

## Analysis of Algebra Communication Skills and Creative Thinking Skill Levels: In Terms of Cognitive Style

Wieka Septiyana\*, Ramzil Huda Zarista, Roudotul Hasanah  
Mathematics Education Department, STKIP Sinar Cendekia, Indonesia  
\*wieka.s@stkipsinarcendekia.ac.id

### ABSTRACT

The students have difference in cognitive style. This research aimed to describe and analyze students' communication skills and creative thinking skill level in view of field dependent and independent cognitive style on algebraic concept. Algebra communication skill is essential skill needed for solving mathematical problems. Algebra must be mastered by the students because related to other materials. Algebra topic analyzed in this study is quadratic equation word problems. The indicators of communication skill include (1) able to state the situation into mathematical notations, structures or symbols, (2) able to demonstrate and describe unique algorithms in problem solving, and 3) able to construct and explain real-world phenomena in graph, sentence, equation, table or other presentation. The student level of creative thinking skill can be seen from fluency, flexibility and novelty. This research used a mixed-method. The object were 16 students of junior high school in Tangerang. The data collection techniques used test and interview. Cognitive styles are grouped using the Group Embedded Figure Test (GEFT) which divide the students into field dependent (FD) and field independent (FI). The results of the study indicated that algebra communication skill of students with FD and FI were not different significantly in problem solving. Both are able to understand the problems into mathematical expressions, but not all groups state the correct mathematical equations. The students used different strategy to solve the problems. FD students used less detailed strategy, incomplete analysis, think generally, and not quite precise in writing mathematical equations, while FI students provided detailed explanations, better accuracy, think more flexibly, and state mathematical equation precisely. In general, they have same creative level.

**Keywords:** Algebra, cognitive style, mathematical communication and creative thinking skill level

### ABSTRAK

Siswa memiliki perbedaan pada gaya kognitif. Penelitian ini bertujuan untuk menggambarkan dan menganalisis kemampuan komunikasi dan level berpikir kreatif matematis siswa berdasarkan gaya kognitif pada konsep aljabar. Aljabar merupakan materi yang harus dikuasai siswa karena berkaitan dengan materi lainnya. Topik yang dibahas dalam penelitian ini yaitu persamaan dan fungsi kuadrat dengan soal cerita. Indikator keterampilan komunikasi yang dianalisis dalam penelitian ini yaitu (1) kemampuan dalam menggunakan istilah, notasi, matematika dan struktur untuk mempresentasikan ide ke dalam model matematika, (2) mampu mendemonstrasikan dan menggambarkan suatu algoritma yang unik dalam memecahkan masalah, dan (3) mampu mengkonstruksikan dan menjelaskan fenomena dalam dunia nyata dalam bentuk grafik, persamaan dan table atau penyajian lainnya. Tingkat berpikir kreatif matematis siswa dilihat berdasarkan kelancaran, keluwesan dan kebaruan. Penelitian ini menggunakan metode campuran dengan subjek penelitian 16 siswa di salah satu sekolah menengah pertama Kabupaten Tangerang. Teknik pengumpulan data menggunakan tes dan wawancara. Gaya kognitif dikelompokkan dengan menggunakan test GEFT yang dibagi ke dalam tipe FD dan FI. Hasil penelitian menunjukkan bahwa kemampuan komunikasi aljabar siswa FD dan FI tidak berbeda secara signifikan dalam menyelesaikan masalah matematis. Perbedaan yang ditemukan yakni pada penggunaan strategi penyelesaian masalah. Siswa dengan FD menyelesaikan masalah dengan langkah yang sederhana dan kurang terperinci, analisis yang tidak menyeluruh, berpikir secara umum, dan belum cukup tepat dalam menuliskan masalah ke dalam persamaan matematika, sedangkan siswa dengan gaya kognitif FI menyelesaikan masalah dalam uraian yang detail, memiliki ketelitian yang baik, berpikir lebih luwes, dan dapat menyatakan persamaan matematika dengan tepat. Secara umum, kedua tipe gaya kognitif tersebut memiliki tingkat berpikir kreatif yang sama.

