AXIOM : Jurnal Pendidikan dan Matematika
(2026) Volume 15, No. 1, Page 112-123
https://doi.org/10.30821/axiom.v15i1.28035

Profile of pre-service teachers' computational thinking abilities based on gender

Bettri Yustinaningrum[1*], Nur Ainun Lubis[2]
[1]UIN Sayyid Ali Rahmatullah Tulungagung, East Java, Indonesia
[2]Universitas Islam Negeri Sumatera Utara, North Sumatra, Indonesia
*Correspondence: bettriyustinaningrum@uinsatu.ac.id

Received: 08 January 2026 / Accepted: 05 June 2026 / Published Online: 29 June 2026

Abstract
Computational thinking is an essential competency for pre-service teachers to meet the challenges of the Fourth Industrial Revolution and Society 5.0. As future elementary school teachers, students enrolled in the Madrasah Ibtidaiyah Teacher Education Program (*Pendidikan Guru Madrasah Ibtidaiyah*/PGMI) need to develop computational thinking skills because they will be responsible for fostering students' learning and problem-solving abilities. However, there is still a lack of in-depth qualitative studies examining the computational thinking processes of male and female pre-service teachers based on the computational thinking framework proposed by Jeannette Wing. Therefore, this study aimed to describe the computational thinking abilities of PGMI pre-service teachers from a gender perspective. This study employed a qualitative descriptive approach. Two participants, NS and DA, were selected through purposive sampling. Data were collected using the 2019 Bebras test, interview protocols, and observation sheets. The findings revealed that both participants demonstrated similar computational thinking abilities. In solving the two Bebras tasks, both participants successfully demonstrated all four computational thinking components, namely decomposition, pattern recognition, abstraction, and algorithmic thinking.

Keywords: Computational thinking, Gender, Pre-service teachers

How to Cite: Yustinaningrum, B., & Lubis, N.A. (2026). Profile of pre-service teachers' computational thinking abilities based on gender. *AXIOM : Jurnal Pendidikan dan Matematika, 15*(1), 112-123. https://doi.org/10.30821/axiom.v15i1.28035

Introduction

The development of technology and information encourages 21st-century society to possess the essential skill of computational thinking. Computational thinking was first introduced by Wing (2006), and its four components, namely decomposition, pattern recognition, abstraction, and algorithmic thinking, were adopted by Choiriyah et al. (2025) in this study. The term computational thinking refers to the application of fundamental computational concepts in problem-solving, system design, and human behavior comprehension (Jayaraman & Joseph, 2025). Computational thinking aligns with the demands and developments of the times in the world of education. Computational thinking has many advantages in the classroom, such as improving curriculum, pedagogy, critical and analytical thinking, and developing computational skills through game-based learning and STEM education among student (Saidin et al., 2021). The many benefits of computational thinking further emphasize the importance of possessing this skill for student, especially prospective teachers.

The Madrasah Ibtidaiyah Teacher Education Program (*Pendidikan Guru Madrasah Ibtidaiyah*/PGMI) students, as prospective elementary school teachers, must possess computational thinking skills because they will transfer and teach knowledge to student. Computational thinking skills are essential for prospective teachers to be ready to face the challenges of the Fourth Industrial Revolution and the Fifth Society (Zen et al., 2021). To address these challenges, many courses integrate computational thinking into their learning outcomes. Computational thinking skills are crucial in elementary education due to the need for primary facilitators to transfer knowledge to student, a role played by elementary school teachers. Innovative learning in elementary schools requires PGMI to possess a strong computational thinking profile. However, this situation contrasts with the reality on the ground, where computational thinking is still limited in PGMI pre-service teachers education.

Global research examining computational thinking is increasingly numerous and diverse, including examining computational thinking based on gender. (Lin & Wong, 2024a) conducted research using a systematic literature review method and found that gender differences in computational thinking skills between pre-service teachers in various regions showed different patterns. (Marta et al., 2025) found differences in computational thinking between male and female elementary school students. Boys tend to have high confidence and active participation in technology-oriented tasks, especially decomposition and abstraction, while girls excel in collaborative algorithm design. In Indonesia, the issue of gender gaps in STEM remains a concern, such as (Septiyanto et al., 2026), who discussed the contribution of women in STEM, and (Widuri et al., 2023), who discussed the urgency of understanding gender concepts for students in the STEM field. However, studies on gender related to student computational thinking are still limited. Computational research tends to be more about the development of learning media (Adipura et al., 2025; Maharani et al., 2021; Melindah et al., 2024), the implementation of unplugged coding (Fitriyah et al., 2023; Kasiono et al., 2025; Rahmawati & Kurniati, 2024), CT measurement based on Wing (2006), and CT analysis at the student level (Latif et al., 2021; Suhendar et al., 2025).

