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Computer facilities, self-efficacy and computational thinking skills of MPLB students at SMKN 1 Boyolali

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Abstrak

Penelitian ini bertujuan untuk mengetahui Pengaruh Fasilitas Komputer dan Self Efficacy terhadap Computational Thinking Skill siswa. Penelitian ini menggunakan pendekatan kuantitatif korelasional, dengan teknik pengambilan sampel yang digunakan yaitu proportional stratified random sampling. Sampel yang digunakan dalam penelitian ini adalah 105 siswa dari kelas X dan XI jurusan Manajemen Perkantoran dan Layanan Bisnis SMK Negeri 1 Boyolali. Teknik pengumpulan data menggunakan kuesioner yang diadaptasi dari penelitian terdahulu. Teknik analisis data yang digunakan adalah PLS-SEM yang dianalisis dengan bantuan Smart-PLS versi 3.0. Temuan penelitian ini menunjukkan bahwa fasilitas komputer berpengaruh positif yang signifikan dalam meningkatkan computational thinking skill siswa sebesar 0,644. Sedangkan untuk Fasilitas komputer juga berpengaruh positif yang signifikan untuk meningkatkan self efficacy siswa sebesar 0,702. Temuan ini juga menunjukkan self efficacy memiliki pengaruh positif yang signifikan dalam meningkatkan computational thinking skill siswa sebesar 0,227. Temuan terakhir dalam penelitian ini juga menunjukkan self efficacy memiliki pengaruh positif yang signifikan dalam memediasi hubungan tidak langsung fasilitas komputer dalam meningkatkan computational thinking skill siswa sebesar 0,159. Hasil-hasil ini menunjukkan bahwa fasilitas komputer dan self efficacy sangat penting dalam meningkatkan computational thinking skill siswa, karena keseluruhan hasil analisis ini mendukung hipotesis yang diajukan.

Kata kunci : kemampuan kognitif; kondisi psikologi; PLS-SEM; teknologi komputer

Abstract

This study aims to examine the influence of computer facilities and self-efficacy on students' computational thinking skills. This research employed a quantitative correlational approach, using proportional stratified random sampling as the sampling technique. The sample consisted of 105 students from grades 10 and 11

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majoring in Office Management and Business Services at SMK Negeri 1 Boyolali. Data collection was conducted using a questionnaire adapted from previous studies. The data were analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM) with the assistance of Smart-PLS version 3.0. The findings indicated that computer facilities had a significant positive effect on improving students' computational thinking skills, with a coefficient of 0.644. Furthermore, computer facilities also had a significant positive effect on students' self-efficacy, with a coefficient of 0.702. The results also showed that self-efficacy had a significant positive influence on improving students' computational thinking skills, with a coefficient of 0.227. Lastly, the study revealed that self-efficacy significantly mediated the indirect relationship between computer facilities and students' computational thinking skills, with a coefficient of 0.159. These results demonstrate that computer facilities and self-efficacy are crucial factors in enhancing students' computational thinking skills, as the overall analysis supports the proposed hypotheses.

Keywords : cognitive ability; computer technology; PLS-SEM; psychological condition

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Introduction

In the 21st century, technological advancement is inevitable as science and technology continue to progress. Therefore, every individual must be able to adapt to the rapid development of information technology today. Technological progress has transformed the field of education and the learning process. In the current era of globalization, the use of information and communication technology in learning has become commonplace. With the internet, learning can take place under any circumstances and on a wide scale through tools such as email, chat, e-books, and e-libraries. Information can also be exchanged without having to meet the source directly (Akbar & Noviani, 2019).

Rapid global growth has led to changes in the education sector, where the modern education system today focuses on skills based on the need to prepare the younger generation to face complex and dynamic future challenges (Farid, 2024). One of the essential skills needed today is computational thinking skill (Mukhibin et al., 2024). Computational thinking skill promotes a systematic problem-solving approach, enabling students to break down complex problems into manageable parts. (Mendrofa, 2024). Computational thinking skills help students think more critically and creatively, communicate effectively, and collaborate to solve problems. It not only teaches logical, mathematical, and technical knowledge but also provides understanding of current technology, digitalization, and computerization, thereby fostering characteristics such as confidence, open-mindedness, tolerance, and environmental awareness (Ansori, 2020). Computational thinking does not mean thinking like a computer; rather, it refers to the way a person thinks when faced with a problem by constructing the problem into a computational form and then solving it with computational solutions, while also providing reasoning for why those solutions are chosen (Setyautami, 2020).

