

STRATEGIES TO ENHANCE CRITICAL THINKING AND PROBLEM-SOLVING IN VOCATIONAL SCHOOLS

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ABSTRACT

This study aims to determine the influence of critical thinking skills and participation in extracurricular activities on students problem-solving ability at SMK Negeri 40 Jakarta. The research employed a quantitative method with a survey approach. The sample consisted of 72 respondents selected through non-probability sampling using the saturated sampling technique. Data were analyzed using multiple linear regression. The results show that critical thinking skills and participation in extracurricular activities simultaneously have a significant effect on students problem-solving ability, with a coefficient of determination (R^2) of 58.7%. Partially, critical thinking skills significantly influence problem-solving ability, especially in the indicator of building basic skills. Participation in extracurricular activities also shows a significant influence, with mental engagement being the most dominant indicator. These findings support the theory that adequate critical thinking skills and consistent participation in extracurricular activities can enhance students ability to solve problems.

Keywords: Critical thinking skills, Participation in extracurricular activities, Problem solving ability, Vocational High School

ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh keterampilan berpikir kritis dan partisipasi dalam kegiatan ekstrakurikuler terhadap kemampuan pemecahan masalah siswa di SMK Negeri 40 Jakarta. Metode yang digunakan adalah kuantitatif dengan pendekatan survei. Sampel penelitian berjumlah 72 responden yang dipilih melalui teknik nonprobability sampling dengan pendekatan sampling jenuh. Teknik analisis data yang digunakan yaitu regresi linear berganda. Hasil penelitian menunjukkan bahwa keterampilan berpikir kritis dan partisipasi dalam kegiatan ekstrakurikuler secara simultan berpengaruh signifikan terhadap kemampuan pemecahan masalah siswa, dengan nilai koefisien determinasi (R^2) sebesar 58,7%. Secara parsial, keterampilan berpikir kritis berpengaruh signifikan terhadap kemampuan pemecahan masalah, terutama pada indikator membangun keterampilan dasar. Partisipasi dalam kegiatan ekstrakurikuler juga memberikan pengaruh signifikan, dengan keterlibatan mental sebagai indikator dominan. Temuan ini mendukung teori bahwa keterampilan berpikir kritis yang baik serta partisipasi aktif dalam kegiatan ekstrakurikuler dapat mengembangkan kemampuan pemecahan masalah siswa.

Kata kunci: Keterampilan berpikir kritis, Partisipasi dalam kegiatan ekstrakurikuler, Kemampuan pemecahan masalah, Sekolah Menengah Kejuruan

INTRODUCTION

Problem-solving skills are essential in the 21st century, recent educational frameworks emphasize that vocational students must be equipped not only with technical skills, but also with adaptive cognitive and behavioral competencies. Critical thinking and collaboration are foundational 21st-century skills that directly support career readiness and employability in technical and vocational education and training environments. However, international assessments such as PISA and PIAAC have reported a significant decline in these skills globally, including in Indonesia. This issue is partly due to instructional approaches that emphasize memorization over critical thinking, as well as students increasing reliance on digital tools, which can hinder independent and creative thinking.

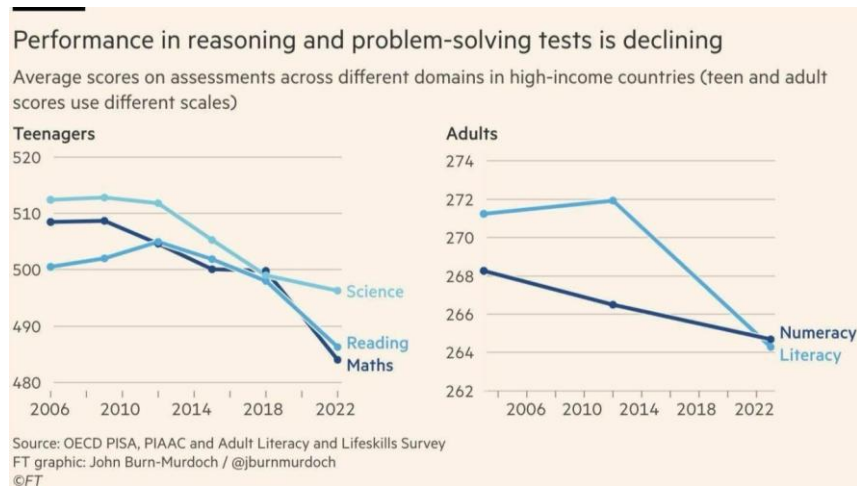


Figure 1. Decreased Reasoning and Problem-Solving Performance
Source: OECD PISA, PIAAC, and Adult Literacy and Lifeskills Survey (2023)

