

ANALYSIS OF GENERATION ALPHA CREATIVE THINKING IN SOLVING MATH WORD PROBLEMS REVIEWED BY LEARNING STYLES

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ABSTRACT

This study aims to investigate and analyze the creative thinking abilities of Generation Alpha junior high school students in solving systems of linear equations in two variables (SPLDV) word problems, viewed from their learning styles. The research employed a descriptive qualitative approach supported by NVivo software for automatic coding (autocode) and thematic visualization. The subjects consisted of 24 eighth-grade students from a school in Tegal regency, with results showing that 45.8% were visual learners, 29.1% auditory learners, and 25% kinesthetic learners. Furthermore, three students were purposively selected since it adequately represents the variety within the category to represent each learning style category for in-depth analysis. The instruments used included a learning style questionnaire, SPLDV word problem tests, and interview guidelines. Data were analyzed using the Miles and Huberman interactive model, while validity was ensured through methodological triangulation. The findings reveal that: (1) visual learners demonstrated all four indicators of creative thinking, with a notable strength in flexibility; (2) auditory learners achieved three indicators, particularly excelling in fluency; and (3) kinesthetic learners fulfilled four indicators, with a strong emphasis on elaboration. The prevalence of short-form visual content on social media influences Generation Alpha's learning preferences, which are faster-paced and more visually oriented.

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INTRODUCTION

In the 21st century, the world of education faces complex challenges not merely limited to mastering technological advancements, but also concerning the development of thinking skills across generations. Education plays a vital role in developing human resources so that they possess the skills to think logically, critically, and creatively, as well as adapt to the changing times (Huliatunisa et al., 2019). The generation born during this era is Generation Alpha; they were born between 2010 and 2025. Nasution (2024) states that Generation Alpha is the generation born and raised amidst the rapid advancement and development of digital technology. In the era of globalization, many of the challenges faced by Generation Alpha can be resolved with the aid of technology. Fadlurrohim et al. (2020) argue that Generation Alpha may grow up to be smarter than

previous generations because they are more closely integrated with digital technology. The distinguishing characteristics of this generation are hyperconnectivity, a technology-dependent lifestyle, strong visual skills, and proficiency in using technology (McCrindle, 2021). This generation has not yet fully maximized the potential of technology implementation in science education, which should hold significant promise for learning.

In 21st century learning, students are expected to possess the 4Cs: *critical thinking, creative thinking, collaboration, and communication skills*. Regulation of the Minister of Basic and Secondary Education No. 1 of 2026 on process standards states that learning must create a positive, challenging, and motivating learning environment. Creative thinking is an activity that involves generating ideas, solving problems, and identifying patterns in situations to provide solutions to given problems; therefore, it requires free-flowing, pressure-free thinking (Fitri & Nuh, 2025). According to Ismunandar *et al.* (2020), creative thinking is a series of cognitive activities that a person engages in regarding an object, a problem, a situation, or an attempt to solve a problem, based on their individual abilities. Creative thinking must be cultivated and integrated into the learning process, it should not merely remain an abstract theory that is difficult to define in practice (Purwosetiyono *et al.*, 2018). Students are not yet familiar with the concept of creative thinking, which acts as a barrier to understanding and developing their own creative thinking abilities.

In theory, creative thinking has indicators that serve as measurements for assessing the extent of one's creative thinking ability, including fluency, flexibility, originality, and elaboration. In line with that was stated by Suripah & Sthephani (2017) the indicators of creative thinking ability include, (a) fluency, where students are able to demonstrate and generate many ideas in solving problems, (b) flexibility, where students are able to solve problems correctly in more than one way, (c) originality, student can solve problems in their own way, (d) elaboration, where students can solve problems with detailed steps. The development of these abilities can be influenced by several factors, one of which is learning style. Learning styles influence how individuals absorb, process, store, and recall knowledge (Hariri *et al.*, 2025). Learning style is defined as an individual's preferred approach to acquiring knowledge and information (Autida, 2024). According to DePorter & Hernacki (2015) learning styles are categorized into three types, (a) visual, a learning style where students tend to rely on their vision to absorb information during learning, (b) auditory, a learning style that relies on hearing to understand and retain information or knowledge, (c) kinesthetic, a learning style in which students tend to require practical and contextual learning. The learning styles of Generation Alpha need to be studied more deeply, and their level of creative thinking ability also needs to be researched because it is influenced by the times. Learning activities tend to prioritize certain learning styles, failing to cover the full range of learning styles, which causes some students to experience difficulty.