This highlights the importance of computational thinking skills for vocational high school students. Computational thinking skills are crucial for vocational students because they can improve their quality as skilled workers, thereby helping to enhance their hard skills through practical experience. (Yahya & Vitalocca, 2022). As shown in the study by (Aydeniz, 2018) computational thinking skills help students analyze data, make decisions, and solve complex problems.

Furthermore, research by (Agbo et al., 2023) also demonstrated that computational thinking skills in secondary education have a positive impact on students' academic achievement. The study found that computational thinking-based learning helps students attain higher scores on standardized tests and develop better problem-solving abilities.

Problems related to computational thinking skills occur at SMK Negeri 1 Boyolali, especially among students majoring in Office Management and Business Services. Based on the results of a preliminary survey, more than 35% of students answered incorrectly on computational thinking skill questions, particularly in the aspects of pattern recognition, abstraction, and problem-solving. In addition, 40% of students involved in the preliminary study answered questions incorrectly in the decomposition aspect. These preliminary survey results indicate that students' computational thinking skills are still not optimal.

One important factor influencing computational thinking skills is the use of technology. According to research conducted by (Fikriyah, 2022), several aspects show how technology usage affects students' computational thinking skills. Issues with the quality of computer facilities also occur at SMK Negeri 1 Boyolali, where the condition of computers used by students for practical learning activities is inadequate. Some computers are inoperable and cannot access the available internet network, causing students to take turns during practical sessions. This situation is considered less effective and efficient during the learning process.

Besides inadequate computer facilities, another factor influencing students' computational thinking skills is self-efficacy. Students majoring in Office Management and Business Services at SMK Negeri 1 Boyolali also face self-efficacy issues, particularly in using computer technology. In the learning process, self-efficacy plays an important role because it affects students' academic goals, performance, and self-regulation. However, the condition of students at SMK Negeri 1 Boyolali is different; these students lack confidence in operating computers, especially in using Microsoft Office software. This is mainly because most students have never operated a computer before, due to the absence of ICT subjects during their junior high school education or not owning personal computers. Nevertheless, some students do have their own laptops or computers at home.

This study is very important because computational thinking skills are one of the key skills needed in everyday life today. This research presents a novel contribution by exploring the relationship between computer facilities and self-efficacy, an area that has rarely been studied before. This study focuses on the direct relationships between computer facilities, self-efficacy, and their mediating effects on students' computational thinking skills. The findings are expected to provide new insights for developing more effective learning strategies to enhance students' self-efficacy and computational thinking skills

This study aims to: 1) determine whether computer facilities have an effect on the computational thinking skills of MPLB students at SMKN 1 Boyolali, 2) determine whether computer facilities have an effect on the self-efficacy of MPLB students at SMKN 1 Boyolali, 3) determine whether self-efficacy affects the computational thinking skills of MPLB students at SMKN 1 Boyolali, 4) determine whether computer facilities influence computational thinking skills through the mediation of self-efficacy among MPLB students at SMKN 1 Boyolali.

Research Methods

This study was conducted at SMK Negeri 1 Boyolali, located at Jalan Perintis Kemerdekaan No. 17, Dawungan Lor, Pulisen, Boyolali District, Central Java 57316. SMK Negeri 1 Boyolali was chosen as the research site because it has the specific problems to be studied, possesses the necessary information and data sources for the researcher, and has not previously been the subject of research involving similar variables. This study used a correlational research design with a quantitative approach because the researcher aimed to describe results in the form of factual and actual numerical data, processed using statistics, with the purpose of testing hypotheses regarding the influence between exogenous and endogenous variables.