**Kata kunci:** Aljabar, gaya kognitif, kemampuan komunikasi dan level berpikir kreatif matematis

Received : December 20, 2022 /Revised : April 30, 2023  
/Accepted : May 21, 2023 /Published : May 30, 2023

## Introduction

Mathematical skill must be mastered by the students because useful for daily life, career and science development. Learning mathematics is not only focus on calculation. Algebra is one of study in mathematics that learn about mathematical modelling, pattern and involved rules manipulating the abstract symbol. The difficulties in algebraic material are lack of optimizing through process (Istikomah et al., 2020).

Communication skill should help students to understand, interpret, explore idea and use mathematical symbol in oral and written form. Mathematical communication skill in learning mathematics needed to be considered because communication skill is used to manage and integrate students' thinking both oral and writing. National Council of Teaching Mathematics (NCTM) also concerned to communication ability as a language tool of mathematics to deliver message (NCTM, 1991). The increased communication skills indicated by (1) students are able to deliver ideas into mathematical sentences, (2) students are actively involved in mathematics discussions, (3) students can formulate and generalize mathematics definitions, (4) students can conclude a definition using their own words (Nartani et al., 2015). The previous researchers found that the students' difficulties of solving problems are translating a mathematical sentence into mathematical operation (Tambychik et al., 2010). So, it needs to be concentrated and can be analyzed in depth. Mathematical skill strongly influenced by communication skill that should students have. NCTM (1991) states that communication is an essential part of mathematics and mathematics education. If the students have communication skills, they will get deep understanding about the learned concepts.

The students' algebraic communication skill can be seen from the way of think or see the problem. Cognitive style is one of way to know how an individual process the information and think what they are learning (Razali et al., 2003). Different characteristics of cognitive style impact on students' mathematical skill (Maulida et al., 2021). Cognitive style presents students' responding method that influence decision-making steps. Likewise what Warli (2010) stated that the cognitive style is an individual characteristic in thinking, remembering, organizing, and solving a problem. Pitt-pantazi & Christou (2009) also said that the cognitive style is, in fact, a preferred approach of individuals and habits in analyzing information, which can affect the way of looking and acknowledging the ideas.

The present research focused on two cognitive styles, field independent (FI) and field dependent (FD). Student with FI cognitive style has difference characteristics from the students with FD cognitive style. FD cognitive style has characteristic in thinking globally, open minded, social-oriented, prioritizing external motivation and social skill profession oriented, acted by goals and information (H. A. Witkin et al., 1977). They have trouble to separate themselves from surrounding environment because get more influences from external and tend to recognize themselves as part of the group. Therefore, their perceptions are easily changed by the environment (Rusdi et al., 2020). Meanwhile, FI cognitive style has type of thinking analytically, tends to analyze an object based on context, organizing objects, impersonally oriented, prefer profession requiring individual capability and prioritizing internal motivation (Suryanti, 2014). Polya said the students with FI used the steps in problem solving, such as understanding the problem, planning, executing plans then reviewing processes and results (Kamandoko & Suherman, 2017). FI students reflect the unique abilities in studying mathematical material more detail in certain parts and persistent of solving problems. So, FI cognitive style has high tendency to achieve high mathematics learning outcomes (Ulya, 2015).

Generally, the cognitive style has relationship to algebraic mathematical thinking (Nisak et al., 2020)

Cognitive factors are always associated with creative thinking (Kao, 2016). The students with creative thinking skill can solve the problems from various points of view (Mursalin et al., 2018). This skill must be possessed in modern area (Nugroho, 2020). Creative thinking aspects are fluency in solving problems, flexibility and create an answer that doesn't exist (originality) (Silver, 1997). Fluency is a fluent thinker who has many answers (Mann et al., 2017). Flexibility is the ability to solve problems with various solutions or ways (Vidal, 2005). Whereas the originality is original and rare responses (Lev & Leikin, 2017). The creative thinking skill can be developed through mathematics education (Widiyasaki et al., 2022).

