JURNAL BECOSS e-ISSN: 2686-2557
(Business Economic, Communication, and Social Sciences), Vol.4 No.3 September 2022: 173-180 DOI: 10.21512/becossjournal.v4i3.8633

Critical Thinking and Problem Solving Among Students

Heruna Tanty[1*], Chistopher Fernando[2], Jessica Valencia[3], Valentino Justin[4]

[1,2,3,4] Mathematics & Statistics Department, School of Computer Science,
Bina Nusantara University
Jakarta 11480, Indonesia
heruna@binus.ac.id; christopher.fernando@binus.ac.id; jessica.valencia@binus.ac.id;
valentino.justin@binus.ac.id

*Correspondence: heruna@binus.ac.id

ABSTRACT

The development of the times is the background of increasingly rapid technological advances. The times have become the basis for the education industry to continue to grow. The development of education is expected to produce high-quality human resources and are able to think critically and creatively in solving problems. Quality education will lead to quality human resources as well. Critical thinking and problem solving as skills that need to be mastered by students, especially the younger generation. It has been widely recognized as one of the most important skills. Someone who has the ability to think critically and problem solving is considered to have many benefits because he has the ability to analyze certain situations and make the right decisions for the situation at hand. The research was conducted to determine the level of critical thinking and problem solving skills among students and students using three variables. The results of the study were analyzed using descriptive analysis to determine the distribution of data and inferential analysis to determine the level of validity and reliability. Validity is calculated to determine the level of data validity is above 95% or 99% and reliability is calculated to determine the level of data. The results of this study indicate that the level of a person's ability to identify problems affects the level of ability to solve the problems experienced. However, a person's ability to identify problems has no effect on the ability to make the right decisions on the problems experienced.

Keywords: *Critical thinking; Problem solving; Variabel; Validity; Reliability*

INTRODUCTION

The development of the times is the background of increasingly rapid technological progress and is the basis for demands on the education industry to continue to grow. The development of education is expected to produce high-quality Human Resources (HR) and areable to think critically, creatively, systematically in solving problems, and have good morals. The ability to think critically is very important for everyone, because it can be used as a basis for solving problems and as a consideration in making the right decisions. Critical thinking hasthe goal of making reasonable decisions about what to do.

The development of the times in the world of education creates a paradigm shift in the activities of the learning process. Learning activities that were originally teacher-centered have developed into student-centered learning activities (learner center). Learning activities with thelearned center system aim to make students have the ability to develop knowledge, skills and attitudes. One of the models applied in the learned center learning system is the case study or the ability to make decisions and solve problems.

The times also demand superior human resources. The formation of superior human beings needs to improve

the quality of education. Qualified students are students who have an understanding of science and its applications (scientific literacy), have values, attitudes, and higher thinking order skills. Quality education will lead to quality human resources as well. High quality education can be achieved through learning reform. The reform in question is a shift from traditional learning to learning that emphasizes higher thinking and critical thinkingskills.

Critical thinking and problem solving as skills that need to be mastered by students, especially the younger generation. It has been widely recognized as one of the most important skills. Someone who has the ability to critical thinking and problem solving is considered to have many benefits because he has the ability to analyze certain situations and make the right decisions for the situation at hand.

Critical thinking allows students to process information well to assist independentlearning. Students who are not equipped with critical thinking and problem solving skills will have difficulties when competing in work and society. This is because the role of critical thinking and problem solving is very important in the education system and the world of work,and is determined as the expected outcome of the learning process. More and more jobs require the ability of prospective workers to think critically, reason, make decisions, and solve problems. Skills in critical thinking play a role in improving problem solving abilities by tryingto create new strategies in solving these problems. They can think critically and pay attention and solve problems efficiently.

Although problem solving skills and critical thinking skills are important aspects, most students are still weak in these competencies. The weakness of this ability can be seen from the results of PISA (Program for International Student Assessment) and TIMSS (Tren Matematika Internasional dan Studi Sains). The results of TIMSS and PISA show that the ability of studentsin Indonesia to solve problems is still very low. The results of TIMSS and PISA show that theability of students in Indonesia to solve problems is still very low. In TIMSS 2011, Indonesia was ranked 40th out of 42 countries (Martin, et al., 2012) while for PISA 2012, Indonesia was ranked 64th out of 65 countries (OECD, 2014). The results of the assessments from the 2 international institutions provide important information about improving the quality of scienceteaching which is currently oriented to the aspect of knowing and as a result students are not trained to develop their thinking skills in problem solving.