The population in this study consisted of X and XI grade students majoring in Office Management and Business Services at SMK Negeri 1 Boyolali for the 2024/2025 academic year who took computer laboratory practice classes, excluding 12th grade students who were undergoing

Field Work Practice. Data processing and analysis were conducted using Smart-PLS version 3.0 software. The sampling technique used was proportional stratified random sampling, with a total sample of 105 respondents calculated based on Slovin's formula. The researcher employed this technique to ensure that samples from each class were proportionally represented according to the number of students, in order to obtain an accurate representation of the population studied and to ensure that the research results could be generalized. The results showed that all respondents completed all 16 statements submitted via Google Forms.

Data collection was conducted using a closed-ended instrument with a Likert scale ranging from 1 to 5, with response options from Strongly Agree to Strongly Disagree. In this case, respondents chose answers according to their actual conditions. The instrument used was adapted from previous research, utilizing all statement items that had been validated, with adjustments made to fit the conditions at the research location. Before distributing the instrument, a preliminary survey was conducted with 20 respondents who were not part of the research sample. The instrument for the computational thinking skill variable fully adapted statement items from the indicators by (Lemay et al., 2021), the computer facilities variable fully adapted statement items from the indicators by (Saadon & Liong, 2012), and the self-efficacy variable adapted statement items from the indicators by (Prasetiyo et al., 2021).

There are three tests conducted, namely the measurement model test (outer model), which includes convergent validity, discriminant validity, and reliability tests. In this study, the researcher used validity tests to measure the validity of the research instruments according to the research objectives, while still considering the evaluation results of the outer model tests. Next, the structural model test (inner model) was performed, which includes R-square (R^2), predictive relevance (Q^2), and the Variance Inflation Factor (VIF) test to report multicollinearity and determine whether each exogenous variable has a correlation relationship. After the data met the prerequisite tests, hypothesis testing was conducted using the Bootstrapping method to obtain the t-statistic and p-value.

Result and Discussion

Research Result

Outer Model Test

1. **Convergent Validity and Reliability Test**

Table 1

Result of Convergent Validity and Reliability Test

Variable	Item	Loading	Cronbach's Alpha	Composite Reliability	AVE
Computational Thinking skill (CTS)	CTS1	0.812	0.796	0.861	0.554
	CTS2	0.750			
	CTS3	0.652			
	CTS4	0.713			
	CTS5	0.784			
Computer Facilities (FK)	FK1	0.738	0.824	0.872	0.533
	FK2	0.711			
	FK3	0.675			
	FK4	0.676			
	FK5	0.799			
	FK6	0.775			
Self Efficacy (SE)	SE1	0.724	0.759	0.835	0.503
	SE2	0.703			
	SE3	0.633			
	SE4	0.744			
	SE5	0.737			

Data analysis using PLS-SEM was conducted in three stages: (1) measurement model testing (outer model), (2) structural model testing (inner model), and (3) hypothesis testing.

Based on the findings in Table 1, the highest loading factor value was found for the CTS1 indicator at 0.812, which exceeds the threshold of 0.500. All indicator loadings (in bold) for each construct were also higher than their cross-loadings on other constructs. The Average Variance Extracted (AVE) score in a model must be greater than 0.50 to be considered valid (Hair et al., 2019). The AVE scores in this study were 0.554 for computational thinking skills, 0.533 for computer facilities, and 0.503 for self-efficacy. All AVE scores exceeded 0.50, thus meeting the confirmatory validity criteria and confirming the validity of the indicators. Discriminant validity can also be evaluated using the Fornell-Larcker Criterion, where the square root of the AVE for each construct must be greater than its correlations with other constructs.

Internal consistency reliability was assessed using Cronbach's alpha (α) and Composite Reliability (CR), with thresholds of $\alpha > 0.700$ and $CR > 0.708$ (Hair et al., 2019). The results show Composite Reliability values ranging from 0.835 to 0.872, indicating that approximately 80% of each latent variable's variance is true score variance, while the remainder is error variance. This indicates that all latent variables in this study have relatively low measurement bias. Additionally, the Cronbach's alpha (α) values for computational thinking skills, computer facilities, and self-efficacy were all above 0.7. These findings demonstrate strong internal consistency among the indicators, supporting the conclusion that the measurement instruments used in this study are both valid and reliable.

