ISSN 2502-5872 (Print)
ISSN 2622-3627 (Electronic)

Volume 9 Number 3, August 2024, 771-782

LITERATURE STUDY ON THE EFFECT OF THE DISCOVERY LEARNING APPROACH ON STUDENTS' COMPUTATIONAL THINKING ABILITY BY CONSIDERING GENDER ASPECTS

Netti Kariani Mendrofa [1*], Edi Surya[2], Edi Syahputra[3], Bornok Sinaga[4], Syawal Gultom[5]
[1] Mathematics Education, Universitas Nias, North Sumatra, Indonesia
[2,3,4,5] Mathematics Education, Universitas Negeri Medan, North Sumatra, Indonesia
*Correspondence: netti.mend14@gmail.com

ABSTRACT
This research aims to explore the findings of previous studies regarding the effect of the discovery approach on students' computational thinking ability, taking into account gender aspects. Computational thinking ability is an essential skill in today's digital era, and the appropriate learning approach can help students develop this ability. The method used in this research is a literature study by analyzing relevant journal articles and research to identify emerging findings and patterns. The research results are expected to provide valuable insights for education practitioners in designing effective and inclusive learning strategies to improve students' computational thinking abilities, considering gender differences.
Keywords: Discovery Approach, Computational Thinking, Gender

How to Cite: Mendrofa, N. K., Surya, E., Syahputra, E., Sinaga, B., & Gultom, S. (2024). Literature Study On The Effect of The Discovery Learning Approach On Students' Computational Thinking Ability By Considering Gender Aspects. *Mathline: Jurnal Matematika dan Pendidikan Matematika, 9*(3), 771-782. http://doi.org/10.31943/mathline.v9i3.672

PRELIMINARY

Computational thinking ability is becoming increasingly crucial in the current digital era, particularly in preparing students to confront future challenges. Computational thinking entails skills such as problem-solving, logical reasoning, and data analysis (Wing, 2006). Computational thinking, defined as a problem-solving approach that involves decomposing complex problems into smaller, more manageable parts, is a fundamental skill in today's technology-driven world (Fang et al., 2022). The integration of computational thinking into educational practices has been demonstrated to enhance students' problem-solving skills, critical thinking abilities, and overall academic performance (Fang et al., 2022).

Studies have demonstrated that computational thinking skills are fundamental for students to address complex problems and develop 21st-century skills (Richardo et al., 2023). Computational thinking, defined as a problem-solving approach that involves breaking down complex problems into smaller, manageable parts, is a fundamental skill in today's technology-driven world (Fang et al., 2022). The integration of computational thinking into educational practices has been shown to enhance students' problem-solving skills, critical thinking abilities, and overall academic performance (Fang et al., 2022).

The development of computational thinking skills is vital for students to excel in subjects such as mathematics and physics. Appropriate learning approaches can aid students in developing computational thinking abilities. Moreover, Lisa (2024) stated that in supporting the development of computational thinking abilities, additional training is needed to improve their skills in delivering material with the appropriate approach. Implementing discovery learning models supported by animation and audio-visual media has been proven to enhance students' problem-solving abilities and promote independent learning (Mutiasari & Rusnilawati, 2022). Research has also emphasized the positive influence of the discovery learning model on students' critical thinking abilities across different subjects, underscoring its effectiveness in enhancing problem-solving skills (Ilmi et al., 2022). The discovery approach, where students actively engage in discovering concepts and principles through exploration and self-guided inquiry, is considered to have potential in developing computational thinking skills (Lye & Koh, 2014). Additionally, computational thinking is not solely about programming but represents a way of thinking that involves designing computations and understanding the world as a complex system of information processes (Denning & Tedre, 2019).

The theory of discovery learning emphasizes the importance of learners actively participating in the learning process, constructing their own knowledge structures, and negotiating this knowledge with others (Zhao, 2021). This approach aligns with the idea that students should be given the autonomy to discover and construct knowledge independently, with minimal intervention from teachers (Doroudi, 2020). Engaging students in hands-on activities, collaborative learning experiences, and creative problem-solving tasks can enhance students' computational thinking abilities and prepare them for real-world challenges (Kirschner et al., 2018).