There are many factors that cause the low critical thinking and problem solving abilities of Indonesian students. Based on a survey conducted in several schools, it can be concluded that students only learn to memorize concepts and theories. The activity of memorizing concepts and theories cannot stimulate students' ability to critical thinking and problem solving. Learners are accustomed to a teacher-centred learning system rather than exploring knowledgeindividually. In addition, the questions contained in the National Examination (UN) cannot bea standard for measuring students' thinking abilities. Therefore, the Government of Indonesia seeks to include critical thinking skills in all subjects (Kemendikbud, 2013). Furthermore, the Minister of Education Regulation (Permendikbud) Number 20 of 2016 regulates six thinking skills that must be achieved by students in competency standards for elementary and secondaryeducation graduates, one of which is critical thinking.

METHODS

Research Types and Approach

The type and research approach used is an approach using quantitative methods. Becausethe data generated is quantitative to test the variables that have been set. The three variables tested are the level of ability to identify problems, the level of ability to solve problems, and thelevel of ability to make decisions.

Object of research

The object of research discussed in this research is the level of critical thinking and problem solving abilities among students and students who are tested using three variables. The variables used are the level of ability to identify problems, the level of ability to solve problems,and the level of ability to make decisions.

Data collection technique

The data collection technique used in this research is to use survey techniques. The survey technique is distributed to 100 respondents or samples. The survey technique is used with the aim of obtaining accurate data from respondents who are students and students. The survey technique was carried out using a Google Form which was distributed to students and students,especially BINUS University students.

Data analysis

The data analysis carried out for the results of the study was descriptive and inferential analysis. Descriptive analysis to provide an overview of the distribution of the sample data. Inferential analysis to test the validity and reliability of the research data.

RESULTS AND DISCUSSION

Critical thinking and problem solving as skills that need to be mastered by students, especially the younger generation. It has been widely recognized as one of the most important skills. Critical thinking and problem solving among students and college students were tested using three variables. The variables used are the level of ability to identify problems, the level of ability to solve problems, and the level of ability to make decisions. The ability to identify problems is assessed based on the level of sensitivity to the problems around them, followed by the level of ability to make the right decisions to solve the problems at hand. The results of theanalysis in the study to determine the comparison between the ability to identify problems withthe ability to make decisions and the comparison between the ability to identify problems withthe ability to make decisions. The research data will be analyzed using two methods, namely descriptive and inferential analysis.

The list of questions given to respondents or samples is shown in Table 1 with each indicator (variable) consisting of four questions and each scale has its own meaning. Scale 1 means always, scale 2 means quite often, scale 3 means rarely, scale 4 means almost never, andscale 5 means never.

Table 1. Survey Questions

Question	Scale				
	1	2	3	4	5
Indicator 1: Skill in Indentifying Problems					
Do you often face problems on things that require critical thingking skills?					
I find it difficult to identify the problem I am facing					
I feel less sensitive to the problems that exist in the environment around me					
I easily analyze the problem at hand					
Indicator 2: Problem Solving Skills					
I make observations in solving a problem					
I find it difficult find a way out in the face of a problem					
I consider the consequences of the way I solve the problem					
I find if difficult to learn with the theme of problem solving (Study Case)					
Indicator 3: Decision Making Skills					
I am afraid to make decisions					
I find it difficult to choose a way out of the problem I face					
I'm always in a hurry a make decisions					
I always consider the decision I make					

Source: (Processed by the Author)

Descriptive Analysis

The data was taken using a survey method with a total sample of 100 people consisting of students and students, especially BINUS University students. This descriptive analysis aims to compare the level of critical thinking and problem solving abilities possessed by students and students based on the variables studied. The level of critical thinking and problem solving abilities possessed by students and students based on the total and percentage scores is shown in Table 2.