Various studies have successfully highlighted how CT can be integrated into learning, particularly in the context of school student and STEM fields. However, when attention is directed to pre-service teachers teachers, particularly those in PGMI, a gap remains largely unexplored. It seems as though they are being prepared to teach 21st-century skills, but their own CT abilities remain largely unexplored. Upon closer examination, most research tends to focus on how CT is taught (Wardani et al., 2022; Wijayanti et al., 2025), rather than on how CT abilities are acquired and developed within pre-service teachers. Yet, before being able to teach a concept, a pre-service teachers teacher needs to have a solid understanding and skills of that concept (Kurniati et al., 2026). Herein lies a problem that often goes unnoticed. PGMI pre-service teachers, who will eventually be at the forefront of shaping pre-service teachers' mindsets at the elementary level, have not had their CT abilities systematically and in-depth.

This situation further demonstrates the significant gap between ideal demands and the reality on the ground. In the independent curriculum for elementary school/Islamic elementary school level in Indonesia, computational thinking is integrated into mathematics, science, and

Indonesian language subjects (Marifah et al., 2022). The curriculum and educational discourse promote the integration of Computational Thinking (CT) as a crucial 21st-century competency, but on the other hand, there is insufficient empirical evidence to illustrate the readiness of PGMI pre-service teachers in this aspect. Without a clear understanding of their ability profile, efforts to develop CT-based curricula and learning strategies have the potential to miss the mark (Salsabila & Yahfizham, 2024). Therefore, a study is needed that addresses not only implementation but also clarifies the CT capabilities of PGMI pre-service teachers. By capturing their ability profiles in greater depth and utilizing a clear conceptual framework, this study seeks to fill this previously overlooked gap and bridge the gap between theoretical and practical demands in education. Building on the limitations of previous research, this study attempts to take a slightly different approach. Rather than directly discussing how Computational Thinking (CT) is taught in the classroom, this study begins by examining the CT capabilities of PGMI pre-service teachers themselves.

The main novelty of this study lies in its comprehensive profiling of PGMI pre-service teachers' CT capabilities using the conceptual framework introduced by Wing (2006). Furthermore, the focus on PGMI pre-service teachers provides a unique perspective rarely explored in CT studies. To date, much research has focused on pre-service teachers or technology pre-service teachers, while prospective elementary education teachers, who will lay the foundation for the next generation of thinking, have received little attention. Furthermore, the results of this study are expected to provide a new contribution by adding a gender perspective, which has rarely been studied in higher education.

Methods

A qualitative descriptive approach was used as the research method. Qualitative descriptive is a methodological approach that provides a comprehensive summary of events or experiences (Hall & Liebenberg, 2024). The research subjects were two fifth-semester male and female pre-service teachers of the PGMI study program using purposive sampling with the consideration that the two subjects answered more completely and in a structured manner compared to other pre-service teachers, and the selection of two subjects was considered sufficient to explore the profile of computational thinking abilities in depth (Putri & Setianingsih, 2025). The research tools included observation sheets, interview instructions, and a test of scomputational thinking skills. Meanwhile, the computational thinking ability test used Bebras questions from 2019. The data collection technique used 2 written tests, question 1 regarding the shortest path and question 2 regarding optimization, the purpose of these questions is to solve problems, algorithmic thinking, and train efficiency and optimization, semi-structured interviews were used to dig deeper into the CT process of pre-service teachers in solving problems, and observation sheets were used to observe CT ability indicators that appeared during the problem solving process. Techniques for data analysis included data reduction, data display, and conclusion-making. Triangulation techniques were employed to validate the research results. The indicators used in the analysis are guided by the 4 components of computational thinking proposed by Wing (2006) in Table 1.

Table 1. Indicators of Computational Thinking Capability Analysis

No.	Computational Thinking Components	Explanation
1.	Decomposition	Pre-service teachers can share problems in more small sub-problems.
2.	Pattern Recognition	Pre-service teachers can find patterns from problem types and patterns from solutions designed/implemented.
3.	Abstraction	Pre-service teachers can get rid of parts that are not relevant.
4.	Algorithm	They can determine steps sorted to finish the problem.

