AL-TANZIM
Jurnal Manajemen Pendidikan Islam
e-ISSN : 2549-5720
p-ISSN : 2549-3663

Al-Tanzim: Jurnal Manajemen Pendidikan Islam
Vol. 08 No. 03 (2024) : 1056-1069
Available online at https://ejournal.unuja.ac.id/index.php/al-tanzim/index

New Trends in Education: Computational Thinking and Its Role in Improving the Quality of School Human Resources

Kasypul Anwar[1*], Muhammad Yuliansyah[2]
[1]Islamic Educational Management Department, Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin, South Kalimantan, Indonesia
[2]Educational Administration Department, Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin, South Kalimantan, Indonesia
Email : kasypulanwar212@gmail.com[1], m.yuliansyahy@yahoo.com[2]

DOI: http://doi.org/10.33650/al-tanzim.v8i3.9361

Received: 25 August 2024	*Revised: 26 September 2024*	*Accepted: 03 October 2024*

Abstract:

This study aims to analyze how the application of computational thinking can affect students' analytical and problem-solving skills, as well as change the mindset of teachers from conventional teachers to innovators in one of the Junior High Schools in Banjarmasin City. This study uses a qualitative case study approach. Data were collected through observation, interviews, and documentation. Data were analyzed using thematic analysis techniques, including coding, identifying important themes, and interpretation in the context of computational thinking theory. Data triangulation was carried out by comparing the results of observations, interviews, and document analysis to ensure the validity of the findings. The results of the study indicate that computational thinking plays a significant role in improving students' technical and analytical skills and encouraging the transformation of teachers' mindsets towards a more innovative and adaptive approach to technology. In addition, this study also found that the implementation of computational thinking successfully addressed the gap in technology skills among students, thereby increasing educational equality. The implications of this study indicate that the application of computational thinking in the school curriculum can be an effective strategy to improve the quality of education in Indonesia. However, this study is limited to one location. It does not consider gender factors and variations in student backgrounds, so further research is needed with a wider scope to obtain a more comprehensive picture.

Keywords: *Computational Thinking, Analytical Skills, Human Resource Quality*

Abstrak:

Penelitian ini bertujuan untuk menganalisis tentang penerapan pemikiran komputasional dapat mempengaruhi keterampilan analitis dan pemecahan masalah siswa, serta mengubah mindset guru dari pengajar konvensional menjadi inovator di salah satu Sekolah Menengah Pertama Kota Banjarmasin. Penelitian ini menggunakan pendekatan kualitatif jenis studi kasus. Data dikumpulkan melalui observasi, wawancara, dan dokumentasi. Data dianalisis menggunakan teknik analisis tematik, meliputi pengkodean, identifikasi tema penting, dan interpretasi dalam konteks teori *computational thinking*. Triangulasi data dilakukan melalui perbandingan hasil observasi, wawancara, dan analisis dokumen untuk memastikan validitas temuan. Hasil penelitian menunjukkan bahwa pemikiran komputasional berperan signifikan dalam meningkatkan keterampilan teknis dan analitis siswa, serta mendorong transformasi

mindset guru menuju pendekatan yang lebih inovatif dan adaptif terhadap teknologi. Selain itu, penelitian ini juga menemukan bahwa implementasi pemikiran komputasional berhasil mengatasi kesenjangan keterampilan teknologi di kalangan siswa, sehingga meningkatkan kesetaraan pendidikan. Implikasi dari penelitian ini menunjukkan bahwa penerapan pemikiran komputasional dalam kurikulum sekolah dapat menjadi strategi efektif untuk meningkatkan kualitas pendidikan di Indonesia. Namun, penelitian ini terbatas pada satu lokasi dan tidak mempertimbangkan faktor gender dan variasi latar belakang siswa, sehingga diperlukan penelitian lanjutan dengan cakupan yang lebih luas untuk mendapatkan gambaran yang lebih komprehensif.
Kata Kunci: *Pemikiran Komputasional, Keterampilan Analitis, Mutu Sumber Daya Manusia*

Please cite this article in APA style as:

Anwar, K., Yuliansyah, M. (2024). New Trends in Education: Computational Thinking and Its Role in Improving the Quality of School Human Resources. *Al-Tanzim: Jurnal Manajemen Pendidikan Islam*, 8(3), 1056-1069.