This study focuses on analyzing mathematical communication abilities and creative thinking level based on field independent and dependent cognitive style. The research analyzed on algebraic concepts. Knowing the level of creative thinking skill students and how the students to use mathematical language is an important role to know how the students think in solving mathematical problem, prepare a good learning process and achievements.

### Research Methods

The research used a mixed-method, therefore it used qualitative and quantitative data. The quantitative data obtained from algebra communication and creative thinking skill instrument. The instrument used essay test and the results are supported by non-test instruments. The qualitative data analysis techniques include reduction, data presentation and concluding. The students' answers are confirmed by direct interviews. All results of qualitative collected, tested and analyzed to determine the students' level in creative thinking skill. Furthermore, the quantitative data were used to represent descriptive statistics and Mann-Whitney U test.

The participants are 16 ninth grade students. The participants were not selected randomly. The selection based on the result of classification cognitive style test adapted from Group Embedded Figures Test (GEFT) were made by Witkin (1977). GEFT is a standard test in America, so that changes on the test should be avoided. The test assesses students' skill provide from the simple patterns to more complicated patterns. It contains 3 parts. The first part consists 7 questions for introduction and the last 2 parts consist 9 questions each. The correct answer is given score 1. The maximum score is 18 and the minimum score is 0. The test for grouping into two groups FI and FD as shown in Table 1.

**Table 1.** Categories of Cognitive Style

Score Interval	Category
Score $\geq 11$	FI
Score $< 11$	FD

Table 1 explains the categories of cognitive style by looking at GEFT results. Scores follow score intervals and categorize into each type of cognitive style. Students with score lower than 11 are classified as FD students, while students with equal or more than 11 score are grouped into FI students.

To analyze the students' algebraic communication skill scores based on indicators (1) states the situation into mathematical notations, structures or symbols (2) able to demonstrate and describe unique algorithms of solving problems, and 3) able to construct and explain real-world

phenomena in graph, sentence, equation, table or other presentation. Meanwhile, the researchers did a recapitulation of each number of questions of communication skill and determine students' level of creative thinking. The indicators of creative thinking skills discussed are fluency, flexibility and novelty. The mechanisms of creative such as the synthesis of ideas, create news idea and using ideas (Isaksen, 2003). The results of creative thinking skills obtained then analyzed in depth and categorized into several levels of thinking described in Table 2 (Tohir & Abidin, 2018).

**Table 2.** The Level of Creative Thinking Skill

Level of Creative Thinking	Indicators		
	Fluency	Flexibility	Novelty
Level 4 (Very Creative)	√	√	√
Level 3 (Creative)	-	√	√
	√	-	√
Level 2 (Fairly Creative)	-	√	-
	-	-	√
Level 1 (Hardly Creative)	√	-	-
Level 0 (Not Creative)	-	-	-

## Result and Discussions

### *Classification of Cognitive Style*

The distribution of students' cognitive style result used the Group Embedded Figure Test (GEFT) shown in Table 3. It seen from 16 students that 43.75% the students with FI and 56.25% the students with FD. It shows that the internal motivation is not helping enough, they need external motivation.

**Table 3.** Frequency Distribution of Students' Cognitive Style

Cognitive Style	Frequency
Field Dependent (FD)	9
Field Independent (FI)	7

### *Algebra Communication Skill Students' Based on Cognitive Style*

The mean score of algebra communication skills of the students with FI is 3.14 in good category, and the mean score of the students with FD is 2.54 in the same category. The mean scores from each group between the two types of cognitive styles described no difference in results. The results of the same analysis were also obtained in the Mann-Whitney test in Table 5. The students with FD are more dominant than the students with FI, furthermore viewed by the variance in Table 4, the scores obtained by the students with FD was more variety than the students with FI. This result showed by the scored of FD varies from very low until very high scores, whereas the scores with FI students only showed the students with high and very high scores.