Research has indicated that the discovery approach, when combined with computational thinking activities, can significantly enhance students' awareness of computational thinking, motivation, and self-efficacy (Fang et al., 2022). By immersing students in problem identification, flow definition, coding, and testing tasks, educators can foster a deeper understanding of computational concepts and promote higher-order thinking skills (Fang et al., 2022).

However, there are questions regarding how this approach impacts male and female students, given the differences in interests, motivations, and self-confidence in the fields of technology and computing between the two genders (Calder, 2019; Dogan & Camci, 2018; Lye & Koh, 2014). Research has shown that gender differences can impact learning styles, motivation, achievement, and the acceptance of different learning technologies. Research also explores how gender moderates the impact of factors such as self-directed learning, self-efficacy, and learning motivation on academic achievement (Noviani et al., 2023). Therefore, understanding how gender influences learning styles, motivation, achievement, and acceptance of learning technologies is crucial for creating an inclusive and effective learning environment that meets the diverse needs of all students.

In the field of education, particularly in mathematics education, the impact of different teaching approaches on students' computational thinking abilities, with a focus on gender differences, has garnered significant attention. Various studies have delved into the effects of different learning models, such as discovery learning, on students' critical thinking skills and computational thinking abilities. Research Andayani (2020) concentrates on creating educational tools that merge the discovery learning model with cognitive conflict strategies to enhance students' critical thinking skills, aiming to boost students' reasoning and problem-solving capabilities, which are integral to computational thinking. Similarly, Mon et al. (2020) discovered gender gaps in students' computational thinking proficiencies, with females generally scoring lower and being perceived as less digitally adept. Recognizing these distinctions is vital for developing interventions that can narrow this divide and foster equal opportunities for all students. Therefore, exploring how gender interacts with computational thinking abilities in the context of problem-solving can guide educators in effectively supporting students. By acknowledging the impact of gender on learning outcomes and levels of computational thinking, educators can tailor their teaching strategies to build an inclusive learning environment that meets the diverse needs of students (Santosa, 2023).

Based on this, this research aims to examine the literature related to the influence of the discovery approach on students' computational thinking abilities, taking into account the aspect of gender. This literature study will analyze relevant findings from previous research to identify emerging findings and patterns. The results of this study are expected to provide valuable insights for education practitioners in designing effective and inclusive learning strategies to develop students' computational thinking abilities, considering gender differences.

METHODS

This research uses a literature review study method, which is a research method conducted by collecting information from written sources such as books, journal articles, and research reports. The data collection procedures carried out are: 1) Literature search: The researcher analyzed journal articles relevant to the research topic using keywords such as "Discovery Learning", "computational thinking skills", "gender", and "education". The researcher conducted a literature search using academic databases such as Google Scholar, ERIC, and Science Direct; 2) Literature selection: The researcher selected journal articles that met the research criteria, such as journals published in accredited scientific journals and relevant to the research topic; 3) Data collection: The researcher read and analyzed the selected journal articles; 4) Data analysis: The researcher recorded information relevant to the research topic and categorized it based on certain themes; and 5) Data synthesis: The researcher combined information from various sources to produce conclusions about the effect of the Discovery Learning approach on students' computational thinking skills, considering the aspect of gender.

RESULTS AND DISCUSSION

Based on the literature review that has been conducted, it was found that the discovery learning approach has the potential to develop students' computational thinking skills. However, there are diverse results regarding gender differences in computational thinking performance in the context of this approach.

1. Discovery Learning Approach

Discovery learning has been a topic of interest in mathematics education research, with several studies highlighting its effectiveness in enhancing students' mathematical learning outcomes. Masfingatin & Murtafiah (2020) explored the creative mathematical reasoning of mathematics education students through discovery learning, emphasizing the positive impact of this approach on learning outcomes. Similarly, Widodo et al. (2021) focused on the application of the discovery learning model to improve students' mathematical communication skills, both orally and in writing.

Moreover, Nur et al. (2020) and Imayati et al. (2020) conducted research demonstrating the effectiveness of the discovery learning model in enhancing students' mathematical problem-solving ability and understanding, respectively. These findings are further supported by studies such as those by Kariman et al., (2019) and Pamungkas et al., (2021), which concluded that guided discovery learning and discovery learning collaboration can lead to improved mathematics learning outcomes and varied mathematical reasoning among students.