Table 2. Variable Percentage Table

Indicator	Total Score	Maximum Total Score	Percentage
Variable 1: Level of Ability to Identify Problems	1293	2000	64.65%
Variable 2: Level of Problem Solving Ability	1286	2000	64.30%
Variable 3: Decision-Making Ability Level	1204	2000	60.20%

Source: (Processed by the Author)

The percentage table shows the largest value is owned by variable 1 of 64.65%, followedby variable 2 of 64.30%, and variable 3 of 60.20%. So based on the table, it can be concluded that students and students have a high ability to identify the problems they are experiencing. However, students and students have difficulty in making decisions as indicated by the smallestpercentage of the total maximum score. This difficulty can be caused by fear when they have to make decisions and find it difficult to choose the right way out of the problems at hand.

Measures of data concentration analyzed for critical thinking and problem solving abilitylevels are mean, median, mode, standard deviation, kurtosis, and skewness. The results of the calculation of data centering on each variable using the Excel application are shown in Table 3.

Tabel 3. Descriptive Data Centering Size

Indicator	Mean	Median	Modus
Variable 1: Level of Ability to Identify Problems	3.55	3.5	3
Variable 2: Level of Problem Solving Ability	3.55	4	3
Variable 3: Decision-Making Ability Level	3.01	3	3

Source: (Processed by the Author)

Variable 1 has a mean of 3.55, a median value of 3.5, and a mode value of 3. The averagelevel of ability to identify problems is 3.55 which can be rounded up to 4. This value means that the average of respondents is almost not never find it difficult to identify the problems thatare around. Variable 2 has a mean of 3.55, a median value of 4, and a mode value of 3. The average problem-solving ability level is 3.55 which can be rounded up to 4. This value means that the average respondent almost never feels difficulty in solving the problems encountered. Variable 3 has a mean of 3.01, a median value of 3, and a mode value of 3. The average problem-solving ability level is 3.01 which can be rounded up to 3. This value means that the average

respondent rarely feels difficulty in solving problems. make decisions or respondents sometimes find it difficult when they have to make decisions.

The size of the distribution of the analyzed data for the level of critical thinking and problem solving abilities among students and college students is the standard deviation. To describe the characteristics of a data distribution, it takes the value of slope (skewness) and curvature (kurtosis). Data regarding standard deviation, kurtosis and skewness are in Table 4.

Table 4. Measures of Data Spread, Kurtosis, and Skewness

Indicator	Standard Deviation	Kurtosis	Skewness
Variable 1: Level of Ability to Identify Problems	0,657129	-0,2934	0,3568781
Variable 2: Level of Problem Solving Ability	0,641573	-0,2925	0,2780897
Variable 3: Decision-Making Ability Level	1,114596	-0,7422	0,1586226

Source: (Processed by the Author)

The value of the standard deviation of variable 1 is 0.657129, variable 2 is 0.641573, and variable 3 is 1.114596. The standard deviation value is smaller than the mean in Table 2. This value means that the data is less varied because the standard deviation value is smaller than themean. Table 3 shows that the kurtosis value is smaller than 3. Therefore, the distribution of thedata is low (platykurtic). The skewness value of each variable is greater than zero. So, the shapeof the distribution is positive (right skewed).

The graph of the comparison of the level of student and student ability on variable 1 to variable 2 is shown in Figure 1.

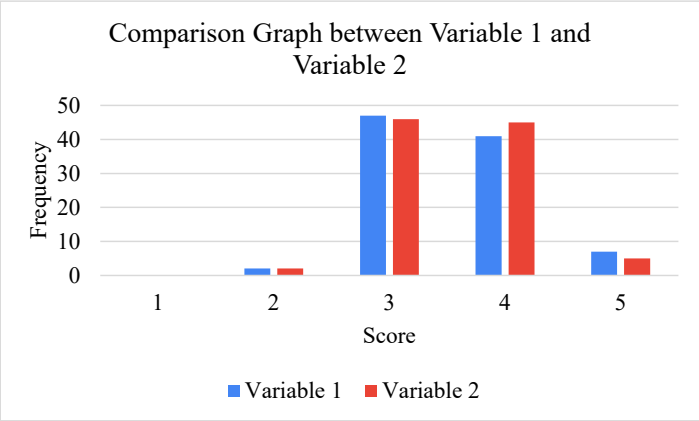

Figure 1. Graph of Comparison Level between Variable 1 and Variable 2
(Source: Processed by the Author)

Figure 1 shows that the level of one's ability to identify problems is directly proportionalto the level of one's ability to solve the problems experienced. This statement is supported by agraph that shows the number of balanced scores between 2 variables. If the score on variable 1increases, then the score on variable 2 also increases simultaneously. The next graph is about the comparison of students' and students' ability levels to variable 1 and variable 3.