The test can be seen in Table 5, that the significant value of algebra communication is  $0.062 > 0.05$ , so  $H_0$  is accepted. It shows that there is no a significant difference in the average of algebra communication skill of FI and FD. The result can be seen from the difference mean score of both cognitive styles is only 0.6.

**Table 4.** The Mean of Algebra Communication Skill

Statistic Description	Cognitive Style	
	FD	FI
Mean	2.54	3.14
Std. Deviation	0.89	0.81
Variance	0.79	0.65
Minimum	0.80	2.00
Maximum	3.40	4.00

**Table 5.** Mann-Whitney U-test of Algebra Communication Skill based on Cognitive Style

Analysis	Result
Mann-Whitney U	14.000
Wilcoxon W	59.000
Z	-1.866
Asymp.sig (2-tailed)	0.062

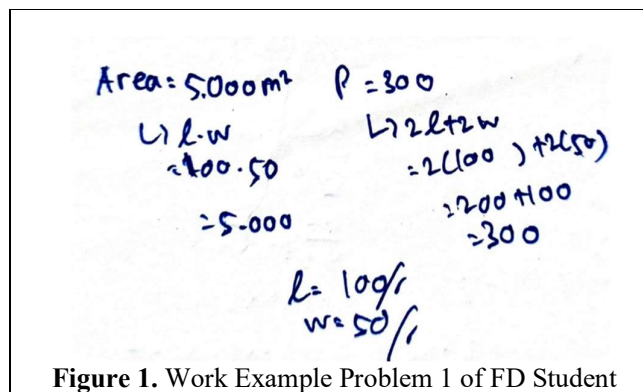
Grouping Variable: Cognitive Style

Based on Table 5, the students FI and FD have same communication ability. Furthermore, students' answers can show the way to communicate the ideas clearly, precisely and concisely. The analysis of the students' answers is explained detail from two different cognitive style described as follows.

*Algebra Communication Skill of FD and FI Students*

The problem 1 is given: Zaid has 300 meters of fence on hand and wants to enclose a rectangular field so that it will contain 5000 square meters in area.

- A. Write the equation to represent the problem!
- B. What should the length and width of the field be?



Based on the student's work, analysis and interview result, it showed that students with FI and FD were able to state the situation into mathematical notation or mathematical symbols. From this problem, students solved the problem by relating the problem into mathematical concept of area and perimeter of rectangle. It found, more than 50% of students wrote the situation into mathematical symbol correctly, but they didn't work algebraically for solving problem 1B. Related to Figure 1, the equations of FD are right by prove in accordance with information provided in area and perimeter, although it used substitution method to prove the possible solutions. The student can conclude the final result of the steps, but besides that to answer the question 1A is not quite right. The student wrote the area and perimeter formulas separately

with the constant number. Not writing the formula and the value of area and perimeter with an equal sign indicates an error in stating the equations according to problem 1A.

Furthermore, viewed from Figure 2, FI students solved the problem 1B correctly and used detailed and systematic concepts of algebra. The student demonstrated and described unique algorithms in problem solving. It was using backward calculation and got the quadratics equations after substituting the equation of perimeter into the equation of area. The student found the factors and roots of quadratics equations as solutions for length and width of the field. Not only that, the student continued to substitute the length and width to the equation of area until stated the conclusion. Based on the analysis from the beginning step, student have written the area and the perimeter in the right way using the equality symbol between the formula and the constant number.