Jatisunda et al. (2020) highlighted the positive impact of discovery learning with scaffolding on enhancing students' mathematical creative thinking abilities and self-efficacy. Furthermore, Pamungkas et al. (2021) emphasized that the application of discovery learning can lead to varied mathematical reasoning among students.

In conclusion, the literature review indicates that the application of discovery learning in mathematics education has shown promising results in improving students' mathematical reasoning, problem-solving abilities, communication skills, and overall learning outcomes. These findings underscore the value of incorporating discovery learning models in mathematics instruction to enhance students' engagement and understanding of mathematical concepts.

2. The Influence of the Discovery Learning Approach on Computational Thinking Ability

The impact of the discovery learning approach on computational thinking ability has been a subject of interest in educational research. Several studies have highlighted the positive impact of the discovery learning model on critical thinking skills (Andayani, 2020; Ilmi et al., 2022; Rizki et al., 2021; Rahmawati et al., 2021; Firdaus et al., 2020; Yuniawati & Purba, 2021; Rudibyani, 2018). These studies emphasize that the discovery learning model not only enhances critical thinking but also improves students' ability to think reflectively, analytically, and creatively (Hoerudin, 2023; Noer et al., 2020; Mustikaningrum et al., 2021). Moreover, the discovery learning model has been found to optimize students' higher-order thinking skills Utaminingsih et al. (2021) and encourage creative thinking (Rahman, 2017).

Studies have indicated that the discovery learning model can positively influence students' critical thinking skills, which are closely linked to computational thinking. For example, Ilmi et al. (2022) illustrated the effect of the discovery learning model on enhancing students' critical thinking abilities, suggesting that this approach can aid in the development of students' higher-order thinking skills, crucial for computational thinking. Furthermore, Richardo et al. (2023) investigated the impact of STEM attitudes and computational thinking on 21st-century skills, emphasizing the importance of developing computational thinking skills in students. This underscores the significance of integrating computational thinking within the framework of discovery learning to enhance students' problem-solving and analytical abilities.

Additionally, Wiono & Meriza (2022) emphasized the positive effects of utilizing the discovery learning model to enhance students' critical thinking skills, indicating that this approach can effectively foster higher-order thinking abilities essential for computational thinking. Furthermore, Yuniawati & Purba (2021) highlighted the effectiveness of the discovery learning model in optimizing students' critical thinking skills, supporting the idea that this approach can improve students' analytical and problem-solving skills, integral to computational thinking.

In conclusion, the synthesis of these studies suggests that the discovery learning approach, particularly when combined with guided discovery methods, can positively impact students' critical thinking skills, which form the basis for developing computational thinking abilities. By incorporating elements of guided discovery, practical skills, and computational thinking within the discovery learning model, educators can effectively enhance students' computational thinking abilities and foster critical thinking skills.

3. Students' Computational Thinking Ability Based On Gender

Based on the literature analysis, various studies have explored the relationship between gender and computational thinking skills. Riadi et al. (2019) found that female students excelled over male students in most thinking skills, except for Creating. This suggests gender differences may exist in computational thinking abilities among students. Mon et al. (2020) discovered that women tend to score lower in computational thinking and are perceived as less digitally competent compared to men, particularly in the technological dimension. Similarly, Wu & Su (2021) noted that while gender differences were not significant in overall computational thinking ability, female students excelled in decomposition, whereas male students performed better in algorithm design. This indicates that gender variations may exist in specific aspects of computational thinking.

Additionally, Harmini et al. (2020) emphasized the influence of gender on students' computational thinking processes, suggesting that gender can impact how students approach and solve problems in computational tasks. Moreover, Demir-Kaymak et al. (2021) conducted a longitudinal study to explore the effects of gender on computational thinking skills, underscoring the importance of considering gender differences in computational thinking development over time. Furthermore, Harmini et al. (2020) specifically focused on the computational thinking ability of students based on gender in calculus learning, indicating that gender can play a role in shaping students' computational thinking skills within specific educational contexts.

In conclusion, the synthesis of these studies suggests that gender can indeed play a role in shaping students' computational thinking abilities. Understanding how gender influences computational thinking can assist educators in developing tailored strategies to enhance computational skills among all students, regardless of gender.