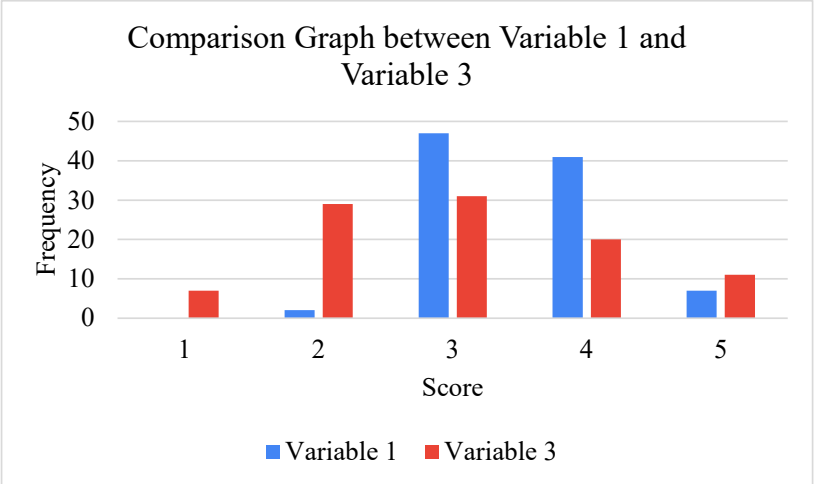

Figure 2. Graph of Comparison Level between Variable 1 and Variable 3
(Source: Processed by the Author)

Figure 2 shows that the level of a person's ability to identify problems does not affect a person's ability to make decisions. This statement is supported by a graph that shows the numberof scores that are not balanced between the 2 variables. There is an increase and decrease in different scores between variable 1 and variable 3. So, if someone can identify the problems that occur, it is not necessarily that that person can make the right decisions on the problems experienced.

Inferensial Analysist

Reliability is an index that shows the extent to which a measuring instrument can be trusted or reliable. The data from the questionnaire results between variables 1 and 2 can be said to be reliable if the value of the Cronbach's alpha calculation is greater than the Cronbach's alpha table value. The calculated values and table

values from Cronbach's alpha are searched using Minitab software and the results are obtained as shown in Table 5.

Table 5. Calculation Results of Cronbach's Alpha Variables 1 and 2 with Minitab

Ommited Variable	Adj Total Mean	Adj Total Stdev	Item AdjTotal Corr	SquaredMultiple Corr	Cronbach's Alpha	Result
P1	22.650	3.743	0.1244	0.4548	0.5894	Not Reliable
P2	22.540	3.904	0.0846	0.4082	0.6012	Not Reliable
P3	22.470	3.591	0.3323	0.2545	0.5243	Reliable
P4	22.570	3.482	0.5698	1.0000	0.4414	Reliable
Y1	22.570	3482	0.5698	1.0000	0.4414	Reliable
Y2	22.700	3.716	0.2427	0.382	0.5532	Reliable
Y3	22.510	3.826	0.1172	0.2187	0.5914	Not Reliable
Y4	22.520	3.563	0.2642	0.4188	0.5464	Reliable

Source: (Processed by the Author)

P indicates a question from variable 1, while Y represents a question from variable 2. Thevalue obtained based on Table 5 shows that the value of Cronbach's alpha as a whole has a value of 0.5744. This value indicates that the value of Cronbach's alpha as a whole is smaller than the value of Cronbach's alpha for the attributes of questions 1, 2, and Question 3 on variable

2. Each variable that has a Cronbach's alpha value of a variable is greater than Cronbach's alphaas a whole, it can be stated that the data is not reliable or unreliable. Meanwhile, for the value of Cronbach's alpha variable which is smaller than the overall Cronbach's alpha, it can be concluded that the attribute of the question is declared reliable or reliable.

