

The Relationship Between Critical Thinking and Problem-Solving Skills Among Vocational College Technical Students

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DOI: <https://doi.org/10.30880/ojtp.2024.09.02.013>

Article Info

Received: 15 July 2024
Accepted: 09 September 2024
Available online: 30 September 2024

Keywords

Critical thinking, problem solving skills, technical and vocational education, relationships, vocational colleges

Abstract

This study aims to examine the relationship between critical thinking and problem-solving skills among technical students at Vocational Colleges. Using a descriptive survey research approach with a questionnaire instrument, the study sample consisted of 271 final year technical students from Batu Pahat Vocational College, Johor, and Kuantan Vocational College, Pahang. The data obtained was analyzed using Statistical Package for Social Sciences (SPSS) software using Pearson's mean score, percentage, and correlation. The results of the analysis show that there is a positive relationship between critical thinking and problem-solving skills among Vocational College technical students. This study aims to justify the research hypothesis. The implication of this study is the importance of strengthening critical thinking and problem-solving skills in the curriculum and teaching strategies to prepare Vocational College technical students to become more competent and adaptive individuals in facing the challenges of a complex and changing world. It is hoped that the results of this study can make a significant contribution in the development of technical and vocational education as well as provide guidance for the preparation of a more effective curriculum to cultivate both skills among vocational college technical students.

1. Introduction

In today's era of information and technology, creativity and innovation in the Teaching and Learning (P&P) process are crucial for developing a new generation equipped with creative and critical thinking skills, essential for navigating the challenges of Industrial Revolution 4.0 and beyond. In 2011, the Malaysian Ministry of Education undertook a comprehensive assessment of the national education system, aiming to develop a new Education Development Plan. This initiative seeks to align the Malaysian education system with international standards and the aspirations of parents and the broader community. Central elements of Malaysia's educational approach include fostering critical and creative thinking skills among students, enabling them to evaluate the validity of information, perform evidence-based assessments, and think innovatively in solving problems.

Problem-solving skills are also emphasized, with students being taught to deconstruct issues into manageable components and devise more effective solutions. Nevertheless, possessing superior academic skills alone does not guarantee employment in today's highly competitive job market. Modern employers seek individuals who not only demonstrate intellectual acumen and outstanding academic performance but also exhibit essential soft skills such as critical thinking and leadership. The interview process often assesses candidates' abilities to think

critically and creatively, underscoring the equivalence of human skills to academic achievements in the contemporary workforce.

1.1 Problem Background

Technical and Vocational Education and Training (TVET) in Malaysia is specially designed to produce a highly skilled workforce to meet the needs of the industry. However, there is concern over the lack of critical thinking and problem-solving skills among students. Abbas (2017) emphasizes that lack of mastery of knowledge can have a negative impact on students' problem-solving processes, causing them to be more inclined to create conventional and less innovative solutions.

Students who are less involved in extra-college programs also face deficiencies in the development of critical thinking and problem-solving skills. Practical activities, such as internships and extracurricular projects, provide real context for honing these skills (Wahab & Saud, 2021). Students' dependence on technology also causes a lack of ability to analyze and organize information in depth (Mohd et al., 2022). High academic pressure results in students focusing more on short-term achievement, neglecting the development of important analytical skills (Tan, 2020).

In the context of technical and vocational education, a curriculum that overemphasizes technical skills without room for creative exploration hinders the development of critical thinking skills. Collaboration in team projects has been found to improve problem-solving skills through discussion and the exchange of diverse ideas (Chen & Li, 2018). Thus, it is important to balance theoretical approaches with practical experience to ensure students can develop the critical thinking skills needed to face complex future challenges. Researchers are interested in studying the relationship between critical thinking and problem-solving skills among Vocational College students to understand the extent to which these two aspects affect graduate job opportunities.

2. Methodology

This study is a descriptive survey aimed at identifying and exploring the relationship between two variables among students at Batu Pahat Vocational College in Johor and Kuantan Vocational College in Pahang. According to Hasan and Mahamod (2016), the survey method is commonly used in research to gather data and information systematically. In this research, data was collected through questionnaires, which were then analyzed and interpreted to summarize the findings.

