Analysis of Computational Thinking Ability of Informatics Education Students

Marisa lobang [1] , Maria Magdalena Beatrice Sogen [2] , Reginaldis Jesika Io [3] , Daniel Lakke Dae [4], Pingkky Kimberly Ledoh[5]
[12345]Pendidikan Informatika, Fakultas Keguruan Dan Ilmu Pendidikan, Universitas Citra Bangsa
Email : marisalobang9@gmail.com[1]

Abstract

Computational thinking (CT) is a systematic and logical problem-solving skil crucial in computer science education for effective problrm-solving. This research aims to analyze the computational thinking abilites of computer science education students, specifically in the aspects of problem identification, decomposition, abstracation, pattern recognition, and algorithms.The study utilized a mixed-methods approach (quantitative and qualitative) with questionnaires as the data collection instrument.The findings indicate that computer science education students possess a good basic CT ability,particularly in identifying problems and developing solution algorithms.however,there was variation in abilities regarding decomposition and abstraction,xhich still need improvement.These findings provide an important basic for developing more effective curricula and teaching methods to enhance students computational thinking skills..improved CT abilities are believed to increase students preparedness for the increasingly complex challenges of technology and the professional world.

Keywords: Computational Thinking,Informatics Education Students,Analysis.

INTRODUCTION

The development of technology in the 21st century, called the digital era, continues to advance and develop rapidly, almost all in the 21st century people use computers and devices integrated with the internet. With the rapid development of technology, all countries compete in technological development. One of the skills needed in the 21st century is the ability to think informatively, or computational thinking (CT). CT is not only for computer professionals, all individuals need this skill. Computational thinking skills, not only needed by computer scientists, are basic reading, counting and writing skills that everyone needs, CT is part of the curriculum in several developed countries (Tsubasa, 2006). The United States, England, the Netherlands, Australia, and Mexico are countries that include CT in their curriculum (Yada vet., 2018.)(Prastyo et al., 2023)

In the era of globalization, learning is the most important thing for the sustainability of Indonesian education. This is done so that students get different ideas, information and ways of thinking and to improve their analytical skills. One of the learning efforts that can be carried out in parallel with the development of literacy in students is to apply computational thinking to students. (Mangiri, Y. F., & Prabawanto, 2024)

Computational Thinking (CT) is a method for learning that is based on the thinking process needed to solve problems. Wing defines computational thinking as problem solving, system design, and understanding human behavior, and explains the basic concepts of computer science. According to this problem solving skills are designed as a system that aims to understand human behavior by using some basic concepts of computer science. (Wing, 2016)

Many schools in Indonesia and abroad are now starting to use this computational thinking method. (Mangiri, Y. F., & Prabawanto, 2024)

This method is the result of the following concepts and applications in various fields of computer science and information technology. Wing argues that the core of computational thinking is the capacity for abstraction.

According to (Angeli, C., Voogt, J., Fluck, A., Webb, M., Cox, M., Malyn-Smith, J., & Zagami, 2016) there are five skill components for computational reasoning ability..(1) Abstraction, the ability to decide what information to retain and what to ignore..(2)Generalization. We formulate a general solution so that it can be applied to different problems.(3) Decomposition, decomposition resolution skills.some complex problems. (4) Skills to design algorithms, workflows, and step-

by-step actions to solve problems(5) Skills to debug. Identify, eliminate, and fix errors.

(Mangiri, Y. F., & Prabawanto, 2024) revealed that computational thinking plays an important role in developing students' problem-solving abilities.