The Figure 1 shows the decline in average scores in problem-solving and reasoning skills among adolescents and adults in high-income countries. It shows that from 2006 to 2022, there is a significant downward trend in average scores, especially after 2018. This decline reflects the global challenge of maintaining and improving critical thinking and problem-solving skills in today's digital age. A similar phenomenon was observed at Vocational High School 40 Jakarta. During a teaching practicum, the researcher found that many students lacked initiative in completing tasks independently and frequently sought immediate help from teachers. This indicates underdeveloped critical thinking and problem-solving abilities in real-life academic settings.

Although asking questions is a natural part of the learning process, this phenomenon reflects a lack of initiative and fighting power in solving simple problems, as well as a lack of courage to experiment with alternative solutions first. This habit shows a weakness in problem-solving skills which, if not addressed immediately, can have an impact on students' readiness when dealing with obstacles in the work environment as well as in everyday life. Critical thinking and participation in extracurricular activities are believed to be two key factors that support students problem-solving skills. Muarifa et al. (2023) found that critical thinking significantly influences problem-solving abilities. Likewise, Arminsyah and Kunaenih (2023) showed that extracurricular activities foster soft skills such as logical thinking, communication, and teamwork.

Despite the growing body of literature highlighting the importance of critical thinking and extracurricular activities in student development, most studies tend to examine these variables separately. Limited research has explored their combined effect on problem-solving ability, particularly within vocational school contexts in Indonesia. This indicates a gap in

understanding how cognitive skills and student engagement interact in shaping practical problem-solving competencies. Therefore, this study aims to analyze the influence of critical thinking skills and participation in extracurricular activities on students' problem-solving abilities and to provide more comprehensive insights into the factors that simultaneously support vocational students' readiness to face real-world challenges. Meanwhile, the novelty of this study lies in the simultaneous examination of critical thinking skills and extracurricular participation as predictors of students' problem-solving ability. Conducted at the vocational high school level (grade X and XI, Office Management major) using a quantitative approach and census method.

LITERATURE REVIEW

Critical Thinking Skills

According to Robert Ennis (Misfalla, 2020), a well-known expert in the development of the critical thinking tradition, argues that critical thinking is a rational and reflective thinking process and is directed at determining actions and beliefs that must be taken. Critical thinking can be easily achieved if individuals have the drive, potential, and personality skills of critical thinking. Then philosophers such as Socrates, Plato, and Aristotle (Rahardhian, 2022) state that critical thinking skills are skills to ask, test, and reflect on ideas and values. Thus, critical thinking skills can be defined as a person's ability that plays a role in the process of solving problems, seeking information, and making decisions. It includes indicators such as providing simple explanations, building basic skills, inferring, making further explanations, strategies, and evaluation.

Critical thinking skills are an important element in education, related to Bloom's Taxonomy Theory revised by Anderson and Krathwohl 2001, which includes six levels of thinking, such as memorizing, interpreting, applying, describing, assessing, and creating (Wiranata et al., 2021). Meanwhile, the critical thinking framework according to Paul-Elder emphasizes the significance of analysis, evaluation, and synthesis in solving a problem, in line with Bloom's Taxonomy (Metzgar, 2023). This combined concept of critical thinking and Bloom's updated Taxonomy provides a foundation for curriculum development that is appropriate in today's education and improves problem-solving skills and designs more efficient evaluations. Recent research by Asrowi et al. (2025) found that vocational students often struggle with critical thinking in hybrid learning environments, indicating a strong need for strategies that promote higher-order thinking in technical education settings.