Descriptive research involves identifying components, elements, variables, and evidence relevant to the study's focus (Khoirunnisa & Malasari, 2021). This study specifically used questionnaires to quantitatively assess the levels of critical thinking and problem-solving skills among technical and vocational students at Batu Pahat Vocational College. The goal was to understand how these skills are mastered by students and to investigate any relationships between them.

2.1 Research Design

This study adopts a descriptive survey approach to investigate and explore the correlation between two key variables among students at Batu Pahat Vocational College, Johor, and Kuantan Vocational College, Pahang. According to Hasan and Mahamod (2016), the survey method is commonly utilized in research to collect and analyze data comprehensively. Through the use of questionnaires, this research aims to quantitatively assess the proficiency levels of critical thinking and problem-solving skills among technical and vocational students at Batu Pahat Vocational College. Additionally, the study seeks to establish a relationship between these skill sets, facilitating deeper insights into their interplay within the educational context. For this study, Batu Pahat Vocational College in Johor and Kuantan Vocational College in Pahang were chosen as the research locations. A sample of 217 students participated, comprising 117 males and 100 female technical students from these institutions. Approval was obtained from both colleges to conduct the survey among their students, facilitated using a Google Form for data collection and analysis.

The study focused on final-year technical students because they have completed the core curriculum and specialized subjects, acquiring substantial knowledge essential for critical thinking and problem-solving skills (Smith et al., 2018). Batu Pahat Vocational College and Kuantan Vocational College were selected based on their reputation for providing comprehensive technical education and their track record of high performance in final examinations and successful industrial placements, as documented in the Annual Report of the Department of Technical and Vocational Education (2021).

2.2 Research Procedure

In this study, the questionnaire method served as the primary research tool to gather feedback from respondents on their critical thinking and problem-solving skills, as well as to explore the relationship between these two constructs. The questionnaire was structured into four parts (Part A, B, C, and D) following Malay standards. The

choice of the questionnaire method was based on its suitability for the study sample and its practicality in data collection aligned with the research objectives and inquiries.

Distribution of the questionnaire was facilitated through Google Forms using Telegram and WhatsApp applications. The collected data will serve as the basis for the researcher to either support or refute the hypotheses formulated in this study. Analysis of the data obtained from the questionnaire will be conducted using SPSS (Statistical Package for the Social Sciences) software version 27.0. As noted by Ismail and Kasman (2020), SPSS provides researchers with efficient tools for data analysis. Inferential statistics, specifically Pearson's correlation, will be employed to examine the hypothesized relationship between critical thinking and problem-solving skills among final-year technical students from Batu Pahat Vocational College and Kuantan Vocational College.

2.3 Research Instrument

The study's objective testing aimed to investigate key aspects of this research. Initially, it assessed the proficiency level of critical thinking among technical students at Vocational Colleges using analyses based on minimum values and percentages. Subsequently, it evaluated the proficiency level of problem-solving skills among the same cohort of students employing analogous analytical methods, specifically focusing on minimum values and percentages. Lastly, the research scrutinized the correlation between critical thinking and problem-solving skills through the Pearson Correlation test, aiming to ascertain the degree of interrelation between these variables within the Vocational College technical student population. Employing this methodology, the study endeavors to provide a comprehensive understanding of competency levels and the interplay between critical thinking and problem-solving skills within the framework of technical education.

3. Result and Discussion

Prior to conducting inferential analysis, a normality test was performed to assess the distribution of data, distinguishing between normal and skewed distributions. This preliminary step is crucial in determining the appropriate statistical tests for examining the two variables under investigation in this study. As detailed in the methodology section regarding the selection of the population and study sample, an initial target of 217 study participants was identified. However, upon issuing the questionnaires, it was observed that the actual number of respondents exceeded this requirement. Table 1 illustrates that all 271 respondents provided complete data on critical thinking and problem-solving skills variables. The inclusion of a larger sample size than initially planned enhances the statistical power of the research, which refers to its ability to detect population effects (Cohen, 1988). This increased sample size reduces variability in estimates, thereby enhancing the stability and reliability of the study results.