INTRODUCTION

In the era of Industrial Revolution 4.0, technology has become the center of almost every aspect of life, including education. A new concept emerged known as computational thinking (CT) during this development (Tedre, 2021; Tekdal, 2021; Zafirah et al., 2023). Computational thinking is an approach to solving problems using a way of thinking that is similar to the thinking processes used by computer scientists. This thinking involves problem decomposition, pattern recognition, abstraction, and algorithms (Rey, 2021; Mardianto, 2024). Saad and Zainudin (2022) said computational thinking (CT) is a technical skill and an intellectual approach that can be applied in various fields, including education. The importance of computational thinking is increasingly recognized in education, especially in preparing students to face global challenges. Developed countries such as the United States and the United Kingdom have incorporated CT into their primary and secondary school curricula to enhance 21st-century skills, such as problem-solving, creativity, and collaboration. Although this concept has yet to be fully adopted in Indonesia, there is increasing interest in integrating CT into the education system as part of efforts to improve the quality of human resources (HR) and global competitiveness (Safitri, Yunianti, & Rostika, 2022).

This research is interesting because little research focuses on how computational thinking can be applied in schools in Indonesia and how this application can contribute to improving the quality of human resources. In addition, considering the increasing need for technical and analytical skills in the job market, this research is very relevant to answer these challenges and offer solutions to improve the quality of education in Indonesia. Although computational thinking has been recognized globally as an essential component in modern education, its implementation in Indonesia still faces various challenges (Prahmana et al., 2024). One of the main problems is the need for more understanding and readiness of teaching staff to implement this concept in the classroom. Many teachers are still accustomed to conventional teaching methods that do not explicitly involve CT in their curriculum. In addition, the education curriculum in Indonesia still tends to focus on memorization rather than developing critical and creative thinking skills, which are the core of computational thinking (Rosali & Suryadi, 2021).

Although there is a growing interest in integrating CT into Indonesian schools, a significant research gap still needs to be regarding specific strategies for its effective implementation. Key aspects such as teacher readiness, the alignment of CT with local educational goals, and the assessment of its long-term impact on student outcomes still need to be explored, leaving critical areas of integration unaddressed in the current literature.

Previous studies have identified the importance of computational thinking in education. For example, research conducted by Juldial and Haryadi (2024) found that computational thinking can help students develop problem-solving and critical thinking skills, which are critical in 21st-century education. Other research by Aytekin (2024) and Khalishah & Mahmudah (2022) shows that early introduction to CT can form the basis for mastering STEM. Additionally, a study by Pou et al. (2022) and Christi (2023) revealed that computational thinking could be integrated into various subjects in computer science and mathematics, science, and the arts.

Implementing CT faces challenges, especially in developing countries, such as more infrastructure, teacher training, and adequate curriculum support. Research is often limited to pilot programs in urban schools, while rural areas still need to be explored. Although CT has been shown to build critical skills, longitudinal studies on its impact on learning outcomes and teacher readiness still need to be made available. This gap must be addressed to understand CT's systemic challenges and scalability in improving education in developing countries like Indonesia.

This shows that CT has broad potential to improve the overall quality of learning. However, most of this research was conducted in countries with more advanced educational infrastructure (Anedin, 2024). More research is needed to study how computational thinking can be applied in developing countries like Indonesia, especially in the context of limited resources and technological access. This research seeks to fill this gap by exploring how computational thinking can be integrated into the school curriculum in Indonesia.

The novelty of this research lies in the contextual approach used to integrate computational thinking into the school curriculum in Indonesia. This research will not only identify the challenges faced in implementing CT but also offer practical solutions that can be adopted by schools in Indonesia, both in urban and remote areas. This research will use a comprehensive approach, considering Indonesia's unique cultural, social, and economic aspects, so it is hoped that it can significantly contribute to the development of education in this country.

This study aims to analyze the application of computational thinking in SMP Negeri 7 Banjarmasin and how this approach can affect students' analytical and problem-solving skills, as well as change the mindset of teachers from conventional teachers to innovators. Computational thinking, with characteristics that prioritize logic, algorithms, and systematic problem-solving, is expected to enrich how students think and act in solving problems. Through this study, ways will be found to improve the quality of education by adopting computational thinking, both in student skills and in the innovation of teacher-teaching methods.