In mathematics, students often face several challenges. Aminah & Kurniawati (2018) suggest that one of the difficulties students often face in mathematics is solving word problems. According to Sari & Wulandari (2022), student's creative thinking abilities can be observed through their problem-solving of mathematical word problems. According to Wahyuddin & Ihsan (2016), mathematical word problems are math questions that involve reading, reasoning, analyzing, and finding solutions, requiring students to master the skills needed to solve them. One of the mathematical topics frequently tested in word problems is Systems of Linear Equations with Two Variables (SPLDV). Based on the researcher's analysis of the preliminary trial data of the answers to word problems provided by several junior high school students who had studied SPLDV, some of them were still unable to convert the problems into mathematical form. They still frequently made mistakes during the elimination stage and lacked attention to detail when reading the problems, resulting in incomplete answers.

Several recent studies indicate that literacy has a significant impact on students' creative thinking skills (Nadzifah *et al.*, 2024). Research by Sigus & Mädamürk (2025) found that motivation and knowledge from outside mathematics have a positive effect on students' ability to solve word problems. Ruiz *et al.*, (2024) stated in their research that Generation Alpha students require special attention regarding new ways of learning. In this study, the proposed concept for learning is AROHA, namely accountability, relevance, ownership, holistic, and applicability. Hardy *et al.*, (2025) noted in their study that identifying student's difficulties in solving word problems should be done as early as possible. Furthermore, research by Wijayanto *et al.*, (2021) merely presents general findings without an in-depth analysis of the characteristics and factors of learning styles. The lack of studies that integrate the VAK (visual, auditory, kinesthetic) learning style perspective to analyze the creative thinking of Generation Alpha junior high school students, particularly in the context of SPLDV word problems, constitutes a research gap that underpins this study. This study aims to analyze how the creative thinking abilities of Generation Alpha junior high school students in solving SPLDV word problems are viewed from the perspectives of visual, auditory, and kinesthetic learning styles.

METHOD

The research method used in this study is descriptive qualitative, to explore student's creative thinking characteristics based on their learning styles in solving SPLDV word problems in depth. The subjects of this study were 24 eighth-grade students at a junior high school in Tegal Regency. The subjects were selected using purposive sampling based on recommendations and considerations from the mathematics teacher, with the criterion of being able to solve word problems effectively. The research was conducted by administering a learning style adaptation from the proceedings by Nizaruddin *et al.* (2020), questionnaire to the students, from this group, three students were selected since it adequately represents the variety within the category to represent each learning style category for in depth analysis, with the criteria being one student a visual learning style, one student an auditory learning style, and one student a kinesthetic learning style, with the following justification: 1) the teacher's assessment based on observations over the course of one semester, 2) Sufficiency of information each representing a dominant learning style. The selected students took the SPLDV word problem test, followed by interviews to obtain valid data. The interviews were recorded and transcribed for further analysis to compare them with the written test results. Documentation was then used to record key findings identified during the study.

The primary instrument used in this study was the researcher, who served as the planner, data collector (through observations and interviews), analyst, and data interpreter in the field. Supporting instruments, including a learning style questionnaire, a word problem test, and interview guidelines were validated by expert validation. The methods for assessing the validity and reliability of the instruments in this study focused on trustworthiness, which encompasses the aspects of credibility, transferability, dependability, and confirmability (Najib *et al.*, 2026). Data analysis in this study followed the interactive model proposed by Miles & Huberman (2018). There are several stages in this data analysis, including the following: 1) Data collection stage, during which the researcher conducted observations, learning style tests, written tests in the form of SPLDV word problems, interviews, and documentation. 2) Data reduction stage: after the data is collected, the next step is to select relevant data in accordance with the research focus; the research results are selected based on categories of creative thinking abilities and grouped according to learning styles with the aim of obtaining more targeted data for the subsequent analysis stage. 3) Data presentation stage: The researcher presents the data in the form of text and tables to identify patterns, relationships among the data, and trends in students' creative thinking