**ANSWER**

$$2(l+w) = 200$$

$$l+w = 150$$

$$w = 150 - l$$

$$5000 = l \cdot w$$

$$5000 = l \cdot (150 - l)$$

$$5000 = 150l - l^2$$

$$l^2 - 150l + 5000 = 0$$

$$-100 \times -50 = 5000$$

$$-100 + -50 = -150$$

$$x - 100 = 0 \quad x - 50 = 0$$

$$x_1 = 100 \quad x_2 = 50$$

$$5000 = l \cdot w$$

$$5000 = 100 \cdot w$$

$$\frac{5000}{100} = w$$

$$50 = w$$

$$5000 = l \cdot w$$

$$5000 = 50 \cdot w$$

$$\frac{5000}{50} = w$$

$$100 = w$$

Figure 2. Work Example Problem 1 of FI Student

The problem 2 is given: A daily profit ( $P$ ) of boutique is given by  $P = -x^2 + 2x + 15$ . When  $x$  represents the number of items sold daily and  $P$  represents the daily profit in dollars. Sketch the graph that shows the maximum profit of the boutique.

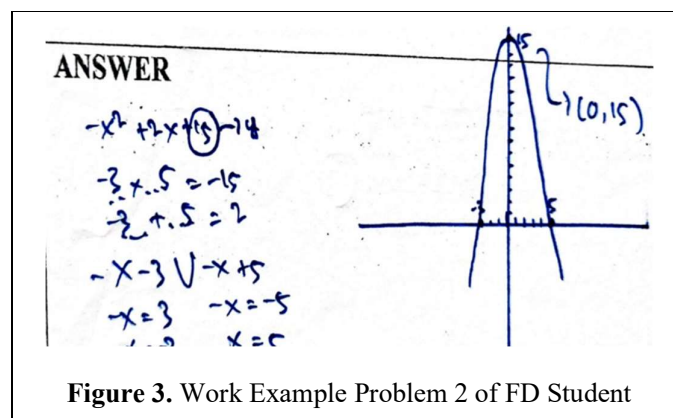


Figure 3. Work Example Problem 2 of FD Student

Figure 3 is one of the student's works of FD. The student made a correct type of parabola but wrong maximum point. She graphed open downward parabola accordance with the situation described in the problem. The graph shown is not quite right because the correct critical point is only x-intercept. The student did not work to get the maximum point, so that the maximum point (0,15) is not correct. The point (0,15) is the y-intercept of the graph. Based on the way of student with FD to find solution appropriate to characteristic of FD who thinks globally and

tends to make a less depth analysis (Maswar et al., 2022). In addition, the student answers indicate that the student is less able to understand and interpret the situation from the equation, then it represents inflexibility in answering the problems. Therefore, student can't find the maximum point precisely.

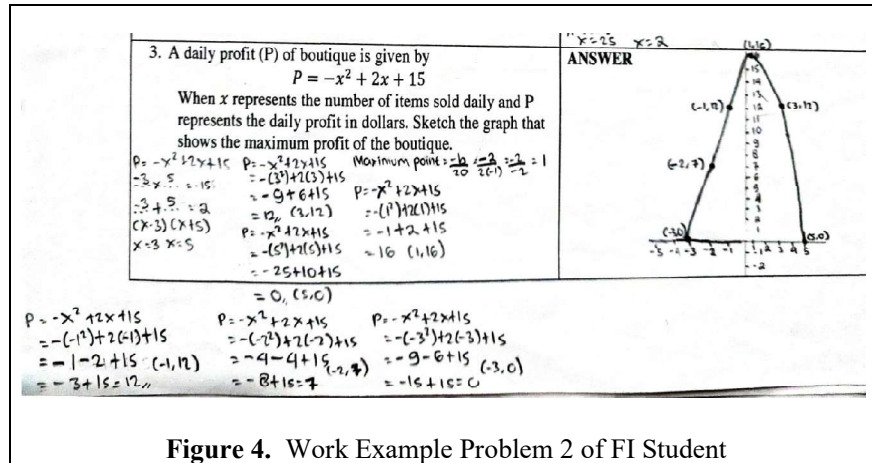


Figure 4. Work Example Problem 2 of FI Student

The result of FI student's work in figure 4 showed detail, proper and clear steps to get the appropriate graph. She started to find the axis of symmetry and then substitute the value  $x$  into equation to find maximum point. The step used to determine the  $x$ -intercept points is right and complete. According to M Yousefi (2011), that the student with FI analyzed and solved relevant details, found patterns and critically evaluate. Based on the results of the analysis, the student has the ability to construct and connect real word problem in graph. Besides that, the student also shows fluency and flexibility in answering problem.