Results

A purposive sampling method was used to select two subjects, representing both genders: male and female. The female subject is identified as NS, and the male subject is identified as DA. The selection was based on the subjects' correct answers to two computational thinking questions. The questions used were from the 2019 Bebras. Computational thinking questions are presented in Figure 1.

Figure 1. Computational Thinking Questions (*Bebras Indonesia Computational Thinking Challenge 2019*, 2019)

The responses from subjects NS (female) and DA (male) were then analyzed using Jeannate Wing's computational thinking components. The following are the results of the computational thinking analysis based on the subject's gender.

Results of Computational Thinking Analysis on NS Subjects (Female)

The first question is about how Tom can visit all his relatives' houses with a minimum amount of money.

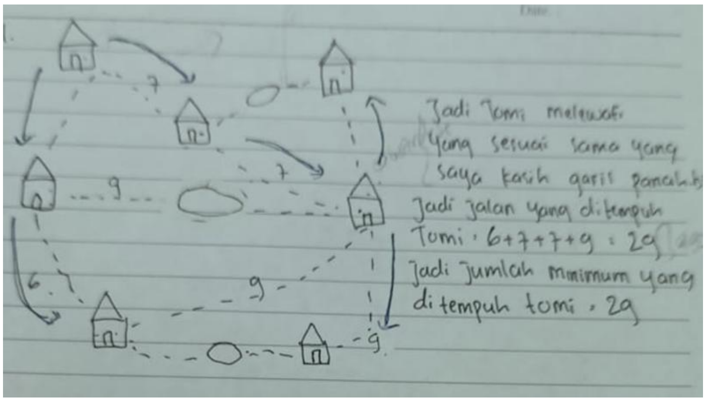

Figure 2. NS's Answer to the Minimum Amount of Money Question

From figure 2, it can be seen that subject NS redraws the problem to make it easier to see the path Tom must take to get to his relative's house. From the picture, there are several things that subject NS did, such as drawing houses without giving names and paying attention to the order of roads, stones, and the distance between houses to show the path Tom took to get to his relative's house. The things that subject NS noticed indicate that NS has succeeded in dividing the problem into smaller sub-problems (decomposition). In the pattern recognition component, subject NS was able to recognize the pattern that all roads have distance weights and chose the shortest route combination. However, subject NS did not compare all possible routes and only chose one route based on the arrow image created without checking whether it was truly the minimum. Subject NS simplified the line as the distance between houses and focused on the sum of the distances rather than the shape of the image. In the abstraction component, subject NS was correct but ignored the illustration and only focused on the distance values. In the algorithmic component, subject NS has implemented sequential steps such as choosing a route, adding up the distances (6 + 7 + 7 + 9 = 29), and concluding the minimum distance. However, in the algorithmic thinking component, subject NS was not optimal because he did not test all alternative routes.

In question no. 2, subject NS was asked to place the ball in the right box. From figure 2 below, subject NS breaks down the problem into several sub-problems, such as the number of balls per size (large 5, medium 2, and small 5), the number of boxes per size (large 3, medium 5, and small 3), and the rules for placing the balls (1 ball = 1 box and can only be put into boxes of the same size). From the sub-problems described, it can be concluded that subject NS has a very good decomposition. Subject NS succeeded in recognizing patterns by adjusting the capacity to the same category so that the pattern was successfully recognized well (pattern recognition). Subject NS has also simplified the problem by ignoring the shape of the ball and box and only focusing on the number and size and changing the real problem into a calculation of the number (a very appropriate abstraction). Subject NS has been able to think algorithmically well because he follows systematic steps such as putting a large ball into a large box, a medium ball into a medium box, a small ball into a small box, and the rest into a medium box, and concluded that the total number of balls put in is 10 balls.