Participation in Extracurricular Activities

Participation in extracurricular activities means that students actively participate in activities outside the classroom. Keith Davis (Apriliyanto, 2020) assumes that participation in extracurricular activities is a person's emotional and psychological contribution to the context of a set that motivates him to participate and be responsible for achieving the goals of a group. Meanwhile, according to Madrie (Hutagalung, 2022), student participation in extracurricular activities is when students are involved in processes and activities and gain knowledge, whether it is carried out by a community or organization.

Referring to the explanation above, participation in extracurricular activities can be interpreted as students' active involvement in outdoor activities influenced by interest, talent, and self-confidence, as well as family, school, and peer support. With support from the surrounding environment and structured school programs, these activities certainly contribute greatly to the development of students' skills, behavior, and psychomotor skills. Jean Piaget and Lev Vygotsky's theory of constructivism emphasizes that students develop knowledge through experience and social interaction (Agustyaningrum et al., 2022). Piaget emphasized personal cognitive development through various stages, while Vygotsky emphasized the

significance of social and cultural contexts that demonstrate learning assistance from others and peers. The Experiential Learning Theory proposed by Kolb is also relevant as it states that learning takes place through direct experience and reflection. Participation in extracurricular activities provides students with opportunities to practice critical thinking, collaboration, and decision-making, which are important components of problem-solving skills. Participation in extracurricular activities indirectly develops students' more critical mindset when facing problems.

Problem Solving Ability

According to Krulik and Rudnick (Erlina, 2022) explain problem solving ability as an effort that utilizes insight, ability, and understanding to find solutions to problems. Then George Polya in 1973 (Agusta, 2020) expressed an opinion about problem solving ability as a very high form of intellectual activity, namely an attempt to get a solution to the problem at hand by utilizing various knowledge that is already owned. There is also an opinion according to Saad & Ghani (Shodiqin et al., 2020), namely a process that has been planned, then implemented to get a certain solution to a problem.

Based on the opinions of experts, it can be concluded that problem solving ability is a person's ability to analyze information, evaluate, and carry out effective solution recommendation strategies. This ability is influenced by several kinds of indicators, such as understanding the problem, formulating a problem, planning a solution, solving the problem according to the plan, re-examining the results, describing the results, and formulating problem solving recommendations. For the theory used on the problem-solving ability variable is the Polya Problem Solving Model, introduced by George Polya in 1945 which describes four main steps, namely problem identification, solution planning, action implementation, and review of results. These steps provide a systematic framework for students to deal with problems, especially in mathematics, and studies indicate that the use of Polya's theory provides a real improvement in student learning outcomes (Nasir & Syartina, 2021).

Referring to the conceptual description and theoretical basis underlying this study, the research hypothesis can be organized with the following scheme (Figure 2).

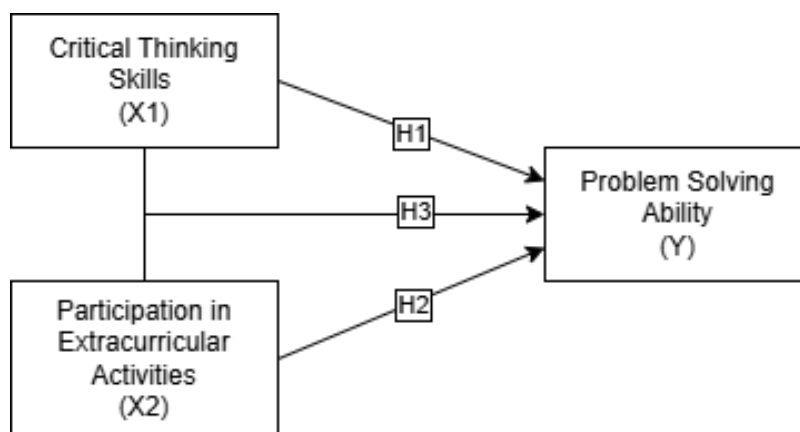


Figure 2. Research Constellation
 Source: Data Processed by Researchers

H1: Critical thinking skills affect student's problem-solving ability

H2: Participation in extracurricular activities affects student's problem-solving ability