RESEARCH METHODS

This research uses a qualitative descriptive research type with a case study approach. This approach was chosen because the research aims to deeply understand the role of computational thinking in improving the quality of human resources (HR) in Banjarmasin City Middle Schools. Case studies allow researchers to explore this phenomenon in a real-world context, considering the various factors that influence it holistically. Research with a descriptive qualitative type and case study approach is more suitable because the main focus is understanding the phenomenon in depth and contextually. In this case, the study aims to explore the role of computational thinking in improving the quality of human resources (HR) in secondary schools in Banjarmasin City. This approach allows researchers to explore specific details related to the experience, perception, and implementation of computational thinking in the school environment.

This research focuses on SMP Negeri 7 Banjarmasin, Jalan Sutoyo S, Kebun Bunga Village, East Banjarmasin District, Banjarmasin City, South Kalimantan. This location was selected based on the school's efforts to implement computational thinking programs in their curriculum.

The data collection technique in this research involves several methods, namely observation, in-depth interviews, and document analysis. Observations were made to observe how computational thinking was integrated into daily learning. In-depth interviews were conducted with various related parties, including teachers, students, and school principals, to obtain their views and experiences regarding implementing computational thinking. Document analysis involves reviewing curricula, learning materials, and school activity reports related to the application of computational thinking.

The collected data was then analyzed using thematic analysis techniques. The analysis process involved coding the data, identifying critical emergent themes, and interpreting the findings in the context of the theory underlying computational thinking. Researchers also used data triangulation to ensure the findings' validity by comparing the results of observations, interviews, and document analysis. The results of this analysis will be used to conclude the role of computational thinking in improving the quality of human resources in Banjarmasin City Middle Schools.

RESULTS AND DISCUSSIONS

Teacher Mindset Transformation: From Conventional Teachers to Educational Innovators

One of the most striking findings is the transformation in the mindset of teachers who apply computational thinking. Teachers who previously relied on conventional teaching methods have now become innovators who actively seek creative solutions to challenges in the classroom. Computational thinking encourages teachers to think systematically and out of the box out of the box, improving teaching quality and student engagement. This shows that computational thinking is a tool and an approach that inspires profound pedagogical transformation. This research found that the application of computational thinking at SMP Negeri 7 Banjarmasin has encouraged a significant transformation in teacher mindsets from conventional to more innovative and

adaptive to change. One teacher stated, "In the past, I only focused on delivering material directly, but now I put more emphasis on how students can understand concepts through problem-solving." This reflects a fundamental change in teaching approaches. This transformation shows that teachers have moved from traditional teacher-centered teaching models, where information is provided in one direction, towards more constructivist learning models. In this new approach, teachers are facilitators who encourage students to actively participate in learning, solve problems, and think critically. This change is essential because it indicates an increase in the quality of teaching that is more adaptive to the needs of the 21st century, where the ability to think independently and solve problems is a much-needed skill. This approach improves students' understanding of the material and equips them with the critical thinking skills necessary for success in their future lives and careers.

To another teacher's statement, "I started integrating technology in learning, such as using simple software to help students understand mathematical concepts through algorithms, "computational thinking has been a catalyst for innovation in teaching methods. Technology integration in the learning process reflects a broader adaptation to digital developments, where technology is no longer considered an addition but an integral component of education. The use of software to explain algorithm concepts in mathematics, for example, shows how technology can help students understand complex material through visualization and simulation. This also reflects an increase in teachers' digital literacy, which improves teaching quality. This innovation is important because it shows how computational thinking can improve the efficiency and effectiveness of the teaching and learning process and prepare students to face future technological challenges.

This was then added by a statement from a teacher who also stated, "Now I learn more with students, especially when facing new challenges in technology. This makes me feel more developed as an educator." this shows a dynamic change in the role of teachers in the digital era. Rather than simply serving as a source of knowledge, these teachers see themselves as lifelong learners who continue to develop alongside their students. This attitude reflects a more collaborative and reflective approach to education, where teachers and students explore new challenges brought by technology. This process increases teacher competency in technology and builds stronger relationships with students, who see their teachers as partners in learning.

Meanwhile, the Integration of Technology in Learning shows how technology has become an integral part of the educational process, not just as a tool but as the main component that supports learning (Christopoulos et al., 2021). Teachers use software and other technology tools to explain complex concepts, aid visualization, and improve student understanding. This also shows increased digital literacy among teachers, who can increasingly utilize technology to enrich the learning experience (Alakrash, 2021; Khan et al., 2022). Finally, the Improving Teacher Competency indicator highlights how teachers develop themselves through lifelong learning, often with their students. In this context, teachers act as educators and as educators and collaborative learning partners who improve

relationships with students and adapt their teaching approaches to the challenges and technological changes in the digital era.

