruni, 8(1). https://doi.org/10.24042/jipfalbiruni.v8i1.3056

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Mardapi, D. (2017). Pengukuran, Penilaian, dan Evaluasi Pendidikan. In Academia Edu (Vol. 7, Issue 2).

Mutohhari, F., Sutiman, S., Nurtanto, M., Kholifah, N., & Samsudin, A. (2021). Difficulties in implementing 21st century skills competence in vocational education learning. *International Journal of Evaluation and Research in Education (IJERE), 10*(4), 1229–1236. https://doi.org/10.11591/ijere.v10i4.22028

National Education Association. (2008). *Preparing 21st century students for a global society: An educator's guide to the "Four Cs"*. National Education Association

Nunnally, J., & Bernstein, I. (1994). Psychometric theory (3rd ed.). *Journal of Psychoeducational Assessment* (Vol. 19, Issue 3).

Nurjanah, N. E., Yetti, E., & Sumantri, M. S. (2023). Teacher's reflection: Learning activities for stimulating preschool children's creative thinking skill. *Scientia: Social Sciences & Humanities, 2*(2), 111–117. https://doi.org/10.51773/sssh.v2i2.238

Özalp, M. T., & Akpınar, M. (2021). Creative thinking skills in social studies written exam questions. *Open Journal for Educational Research, 5*(2), 255–274. https://doi.org/10.32591/coas.ojer.0502.10255o

Patston, T. J., Kaufman, J. C., Cropley, A. J., & Marrone, R. (2021). What is creativity in education? A qualitative study of international curricula. *Journal of Advanced Academics, 32*(2), 207–230. https://doi.org/10.1177/1932202X20978356

Saptenno, A. E., Tuaputty, H., Rumahlatu, D., & Papılaya, P. M. (2019). The improvement of learning motivation and creative thinking skills of senior high school students through modified problem based learning model. *Journal for the Education of Gifted Young Scientists, 7*(4), 1175–1194. https://doi.org/10.17478/jegys.597519

Sari, M., Andra, D., Distrik, I. W., & Aleksandervic, K. S. (2022). Problem-based e-module integrated with STEM and assisted by LMS to foster creative thinking ability. *Indonesian Journal of Science and Mathematics Education, 5*(2), 224–237. https://doi.org/10.24042/ijsme.v5i2.13087

Storme, M., Lubart, T., Myszkowski, N., Cheung, P.C., Tong, T. and Lau, S. (2017), A cross-cultural study of task specificity in creativity. *J Creat Behav, 51*: 263-274. https://doi.org/10.1002/jocb.123

Supriadi, u., Alfarisa, F., Hanif, M., & Belinda, B. (2023). Elementary school students: Analysis of questionnaire in creative thinking and mathematical modelling in ethnomathematics learning. *AIP Conference Proceedings, 2621*(1), 020008. https://doi.org/10.1063/5.0142463

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Ucus, S. (2018). Exploring creativity in social studies education for elementary grades: Teachers' opinions and interpretations. *Journal of Education and Learning, 7*(2), 111–121. https://doi.org/10.5539/jel.v7n2p111

Xu, X., Xia, M., Zhao, J., & Pang, W. (2021). Be real, open, and creative: How openness to experience and to change mediate the authenticity–creativity association. *Thinking Skills and Creativity, 41*, 100857. https://doi.org/10.1016/j.tsc.2021.100857

ISSN (print) 2685-7111 | ISSN (online) 2338-6061

10.21831/pep.v29i1.79429

Yasa, A. D., Kumala, F. N., Wibawa, A. P., & Hidayah, L. (2023). Evaluation of creative thinking skills in the development of elementary science learning in elementary schools: A mix method study. *Journal of Education Research and Evaluation, 7*(4), 559–568. https://doi.org/10.23887/jere.v7i4.68255

ISSN (print) 2685-7111 | ISSN (online) 2338-6061