However, several other studies explain other things, for example, Latifah et al. (2022) studied the impact of the ICARE learning model on students' computational thinking skills by gender. The results indicated that the ICARE learning model significantly enhanced students' computational thinking skills, with no significant gender-based differences observed. This implies that the ICARE learning model could be effective in improving computational thinking skills regardless of gender. Oluk & Korkmaz (2016) compared students' Scratch skills with their computational thinking skills across various variables. The study revealed that there were no differences in scores based on gender, indicating that gender did not significantly influence students' programming skills with Scratch and their computational thinking skills.

In conclusion, while some studies suggest gender disparities in computational thinking skills, particularly in specific areas, other research indicates that certain teaching models or tools may effectively enhance computational thinking skills irrespective of gender. These varied results indicate that the type of discovery learning activities used in developing computational thinking abilities may play a role in the performance differences between male and female students. Other factors such as interests, motivation, self-confidence, and gender stereotypes in technology and computing fields can also influence the performance gap between the two genders (Lye & Koh, 2014; Cheryan et al., 2017). This approach can increase participation and engagement of female students, as well as create an inclusive learning environment. However, the role of teachers, learning materials, and efforts to reduce gender stereotypes are also important in minimizing the gender gap in this field. Various theoretical perspectives, such as socio-cognitive theory, gender identity theory, and expectancy-value theory, can provide insights into how personal, behavioral, environmental, gender identity, as well as the expectations and values associated with computational thinking and discovery learning activities can influence the engagement and performance of male and female students in this context.

Further research is needed to gain a deeper understanding of the interaction between the discovery learning approach, computational thinking abilities, and gender aspects. Additionally, it is important to identify effective and inclusive learning strategies that can facilitate the development of computational thinking abilities in male and female students equally, taking into account the factors that influence gender differences in this context. However, this research only used a descriptive literature review method, so it has not been able to provide comprehensive conclusions and strong generalizations. Additionally, the articles reviewed may have varied in quality and methodology, so a more systematic quality assessment is necessary. This research also has not explored in depth the specific factors that influence gender differences in the development of computational thinking abilities. Furthermore, the results of this research are limited to the information available up to August 2023, so it needs to be updated with the latest literature after that period. In conclusion, this research provides an initial perspective on an interesting topic, but it still requires further investigation using more comprehensive and systematic methodologies to generate stronger and more generalizable findings.

CONCLUSION

Considering the various studies on the influence of discovery learning on critical thinking and computational skills, it is evident that gender can significantly shape students' computational thinking abilities. These studies collectively suggest that gender considerations are crucial when examining the impact of the discovery learning approach on students' computational thinking abilities. By integrating gender considerations into the design and implementation of discovery learning approaches, educators can establish more inclusive and effective learning environments that address the diverse needs and strengths of all students. To further advance the understanding of the relationship between gender, discovery learning, and computational thinking, future research should explore in-depth longitudinal studies, investigate specific factors contributing to gender differences, explore the combination of discovery learning with other approaches, and expand the research to diverse cultural and socio-economic contexts.

REFERENCES

Bednar, A. K., Cunningham, D., Duffy, T. M., & Perry, J. D. (1992). Constructivist Learning Theory. In T. M. Duffy & D. H. Jonassen (Eds.), Constructivism and the Technology of Instruction: A Conversation. Lawrence Erlbaum Associates.

Browne, M. N., & Keeley, S. M. (2007). Teaching for Critical Thinking. Rowman & Littlefield Publishers.

Cuny, J., Snyder, L., & Wing, J. M. (2010). Demystifying computational thinking for non-computer scientists. Unpublished manuscript, referenced in https://www.cs.cmu.edu/~CompThink/resources/TheLinkWing.pdf

DEMİR-KAYMAK, Z., Duman, İ., Randler, C., & Horzum, M. (2021). The effect of gender, grade, time and chronotype on computational thinking: longitudinal study. Informatics in Education, 21(3), 465-478. https://doi.org/10.15388/infedu.2022.22

Denning, P. & Tedre, M. (2019). Computational thinking. The MIT Press, Cambridge, MA, USA.