Validity is the degree of accuracy of the research measuring instrument against the actual content being measured. There are two kinds of validity used, namely validity above 95% and validity above 99%. The data from the correlation matrix for the validity test can be searched using the Minitab software as shown in Table 6.

Table 6. Calculation Results Correlation Matrix Variables 1 and 2 with Minitab

	P1	P2	P3	P4	Y1	Y2
P2	-0.453					
P3	-0.093	0.374				
P4	0.436	-0.057	0.114			
Y1	0.436	-0,057	0.114	1.000		
Y2	-0.277	0.511	0.412	0.011	0.011	
Y3	-0.132	0.259	0.323	-0.125	-0.125	0.402
Y4	0.551	-0.256	-0.058	0.533	0.533	-0.186
Total Score	0.411	0.285	0.542	0.713	0.713	0.449
*/**	**	**	**	**	**	**

	Y3	Y4
Y4	-0.16	
Total Score	0.353	0.533
*/**	**	**

Source: (Processed by the Author)

The calculated data in Table 6 shows that all questions on variable 1 and variable 2 are valid. The level of validity of all questions on variables 1 and 2 is above 99%. This test will usethe R value in the Simple Correlation Coefficient Table (Rtable value) at an alpha of 5% or

0.05 with a degree of freedom (df) of 25 is 0.381 and an Rtable value of 1% or 0.01 alpha witha degree of freedom of 25 gets a value of 0.487. Observation of the total value in the correlationtable has several statements that adjust the Rtable value that has been obtained. Each attribute has a validity value above 95% if it has a total score greater than 0.381 and has a validity valueabove 99% if it has a total score greater than 0.478. One asterisk (*) is a sign for validity above95%, while two asterisks (**) is a sign for validity above 99%.

Reliability testing was carried out again to test the questions between variable 1 and variable 3, the test was carried out using the Minitab application with the calculated data in Table 7.

Table 7. Calculation Results of Cronbach's Alpha Variables 1 and 3 with Minitab

Ommited Variable	Adj Total Mean	Adj Total Stdev	Item AdjTotal Corr	SquaredMultiple Corr	Cronbach's Alpha	Result
P1	21.830	5.492	-0.286	0.3945	0.8506	Not Reliable
P2	21.720	4.881	0.3605	0.3601	0.7527	Reliable
P3	21.650	4.693	0.4542	0.2352	0.7363	Reliable
P4	21.750	5.161	0.0336	0.2262	0.8055	Not Reliable
X1	21.960	4.276	0.8500	1.0000	0.6597	Reliable
X2	21.960	4.276	0.8500	1.0000	0.6597	Reliable
X3	21.960	4.276	0.8500	1.0000	0.6597	Reliable
X4	21.960	4.276	0.8500	1.0000	0.6597	Reliable

Source: (Processed by the Author)

The results that have been obtained show that the overall Cronbach's alpha value between variable 1 and variable 3 gets a value of 0.7608. So there are attributes of questions that are unreliable or unreliable because the value of Cronbach's alpha variable is greater than the overall Cronbach's alpha value. Attributes of unreliable questions are the attributes of question 1 on variable 1 and question 4 on variable 1. Other questions are declared reliable because the value of Cronbach's alpha on that attribute has a value that is smaller than the value of Cronbach's alpha as a whole.

Validity testing was carried out for all questions on variable 1 and variable 3, where therewere two kinds of validity tests used, namely validity above 95% and validity above 99%. Thedata from the correlation matrix for the validity test can be searched using the Minitab softwareand the results are obtained as shown in Table 8.