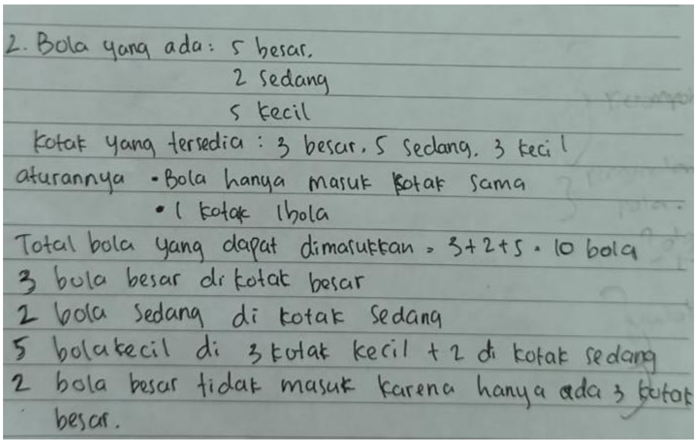

Figure 3. NS's answer to the question of placing the ball in the correct box

Results of Computational Thinking Analysis on DA Subjects (Male)

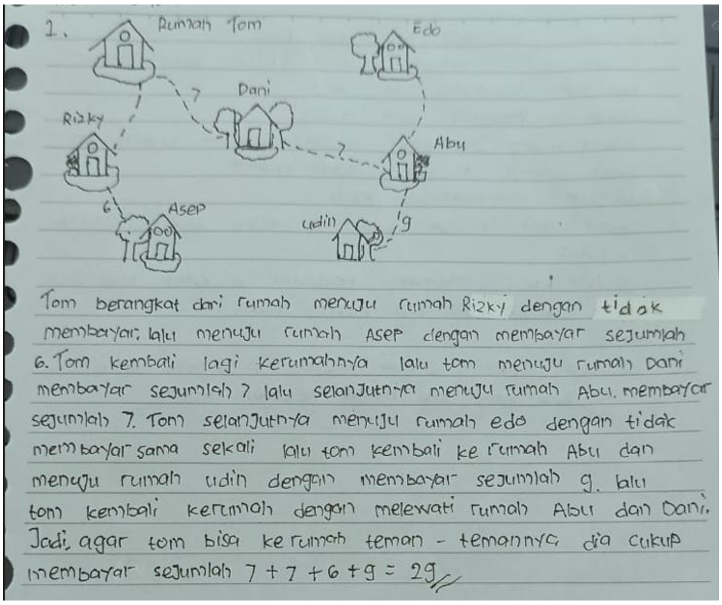

Figure 4. DA's Answer to the Minimum Amount of Money Question

In Figure 4, it can be seen that each house is given a name to make it easier to pronounce. In addition, the DA subject breaks down Tom's travel problem into several smaller, more easily understood parts, such as Tom to Rizki's house (no payment), from Rizki's house to Asep's house (payment of 6), from Asep's house back to Tom's house (no payment), Tom to Dani's house (payment of 7), from Dani's house to Abu's house (payment of 7), and from Abu's house to Edo's house (payment of 9). Through this description, the complex problem is broken down into a sequence of small, clear trips, demonstrating good decomposition skills. The DA subject has also recognized patterns, such as not all trips cost money, and seen patterns in the direction of the path and the cost on each route (pattern recognition). In addition, the DA subject has been able to select important information and ignore irrelevant things. The information that is retained includes the houses visited, routes that have costs, and the final destination. Meanwhile, what is ignored includes details of the house pictures, the shape of the path on the map, the direction of the arrows that do not affect the cost, and additional stories that are not related to the calculation. Therefore, it can be concluded that the DA subject demonstrated appropriate abstraction skills. The DA subject demonstrated good algorithmic skills by being able to develop logical and systematic steps to calculate Tom's total cost. The algorithm used by the DA subject included identifying which route was charged, recording the costs paid, performing the calculation steps, and deducing the travel cost of 29.

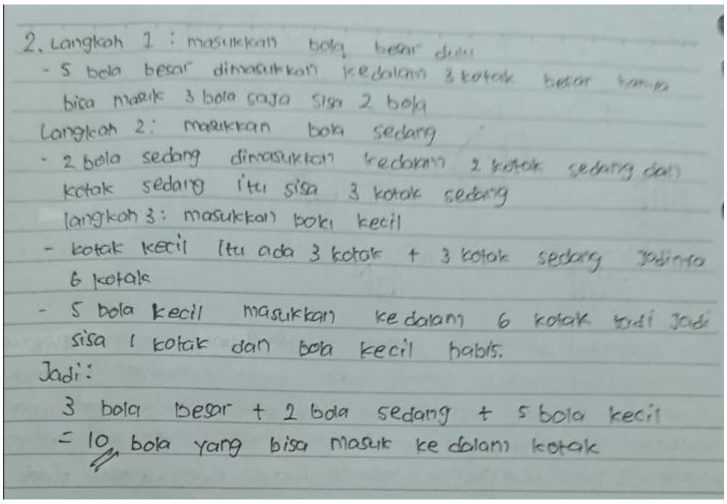
2. Langkah 1 : masukkan bola besar dulu
- 5 bola besar dimasukkan kedalam 3 kotak besar hanya bisa masuk 3 bola saja sisa 2 bola
Langkah 2: masukkan bola sedang
- 2 bola sedang dimasukkan kedalam 2 kotak sedang dan kotak sedang itu sisa 3 kotak sedang
langkah 3: masukkan bola kecil
- kotak kecil itu ada 3 kotak + 3 kotak sedang jadinya 6 kotak
- 5 bola kecil masukkan ke dalam 6 kotak jadi Jadi sisa 1 kotak dan bola kecil habis.
Jadi:
3 bola besar + 2 bola sedang + 5 bola kecil
= 10 bola yang bisa masuk ke dalam kotak