Table 1 *Number of respondents*

Variable	Total Respondent
Critical Thinking	271
Problem Solving	271

The skewness and kurtosis values obtained support the finding that both critical thinking and problem-solving skills data are normally distributed. For critical thinking, the skewness value is 0.13 and the kurtosis value is 0.07, indicating nearly symmetrical data without extreme peaks, which is typical of a normal distribution. Similarly, for problem-solving skills, the skewness value is -0.14 and the kurtosis value is 0.26. These values suggest a slight leftward skewness but still within the normal range, and the kurtosis value also indicates data distribution close to normal.

According to Hair et al. (2010), data is considered normal when skewness values range from -1 to +1 and kurtosis values range from -1 to +1. In summary, based on these findings, both critical thinking and problem-solving skills data show normal distribution characteristics. This means that statistical methods relying on normal data can be appropriately used for further analysis in this study.

Table 2 *Normality test findings based on Skewness and Kurtosis ratio*

Variable	Skewness	Kurtosis
Critical Thinking	0.13	0.07
Problem Solving	-0.14	0.26

Based on the findings presented in Table 2, which demonstrate a normal distribution of data, indicated by skewness and kurtosis values for Critical Thinking (0.13 and 0.07) and problem-solving skills (-0.14 and 0.26), parametric tests are deemed suitable for addressing the third research question. Given the normal data

distribution, parametric analysis using mean and percentage values has been chosen by the researcher to assess the proficiency levels of critical thinking and problem-solving skills. This methodological approach is considered appropriate and robust, ensuring reliable outcomes while addressing research questions 1 and 2.

To investigate the relationship between these two variables, the Pearson correlation test will be employed. This statistical test is selected due to the normal distribution of data, enabling the researcher to determine both the strength and direction of the linear association between critical thinking and problem-solving skills. Pearson's correlation yields a coefficient (r) ranging from -1 to 1, where a positive r signifies a positive relationship and a negative r indicates a negative relationship. Utilizing the Pearson correlation test will provide a comprehensive understanding of the interplay between critical thinking and problem-solving skills within the scope of this study.

3.1 Analysis

Analysis of the research questions involves interpreting the collected data to address the three key inquiries of this study. Firstly, the research will explore the proficiency levels of critical thinking among technical students. Secondly, it will investigate the proficiency levels of problem-solving skills among the same group of students. Lastly, the study seeks to determine if there exists a relationship between critical thinking and problem-solving skills among technical students from Batu Pahat Vocational College and Kuantan Vocational College. This analysis aims to offer a comprehensive understanding of students' capabilities in these critical areas and to uncover any potential correlations between them.

Analysis of Research Question 1: Level of Critical Thinking Mastery

In addressing the first research question, part B of the questionnaire was scrutinized to assess the degree of critical thinking mastery among the respondents. Critical thinking proficiency was evaluated using a 5-point Likert scale ranging from strongly disagree to strongly agree. This scale was chosen to gather nuanced insights into students' self-perceived abilities in critical thinking, offering a comprehensive assessment of their capabilities.

The analysis focused on responses to questions B1 to B19, which delved into various aspects of critical thinking such as analysis, evaluation, inference-making, explanation, and reflection on processed information. These questions aimed to gauge students' aptitude in applying critical thinking skills across different scenarios, including evaluating information validity, making evidence-based judgments, and critically assessing arguments. The findings from this analysis will provide a detailed overview of the level of critical thinking proficiency among technical students, crucial for enhancing educational strategies and curriculum development in the participating institutions.

The overall average mean score is 3.64, indicating a standard deviation of 1.13, which signifies a high level. This suggests that students demonstrate a strong inclination towards applying critical thinking in both academic contexts and everyday situations. While there are areas for improvement, such as identifying conflicting facts, the general findings indicate that students possess a robust base in critical thinking skills.