Technology Adaptability in Schools

While accelerating technology, computational thinking is the key for educators to keep up with developments and lead change. Teachers who master computational thinking can utilize technology creatively and efficiently, introducing new teaching methods that are engaging and interactive. This increases learning effectiveness and encourages students to participate more in the educational process. The following are the results of interviews with several informants, which will strengthen the findings regarding technological adaptability in schools.

Table 1. Research Informant Interview Results

Interview Results	Code	Informant
"We are starting to realize that technology is not just a tool but has become an important part of the teaching and learning process. For example, projectors and educational software have helped teachers deliver material more interactively and interestingly for students."	Role of Technology in Education	Headmaster
"Technology has been integrated into various subjects, not just computer classes. For example, I use math software to help students understand calculus concepts more visually and practically."	Adaptation of Technology in the Curriculum	Teacher
"Access to digital resources such as e-books and video tutorials makes it easier to understand lessons. I can look for more in-depth information and study material I do not understand."	Benefits of Access to Digital Resources	student
"We have integrated technology into science lessons by using simulations and virtual experiments. This allows students to perform experiments that might not be possible in a physical laboratory and understand science concepts in greater depth."	Adaptation of Technology in the Curriculum	Teacher
"With the various educational apps and websites we access outside class hours, I can learn additionally and complete assignments better. These digital resources help me get answers quickly and learn more from the material provided."	Benefits of Access to Digital Resources	student

From the results obtained in the analysis, technology integration in learning shows several vital indicators that influence the quality and effectiveness of the educational process: First, The role of technology in education illustrates how technology not only functions as a tool but has also become an integral component of teaching methods. This reflects a significant change in views towards technology, from merely an addition to becoming an essential element in the learning process. Second, Technology Adaptation in the Curriculum shows how widely technology is applied in various subjects, indicating that students are now more accustomed to using technology in various disciplines. This shows that technology has gone beyond the confines of the computer classroom and has become an integral part of various subjects. Third, Benefits of Access to Digital

Resources assesses the positive impact of technology on students' learning experiences, including ease of accessing various resources and improving independent learning skills. By paying attention to these indicators, we can assess the extent to which technology integration has improved the quality of education and influenced student engagement and understanding.

Furthermore, the application of technology in learning significantly impacts students' mastery of material and learning skills. The Role of Technology in Education reflects how technology contributes to increasing the effectiveness of teaching methods and adapting teachers to changing times. Adaptation of Technology in the Curriculum shows how integrating technology in various subjects broadens students' learning and understanding of the material. Benefits of Access to Digital Resources assesses how technology increases ease and flexibility in learning and how access to digital resources supports more profound understanding. Thus, these indicators provide a comprehensive picture of how technology influences the teaching and learning process, increases student engagement, and supports the development of essential skills in the digital era.

The Role of Technology in education illustrates how technology has become an integral part of the teaching and learning process. No longer just considered an additional tool, technology now functions as an essential component that supports interactivity and teaching effectiveness. Using devices such as projectors and educational software allows teachers to deliver material more engagingly and interactively, enriching students' learning experience and increasing their engagement in the educational process (Ferreira et al., 2024).

Adaptation of technology in the curriculum reflects how technology has been integrated into a variety of subjects, not just limited to computer classes (Leary et al., 2021; Bereczki & Kárpáti, 2021). The use of software and digital tools in subjects such as mathematics and science means that technology is now an essential part of the curriculum, helping students understand complex concepts more visually and practically and expanding the range of teaching methods across disciplines.

Benefits of Access to Digital Resources show the positive impact of the ease of access to additional information provided by digital technology. Students can utilize e-books, video tutorials, and other online resources to deepen their understanding of the course material (Murtado et al., 2023). This flexible and varied access simplifies the independent learning process, allows students to learn according to their needs, and improves the overall quality of learning

The Role of Technology in Digital Education the importance of digital technology in connecting learning material with actual practice through e-learning platforms and educational applications. Digital technology supports learning and modernizes teaching, helping students learn with methods that are more relevant and connected to today's digital world. This allows the integration of course material with real-world practice and applications that enrich the student's learning experience.