The results for item loadings, AVE, Composite Reliability, and Cronbach's alpha indicate that the measurement model meets the required reliability and validity criteria. Each construct CTS (Computational Thinking Skills), FK (Computer Facilities), and SE (Self-Efficacy) demonstrates strong internal consistency and convergent validity, providing a solid foundation for further structural analysis.

2. **Discriminant Validity Test**

Discriminant validity can be evaluated by examining cross-loadings; when the cross-loading of an indicator on its own construct is greater than all cross-loadings on other constructs, discriminant validity is established. Discriminant validity was also assessed using the Fornell-Larcker Criterion, which requires that the square root of the AVE for each construct be greater than its correlations with other constructs.

Table 2

Fornell-Larcker Criterion

	CTS	FK	SE
CTS	0.744		
FK	0.806	0.730	
SE	0.681	0.702	0.709

Note:
CTS : Computational Thinking Skill
FK : Computer Facilities
SE : Self Efficacy

Table 2 shows the results of the Fornell-Larcker Criterion, confirming that discriminant validity is acceptable for this measurement model and supports discriminant validity between constructs (Hamid et al., 2017).

Inner Model Test

The structural model is used to predict causal relationships between the variables involved. This test examines the R^2 score, or the coefficient of determination, for the constructs. The R^2 value indicates how much the exogenous variables explain the variation in the endogenous variable, with values ranging between 0 and 1. The higher the R^2 value of the exogenous variables in the model, the better the model explains the endogenous variable.

Table 3
R^2 dan Q^2

Variabel endogen	R^2	R^2 Adjusted	Q^2
CTS	0.676	0.669	0.355
SE	0.492	0.487	0.228

In Table 3, the R^2 values for computational thinking skill and self-efficacy are 0.676 and 0.492, respectively. This indicates that 67.6% of the variability in computational thinking skill can be explained by computer facilities and self-efficacy, while the remaining 32.4% is explained by other variables outside the research model. Meanwhile, for the self-efficacy variable, 49.2% of its variability is explained by the variability of the computer facilities variable, with the remaining 50.8% explained by other variables outside the research model.

The predictive model test was conducted by calculating the Q^2 value. The predictive model value describes how well the exogenous variables predict the endogenous variables within the structural model. A Q^2 value greater than 0 indicates predictive relevance of the model. Specifically, a Q^2 value of 0.02 indicates small predictive relevance, 0.15 indicates medium predictive relevance, and 0.35 indicates large predictive relevance (Hair et al., 2019). In this study, the Q^2 value for computational thinking skill is 0.355, which indicates a large predictive relevance for the model since the Q^2 score is greater than 0. Meanwhile, the Q^2 value for self-efficacy is 0.228, indicating a medium predictive relevance, also because the Q^2 score is above 0.

After analyzing the predictive model values in this study, the next step is to report collinearity based on the VIF scores. The VIF test is conducted to determine whether each exogenous variable has a correlation relationship.

Table 4
VIF Values

	CTS	FK	SE
CTS			
FK	1.970		1.000
SE	1.970		

Collinearity becomes a concern if the VIF value exceeds 3.000 (Hair et al., 2019). In Table 4, computer facilities as a predictor of computational thinking skill has a VIF of 1.970. Computer facilities as a predictor of self-efficacy has a VIF of 1.000. Self-efficacy as a predictor of computational thinking skill has a VIF of 1.970. Based on these findings, collinearity is not an issue in this study because all VIF values are below 3.000, indicating that the indicators do not experience multicollinearity problems.