Figure 5. DA's Answer to the Question of Placing the Ball in the Correct Box

In figure 5. The DA subject can determine the capacity of each type of box, group the balls by size, and arrange the steps to fill the box, such as filling it with large, medium, and small balls. The DA subject can also calculate the remaining balls and remaining boxes at each stage and determine the total number of balls successfully put into the box. So it can be said that the DA subject can break down large problems into small parts (decomposition). The DA subject can find patterns in the activity of placing balls in the right box, such as each type of box can only contain a certain number of balls, the number of balls entered decreases according to the capacity of the box, and when the capacity of a type of box is exhausted, the process continues to the next type of box (Pattern Recognition). In the abstraction stage, the DA subject can distinguish important and unimportant information. Things that are considered important by the DA subject include the number of balls and boxes of each size, as well as the capacity of the box for certain balls. The DA subject can already perform the algorithm component by adding 3 large balls + 2 medium balls + 5 small balls = 10 balls.

Discussion

In questions 1 and 2, NS subjects (female) and DA subjects (male) did not show any differences in computational thinking abilities. In questions 1 and 2, both subjects, NS and DA, were able to complete all components of computational thinking, starting from decomposition, pattern recognition, abstraction, and algorithmic thinking. This is not in line with the statements of (An'Imah et al., 2025; Harmini et al., 2020), who found that there was a significant difference in computational thinking abilities between male and female student. (Angraini & Sthephani, 2024) stated that male student tend to have better computational thinking skills than female student, while (Richardo et al., 2023) found that female student have better computational thinking skills than male student. These differences in results indicate that pre-service teachers' computational thinking is influenced by several factors, including the learning environment and adjustments to educational strategies (Lin & Wong, 2024), the type of project (Niousha et al., 2023), and prior experience (Paucar-curasma et al., 2023; Villalustre & Cueli, 2023). Adaptation of learning strategies and environments influences computational thinking skills because they are tailored to the specific needs of pre-service teachers, promote engagement, and foster an inclusive atmosphere that encourages the participation of both male and female participants (Torres et al., 2024). Project type influences the computational thinking scores of male and female student, indicating that gender plays a role in project implementation (Niousha et al., 2023). Prior experience among male and female subjects has been shown to be more influential than overall ability (Elmawati et al., 2024). The diverse research findings on computational thinking skills based on gender cannot be simply generalized. These differences in results are influenced by factors from the individual, learning experiences, and the social context of education. Therefore, in the context of learning in higher education, efforts to develop computational thinking skills should be focused on contextual, inclusive learning and provide equal space for pre-service teachers regardless of gender.

In contextual learning, computational thinking skills are enhanced by linking material to real-world situations experienced by student (Ariza, 2026). When pre-service teachers are faced with problems, they are encouraged to engage in computational thinking processes such as problem decomposition, pattern recognition, abstraction, and algorithmic solution design. This naturally stimulates components of computational thinking, enabling contextual learning to stimulate the components of computational thinking. An inclusive approach provides pre-service teachers with equal opportunities to develop computational thinking skills (Fredicia et al., 2025). In an inclusive classroom, social background, differences in ability, and special needs are not barriers but rather enrichments that support the learning process to enhance computational thinking. Equality is fundamental to implementing computational-thinking learning (Vakil, 2018). Equality does not entail uniform treatment of pre-service teachers; instead, it requires individualized care that addresses their specific needs. For example, pre-service teachers with low initial abilities can be given more intensive guidance, while pre-service teachers with lower initial abilities can be given more complex challenges. In the context of computational thinking, this can be achieved through task differentiation, varying problem difficulty levels, and the use of adaptive technology.s