(Herlina, L., & Rusdiana, 2020) Computational thinking skills are an important foundation in 21st century education because they support the development of high-level thinking skills. (Israwati Hamsar, Nur Fadhylah As, Rosidah, Muhammad Dwi Andika, 2024) emphasized the importance of implementing computational thinking learning in the informatics education curriculum. They stated that the use of interactive learning media and technology-based projects can improve students' abilities in identifying problems, abstracting, and compiling algorithms systematically. (Daniel Enrique Triosandriawan. (2023)., 2023)

The development of computational thinking skills is very important in informatics education to prepare students to face the challenges of solving complex problems. According to (Dyah Susilowati, Reny Refitaningsih Peby Ria, Rini Anggriani, Suci Indah Salsabila, Rifqi Aditia, 2023) In the journal Community Development, Dyah Susilowati and colleagues discussed improving the competence of STEM teachers in HOTS-based informatics learning and computational thinking to support the implementation of the Merdeka Curriculum at MTsN 1 Mataram. This study emphasizes the importance of teacher training in integrating CT in learning to improve the quality of education. (Sari, 2023) Research on computational thinking has been conducted in various learning contexts. Shows that the open-ended Problem Based learning model can improve the computational thinking skills of junior high school students, especially in terms of problem identification and algorithm development.

(Lestari, 2023) found that students' mathematical computational thinking abilities in linear programming material were demonstrated through good decomposition and abstraction processes.

(Irvan Malay. (2023)., 2023) Analysis of Students' Computational Thinking Skills in the Context of Information Technology. This study examines students' computational thinking skills in solving information technology-based problems, emphasizing the importance of integrating CT into the higher education curriculum.

(Fenti Kumala Sari. (2023)., 2023) In her research, Fenti Kumala Sari analyzed the computational thinking ability patterns of high school students in Kayen District, Pati, especially in biology learning.

(Agnes Firdatun Nisa. (2022)., 2022) Agnes Firdatun Nisa in her thesis studied the computational thinking abilities of high school students on vector material, viewed from gender differences. This study shows that there are differences in CT abilities between male and female students, with male students showing higher abilities in the aspects of decomposition and abstraction.

(Princess, 2021) Computational thinking (CT) is a core skill that everyone in the world needs in the mid-21st century. This skill is not only important for computer scientists, but is a must alongside the ability to read, write, and count. Computational Thinking (CT) involves problem solving, system design, and understanding human behavior by describing basic concepts about things (Computational Thinking and Programming with Python, n.d., 2020; 2)

RESEARCH METHOD

This study applies a mixed method between qualitative and quantitative (mixed metbod) . This method allows the data collection process to be carried out at one point in time which provides a picture of the population (6th semester Informatics Education Students) and the sample is the number of questionnaire answers. In determining respondents or research samples, this is carried out through the use of questionnaires as a research method. According to (Wijaya, A. F., & Sujana, 2019) the research method used in their study is a qualitative method using a questionnaire as the main instrument for data collection

RESULTS AND DISCUSSION

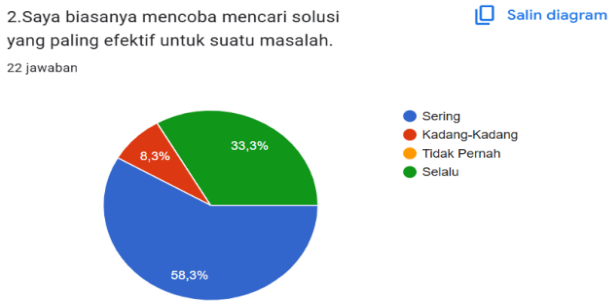
In this study, we collected data from 20 respondents, with details of 9 men and 11 women. The results of the study showed that the level of participation was balanced between men and women in the environment of informatics education students, with very little difference between the two. This shows that the analysis of Computational Thinking abilities of informatics education students is very beneficial for learning during lectures and in everyday life. students show good abilities in the identification aspect

problems, problem solving, and they are able to break down problems into smaller parts (decomposition), and select important information (abstraction), computational thinking skills in. The results of this study provide an important basis for the development of more effective educational programs in improving students' computational thinking skills. Strengthening CT is very important considering that the world of work increasingly demands high technological and data processing skills. Therefore, the informatics education curriculum needs to emphasize the development of CT explicitly and systematically.