Hypothesis Testing

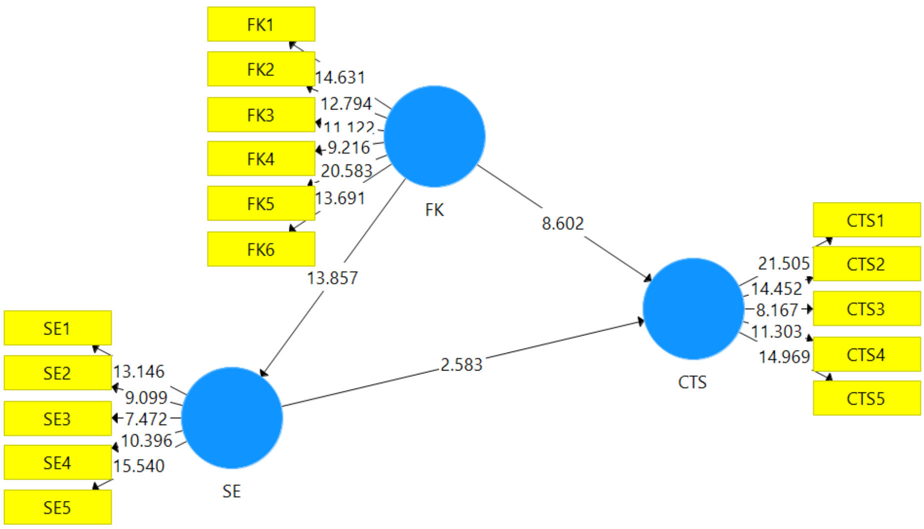
The hypothesis testing results were obtained through the Path Coefficient using the Bootstrapping technique in the Smart-PLS software. The significance level applied for the p-value must be below 5% or < 0.05 for all hypotheses in the study to be accepted. Meanwhile, the significance between constructs is determined by the t-statistic value, with a rejection and acceptance threshold of 1.96. If the t-statistic value is less than 1.96, the hypothesis is rejected.

Table 5
Hypothesis Testing

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
FK -> CTS	0,647	0,644	0.075	8.602	0.000
FK -> SE	0,702	0,709	0.051	13.857	0.000
SE -> CTS	0,227	0,231	0.088	2.583	0.010
FK -> SE -> CTS	0,159	0,164	0.064	2.507	0.012

Based on the findings in Table 5, all hypotheses are accepted, namely: H1: Computer facilities have a significant positive effect on computational thinking skill (t-statistic = 8.602; p-value = 0.000). H2: Computer facilities have a significant positive effect on self-efficacy (t-statistic = 13.857; p-value = 0.000). H3: Self-efficacy has a significant positive effect on computational thinking skill (t-statistic = 2.583; p-value = 0.010). H4: Computer facilities have a significant positive effect on computational thinking skill through mediation by self-efficacy (t-statistic = 2.507; p-value = 0.012)

Figure 1
Final Mode



Based on the hypothesis testing results, there is a significant positive effect of computer facilities on students' computational thinking skills, as shown in Figure 1. This hypothesis is accepted, as evidenced by a t-statistic value of 8.602, which is greater than 1.96, and a p-value of 0.000, which is less than 0.05. The regression coefficient obtained is 0.647, indicating that computer facilities and computational thinking skills have a positive or direct relationship. This means that if computer facilities increase by one unit, computational thinking skills will also increase by 64.7%, and vice versa. These findings demonstrate that computer facilities play an important role in enhancing students' computational thinking skills. Adequate computer facilities, when optimally utilized, assist students in mastering computer operation, which impacts their ability to think critically, creatively, cooperatively, and solve problems all of which are essential components of computational thinking skill indicators. In this digital era, the ability to operate computers is becoming increasingly relevant and important across various activities and objectives. This finding aligns with previous studies conducted by Mukhibin (2024) and Juškevičiene & Dagiene (2018), which found that access to technology and programming activities significantly promote the improvement of computational thinking skills, especially through the use of computer-based software that helps students practice and develop their computational thinking skills more effectively.

The second hypothesis in this study states that there is a significant positive effect of computer facilities on self-efficacy. This hypothesis is accepted, as evidenced by a t-statistic value of 13.857, which is greater than 1.96, and a p-value of 0.000, which is less than 0.05. The regression coefficient obtained is 0.702, indicating that computer facilities and self-efficacy have a positive or direct relationship. This means that if computer facilities increase by one unit, self-efficacy will also increase by 70.2%, and vice versa. This implies that the better the computer facilities used, the higher the level of confidence or self-efficacy possessed. Thus, these findings indicate that computer facilities play an important role in enhancing an individual's self-efficacy. Individuals with good computer facilities tend to have better mastery in operating computer technology, which results in higher self-efficacy compared to those who do not have adequate computer facilities. These results align with the findings of Qureshi (2016), which show that individuals with high self-efficacy tend to adapt more easily to the use of computer technology.