By integrating contextual learning, an inclusive approach, and equity, a learning ecosystem will be created that not only enhances computational thinking skills but also builds pre-service teachers' independence, collaborative skills, and self-confidence. Furthermore, the teacher's role becomes even more crucial as a facilitator capable of designing meaningful learning experiences. Teachers need to understand student characteristics, use adaptive learning strategies, and integrate local contexts. Learning evaluations should reflect these principles by assessing not only the final outcome but also the pre-service teachers' computational thinking processes. Thus, inclusive, contextual, and equity-based learning constitute a comprehensive approach that can significantly enhance computational thinking. These three approaches cannot be separated but must be implemented synergistically to create equitable learning oriented toward the development of computational thinking skills.

Conclusion

The computational thinking abilities of male and female participants did not different. Both male and female subjects were able to pass the four components of computational thinking: decomposition, pattern recognition, abstraction, and algorithmic reasoning. The diverse research findings related to computational thinking abilities by gender make the results difficult to generalize. Several factors contribute to the varying results, such as previous experience, project type, and learning environment. Future research should consider these factors and recruit more subjects.

Declarations

Author Contribution	:	BY: Conceptualization, Writing - Original Draft, Editing and Visualization, Review & Editing NAL: Formal Analysis, and Methodology.
Funding Statement	:	No funding.
Conflict of Interest	:	The authors declare no conflict of interest.
Additional Information	:	Additional information is available for this paper.

References

Adipura, L., Handayani, A., & Srini. (2025). Pengembangan media interaktif pembelajaran computational thinking “jejak logika” untuk meningkatkan kemampuan berpikir kritis siswa SMP. *Pendas:Jurnal Ilmiah Pendidikan Dasar*, *10*(2), 1925–1936. https://doi.org/10.23969/jp.v10i2

Angraini, L. M., & Sthephani, A. (2024). Differences in students ’ computational thinking mathematical ability using augmented reality based on gender. *IJCSE*, *3*(3), 256–268. https://doi.org/10.56855/ijcse.v3i3.1098

An’Imah, F., Wijayanti, E., & Tauhidah, D. (2025). Pengaruh gaya belajar dan gender terhadap kemampuan berpikir komputasional dalam pembelajaran biologi di kalangan siswa SMA Indonesia. *Konferensi Internasional Tentang Pendidikan Biologi, Ilmu Pengetahuan Alam Dan Teknologi*, *3*(1), 229–237. https://eprints.walisongo.ac.id/id/eprint/28946

Ariza, J. Á. (2026). Investigating the impact of education 4 . 0 and digital learning on students ’ learning outcomes in engineering : A Four-Year Multiple-Case Study. *Informatics*, *13*(18), 1–30. https://doi.org/10.3390/informatics13020018

Bebras Indonesia computational thinking challenge 2019. (2019). NBO Bebras Indonesia. https://bebras.r.id/

Choiriyah, Pertiwi, L., Rohanah, & Valencia, E. (2025). Teacher’s perspectives on young children ’ s computational thinking skills through unplugged coding activities , A Case Study of Children Aged 5-6 Years. *Indonesian Journal of Early Childhood Education Studies (IJECES)*, *14*(1), 54–68. https://doi.org/10.15294/ijeces.v14i1.29613

Elmawati, Dahlan, J. A., & Avip, B. (2024). Student’s computational thinking ability in solving sequences and series : The difference between male and female. *Mosharafa:Jurnal Pendidikan Matematika*, *13*(1), 199–214. https://doi.org/10.31980/mosharafa.v13i1.1987

Fitriyah, Q. F., Saputri, L. R., & Aljawad, H. I. (2023). Praktik unplugged coding berbasis daily lives dalam meningkatkan computational thinking pada anak usia dini. *Jurnal Pendidikan Anak*, *12*(2), 176–185. https://doi.org/10.21831/jpa.v12i2.57349

Fredicia, Daniyola, S. K. D., Muljono, J. B., Felizio, S., & Gabriela, A. (2025). Pengaruh pre-test dan post-test pada inklusivitas ekstrakurikuler python bagi siswa- siswi SMA di Jakarta. *Jurnal Atma Inovasia (JAI)*, *5*(2), 100–105. https://doi.org/10.24002/jai.v5i2.10250