Based on the results of the analysis through observations that researchers have carried out from the distribution of the questionnaires, the results of the analysis can be taken as described below:

With the statement below (63.6%) students are able to think of a quick solution to a problem.

With the statement below (58.3%) students "**often**" to find the most effective solution to a problem.

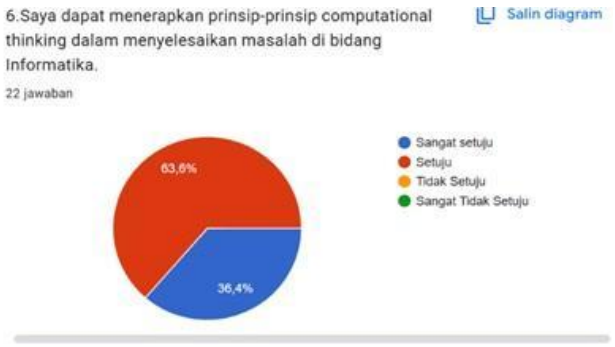


With the statement below (45.5%) students "**often**" to describe a problem.

With the statement below (40.9%) students**"**sometimes-**sometimes"** are able to analyze general patterns of different problems.

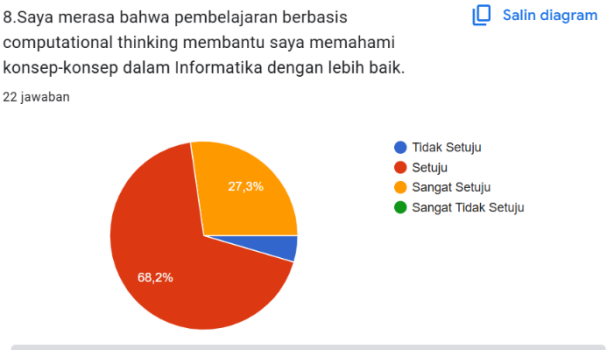
With the statement below (63.6%) students "agree" to be more confident in problem solving after attending the lecture.

With the statement below (63.6%) students**"agree"** able to apply the principles of computational thinking in solving problems in the field of Informatics.



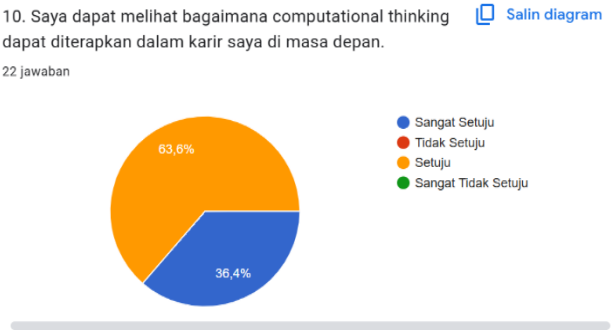
With the statement below (54.5%) students**"Agree"** to collaborate with classmates on Computational Thinking-based projects.

With the statement below (68.2%) students**"Agree"**that computational thinking-based learning can help students understand concepts in informatics well.

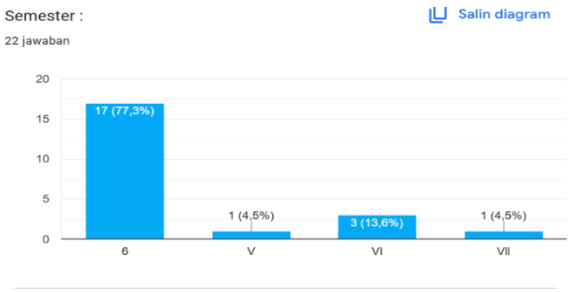


With the statement below (77.3%) students**"Agree"**Computational thinking-based learning improves problem-solving abilities.

With the statement below (63.6%) students**"Agree"**that the application of computational thinking can help students' future careers.



Based on the results of this study, it is shown that the Computational Thinking skills of informatics education students show that most students have good basic abilities, especially in identifying and solving problems.