Adaptation of Technology in the Curriculum how technology is used in

science lessons through virtual simulations and experiments, replacing or complementing traditional teaching methods. This technology allows students to conduct experiments and explore science concepts in an interactive and immersive way, which may not be possible in a physical laboratory (Siyamsih, 2024). Technology in the curriculum increases students' understanding and engagement with course material (Arini, 2023).

The benefits of Access to Digital Resources Underscore how educational apps and websites help students learn and complete assignments. Quick and easy access to various digital resources accelerates learning, allowing students to get answers and additional information outside class hours. This supports more effective independent learning and enriches the educational experience with broader and more varied material.

Solving the Technology Skills Gap: Improving Educational Quality and Equity

The application of computational thinking has also been proven to reduce the technology skills gap between teachers and students. The findings show that through appropriate training, computational thinking helps teachers who were previously less familiar with technology to become more proficient, thus able to integrate digital tools into everyday learning. This improves the quality of education and creates a more inclusive environment where all teachers and students have equal access to cutting-edge educational technology. One of the most prominent findings in this research is closing the technology skills gap among students, ultimately improving education quality and equality.

One teacher stated, "Earlier, there was a stark difference between students familiar with technology and those not. Now, with computational thinking, the gap is getting smaller." Then, one of the students also admitted, "At first, I was afraid of computers, but now I can use various applications to study, which makes me more confident." Another student added, "Now I can help my friends who have difficulty with technology, even though before I did not know much." From interviews with several informants above, a common thread can be drawn that the application of computational thinking in education has significantly reduced the gap in technology skills among students. With this approach, the difference in technology skills between students who are previously familiar with technology and those who are not is increasingly minor. Students who initially felt anxious or lacked confidence with technology can now utilize various learning applications, increasing their self-confidence.

Additionally, computational thinking has empowered students with their technology skills and their struggling peers. This reflects positive change involving increasing individual competence and developing a culture of mutual support in using technology. Computational thinking plays a role in leveling technology skill levels among students and strengthening collaborative learning environments.

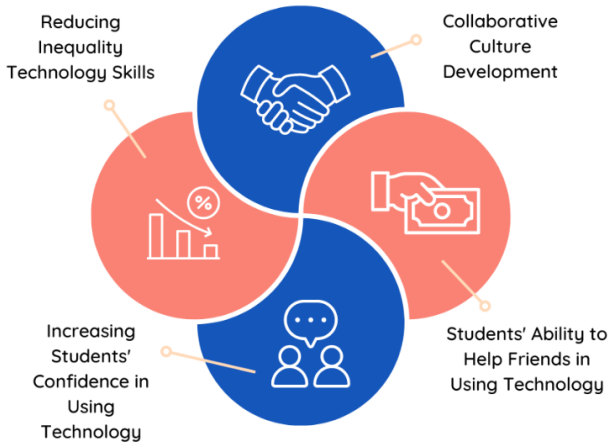

Figure 1. Technology Skills

From the Figure 1, it can be understood that from the interview results, there are several indicators of findings that contribute to the technology skills gap that is being addressed in improving the quality and equality of education, namely, The application of computational thinking in education has shown a significant positive impact in several aspects of students' technology skills. One key indicator is a reduction in the technology skills gap, which refers to the reduced difference between students with a technological background and those who become more familiar with it. By using this approach, students who were previously unfamiliar with technology now have the opportunity to develop skills on par with their more experienced peers. Furthermore, increasing students' confidence in using technology is also an important indicator. Students who initially felt anxious or less confident about technology showed significant progress using various learning applications (Chen et al., 2024). This increase in self-confidence allows them to utilize technology more effectively and influences their attitude toward learning.

Students' ability to help peers use technology is an additional indicator of the positive impact of computational thinking. Students who have mastered technology tend to play an active role in supporting their friends who face difficulties, indicating the development of knowledge-sharing and support skills among students. Finally, developing a collaborative culture among students is an essential indicator of the application of computational thinking. This approach encourages creating a more cooperative learning environment where students learn independently, collaborate, and help each other use technology. Considering these indicators, it is clear that computational thinking plays a crucial role in leveling technology skills, increasing student self-confidence, and facilitating a collaborative culture that supports more effective and inclusive learning.

Transforming Analytical and Problem Solving Skills

Computational thinking teaches a systematic and profound way of thinking, which is very much needed in facing the complexity of modern education. Teachers and school staff trained in this approach can break down significant problems into smaller, more manageable parts. They are not only able

to solve problems effectively but can also find innovative solutions that have never been thought of before. This takes education to a new level, transforming every challenge into an opportunity for further learning and development.