Table 3 *Level of critical thinking among technical students*

No	Items	Min Score	Standard Deviation	Interpretation Min
B1	I can identify conflicting facts in an article.	3.38	1.11	Low
B2	I will analyze all the information before making a decision.	3.78	0.99	High
B3	I will analyze all related situations before making a decision.	3.75	1.06	High
B4	I always make sure all the information received is reliable before making a decision.	3.58	1.12	High
B5	I care about the current issues happening around me.	3.62	0.98	High
B6	I will think logically and then analyze regularly before making a decision.	3.62	1.20	High
B7	I always research the views given by others before using them.	3.68	1.12	High
B8	I often reflect back on things I have done in the past.	3.68	1.12	High
B9	I always learn as much as possible, although I don't know when I will use the things I have learned.	3.57	1.17	High

B10	Before making an important decision, I try to gather all the relevant information.	3.65	1.18	High
B11	I always improve my outlook in achieving the best results.	3.63	1.11	High
B12	I try to delve into all the views given by others before making a decision.	3.63	1.20	High
B13	My group mates always expect me to provide an initial insight during the discussion process.	3.60	1.11	High
B14	I try to find all potential solutions before deciding on the best decision.	3.64	1.20	High
B15	During the discussion, I was able to express my views during the discussion.	3.69	1.08	High
B16	I encourage discussion to celebrate the opinions of other group mates.	3.63	1.11	High
B17	I accept views from others with an open heart.	3.66	1.21	High
B18	I will correct my point of view when it does not fit the issue discussed.	3.66	1.20	High
B19	I will re-examine what I have discussed to avoid misunderstandings from others.	3.65	1.20	High
Total Average		3.64	1.13	High

The overall average mean score is 3.64, indicating a standard deviation of 1.13, which signifies a high level. This suggests that students demonstrate a strong inclination towards applying critical thinking in both academic contexts and everyday situations. While there are areas for improvement, such as identifying conflicting facts, the general findings indicate that students possess a robust base in critical thinking skills.

Analysis of Research Question 2: Mastery of Problem-Solving Skills

In addressing the second research question, part C of the questionnaire was scrutinized to evaluate the proficiency level of problem-solving skills among technical students at Batu Pahat Vocational College and Kuantan Vocational College. This assessment encompasses the identification, generation, and application of problem-solving techniques. Utilizing a 5-point Likert scale, responses are categorized from strongly disagree to strongly agree. Questions within this section (C1 to C5) aim to gauge students' agreement with statements concerning problem-solving skills, including processes of problem identification, solution generation, and application. A detailed analysis of these responses will provide insights into the extent of problem-solving skill mastery among technical students across both institutions.

Table 4 Level of problem-solving skills among technical students

No	Items	Min Score	Standard Deviation	Interpretation Min
C1	I can describe in detail the given problem clearly.	3.39	1.18	Low
C2	I know clearly why such a solution I will take.	3.48	1.14	High
C3	I always study the best solution before a permanent decision is taken.	3.47	1.12	High
C4	I can anticipate the issues that may arise during the discussion.	3.70	1.02	High
C5	I accept any changes to each solution if my opinion contradicts the opinion of other group members.	3.61	1.16	High
Total Average		3.53	1.12	High

The total average mean score for all items was 3.53 with a standard deviation of 1.12, which overall was interpreted as a high level of problem-solving skills among technical students from Batu Pahat Vocational College and Kuantan Vocational College. This finding shows that these students have good skills in identifying problems, producing solutions, and applying problem solving skills.

Analysis of Research Question 3: The Relationship between Critical Thinking and Problem-Solving Skills Among Vocational College Technical Students

Based on the research question before measuring the level of mastery of critical thinking and problem-solving skills among technical students, the researcher chose to use the Pearson correlation test to test the relationship between the two variables. The selection of the Pearson correlation test is because the data collected is continuous and the data distribution is normal, as confirmed by the previous analysis. Through this test, researchers were able to determine whether there was a significant relationship between critical thinking and problem-solving skills among respondents from Batu Pahat Vocational College and Kuantan Vocational College.

Table 5 *Analysis of the relationship between critical thinking and problem-solving skills*

Variable	Pearson Correlation	Sig. (2-tailed)
Critical Thinking	1.00	0.00
Problem Solving	1.00	0.00

Pearson's correlation value between critical thinking and problem-solving skills is 1.00. This shows that there is a perfect and positive relationship between the two variables. Value sig. (p-value) is 0.00, which means the relationship between critical thinking and problem-solving skills is significant at a reliability level of 95% ($p < 0.05$). Value sig. a very low one indicates that the probability of this relationship happening by chance is very small.