Fang, J., Shao, D., Hwang, G., & Chang, S. (2022). From critique to computational thinking: a peer-assessment-supported problem identification, flow definition, coding, and testing approach for computer programming instruction. Journal of Educational Computing Research, 60(5), 1301-1324. https://doi.org/10.1177/07356331211060470

Firdaus, M., Yuliafitri, S., Swistoro, E., Ghufira, G., & Wardana, R. (2020). Implementation of discovery learning on electromagnetic wave material based on adsorption congo red by silica from bengkulu beach sand. Journal of Science Education Research, 3(2), 103-107. https://doi.org/10.21831/jser.v3i2.30627

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

Hoerudin, C. (2023). Indonesian language learning using the discovery learning model based on high order thinking skills (hots) on students' analytical thinking ability. *Munaddhomah Jurnal Manajemen Pendidikan Islam*, 4(1), 122-131. https://doi.org/10.31538/munaddhomah.v4i1.370

Ilmi, S., Soekamto, H., & Astina, I. (2022). *The effect of the discovery learning model on the critical thinking abilities of geography students*. Kne Social Sciences. https://doi.org/10.18502/kss.v7i16.12159

Imayati, I., Kartini, K., & Zulkarnain, Z. (2020). Improving students mathematical understanding by using discovery learning models for senior high school students in kampar district. *Journal of Educational Sciences*, 4(2), 357 357-367. https://doi.org/10.31258/jes.4.2.p.357-367

Kariman, D., Harisman, Y., Sovia, A., & Prahmana, R. (2019). Effectiveness of guided discovery-based module: a case study in padang city, indonesia. *Journal on Mathematics Education*, 10(2), 239-250. https://doi.org/10.22342/jme.10.2.6610.239-250

Krauss, J., & Prottmann, K. (2017). *Teaching Computational Thinking*. Gesellschaft für Informatik eV.

Latifah, S. & Malik, S. (2022). Icare model (introduction, connection, application, reflection, extension) in physics learning: analysis of its effect on students' computational thinking skills based on gender. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, 8(2), 229-240. https://doi.org/10.21009/1.08205

Lethbridge, T. C., Díaz-Herrera, J. L., LeBlanc Jr, R. J., & Thompson, J. B. (2022). *Computational Thinking Across the Disciplines*. CRC Press.

Lye, S. Y., & Koh, J. H. L. (2014). Review on teaching and learning of computational thinking through programming: What is next for K-12?. *Computers in Human Behavior*, 41, 51-61. https://doi.org/10.1016/j.chb.2014.09.012

Lisa, L., Hasratuddin, H., Sinaga, B., Napitupulu, E. E., & Panjaitan, A. (2024). Computational Thinking Skills in Understanding The Limit of Algebraic Functions. *Mathline: Jurnal Matematika dan Pendidikan Matematika, 9*(2), 365-380. https://doi.org/10.31943/mathline.v9i2.549

Liukas, L. (2015). *Computational Thinking and Coding for Every Student*. No Starch Press.

Masfingatin, T. & Murtafiah, W. (2020). Exploring the creative mathematical reasoning of mathematics education student through discovery learning. *Aksioma Jurnal Program Studi Pendidikan Matematika*, 9(2), 296-305. https://doi.org/10.24127/ajpm.v9i2.2714

Mon, F., Llopis, M., & Segura, J. (2020). Digital competence and computational thinking of student teachers. *International Journal of Emerging Technologies in Learning (Ijet)*, 15(02), 29-41. https://doi.org/10.3991/ijet.v15i02.11588

Mustikaningrum, G., Widiyanto, W., & Mediatati, N. (2021). Application of the discovery learning model assisted by google meet to improve students' critical thinking skills and science learning outcomes. *International Journal of Elementary Education*, 5(1), 30-38. https://doi.org/10.23887/ijee.v5i1.34344

Mutiasari, N. & Rusnilawati, N. (2022). Discovery learning assisted by animation audio visual media optimizes problem solving ability and students' independent attitude. *Jurnal Ilmiah Sekolah Dasar*, 6(3), 516-524. https://doi.org/10.23887/jisd.v6i3.53394

Noer, S., Gunowibowo, P., & Triana, M. (2020). Development of guided discovery learning to improve students reflective thinking ability and self learning. *Journal of Physics Conference Series*, 1581(1), 012041. https://doi.org/10.1088/1742-6596/1581/1/012041

Nur, F., Tayeb, T., Widayanti, V., Sriyanti, A., & Nurhidayah, N. (2020). Effectiveness of discovery learning model on students' mathematical problem solving ability. *Mapan*, 8(1), 125-139. https://doi.org/10.24252/mapan.2020v8n1a10