H3: Critical thinking skills and participation in extracurricular activities influence in improving students' problem-solving ability

METHOD

The method used in this research is quantitative method, which refers to the positivistic paradigm and is used to study certain populations or samples. This method collects data with research instruments and analyzes it quantitatively in order to test the hypotheses that have been formulated previously. Thus, this research involves independent and dependent variables, each of which has an influence on the dependent variable. Meanwhile, the approach used is description or survey, to compile a structured, objective, and reliable analysis of the characteristics of a particular population (Sugiyono, 2018)

This study applies a non-probability sampling technique with a census or saturated sampling approach, which uses all members of the population as respondents because the population is less than 100 people. Although rarely used in a study, saturated or census sampling techniques can achieve a high level of data accuracy. The data collected in this study was obtained by distributing questionnaires to participants, containing a series of questions that have been carefully designed by utilizing a Likert scale. Each answer on an instrument that uses a Likert scale consists of response options that range from strongly agree to strongly disagree.

All data from the questionnaires obtained through Microsoft forms were analyzed using the SPSS version 23 program with descriptive and regression statistical methods, then the results were processed into Microsoft Excel. The descriptive statistical approach was used to describe the characteristics of respondents and the distribution of variables, while regression analysis was used to test the hypothesis.

RESULTS AND DISCUSSION

Validity and Reliability Test

In this study, the number of samples was 72 respondents, so the value $(df) = n - 2$, namely $(df) = 72 - 2$, therefore the r-table value with df 70 and a significance level of 5% or 0.05 is 0.232. After testing, the results show that each statement item has an r-count value greater than the r-table of 0.232, so it can be concluded that each statement from the indicator for the critical thinking skills variable, participation in extracurricular activities, and problem-solving ability is valid and suitable for use as data in a study. Based on Table 1, it can be stated that the critical thinking skills variable has a Cronbach alpha value of 0.712 or 71.2%, while the participation in extracurricular activities variable has a Cronbach alpha value of 0.728 or 72.8%, and the problem-solving ability variable has a Cronbach alpha value of 0.686 or 68.6%. All variables in this study have a value greater than the Cronbach alpha value of 0.60. Therefore, all variables can be said to be reliable and suitable for use as data in a study.

Table 1. Reliability Test Results

Variable	Cronbach's Alpha	Criteria	N of Items	Description
Critical Thinking Skills (X1)	0,712	0,60	12	Reliable
Participation in Extracurricular Activities (X2)	0,728	0,60	19	Reliable
Problem Solving Ability (Y)	0,686	0,60	15	Reliable

Source: Data Processed by Researchers

Normality Test

The results of the normality test that have been carried out in accordance with Table 2 above show that the Kolmogorov-Smirnov value is 0.081 and the Asymp. Sig (2-tailed) or its significance is 0.200, which means that the data in this study are declared normally distributed.

Table 2. Normality Test Results

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		72
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	3.26706875
Most Extreme Differences	Absolute	.081
	Positive	.081
	Negative	-.069
Test Statistic		.081
Asymp. Sig. (2-tailed)		.200 ^{c,d}

Source: Data Processed by Researchers

Multicollinearity Test

Table 3 shows that the tolerance value of each variable in this study is greater than 0.1, namely the tolerance value of the critical thinking skills variable (X1) and participation in extracurricular activities (X2) of 0.959. Meanwhile, the VIF value of the critical thinking skills variable (X1) and participation in extracurricular activities (X2) is 1.043, so it can be concluded that each variable does not occur multicollinearity in the regression model.

Table 3. Multicollinearity Test Results

Coefficients ^a			
Model		Collinearity Statistics	
		Tolerance	VIF
1	Critical Thinking Skills	.959	1.043
	Participation in Extracurricular Activities	.959	1.043

a. Dependent Variable: Problem Solving Ability

Source: Data Processed by Researchers

Heteroscedasticity Test

Based on Table 4 of the heteroscedasticity test results above, the significance value of the critical thinking skills variable is 0.148 and the participation variable in extracurricular activities is 0.933. These values are of course > 0.05, which means that this regression model does not occur heteroscedasticity, therefore it is considered suitable for use in a study.