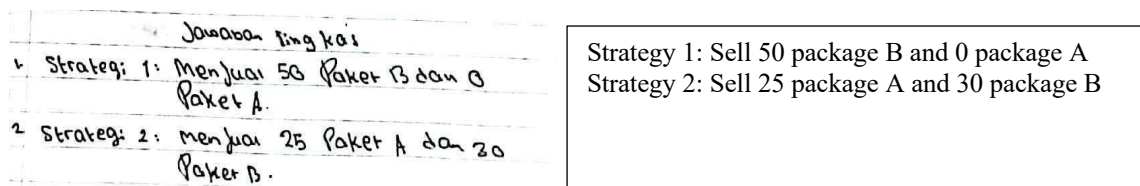


Figure 2. ZEK Visual Student Written Test Results (originality)

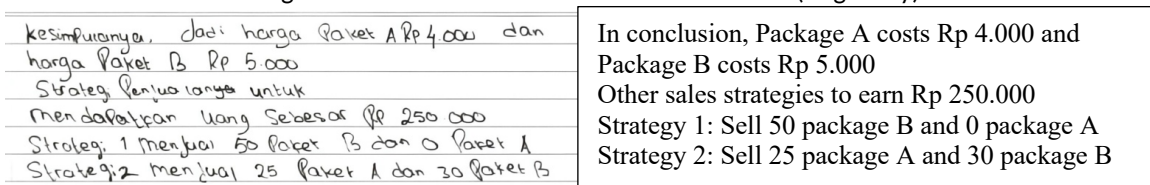


Figure 3. ZEK Visual Student Written Test Results (elaboration)

Figure 1 shows that ZEK visual learners demonstrate fluency, are able to convert existing information into mathematical form, accurately determine unknown values, and answer questions fluently to obtain relevant results. Additionally, Figure 1 demonstrates flexibility; ZEK visual learners can solve problems using the elimination and substitution methods, as well as combinations and rounding of positive integers. Figure 2 demonstrates originality. ZEK visual learners are capable of generating unconventional ideas by employing unique combinations of strategies to achieve a specified revenue, such as selling only Package A, which implies that Package B amounts to 0. Furthermore, in Figure 3, ZEK visual learners are able to provide detailed answers (elaboration), starting from identifying unknown values through to finding the solution to the question and drawing relevant conclusions.

Table 2. Result of Method Triangulation of ZEK Visual Student

Indicator	Written Test	Interview	Conclusion
Fluency	Student 1 ZEK is able to correctly convert the expression into a two variable equation, providing many ideas for answering the question correctly.	Student 1 from ZEK was able to explain their answer correctly and fluently	Demonstrate the criteria for fluency.
Flexibility	Student ZEK was able to answer the question using the process of elimination, followed by substitution, a combination of methods, and rounding to the nearest whole number.	Student 1 ZEK is able to explain their answer by listing the methods, approaches, or strategies used to answer more than one question.	Demonstrate the indicator for flexible thinking
Originality	Was able to come up with original new ideas based on the questions provided, by creating unique combinations based on their own thinking.	Grade 1 ZEK students can explain what new ideas they used to answer the questions.	Demonstrate the criteria for originality
Elaboration	Student 1 ZEK is able to provide detailed answers, starting from the process of finding the unknown value through to drawing relevant conclusions.	Student 1 from ZEK was able to explain their answer in detail.	Demonstrate the indicators for elaborative thinking

Student 2 SZN Auditory:

a. Dikefakui
 15 Paket A + 10 Paket B = 140.000
 10 Paket A + 20 Paket B = 140.000
 misal :
 Harga Paket A = a
 Harga Paket B = b
 persamaan
 1. $15a + 10b = 140.000$
 2. $10a + 20b = 140.000$
 sederhanakan
 1. $\div 5 \rightarrow 3a + 2b = 28.000$
 2. $\div 10 \rightarrow a + 2b = 14.000$
 kurangkan :
 $(3a + 2b) - (a + 2b) = 28.000 - 14.000$
 $2a = 14.000$
 $a = 7.000$
 Substitusi :
 $7.000 + 2b = 14.000$
 $2b = 7.000$
 $b = 3.500$
 Jadi = harga Paket A = 7.000
 harga Paket B = 3.500