Hall, S., & Liebenberg, L. (2024). Qualitative description as an introductory method to qualitative research for master ' s-level students and research trainees. *International Journal of Qualitative Methods*, *23*, 1–5. https://doi.org/10.1177/16094069241242264

Harmini, T., Annurwanda, P., & Suprihatiningsih, S. (2020). Computational thinking ability students based on gender in calculus learning. *Aksioma:Jurnal Program Studi Pendidikan Matematika*, *9*(4), 977–986. https://doi.org/10.24127/ajpm.v9i4.3160

Jayaraman, J. J. R. J. C., & Joseph, A. (2025). A comprehensive analysis on computational thinking in education: Open issues and challenges †. *Engineering Proceedings*, 1–11. https://doi.org/10.3390/engproc2025107006?urlappend=%3Futm_source%3Dresearchgate.net%26utm_medium%3Darticle

Kasiono, B., Pradhana, G., Huda, N., Utami, S., & Haerussaleh. (2025). Unlocking young minds: The impact of unplugged coding on elementary students' computational thinking. *Pendidikan, Jurnal Paedagogy:Jurnal Penelitian Dan Pengembangan*, *12*(3), 754–763. https://doi.org.10.33394/jp.v12i3.15650

Kurniati, A., Yuniati, S., & Rahmi, D. (2026). Keterampilan Mengajar: Siap atau tidak menjadi calon guru profesional? *Pedagogy*, *10*(2). https://doi.org/10.30605/pedagogy.v10i2.5900

Latif, K. A., Hammad, R., & Muhid, A. (2021). Pengenalan Computational thinking pada Siswa Madrasah Ibtidaiyah Nahdatul Wathan Marcapada Lombok Barat. *JPMB:Jurnal Pemberdayaan Masyarakat Berkarakter*, *4*(1), 33–40. https://journal.rekarta.co.id/index.php/jpmb/article/view/178

Lin, S., & Wong, G. K. W. (2024a). *education sciences gender differences in computational thinking skills among primary and secondary school students : A systematic review*.

Lin, S., & Wong, G. K. W. (2024b). Gender Differences in Computational Thinking Skills Among Primary and Secondary School Students:A Systematic Review. *Education Sciences*, *14*(790), 1–18. https://doi.org/10.3390/educsci14070790

Maharani, S., Nusantara, T., A'ari, A. R., & Abd.Qohar. (2021). Computational thinking : media pembelajaran CSK (CT- Sheet for Kids) dalam matematika PAUD abstrak. *Jurnal Obsesi:Jurnal Pendidikan Anak Usia Dini*, *5*(1), 975–984. https://doi.org/10.31004/obsesi.v5i1.769

Marifah, S. N., L, D. A. M., & M, M. R. W. (2022). Systematic literature review: Integrasi computational thinking dalam kurikulum sekolah dasar di Indonesia. *Collase:Creative of Learning Students Elementary Education*, *5*(5), 928–938. https://doi.org/10.22460/collase.v5i5.12148

Marta, R., Nusantara, T., Atmoko, A., & Rahayuningsih, S. (2025). Gender differences in computational thinking skills among elementary school students. *Al-ISHLAH:Jurnal Pendidikan*, *17*(2), 2392–2401. https://doi.org/10.35445/alishlah.v17i2.7524

Melindah, V., Zawawi, I., & Huda, S. (2024). Pengembangan LKPD berbasis CT pada pembelajaran berdiferensiasi jenjang SMK. *Journal Ilmiah Ilmu Pendidikan*, *7*(1), 1049–1057. https://doi.org/10.54371/jiip.v7i1.3874

Niousha, R., Saito, D., Washizaki, H., & Fukazawa, Y. (2023). Investigating the efffect of binary gender preferences on computational thinking skills. *Education Sciences*, *13*(433), 1–14. https://doi.org/10.3390/educsci13050433

Paucar-curasma, R., Villalba-condori, K. O., Mamani-calcina, J., Rondon, D., Gustavo, M., & Acra-despradel, C. (2023). Use of technological resources for the development of computational thinking following the steps of solving problems in engineering students recently entering college. *Education Sciences*, *13*(279), 1–14. https://www.mdpi.com/2227-7102/13/3/279#

Putri, K. D., & Setianingsih, R. (2025). kemampuan berpikir komputasional peserta didik dengan kecerdasan logis matematis tinggi dan sedang dalam menyelesaikan bebras task. *MATHEdunesa*, *14*(1), 118–128. https://doi.org/10.26740/mathedunesa.v14n1.p118-128