Table 2. Research Informant Interview Results

Indicator	Interview Results	Interpretation
Improved Analytical Skills	"Students are now better able to solve complex problems because they are taught to think systematically and usefully"	The application of computational thinking has improved students' ability to handle complex problems using systematic and algorithmic thinking. This allows students to develop structured problem-solving steps, facilitating a more organized and practical approach.
Increased Understanding of Concepts	"I find it easier to understand math problems now because I was taught how to break them down into smaller parts."	Computational thinking makes it easier for students to understand mathematical material by breaking down problems into simpler components. This technique helps students overcome difficulties in complex concepts in a more accessible and scalable way.
Development of Divergent Thinking Skills	"Now I think more often about different ways to solve problems, not just one way."	Development of divergent thinking skills in students, where they now look for multiple solutions to a problem rather than just one approach. It shows how computational thinking encourages creativity and innovation in problem-solving, facilitating the exploration of broader alternatives.

From Table 2 above, the research results show that the application of computational thinking significantly improves analytical and problem-solving skills among students. The first indicator, namely the ability to solve complex problems, underlines the effectiveness of computational thinking in teaching students to think systematically and use algorithmic approaches. This impacts students' ability to face and solve more complex problems by applying structured and organized methods. This reflects improvements in students' technical and analytical skills, which are essential in many academic areas, including mathematics and science. Furthermore, the second indicator, namely a better understanding of concepts, shows how computational thinking allows students to break down complex problems into smaller parts, making it easier to understand and apply more complicated concepts. This improves students' ability to handle material that was previously difficult to understand. The third indicator, namely divergent thinking in problem-solving, describes the development of students' creative skills in finding various solutions to one problem, not just a single solution. The application of computational thinking facilitates a more flexible and innovative approach to problem-solving, which supports creativity and adaptability in the learning process. These indicators highlight how computational thinking contributes to developing excellent analytical skills and more effective problem-solving abilities among students.

Computational thinking significantly improves the quality of human resources in Banjarmasin City Middle Schools by improving students' analytical

and problem-solving skills. The finding that computational thinking significantly improves the quality of human resources in Banjarmasin City high schools, especially in students' analytical and problem-solving abilities, shows that this approach strengthens the cognitive skills needed in the digital era. By preparing students to face the challenges of the Industrial Revolution 4.0, they become better prepared to compete in the world of work that prioritizes digital literacy and systematic thinking. These skills help in academic contexts and real life, making them more resilient and solution-oriented individuals.

This approach helps students develop the ability to solve complex problems through systematic and algorithmic methods, which not only strengthens their technical skills but also increases their capacity to face more complex academic challenges in the future. Students' increased understanding of complex concepts, thanks to their ability to break down problems into smaller parts, shows that computational thinking is effective in helping students master course material better (Rozi & Rohman, 2024). Additionally, the development of divergent thinking skills demonstrated by students, which allows them to seek multiple solutions to a single problem, reflects how computational thinking encourages creativity and flexibility. These skills are invaluable in a dynamic world of work that requires innovative approaches to problem-solving (Nilimaa, 2023). Thus, computational thinking improves academic outcomes and prepares students to become more qualified and adaptive human resources (Altaie, 2021; Kerimbayev et al., 2023).

CONCLUSION

This research found that the application of computational thinking at SMP Negeri 7 Banjarmasin has significantly improved the quality of human resources, both among students and teachers. The most important lesson from this research is that integrating computational thinking in the curriculum improves students' technical and analytical skills and encourages the transformation of teachers' mindsets from conventional teachers to educational innovators who adapt to technological changes. These findings emphasize the importance of adopting a learning approach based on problem-solving and critical thinking, which can equip students with relevant skills to face future challenges. In addition, this research provides scientific contributions by updating perspectives on how computational thinking can be implemented effectively in the educational context in Indonesia, especially in developing regions.

However, this study has several limitations that need to be considered. First, this research is limited to one school in Banjarmasin City, so the results may only be generalized to some of Indonesia. Additionally, this research did not explicitly consider gender, age, and student background variations, which may influence how computational thinking is perceived and implemented. The research methods are also limited to a qualitative approach, which provides in-depth insights but does not allow for a broader quantitative picture. Therefore, further research is needed that accommodates variations in gender, age, and student background and uses quantitative survey methods to get a more comprehensive picture. This further research can be the basis for more targeted

policy-making in improving the quality of education in Indonesia, especially in terms of developing computational skills at various levels of education.