Students' answers from two problems represent the same open downward graph but in the different strategies. There are differences in answers obtained by two groups of students because they have different way to communicate the situation and the mathematical words and have different way to think creatively in solving problems.

*Students' Creative Thinking Skill Level*

Creative thinking skill needs to generate news ideas. The result of student with FD and FI divided to 3 levels, fairly creative, hardly creative and creative. This found not only in FD students, but also in FI students. Table 6 states the percentage of each level viewed from students' answers.

Table 6. Percentage of Students' Creative Thinking Skill Level Based on Cognitive Style

No	Level	FD Results		FI Results	
		Frequency	Percentage	Frequency	Percentage
1	Fairly Creative	3	33.33%	2	28.57%
2	Hardly Creative	4	44.44%	1	14.29%
3	Creative	2	22.22%	3	57.14%

Students FD used same steps on generally. Likewise at the creative level, the number of FI students is higher that FD. Description of students' process described the problem as in the Figure 5 – 8. Instrument of algebra communication skill lead by written instructions of creative

thinking skill indicators. The student works show creative thinking skill in following description as in the Figure 5 and 6.

The problem 3 is given: A farmer has rectangular field of length  $(7 - 2x)$  m and the width  $(2x - 3)$  m. Determine the maximum area of field using more than one way!.

Handwritten student work for Problem 3 showing two methods to solve for  $x$ .

Method 1:

$$l = 7 - 2x$$

$$w = 2x - 3$$

$$7 - 2x = 2x - 3$$

$$-2x - 2x = -3 - 7$$

$$-4x = -10$$

$$x = \frac{10}{4} = \frac{5}{2}$$

Method 2:

$$l = 7 - 2(2.5) = 7 - 5 = 2 \text{ m}$$

$$w = 2(2.5) - 3 = 5 - 3 = 2 \text{ m}$$

Area:

$$\text{Area} = l \cdot w = 2 \cdot 2 = 4 \text{ m}^2$$

Figure 5. Work Example Problem 3 of FD Student

The students with FD in Figure 5 solved in one way. It shows that the student made the equations from two expression. It means she interpreted the rectangular field is the same as a square field. Based on the interview, she only focused to get the value  $x$  for finding the value of length and width. Without looking for the maximum area, the student answered the question by using the area formula because it's enough to answer the question. This result supports Taufik & Zainab's analysis (2021), that the difficulties of solving algebraic problems explaining rational solutions. In addition, it was demonstrating that the student has the ability to think creatively to generate unusual ways. It related to Simonton (2020) said that the creativity produces different ideas as usual. To compare with other students with other cognitive style, the following shows the answers of student with FI.

Handwritten student work for Problem 3 showing a systematic approach.

5. A farmer has rectangular field of length  $(7 - 2x)$  meter and the width  $(2x - 3)$  meter. Determine the maximum area of field using more than one way!