The third hypothesis in this study states that there is a significant positive effect of self-efficacy on students' computational thinking skills. This hypothesis is accepted, as evidenced by a t-statistic value of 2.583, which is greater than 1.96, and a p-value of 0.010, which is less than 0.05. The regression coefficient obtained is 0.227, indicating that self-efficacy has a positive or direct effect on computational thinking skills. This means that if self-efficacy increases by one unit, computational thinking skills will also increase by 22.7%, and vice versa. This implies that the higher the self-efficacy possessed, the more optimal the computational thinking skills will be. Thus, these findings indicate that self-efficacy plays an important role in an individual's computational thinking skills. Individuals with high self-efficacy tend to have strong confidence in solving complex problems, mastery of critical and creative thinking skills, and high persistence in seeking solutions. These characteristics strongly support the enhancement of computational thinking skills, which require systematic problem-solving abilities. This finding aligns with studies conducted by Başaran & İlter (2023) and Mukhibin (2024), which show that individuals with high levels of self-efficacy usually possess superior computational thinking skills, as these skills are an essential component of problem-solving abilities in today's modern era.

The fourth hypothesis in this study states that there is a significant positive indirect effect of computer facilities on computational thinking skills through self-efficacy. This hypothesis is accepted, as evidenced by a t-statistic value of 2.507, which is greater than 1.96, and a p-value of 0.012, which is less than 0.05. The regression coefficient obtained is 0.159, indicating that computer facilities have a positive or direct effect on computational thinking skills mediated by self-efficacy. An increase of one unit in computer facilities will increase computational thinking skills through self-efficacy by 15.9%. This implies that self-efficacy has an indirect influence in the relationship between computer facilities and computational thinking skills. Individuals with high self-efficacy in operating computer technology tend to be more creative, critical, cooperative, and structured in problem-solving, which are essential components of computational thinking skills. These findings align with Qureshi (2016), who found that good computer facilities support students in practicing and mastering technology, thereby boosting their confidence in completing tasks. Additionally, Mukhibin (2024) found that high levels of self-efficacy motivate students to be more optimistic, persistent, and systematic in solving problems based on computational thinking skills.

Conclusion

Based on the results of this study, the following conclusions can be drawn (1) There is a significant positive effect of computer facilities on the computational thinking skills of MPLB students at SMK Negeri 1 Boyolali. The better the quality of computer facilities used and the more proficient individuals are in operating computer technology, the higher the students' level of computational thinking skills. (2) There is a significant positive effect of computer facilities on the self-efficacy of MPLB students at SMK Negeri 1 Boyolali. The better the computer facilities used, the higher the self-efficacy in mastering computer technology (3) There is a significant positive effect of self-efficacy on the computational thinking skills of MPLB students at SMK Negeri 1 Boyolali. The higher the self-efficacy possessed, the higher the level of computational thinking skills in each student (4) There is a significant positive indirect effect of computer facilities on computational thinking skills through self-efficacy among MPLB students at SMK Negeri 1 Boyolali. Self-efficacy in using computer technology helps improve students' computational thinking skills. This study has limitations that can be used as evaluation material for future research to produce better results. Suggestions for the school principal include providing better facilities to support teaching and learning activities, especially for computer practice in the computer laboratory, regularly monitoring the maintenance of computer equipment through reporting, and improving the performance of the school's internet network. For MPLB teachers, it is recommended to design learning strategies that encourage soft skills and the development of self-efficacy, stimulate creative skills, and provide constructive feedback to enhance computational thinking skills. Teachers should vary teaching methods to avoid monotony and boredom among students. Additionally, teachers need to pay more attention to students who have difficulty understanding the material during the learning process to provide more intensive guidance. For future research, it is expected to analyze other variables that potentially influence computational thinking skills. Discussions and studies should be expanded to explore other factors that can enrich this phenomenon, such as critical thinking or social and cultural factors affecting computational thinking skills. Furthermore, it is also recommended to broaden the research population and sample to obtain more representative results.

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