CONCLUSION

Based on the discussion above, it can be concluded that the analysis of Computational Thinking abilities of informatics education students is very beneficial for learning during lectures and in everyday life. students show good abilities in basic aspects such as problem identification, decomposition, and abstraction. Informatics education students show good basic CT abilities, especially in breaking down

complex problems into small parts, recognizing patterns, and compiling systematic steps to find solutions.

This study also emphasizes the importance of integrating computational thinking learning explicitly into the curriculum so that students can develop critical, creative, and problem-solving skills effectively. Project-based learning approaches and hands-on practice have been shown to be effective in improving CT skills.

Overall, computational thinking skills are an important asset that is needed to face the challenges of today's digital and technological world. Therefore, strengthening these skills through appropriate learning strategies is essential to produce graduates who are ready to compete in the technological era.

SUGGESTION

From the results of the research that we have conducted, there are inputs or suggestions in this computational-based learning so that there is an increase in the curriculum applied in the informatics education curriculum to include more materials and also the use of interactive and project-based teaching techniques to increase student involvement so that there is collaboration between lecturers and students and also with classmates to train students' computational abilities to think critically and creatively.

ACKNOWLEDGEMENT

We would like to thank all parties who have contributed to this research, including students who have participated in the analysis of computational thinking skills. Thanks are also given to the lecturers who have provided support and guidance during the research process. Hopefully the results of this study can provide benefits for computational thinking skills among students.

BIBLIOGRAPHY

Agnes Firdatun Nisa. (2022). (2022). Agnes Firdatun Nisa. (2022). Analisis Kemampuan Computational Thinking Siswa SMA Pada Materi Fisika. Skripsi. UIN Walisongo.

Angeli, C., Voogt, J., Fluck, A., Webb, M., Cox, M., Malyn-Smith, J., & Zagami, J. (2016). (2016). Angeli, C., Voogt, J., Fluck, A., Webb, M., Cox, M., Malyn-Smith, J., & Zagami, J. (2016). A K-6 computational thinking curriculum framework: Implications for teacher knowledge. Educational Technology & Society, 19(3), 47–57. eric.ed.gov +6 kclpure.kcl.ac. A K-6 Computational Thinking Curriculum Framework: Implications for Teacher Knowledge. Educational Technology & Society, 19(3), 47–57. Eric.Ed.Gov +6 Kclpure.Kcl.Ac.Uk +6.

Daniel Enrique Triosandriawan. (2023). (2023). Daniel Enrique Triosandriawan. (2023). Analisis Computational Thinking Mahasiswa PTIK UNS Pada Mata Kuliah Basis Data. Skripsi, Universitas Sebelas MaretSurakarta.Https://Digilib.Uns.Ac.Id/Dokumen/Detail/103309/Analisis-Computational-Thinking-Mahasiswa-PTIK-UNS-Pada-Mata-Kuliah-Basis-Data.

Dyah Susilowati, Reny Refitaningsih Peby Ria, Rini Anggriani, Suci Indah Salsabila, Rifqi Aditia, & F. A. (2023). (2023). Peningkatan Kompetensi Guru STEM dalam Pembelajaran Informatika Berbasis HOTS dan Computational Thinking Guna Mendukung Implementasi Kurikulum Merdeka di MTsN I Mataram. Journal of Community Development, 5(3), 210–220. https://doi.org/10.47134/comdev.v5i3. Dyah Susilowati, Reny Refitaningsih Peby Ria, Rini Anggriani, Suci Indah Salsabila, Rifqi Aditia, & Fatahul Aziz. (2023).

Fenti Kumala Sari. (2023). (2023). Fenti Kumala Sari. (2023). Pola Kemampuan Computational Thinking Siswa SMA Di Era Digital. Skripsi. Universitas PGRI Semarang.

Herlina, L., & Rusdiana, D. (2020). (2020). Peningkatan kemampuan berpikir komputasional melalui pembelajaran berbasis proyek pada siswa SMA. Jurnal

Inovasi Pendidikan IPA, 6(2), 234–240. Peningkatan Kemampuan Berpikir Komputasional Melalui Pembelajaran Berbasis Proyek Pada Siswa SMA. Jurnal Inovasi Pendidikan IPA, 6(2), 234–240.