1.  $-4x^2 + 20x - 21$

2.  $(7 - 2x) \cdot (2x - 3)$

3.  $(7 - 2(2.5)) \cdot (2(2.5) - 3)$

4.  $(7 - 5) \cdot (5 - 3)$

5.  $2 \cdot 2$

6.  $4$

ANSWER

Area =  $l \cdot w$

$$= (7 - 2x) \cdot (2x - 3)$$

$$= 14x - 21 - 4x^2 + 6x$$

$$= -4x^2 + 20x - 21$$

Vertex  $(-\frac{b}{2a}, f(\frac{-b}{2a}))$

$$-\frac{b}{2a} = \frac{-20}{2(-4)} = 2.5$$

Figure 6. Work Example Problem 3 of FI Student

Based on the result in Figure 6, student with FI shows systematic steps started from finding the quadratics equation then looked for  $x$  - value using axis of symmetry formula to get maximum area. The student input  $x$  - value into function made to find  $y$  - value. The student calculated properly, correctly and clearly. The student also has better accuracy than student with FD. It described the indicators of fluency and flexibility.

## Conclusion

Based on the results of this study, it can be concluded that the most of students FD used simple analysis without thinking deeply and less accuracy. While the students with FI used complete steps to give detail explanation, clear and appropriate reasons. FI and FD understand the

problem well, but have different strategies to solve. This results also related to statistics analysis that there is no difference significantly for algebra communication skill based on FI and FD.

The same findings were found in the analysis of the level of students' creative thinking skill, it showed no difference level. The highest level of students achieved creative level. The students solved the problems using less than 3 indicators of creative thinking skills. Student with FI more flexibly than FD in solving problems.

### **Acknowledgement**

We express our sincere thanks to STKIP Sinar Cendekia for supporting this article can be completed properly. We also thanks to the students who have helped and contributed to this research.

### **Bibliography**

- Isaksen, S. G. (1987). A new dimension for creativity research: Examining style and level of creativity. In *KAI 10th Anniversary International Conference, London, England*.
- Istikomah, I., Astuti, E. P., & Kurniawan, H. (2020). Kemampuan Berpikir Aljabar Siswa Climber Dalam Menyelesaikan Masalah SPLDV. *Alphamath: Journal of Mathematics Education*, 6(2), 96–107.
- Kamandoko, K., & Suherman, S. (2017). Profil intuisi matematis siswa dalam pemecahan masalah Matematika ditinjau dari gaya kognitif Field Independent dan Field Dependent. *Jurnal Penelitian LPPM (Lembaga Penelitian Dan Pengabdian Kepada Masyarakat) IKIP PGRI MADIUN*, 5(1), 1–8.
- Kao, C. (2016). Analogy's straddling of analytical and creative thinking and relationships to Big Five Factors of personality. *Thinking Skills and Creativity*, 19(Thinking Skills and Creativity), 26–37.
- Lev, M., & Leikin, R. (2017). The interplay between excellence in school mathematics and general giftedness: Focusing on mathematical creativity. *Creativity and Giftedness: Interdisciplinary Perspectives from Mathematics and Beyond*, 225–238.
- Mann, E. L., Chamberlin, S. A., & K Graefe, A. (2017). The prominence of affect in creativity: Expanding the conception of creativity in mathematical problem solving. *Creativity and Giftedness: Interdisciplinary Perspectives from Mathematics and Beyond*, 57–73.
- Maswar, M., Tohir, M., Pradita, D. A. R., Asyari, D. N., Sardjono, W., & Selviyanti, E. (2022). Mathematics Problem Solving Based On Cognitive Style To Determine Of Student Reasoning Abilities In The Covid-19 Pandemic Era. *Alifmatika: Jurnal Pendidikan Dan Pembelajaran Matematika*, 4(1), 37–51.
- Maulida, A. R., Suyitno, H., & Asih, T. S. N. (2021). Mathematical Connection Ability viewed from Cognitive Style and Gender in the CONINCON Learning (Constructivism, Integrative & Contextual). *Unnes Journal of Mathematics Education Research*, 10(A).
- Mursalin, M., Nuraini, N. L. S., Purnomo, H., Damayanti, N. W., Kristanti, D., Rohim, A., Widyastuti, R., Wulandari, Y. O., Saleh, H., & Mayangsari, S. N. (2018). The development of algebra teaching materials to foster students' creative thinking skills in higher education. *Journal of Physics: Conference Series*, 1088(1), 012101.
- Nartani, C. I., Hidayat, R. A., & Sumiyati, Y. (2015). Communication in Mathematics Contextual. *IJIREs: International Journal of Innovation Research in Educational Science*, 2(4), 2349–5219.