Tabel 8. Calculation Results Correlation Matrix Variables 1 and 3 with Minitab

	P1	P2	P3	P4	X1	X2
P2	-0.453					
P3	-0.093	0.374				
P4	0.436	-0.057	0.114			
X1	-0.336	0.434	0.396	-0.083		
X2	-0.336	0.434	0.396	-0.083	1.000	
X3	-0.336	0.434	0.396	-0.083	1.000	1.000
X4	-0.336	0.434	0.396	-0.083	1.000	1.000
Total Score	-0.090	0.507	0.604	0.207	0.915	0.915
*/**	Not Valid	**	**	*	**	**

	X3	X4
X4	1.000	
Total Score	0.915	0.915
*/**	**	**

Source: (Processed by the Author)

This test will use the R value in the Simple Correlation Coefficient Table (Rtable value)at an alpha of 5% or 0.05 with a degree of freedom (df) of 25 is 0.381 and an Rtable value of 1% or 0.01 alpha with a degree of freedom of 25 gets a value of 0.487. Observation of the total value in the correlation table has several statements that adjust the Rtable value that has been obtained. Each attribute has a validity value above 95% if it has a total score greater than 0.381and has a validity value above 99% if it has a total score greater than 0.478. One asterisk (*) isa sign for validity above 95%, while two asterisks (**) is a sign for validity above 99%. The results that have been obtained indicate that there is 1 question attribute that is not valid, namelythe question attribute 1 on variable 1. So it can be said that the results obtained for question 1 on variable 1 cannot be used in research. The results above also show that there are questions that have a validity level above 95%, namely for question attribute 4 in variable 1. Other question attributes get a validity level above 99%.

CONCLUSIONS

The conclusions that can be drawn from the research conducted are:

- The research was conducted using three variables, namely the level of ability to identify problems, the level of ability to solve problems, and the level of ability to make decisions.
- Students and students have a high ability to identify problems experienced with a percentage of 64.65% and the smallest percentage is owned by the level of ability to makedecisions, which is 60.20%.
- On average, the respondents almost never find it difficult to identify the problems they are experiencing and find it difficult to solve the problem. However, on average, the respondents rarely find it difficult to make decisions.
- The level of one's ability to identify problems is directly proportional to the level of one'sability to solve the problems experienced. This statement is supported by a graph that shows a balanced number of scores between variable 1 and variable 2. While the level ofa person's ability to identify problems does not affect a person's ability to make decisions. This statement is supported by a graph that shows the number of scores that are not balanced between variable 1 and variable 3.
- The correlation between questions between variable 1 and variable 2 gets 2 question attributes that are not reliable, namely question attribute 1 variable 1, question attribute 2variable 1, and question attribute 3 variable 2. The correlation between questions betweenvariable 1 and variable 3 shows that there are 2 question attributes that are not reliable, namely question attribute 1 and variable 4 variable 1.
- The validity between these two variables shows that each question attribute is valid withall question attributes having validity above 99%. The validity between these two variables shows that there is one question attribute that is not valid, namely the question attribute 1 variable 1. The validity results also show that there is one question attribute that has a validity level above 95%, namely the question attribute 4 variable 1. Other question attributes have a validity level above 99%.

Suggestions that can be given for further research are:

- The scale used should be a scale of 1 which means never, a scale of 2 which means almostnever, a scale of 3 which means rarely, a scale of 4 which means quite often, and a scaleof 5 which means always. Because in general, the larger the scale, the more frequent the frequency. This scale change aims to prevent the respondent from making mistakes whenfilling out the questionnaire.
- Change the questions used in order to obtain more valid and reliable results for research.
- The connotation of a question or statement can be uniformed. If the connotation of the question is positive, then it is better that all questions are structured similarly. An example of a positive statement connotation is "I always consider the decisions I make" and an example of a negative statement connotation is "I find it difficult when making decisions."

REFERENCE

Amalia, R. U. (2016). *Pengaruh Independensi Dewan Komisaris, Ukuran Dewan Komisaris, Keahlian Keuangan Komite Audit, Kepemilikan Institusional, Kepemilikan Blockholder, dan Kualitas Audit terhadap Keterjadian Restatemen.* Universitas Katolik Soegijapranata, Fakultas Ekonomi dan Bisnis, Semarang.

Rabbanie, R., & Adi, H. Z. (2017). *Analisis Karakteristik Mahasiswa Statistika ITS dengan Metode Statistika Deskriptif.* Institut Teknologi Sepuluh Nopember, Departemen Statistika.