Known $15a + 10b = \text{Rp } 140.000$
 $10a + 20b = \text{Rp } 140.000$
 For Example price for package A = a
 Price for package B = b
 Equation
 $15a + 10b = \text{Rp } 140.000$
 $10a + 20b = \text{Rp } 140.000$
 Simplify
 $3a + 2b = \text{Rp } 28.000$
 $a + 2b = \text{Rp } 14.000$
 Elimination
 $(3a + 2b) - (a + 2b) = 28.000 - 14.000$
 $2a = 14.000$
 $a = 7.000$
 Substitution
 $7.000 + 2b = 14.000$
 $2b = 7.000$
 $b = 3.500$
 Jadi harga paket A = 7.000
 harga paket B = 3.500

Figure 4. SZN Auditory Student Written Test Results (fluency & elaboration)

b. Pendapatan yang diinginkan = Rp. 250.000
 rumus : $7.000x + 3.500y = 250.000$
 $3.500(2x + y) = 250.000$
 $250.000 : 3.500 = 71.428$
 tidak mungkin khal 250.000, karena 250.000 bukan kelipatan 3.500

Desired income = Rp 250.000
 Formula: $7.000x + 3.500y = 250.000$
 $250.000 : 3.500 = 71.428$
 It's impossible 250.000, because 250.000 it's not a multiple 3.500

Figure 5. SZN Auditory Student Written Test Results (originality)

Figure 4 shows that SZN students with an auditory learning style are able to note down what they already know, what is being asked, and how to solve the problem. Students can answer questions fluently. SZN students have not yet used various strategies to solve problems. Figure 5 shows that the SZN student with an auditory learning style has a new idea for answering the problems. He answers that it is impossible to get 250.000 because that number is not a multiple of 3.500, the answer is incorrect, but it demonstrates an unconventional approach. SZN students are able to provide detailed and step-by-step answers, starting by writing down what they know, determining the value of the unknown variable, and drawing a conclusion.

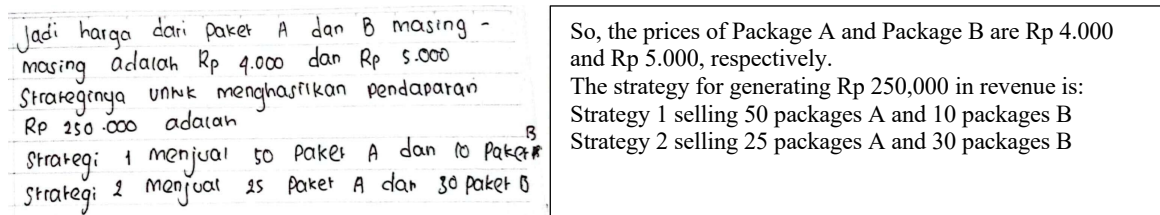


Figure 8. OAS Kinesthetic Student Written Test Results (Elaboration)

Figure 6 shows that OAS students are able to understand the information in the questions, they can identify what is given and what is being asked. Students are able to answer in a logical sequence, enabling them to solve problems accurately. This indicates that OAS students demonstrate the criteria for fluency. Figure 6 and 7 show that it's evident that OAS students employ a variety of strategies to solve problems. Students use the elimination method followed by the substitution method, and they also employ two strategies: direct calculation and variable substitution to answer questions with accurate results. This indicates that the students demonstrate the indicator for flexible thinking. Based on Figure 7, OAS students were able to generate new ideas on their own to answer the question of how to earn Rp 250.000 they were able to propose several ideas for the exact amount using a variety of quite different combinations. Figure 8, OAS kinesthetic learners were able to answer the question in detail, convert it into a linear equation with two variables, set up the variables, solve for the values of the variables using elimination followed by substitution, and provide the correct answer.