- National Council of Teacher Mathematics. (1991). *Professional standards for teaching mathematics*. National Council of Teachers of.
- Nisak, A. R. Z., As' ari, A. R., Rahardi, R., & Subanji, S. (2020). The Relationship of Student's Algebraic Thinking and Cognitive Learning Style. *IndoMath: Indonesia Mathematics Education*, 3(2), 70–77.
- Nugroho, S. W. P. (2020). The analysis of algebra creative thinking skill based on strong mathematical habit of mind. *Journal of Physics: Conference Series*, 1538(1), 012100.
- Pitta-Pantazi, D., & Christou, C. (2009). Cognitive styles, dynamic geometry and measurement performance. *Educational Studies in Mathematics*, 70, 5–26.
- Razali, M., Jantan, R., & Hashim, S. (2003). *Psikologi pendidikan*. PTS Professional.
- Rusdi, M., Fitaloka, O., Basuki, F. R., & Anwar, K. (2020). Mathematical Communication Skills Based on Cognitive Styles and Gender. *International Journal of Evaluation and Research in Education*, 9(4), 847-856.
- Silver, E. A. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. *Zdm*, 3(29), 75–80.
- Simonton, D. K. (2000). Creativity: Cognitive, personal, developmental, and social aspects. *American psychologist*, 55(1), 151
- Suryanti, N. (2014). Pengaruh Gaya Kognitif Terhadap Hasil Belajar Akuntansi Keuangan Menengah 1. *Jurnal Ilmiah Akuntansi Dan Humanika*, 4(1).
- Tambychik, T., Meerah, T. S. M., & Aziz, Z. (2010). Mathematics skills difficulties: A mixture of intricacies. *Procedia-Social and Behavioral Sciences*, 7, 171–180.
- Taufik, A. R., & Zainab, N. (2021). Mathematical literacy of students in solving PISA-like problems based on cognitive styles of field-dependent and field-independent. *Journal of Physics: Conference Series*, 1918(4), 042080.
- Tohir, M., & Abidin, Z. (2018). Students creative thinking skills in solving two dimensional arithmetic series through research-based learning. *Journal of Physics: Conference Series*, 1008(1), 012072.
- Ulya, H. (2015). Hubungan gaya kognitif dengan kemampuan pemecahan masalah matematika siswa. *Jurnal Konseling GUSJIGANG*, 1(2).
- Vidal, R. V. V. (2005). Creativity for operational researchers. *Investigacao Operacional*, 25(1), 1–24.
- Warli, W. (2010). Profil Kreativitas Siswa yang Bergaya Kognitif Reflektif dan Siswa yang Bergaya Kognitif Impulsif dalam Memecahkan Geometri. *Universitas Negeri Surabaya*.
- Widiyari, E., Mujib, M., Suherman, S., Komarudin, K., Anggoro, B. S., & Mardiyah, M. (2022). CORE Teaching Model Based Mnemonic Technique Impact Students' Mathematical Creative Thinking Ability and Metacognitive Awareness. *AlphaMath: Journal of Mathematics Education*, 8(1), 49–59.
- Witkin, C. A. (n.d.). More, DR Goodenough, PW Cox. 1977. *Field Dependent and Field Independent Cognitive Style and Their Educational Implication*.
- Witkin, H. A., Moore, C. A., Goodenough, D. R., & Cox, P. W. (1977). Field-dependent and field-independent cognitive styles and their educational implications. *Review of Educational Research*, 47(1), 1–64.
- Yousefi, M. (2011). Cognitive style and EFL learners' listening comprehension ability. *Indonesian Journal of Applied Linguistics*, 1(1), 73–83.