ACKNOWLEDGMENT

We want to express our deepest gratitude to the leaders, teachers, employees and students of SMP Negeri 7 Banjarmasin for their support, cooperation and involvement in this research. The results of this research can provide real contributions to improving the quality of education in the future.

REFERENCES

Alakrash, H. M. (2021). Technology-based Language Learning: Investigation of Digital Technology and Digital Literacy. *Sustainability*, *13*(21), 12304. https://doi.org/10.3390/su132112304

Altaie, M. A., & Jawawi, D. N. A. (2021). Adaptive Gamification Framework to Promote Computational Thinking in 8-13 Year Olds. *Journal of e-Learning and Knowledge Society*, *17*(3), 89-100.

Anedin, G. A. R. (2024). Implementasi Pendidikan Global berbasis Keunggulan Lokal dalam Pencapaian SDG Nomor 4 di Provinsi Riau. *Ranah Research: Journal of Multidisciplinary Research and Development*, *6*(3), 340–350. https://doi.org/10.38035/rrj.v6i3.832

Arini, R. E. (2023). Merangkul Teknologi: Mengintegrasikan Realitas Virtual dalam Pengalaman Pembelajaran. *Jurnal Pendidikan West Science*, *1*(06), 350–356. https://doi.org/10.58812/jpdws.v1i6.458

Aytekin, A., & Topçu, M. S. (2024). The Effect of Integrating Computational Thinking (CT) Components into Science Teaching on 6th Grade Students' Learning of The Circulatory System Concepts and CT Skills. *Education and Information Technologies*, *29*(7), 8079-8110. https://doi.org/10.1007/s10639-023-12103-x

Bereczki, E. O., & Kárpáti, A. (2021). Technology-Enhanced Creativity: A Multiple Case Study of Digital Technology-Integration Expert Teachers' Beliefs and Practices. *Thinking Skills and Creativity*, *39*, 100791. https://doi.org/10.1016/j.tsc.2021.100791

Chen, Y. C. (2024). Effects of Technology-Enhanced Language Learning on Reducing EFL Learners' Public Speaking Anxiety. *Computer Assisted Language Learning*, *37*(4), 789-813. https://doi.org/10.1080/09588221.2022.2055083

Christi, S. R. N., & Rajiman, W. (2023). Pentingnya Berpikir Komputasional dalam Pembelajaran Matematika. *Journal on Education*, *5*(4), 12590–12598. https://doi.org/10.31004/joe.v5i4.2246

Christopoulos, A., & Sprangers, P. (2021). Integration of Educational Technology During the Covid-19 Pandemic: An Analysis of Teacher and Student Receptions. *Cogent Education*, *8*(1), 1964690. https://doi.org/10.1080/2331186X.2021.1964690

Ferreira, A., Lima, D. A., Oliveira, W., Bittencourt, I. I., Dermeval, D., Reimers, F., & Isotani, S. (2024). Exploring Brazilian Teachers' Perceptions and A Priori Needs to Design Smart Classrooms. *International Journal of Artificial Intelligence in Education*, 1-52. https://doi.org/10.1007/s40593-024-00410-4

Juldial, T. U. H., & Haryadi, R. (2024). Analisis Keterampilan Berpikir Komputasional dalam Proses Pembelajaran. *Jurnal Basicedu*, *8*(1), 136–144. https://doi.org/10.31004/basicedu.v8i1.6992

Kerimbayev, N., Nurym, N., & Abdykarimova, S. (2023). Educational Robotics: Development of Computational Thinking in Collaborative Online Learning. *Education and Information Technologies*, *28*(11), 14987-15009. https://doi.org/10.1007/s10639-023-11806-5

Khalishah, N., & Mahmudah, U. (2022). Analisis Perkembangan Pembelajaran STEM (Science, Technology, Engineering, and Mathematics) pada Keterampilan Abad 21. *SANTIKA: Seminar Nasional Tadris Matematika*, *2*, 417–431.