Rahmawati, I., & Kurniati, E. (2024). Implementation of Unplugged Coding In Playdate. *Research in Early Childhood Education and Parenting*, *5*(2), 79–88. https://doi.org/10.17509/recep.v5i2.75926

Richardo, R., Dwiningrum, S. I. A., & Wijaya, A. (2023). Keterampilan berpikir komputasional untuk matematika dan sikap berdasarkan gender : Perbandingan dan analisis hubungan. *Jurnal Pendidikan Dan Pengajaran Pegem*, *13*(2), 345–353. https://doi.org/10.47750/pegegog.13.02.38

Saidin, N. D., Khalid, F., Martin, R., Kuppusamy, Y., & Nalini, A. P. (2021). Benefits and challenges of applying computational thinking in education. *International Journal of Information and Education Technology*, *11*(5), 248–254. https://doi.org/10.18178/ijiet.2021.11.5.1519

Salsabila, A., & Yahfizham, Y. (2024). Studi Literatur : Analisis berpikir komputasi pada guru dan siswa dalam konteks implementasi kurikulum merdeka. *Bilangan:Jurnal Ilmiah Matematika, Kebumian, Dan Angkasa*, *2*(3), 129–141. https://doi.org/10.62383/bilangan.v2i3.72

Septiyanto, A., Rosawati, E. E., Prasetyo, A., Rahmania, N., Malazoni, A., & Widiarni, U. (2026). Women in STEM:An overview protocol for understanding gender disparities across STEM fields. *Indonesian Journal of Inclusion, Child, and Gender Studies*, *1*(1), 52–70. https://doi.org/10.15642/ijigs.2026.1.1.52-70

Suhendar, Y., Rosita, N. T., & April, U. S. (2025). Analisis kemampuan computational thinking (CT) peserta didik kelas 8 SMP Negeri 1 Jatinangor. *Symmetry:Pasundan Journal of Research in Mathematics*, *9*(2), 191–203. https://doi.org/10.23969/symmetry.v9i2.19506

Torres, Y. D. T., Gonzalez, M. R., & Gonzalez, J. C. perez. (2024). Didactic strategies for the education of computational thinking from a gender perspective : A systematic review. *European Journal of Education*, (February), 1–22. https://doi.org/10.1111/ejed.12640

Vakil, S. (2018). Ethics, identity, and political vision: Toward a justice-centered approach to equity in computer science education. *Harvard Educational Review*, *88*(1), 26–53. https://doi.org/10.17763/1943-5045-88.1.26

Villalustre, L., & Cueli, M. (2023). Education sciences assessing the computational thinking of pre-service teachers: A gender and robotics programming experience analysis. *Education Sciences*, *13*(1032), 1–12. https://doi.org/10.3390/educsci13101032

Wardani, S. S., Susanti, R. D., & Taufik, M. (2022). Implementasi pendekatan computational thinking melalui game jungle adventure terhadap kemampuan problem solving. *SJME (Supremum Journal of Mathematics Education)*, *6*(1), 1–13. https://doi.org/10.35706/sjme.v6i

Wing, J. M. (2006). Computational thinking. *Communications of the ACM, 49*(3), 33–35. https://doi.org/10.1145/1118178.1118215

Widuri, I. L., Murti, R. H., Nurhidayati, Z. A., Purnomosari, W., & Pratiwi, T. H. (2023). Urgensi pengetahuan kesetaraan gender dalam model pembelajaran kurikulum berbasis gender bagi mahasiswa pendidikan vokasi bidang STEM. *Orbith*, *19*(3), 280–289. https://doi.org/10.32497/orbith.v19i3.5260

Wijayanti, C. T., Eko, B., Cahyono, H., & H, B. P. D. (2025). Implementasi computational thinking dalam pembelajaran mengalihwahanakan teks negosiasi untuk meningkatkan kemampuan berpikir kritis pada siswa kelas X-4 SMA Negeri 2 Madiun. *Jurnal Media Akademik (JMA)*, *3*(7), 1–21. https://doi.org/10.62281/v3i7.2523

Zen, B. P., Fitriana, G. F., & Gustalika, M. A. (2021). Peran kompetensi melalui berfikir komputasi dalam membangun karir di dunia it menuju era society 5.0. *Dedikasi Sains dan Teknologi*, *1*(2), 94–98. https://doi.org/10.47709/dst.v1i2.1122