Table 4. Heteroscedasticity Test Results

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	-1.878	2.512		-.748	.457
X1	.105	.055	.230	1.909	.060
X2	.003	.030	.010	.084	.933

a. Dependent Variable: ABS RES

Source: Data Processed by Researchers

Multiple Linear Regression

In accordance with Table 5, there is a value in column B, where the first row shows the constant (α) and the subsequent rows show the independent variables. By referring to the table, a multiple linear regression equation can be arranged as follows: $Y = 10,475 + 0,770X1 + 0,124X2 + e$. Therefore, it can be concluded that the b1 value or the X1 regression coefficient value of 0.770 indicates that critical thinking skills have a positive influence on problem

solving ability and the b2 value or X2 regression coefficient value of 0.124 indicates participation in extracurricular activities has a positive influence on problem solving ability.

Table 5. Multiple Linear Regression Analysis Results

Model	Coefficients ^a				
	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
1 (Constant)	10.475	3.990		2.625	.011
Critical Thinking Skills	.770	.087	.697	8.820	.000
Participation in Extracurricular Activities	.124	.048	.206	2.601	.011

a. Dependent Variable: Problem Solving Ability

Source: Data Processed by Researchers

Partial Test (T Test)

Based on the test results in accordance with Table 6, to get the t-table value the researcher uses the formula $t(\alpha/2; n-k-1) = t(0.05/2; 72-2-1) = t(0.025; 69)$ so that the t-table value is 1.995. The critical thinking skills variable (X1) shows a t value of 8.820 which is greater than the t table value of 1.995 and has a significance value of 0.000 which is smaller than the significance value of 0.05. b. The variable of participation in extracurricular activities (X2) shows a t value of 2.601 which is greater than the t table value of 1.995 and has a significance value of 0.011 which is smaller than the significance value of 0.05. So, it can be concluded that if critical thinking skills and participation in extracurricular activities, together have a significant effect on problem solving ability.

Table 6. Partial Test Results (T Test)

Model	Coefficients ^a				
	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
1 (Constant)	10.475	3.990		2.625	.011
Critical Thinking Skills	.770	.087	.697	8.820	.000
Participation in Extracurricular Activities	.124	.048	.206	2.601	.011

a. Dependent Variable: Problem Solving Ability

Source: Data Processed by Researchers

Simultaneous Test (F Test)

Table 7 shows that the calculated f value is 48.946 and the significance value is 0.000. Then the value of f table obtained from the formula $df(N1) = k-1 = 3-1 = 2$ and $df(N2) = n-k = 72-3 = 69$, then the value of f table obtained is 3.13. So it can be explained that the significance value is $0.000 < 0.05$ and the calculated f value is $48.946 > 3.13$, which means H_0 is rejected and H_a is accepted. So, it can be concluded that the independent variables of critical thinking skills and participation in extracurricular activities simultaneously have a significant influence on the problem-solving ability variable.

Table 7. Simultaneous Test Results (F Test)

Model	ANOVA ^a				
	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1075.151	2	537.575	48.946	.000 ^b
Residual	757.835	69	10.983		
Total	1832.986	71			

a. Dependent Variable: Y

b. Predictors: (Constant), X2, X1

Source: Data Processed by Researchers

Test of the Coefficient of Determination (R^2)

In accordance with table 8 of the coefficient of determination (R^2) test results above, it can be seen that the R-square value for the independent variable is 0.587, which means that the independent variable of critical thinking skills and participation in extracurricular activities contributes 58.7% to affect the dependent variable of problem-solving ability.