Oluk, A. & Korkmaz, Ö. (2016). Comparing students' scratch skills with their computational thinking skills in terms of different variables. *International Journal of Modern Education and Computer Science*, 8(11), 1-7. https://doi.org/10.5815/ijmecs.2016.11.01

Pamungkas, A., Sugiman, S., & Setyaningsih, N. (2021). Mathematics learning achievement: discovery learning collaboration think pair share viewed from reasoning. *Aksioma Jurnal Program Studi Pendidikan Matematika*, 10(1), 85-95. https://doi.org/10.24127/ajpm.v10i1.3177

Rahman, M. (2017). Using discovery learning to encourage creative thinking. *International Journal of Social Sciences and Educational Studies*, 4(2), 98-103. https://doi.org/10.23918/ijsses.v4i2sip98

Rahmawati, S., Masykuri, M., & Sarwanto, S. (2021). The effectiveness of discovery learning module classification of materials and its changes to enhance critical thinking skills. Jurnal Inovasi Pendidikan Ipa, 7(1), 74-84. https://doi.org/10.21831/jipi.v7i1.33253

Riadi, A., Atini, N., & Ferita, R. (2019). Thinking skills of junior high school students related to gender. International Journal of Trends in Mathematics Education Research, 2(3), 112-115. https://doi.org/10.33122/ijtmer.v2i3.66

Richardo, R., Dwiningrum, S., Wijaya, A., Retnawati, H., Wahyudi, A., Sholihah, D., & Hidayah, K. (2023). The impact of stem attitudes and computational thinking on 21st-century via structural equation modelling. International Journal of Evaluation and Research in Education (Ijere), 12(2), 571-578. https://doi.org/10.11591/ijere.v12i2.24232

Rizki, A., Khaldun, I., & Pada, A. (2021). Development of discovery learning student worksheets to improve students' critical thinking skills in chemical balance materials. Jurnal Penelitian Pendidikan Ipa, 7(4), 707-711. https://doi.org/10.29303/jppipa.v7i4.829

Rudibyani, R. (2018). The effectiveness of discovery learning to improve critical thinking skills college student on mastery of arrhenius acid base. Science Engineering Education and Development Studies (Seeds) Conference Series, 2(1), 41-54. https://doi.org/10.20961/seeds.v2i1.24310

Santosa, E. (2023). Ability to solve complex social problems of prospective teachers according to gender and computational thinking. JTP - Jurnal Teknologi Pendidikan, 25(3), 394-405. https://doi.org/10.21009/jtp.v25i3.38749

Silberman, M., & Biech, E. (2015). Active Learning: Strategies for Engaging Students. Pfeiffer.

Starko, A. J. (2018). Creativity in the Classroom: Schools of Curious Delight (6th ed.). Routledge.

Utaminingsih, S., Inayah, N., & Shufa, N. (2021). Pengelolaan pembelajaran discovery untuk meningkatkan kemampuan berpikir tingkat tinggi pada siswa di sekolah dasar. Refleksi Edukatika Jurnal Ilmiah Kependidikan, 12(1), 117-125. https://doi.org/10.24176/re.v12i1.6908

Wu, S. & Su, Y. (2021). Visual programming environments and computational thinking performance of fifth- and sixth-grade students. Journal of Educational Computing Research, 59(6), 1075-1092. https://doi.org/10.1177/0735633120988807

Yadav, A., Gretter, S., Good, J., & McLaughlin, T. (2017). Gender and Computational Thinking. Proceedings of the 2017 ACM Conference on Innovation and Technology in Computer Science Education, 187-192. https://doi.org/10.1145/3059009.3059027

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

Wiono, W. & Meriza, N. (2022). Environmental issues-based discovery learning to enhance metacognitive awareness and students' higher-order thinking skills. Tadris Jurnal Keguruan Dan Ilmu Tarbiyah, 7(1), 35-45. https://doi.org/10.24042/tadris.v7i1.10464

Wu, S. & Su, Y. (2021). Visual programming environments and computational thinking performance of fifth- and sixth-grade students. Journal of Educational Computing Research, 59(6), 1075-1092. https://doi.org/10.1177/0735633120988807

Yuniawati, T. & Purba, F. (2021). Discovery learning model to optimize students' critical thinking skills on hydrocarbon material. Jurnal Pendidikan Kimia, 13(3), 269-277. https://doi.org/10.24114/jpkim.v13i3.30208