Table 4. Result of Method Triangulation of OAS Kinesthetic Student

Indicator	Written Test	Interview	Conclusion
Fluency	Students 3 OAS are able to create mathematical models from the problems presented and solve them smoothly and accurately.	Students 3 OAS can explain their answers fluently and accurately.	Demonstrate the fluency criterion
Flexibility	Can solve problems using different methods, such as elimination followed by substitution; they can demonstrate two different strategies by calculating directly and using variable substitution.	Students in 3 OAS can explain their answers by describing the methods and strategies they used to arrive at the correct answer.	Demonstrate the flexibility indicator
Originality	come up with original ideas when answering questions; they use their own thinking and logic to generate the correct number combinations.	Explain how they can come up with new ideas through logical thinking.	Demonstrate indicators of original thinking
Elaboration	Answer questions in detail, convert them into linear equations with two variables, introduce variables, solve for the values of the variables using elimination followed by substitution, and provide the correct answer.	Describe the work process in detail and accurately.	Demonstrate the indicators of elaborative thinking

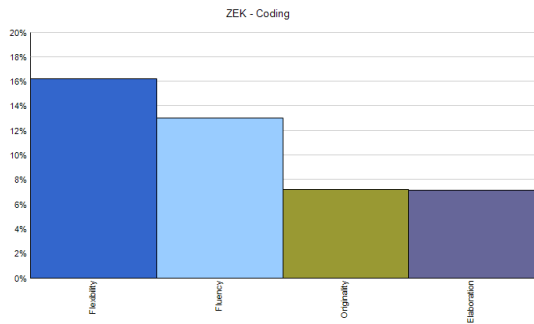


Figure 9. Visualization Visual Coding in NVivo

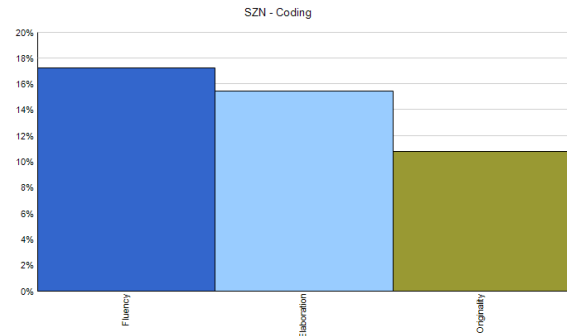


Figure 10. Visualization Auditory Coding in NVivo

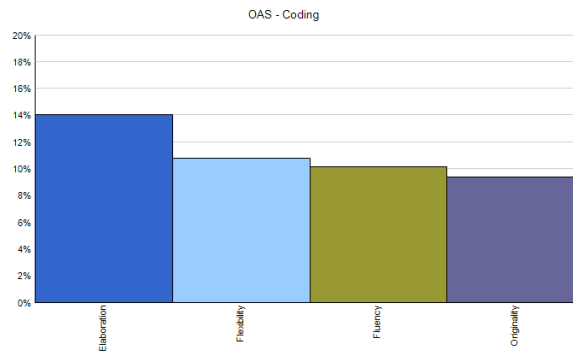


Figure 11. Visualization Result of Kinesthetic Coding in NVivo

Based on thematic coding analysis using NVivo 12, the data contained the following main nodes: fluency, flexibility, originality, and elaboration. Figure 9 shows that visual ZEK students produced 16% flexibility codes, 7% higher than kinesthetic students; this dominance is evident in the visual subjects' ability to switch between representations, reflecting Generation Alpha's digital adaptation to short visual content. Figure 10 shows that SZN auditory learners generated 17% of the fluency codes, 5% higher than visual learners and 7% higher than kinesthetic learners. Figure 11 shows that OAS kinesthetic learners generated 14% of the elaboration codes, 1% higher than visual and auditory learners.