The results of the data analysis for the research question determined that the null hypothesis stating that there is no significant relationship between critical thinking and problem-solving skills was rejected. These findings show that there is a significant and perfect relationship between critical thinking and problem-solving skills among the students studied. Pearson's correlation value of 1.00 shows that critical thinking and problem-solving skills go hand in hand perfectly, i.e. every change in one variable will be followed by an equivalent change in another variable. These findings support the hypothesis that an increase in critical thinking will improve problem-solving skills and vice versa, which is very important in the context of technical and vocational education.

3.2 Discussion

This study has analyzed the level of mastery of critical thinking and problem-solving skills among technical students through three main research questions. For the first question, the level of mastery of critical thinking is analyzed using mean and percentage values. Findings show that technical students have a high level of mastery of critical thinking, with different mean values for each questionnaire item ranging from low to high. For the second question, the level of mastery of problem-solving skills was also analyzed using mean and percentage values. The results of the analysis show that students have a high level of problem-solving skills, with a consistently high mean value for most questionnaire items.

To answer the third question, this study used Pearson's correlation test to determine the relationship between critical thinking and problem-solving skills. The selection of this test is based on the fact that the data distribution is normal and only two variables are studied. The results of the analysis show a perfect Pearson correlation value ($r = 1.00$) and a very low significant value ($p < 0.05$), showing a strong and significant relationship between the two variables. Therefore, the null hypothesis stating that there is no significant relationship between critical thinking and problem-solving skills is rejected. These findings show that improvement in critical thinking is directly related to improvement in problem-solving skills among technical students, proving the effectiveness of education that emphasizes critical thinking training in improving problem-solving skills.

4. Conclusion

The results of this finding have been thoroughly analyzed using Statistical Package for Social Sciences (SPSS) software version 27.0. The researcher concluded that all three research questions were successfully achieved, where students showed a high level of mastery in both critical thinking and problem-solving skills. Furthermore, there is a significant relationship between the two variables, which emphasizes the importance of critical thinking in improving problem-solving skills among technical students. This study proves that the higher the level of critical thinking of a student, the higher the mastery of problem-solving skills, showing that more critical students tend to have better abilities in solving problems (Schmidt, 2016; Dreyfus, 2019).

In particular, the Ministry of Education needs to consider the integration of special modules in the curriculum that promote the development of critical thinking at every level of vocational education. Vocational colleges need to increase emphasis in teaching and learning that promotes critical reflection and application of concepts in a practical technical context. Teachers need to be trained to practice teaching approaches that stimulate critical thinking through activities such as guided conversations and problem-based projects. In addition, parents need to be made aware of the importance of encouraging the development of critical thinking at home through supporting their children's interests and academic achievements. Students should be encouraged to take the initiative in

improving critical thinking skills through active involvement in co-curricular activities that require continuous analysis, evaluation and problem solving (Mohd *et al.*, 2022).

Acknowledgement

I would like to express my sincere gratitude to my supervisor, Associate Professor Dr. Mohamad Zaid bin Mustafa, for his invaluable guidance and unwavering support throughout the ups and downs of completing this research. His expertise and encouragement have been instrumental in shaping this work. I am also deeply thankful to my parents for their endless love, understanding, and encouragement throughout my academic journey. Their unwavering support and belief in my abilities have been a constant source of strength. Additionally, I extend my heartfelt thanks to my friends for their support and encouragement during this research endeavor. Their insights and camaraderie have enriched my experience and kept me motivated.

Conflict of Interest

The authors declare that there are no potential conflicts of interest regarding this research, writing, and publication. The findings and conclusions presented in this article are solely those of the authors and do not involve any financial, personal, or professional affiliations that could influence the research or its interpretation.

Author Contribution

The author confirms sole responsibility for the following aspects of this study: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation. All work was conducted independently to ensure the integrity and originality of the research.

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