Khan, N., Sarwar, A., Chen, T. B., & Khan, S. (2022). Connecting Digital Literacy in Higher Education to The 21st Century Workforce. *Knowledge Management & E-Learning*, *14*(1), 46-61. https://doi.org/10.34105/j.kmel.2022.14.004

Leary, H., Lee, V. R., & Recker, M. (2021). It's More Than Just Technology Adoption: Understanding Variations in Teachers' Use of An Online Planning Tool. *TechTrends*, *65*(3), 269-277. https://doi.org/10.1007/s11528-020-00576-3

Mardianto, N. F. D., & Yahfizham, Y. (2024). Systematic Literature Review: Penerapan Berpikir Komputasi dalam Pembelajaran Matematika. *Journal of Student Research*, *2*(4), 41–55. https://doi.org/10.62383/bilangan.v2i4.140

Murtado, D. (2023). Optimalisasi Pemanfaatan Media Pembelajaran Online sebagai Upaya Meningkatkan Hasil Belajar Siswa di Sekolah Menengah Atas. *Journal on Education*, *6*(1), 35–47. https://doi.org/10.31004/joe.v6i1.2911

Nilimaa, J. (2023). New Examination Approach for Real-World Creativity and Problem-Solving Skills in Mathematics. *Trends in Higher Education*, *2*(3), 477-495. https://doi.org/10.3390/higheredu2030028

Pou, A., Canaleta, X., & Fonseca, D. (2022). Computational Thinking and Educational Robotics Integrated into Project-Based Learning. *Sensors*, *22*(10), 3746. https://doi.org/10.3390/s22103746

Prahmana, R. C. I., Kusaka, S., Peni, N. R. N., Endo, H., Azhari, A., & Tanikawa, K. (2024). Cross-Cultural Insights on Computational Thinking in Geometry: Indonesian and Japanese Students' Perspectives. *Journal on Mathematics Education*, *15*(2), 613-638. https://doi.org/10.22342/jme.v15i2.pp613-638

Putra, A. R. A., Lidinillah, D. A. M., & Nuryadin, A. (2023). Pengembangan Bahan Ajar Pemrograman Berbantuan Scratch pada Materi Bangun Datar di Sekolah Dasar. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *8*(2), 911–920.

Rey, Y. A., Cawanga Cambinda, I. N., Deco, C., Bender, C., Avello-Martínez, R., & Villalba-Condori, K. O. (2021). Developing Computational Thinking with A Module of Solved Problems. *Computer Applications in Engineering Education*, *29*(3), 506-516. https://doi.org/10.1002/cae.22214

Rosali, D. F., & Suryadi, D. (2021). An Analysis of Students' Computational Thinking Skills on the Number Patterns Lesson during the Covid-19 Pandemic. *Formatif: jurnal ilmiah pendidikan MIPA*, *11*(2). https://doi.org/10.30998/formatif.v11i2.9905

Rozi, F., & Rohman, A. (2024). Pengembangan Aplikasi Pembelajaran berbasis Android (SAC) sebagai Media Pembelajaran pada Materi Berpikir Komputasional. *Petik: Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, *10*(1), 15–31.

Saad, A., & Zainudin, S. (2022). A Review of Project-Based Learning (PBL) and Computational Thinking (CT) in Teaching and Learning. *Learning and Motivation*, *78*, 101802. https://doi.org/10.1016/j.lmot.2022.101802

Safitri, A. O., Yunianti, V. D., & Rostika, D. (2022). Upaya Peningkatan Pendidikan Berkualitas di Indonesia: Analisis Pencapaian Sustainable Development Goals (SDGs). *Basicedu*, *6*(4), 7096–7106. https://doi.org/10.31004/basicedu.v6i4.3296

Siyamsih, D. (2024). Persepsi Mahasiswa terhadap Penggunaan Virtual Reality dalam Pembelajaran Praktikum Laboratorium. *Journal EduTech*, *1*(1), 25–29. https://doi.org/10.62872/12tsrd26

Tedre, M., & Denning, P. J. (2021). Computational Thinking: A Professional and Historical Perspective. In *Computational Thinking in Education* (pp. 1-17). Routledge. https://doi.org/10.4324/9781003102991-1

Tekdal, M. (2021). Trends and Development in Research on Computational Thinking. *Education and Information Technologies*, *26*(5), 6499-6529. https://doi.org/10.1007/s10639-021-10617-w

Zafirah, A., Gistituati, N., Bentri, A., Fauzan, A., & Yerizon, Y. (2023). Studi Perbandingan Implementasi Kurikulum Merdeka dan Kurikulum 2013 pada Mata Pelajaran Matematika: Literature Review. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *8*(1), 276–304. https://doi.org/10.31004/cendekia.v8i1.2210