Table 8. Test Results of the Coefficient of Determination (R^2)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.766 ^a	.587	.575	3.314

a. Predictors: (Constant), X2, X1

Source: Data Processed by Researchers

Discussion

Effect of Critical Thinking Skills (X1) on Problem Solving Ability (Y)

Based on the results of the hypothesis test, namely the partial test (t test) that has been carried out, the t-count value of the critical thinking skills variable is $8.820 >$ the t table value of 1.995 and has a significance value of $0.000 < 0.05$. In conclusion, critical thinking skills are proven to have a significant effect on problem solving ability. The results of the current study are in line with the research of Muarifa et al. (2023) which states that critical thinking skills have a significant effect on problem solving ability. In the research he conducted, a t-count value of 4.925 was obtained with a significance value of $0.000 < 0.05$, which means that the hypothesis is accepted. The higher the critical thinking skills possessed by students, the higher their ability to digest conditions and find effective solutions to problems. These findings are also supported by Gelerstein et al. (2023), who emphasized that instructional designs focused on cognitive engagement significantly enhance critical thinking in vocational learners, particularly when integrated with real-world problem contexts. Critical thinking skills are skills that allow students to analyze problems that occur, then evaluate them, and then develop logical and systematic solutions to these problems. If students have good critical thinking skills, they will be more able to solve problems effectively.

Effect of Participation in Extracurricular Activities (X2) on Problem Solving Ability (Y)

Based on the results of the hypothesis test, namely the partial test (t test) that has been carried out, the t-count value of the participation variable in extracurricular activities is $2.601 >$ the t table value of 1.995 and has a significance value of $0.011 < 0.05$. In conclusion, participation in extracurricular activities is proven to have a significant effect on problem solving ability. The results of the current study are in line with the research of Prabowo and Yuhelma (2023) which states that participation in extracurricular activities has a significant effect on problem solving ability through student learning discipline. Based on statistical tests, a t-count value of $3.070 >$ t-table 2.002 and a significance value of $0.003 < 0.05$ were obtained, which shows a positive and significant effect. The more often students are involved in extracurricular activities, the better their ability to face and solve various problems. Similarly, Sartori et al. (2022) demonstrated that reflective extracurricular programs, when combined with media literacy and critical discourse, significantly improve students' decision-making and adaptive thinking in VET programs across Europe. Participation in extracurricular activities provides an interactive learning experience (Yulianti et al., 2023). Students become accustomed to dealing with challenges, making decisions, and working together in solving problems.

The Effect of Critical Thinking Skills (X1) and Participation in Extracurricular Activities (X2) on Problem Solving Ability (Y)

Based on the results of simultaneous test hypothesis testing (f test), the f-count value is $48.946 > 3.13$ and a significance of $0.000 < 0.05$, which means H_0 is rejected and H_a is accepted. So, it can be concluded that the independent variables of critical thinking skills and participation in extracurricular activities simultaneously have a significant influence on the problem-solving ability variable. In addition, the R-square value obtained from testing the coefficient of determination (R^2) for the independent variable is 0.587, which means that the independent variable of critical thinking skills and participation in extracurricular activities contributes 58.7% to influence the dependent variable of problem-solving ability. Research by Lestari et al. (2020) showed that 58.34% of vocational students in an automotive engineering program had low critical thinking skills with 5.56% classified as very low. These comparable trends indicate that the challenge in developing critical thinking remains persistent in vocational settings, reinforcing our finding that when critical thinking skills and extracurricular participation develop in tandem, student problem-solving ability improves significantly.

CONCLUSION AND RECOMMENDATION

Conclusion

Critical thinking skills and participation in extracurricular activities simultaneously have a significant effect on the problem-solving ability of students of Vocational High School 40 Jakarta with a contribution of 58.7%. This shows that the development of problem-solving abilities in students is not only influenced by students' critical thinking skills, but also followed by students' experiences gained from their contribution to extracurricular activities. This reflects that students who are actively involved tend to show their commitment to the extracurricular activities they participate in, so the greater the opportunity for students to develop their skills and abilities such as problem solving.

Recommendation

Based on the results of the descriptive analysis in this study, there are still indicators of each variable whose values are relatively low compared to other indicators. Therefore, the researcher provides several suggestions that can improve future research, such as teachers are advised to familiarize students with problem-solving strategies through logical thinking exercises. That way, students will feel helped in developing their thinking skills to face various challenges or problems that exist. Then for extracurricular coaches, it is recommended that they be more active in instilling disciplinary values to students, for example by conducting an activeness assessment system, as well as providing responsibility and rewards for participants who show consistency.

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