DISCUSSION

The results of the analysis of the creative thinking abilities of Generation Alpha students with a visual learning style show that ZEK students are able to demonstrate all four indicators of creative thinking. According to Nugraha *et al.* (2023), students with a visual learning style can demonstrate fluency, flexibility, originality, and elaboration in their thinking. Generation Alpha students with a visual learning style demonstrated stronger flexibility, evidenced by their ability to employ a wider range of strategies in problem-solving, resulting in a flexibility score of 16%. Based on interview findings, students tend to utilize digital technologies such as educational videos, animations, and visualizations of mathematical concepts, which reinforce their visual representation skills. This aligns with McCrindle's (2021) observation that Generation Alpha frequently interacts with visual and digital technologies. This study identified a new trend in Generation Alpha's creative thinking abilities compared to Generation Z. Although Generation Z also experiences similar phenomena, the intensity of digital technology exposure from an early age in Generation Alpha exerts a more significant influence on their learning methods and the development of their creative thinking abilities. Generation Alpha is more tech-savvy than previous generations because they are more immersed in digital technology (Fadlurrohim *et al.*, 2020). Short-form visual content has made Generation Alpha more accustomed to receiving information quickly, concisely, and in a visual

format. This situation has implications for students' learning styles, where visual learning appears to be more dominant, thereby not only influencing their learning preferences but also shaping a mindset that is more responsive to visual stimuli.

Analysis of Generation Alpha students with an auditory learning style shows that SZN students were able to demonstrate three indicators of creative thinking: fluency, flexibility, and elaboration. This aligns with the findings of Sholihah & Aini (2023), who noted that students with an auditory learning style demonstrate these three indicators of creative thinking ability. Generation Alpha students with an auditory learning style demonstrated strengths in fluency (Musaidah et al., 2020). This was evident when students answered questions fluently and with detailed precision, resulting in a 17% score on the fluency scale. The researchers found that the subjects possess strengths in verbal ability and logical reasoning, evident during interviews where they provided clear explanations and used appropriate language compared to other learning styles. This is attributed to the tendency of students to absorb information primarily through listening during learning processes and discussions, enabling students with this learning style to communicate effectively during interview sessions. DePorter & Hernacki (2015) state that students with this learning style easily grasp information through discussion, learning by listening to what is being discussed.

The results of the analysis of Generation Alpha students with a kinesthetic learning style show that OAS students were able to demonstrate the four indicators of creative thinking: fluency, flexibility, originality, and elaboration. According to Wijayanto, Purwosetiyono, & Prasetyowati (2021), who noted that students with a kinesthetic learning style are capable of meeting the four indicators of creative thinking skills. Generation Alpha students with a kinesthetic learning style excel in elaboration, as demonstrated when they answer questions in detail, resulting in a 14% higher elaboration score compared to visual and auditory learners. Students with this learning style prefer hands-on practice, enabling them to explain processes in a detailed and systematic manner. According to Budi *et al.* (2021) students with this learning style find it easier to understand concepts through practice and require contextual learning due to their very strong exploratory nature. Consequently, they are accustomed to carrying out processes step by step and in detail.

CONCLUSION

This study reveals that the characteristics of creative thinking among Generation Alpha junior high school students in solving SPLDV word problems are highly differentiated based on VAK learning styles. Visual learners dominate by demonstrating all four indicators of creative thinking and excel in the flexibility indicator due to their optimal adaptation to digital technology. Auditory learners are strong in fluency (the ability to articulate answers smoothly) but weak in flexibility. Kinesthetic learners, as a minority group, successfully demonstrated all indicators with a particular strength in elaboration. This study was limited to 3 eighth-grade students from a single school in Tegal Regency using purposive sampling. Therefore, the generalizability of the findings to a broader student population requires further validation. Additionally, the study focused solely on SPLDV word problems without comparing other mathematical topics. Theoretically, this research provides a new framework regarding the interaction between VAK learning styles and Generation Alpha's creative thinking within the SPLDV context. For future research, it is recommended to compare other mathematical topics using a similar approach, as well as to delve deeper into the creative thinking abilities of Generation Alpha, particularly in mathematics learning.

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The authors acknowledge the use of [insert AI system(s) and link] to [specific use of generative artificial intelligence]. The prompts used include [list of prompts]. The output from these prompts was used to [explain use]. While the authors acknowledge the usage of AI, they maintain that they are the sole authors of this article and take full responsibility for the content therein, as outlined in COPE recommendations.

INFORMED CONSENT

The authors have obtained informed consent from all participants.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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