Irvan Malay. (2023). (2023). Irvan Malay. (2023). Analisis Kemampuan Berpikir Komputasi Mahasiswa Dalam Konteks Teknologi Informasi. Jurnal MESUISU, 7(1), 45–52.

Israwati Hamsar, Nur Fadhylah As, Rosidah, Muhammad Dwi Andika, & M. A. A. (2024). (2024). Analisis Kemampuan Computational Thinking Mahasiswa Teknik Informatika Dan Komputer. Jurnal Pendidikan Terapan, 2(2), 90–103. Https://Doi.Org/10.61255/Jupiter.V2i2.221.

Lestari, S. (2023). (2023). Analisis Kemampuan Berpikir Komputasional Matematis Siswa pada Materi Program Linear. RANGE: Jurnal Pendidikan Matematika, 4(2), 178–188. https://doi.org/10.32938/jpm.v4i2.3592. Analisis Kemampuan Berpikir Komputasional Matematis Siswa Pada Materi Program Linear. RANGE: Jurnal Pendidikan Matematika, 4(2), 178–188. Https://Doi.Org/10.32938/Jpm.V4i2.3592.

Mangiri, Y. F., & Prabawanto, S. (2024). . (2024). Pengembangan Berpikir Komputasional Mahasiswa melalui Pemrograman Berbasis Open Source. Jurnal Pendidikan Teknologi dan Kejuruan, 7(2), 110–118. https://journal.aspirasi.or.id/index.php/Semantik/article/view/1694. Pengembangan Berpikir Komputasional Mahasiswa Melalui Pemrograman Berbasis Open Source. Jurnal Pendidikan Teknologi Dan Kejuruan, 7(2), 110–118. Https://Journal.Aspirasi.or.Id/Index.Php/Semantik/Article/View/1694.

Putri, A. R. (2021). (2021). Putri, A. R. (2021). Pemanfaatan Scratch Untuk Meningkatkan Kemampuan Berpikir Kritis Mahasiswa Informatika. Jurnal Pendidikan Teknologi Informasi, 7(2), 134–142.

Sari, A. E. R. M. (2023). (2023). Sari, A. E. R. M. (2023). Analisis Kemampuan Computational Thinking (CT) Mahasiswa dalam Menyelesaikan Masalah Kontekstual pada Materi Pengantar Teori Probabilitas. Prosiding Mahasaraswati Seminar Nasional Pendidikan Matematika, 1(1), 45–52. https://e-jou. Analisis Kemampuan Computational Thinking (CT) Mahasiswa Dalam Menyelesaikan Masalah Kontekstual Pada Materi Pengantar Teori Probabilitas. Prosiding Mahasaraswati Seminar Nasional Pendidikan Matematika, 1(1), 45–52. Https://EJournal.Unmas.Ac.Id/Index.Php.

Tsubasa, K. (2006). (2006). Tsubasa, K. (2006). Pengembangan keterampilan berpikir komputasional dalam kurikulum pendidikan abad 21. Jakarta: Pustaka Pendidikan. Pengembangan Keterampilan Berpikir Komputasional Dalam Kurikulum Pendidikan Abad 21. Jakarta: Pustaka Pendidikan.

Wijaya, A. F., & Sujana, M. (2019). (2019). Wijaya, A. F., & Sujana, M. (2019). Pengembangan Instrumen Kuisioner Berpikir Komputasional Pada Siswa Sekolah Menengah. Jurnal Pendidikan Teknologi Dan Kejuruan, 25(2), 89–97.

Wing, J. M. (2016). (2016). . Computational thinking: 10 years later. Communications of the ACM, 59(11), 10–11. https://doi.org/10.1145/2979641. Computational Thinking: 10 Years Later. Communications of the ACM, 59(11), 1011.Https://Doi.Org/10.1145/2979641.