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The Correlation of Critical Thinking Skill and Science Problem-Solving Ability of Junior High School Students

Irma Lismayani[1)*], **Parno**[2)], **Susriyati Mahanal**[3)]
[1)]SMPN 17 Kendari–Southeast Sulawesi
[2)]Physics Education–Universitas Negeri Malang
[3)]Biology Education–Universitas Negeri Malang
Jl. Mekar Jaya No.1, Kadia, Kendari, Southeast Sulawesi, 93115. E-mail: lismayaniirma@gmail.com[*]

Abstract: This paper intends to seek the correlation of critical thinking skill and problem-solving ability of students on Natural Sciences Subject within Junior High School in Ecosystem topic. The subject of this research consisted of 135 students of 8th Graders in Odd Semester SMPN 17 Kendari Academic Year 2016/2017. This research employed two instruments, namely, critical thinking skill test in the form of multiple choices and problem-solving ability test in the form of an essay. The data obtained were then analyzed by calculating the average and employing correlational statistics. This research proves that students' critical thinking skill average is 35.74, the problem-solving ability is 48.18, and the correlation coefficient is 0.31. It further means that only 9.61% of problem-solving ability could be explained by critical thinking ability.

Key Words: critical thinking skill, problem-solving ability

Abstrak: Penelitian ini bertujuan untuk mengetahui hubungan kemampuan berpikir kritis dan kemampuan pemecahan masalah IPA siswa SMP pada topik Ekosistem. Subjek penelitian ini terdiri atas 135 siswa kelas VIII Semester I SMPN 17 Kendari tahun pelajaran 2016/2017. Penelitian ini menggunakan dua instrumen, yaitu tes kemampuan berpikir kritis berbentuk pilihan ganda dan tes kemampuan pemecahan masalah berbentuk esai. Data hasil penelitian dianalisis secara rata-rata dan statistik korelasi. Hasil penelitian menunjukkan bahwa siswa memiliki skor rata-rata kemampuan berpikir kritis 35,74, kemampuan pemecahan masalah 48,18 dan koefisien korelasi sebesar 0,31. Hal ini berarti hanya 9,61% kemampuan pemecahan masalah dapat dijelaskan oleh kemampuan berpikir kritis.

Kata kunci: kemampuan berpikir kritis, kemampuan pemecahan masalah

Critical thinking has been defined by some scholars and experts. Ennis (2011) defines critical thinking as a reasonable and reflective thinking on a decision regarding what we need to believe or do. While according to Beyer (1995), critical thinking is a process of generating common sensical assessment. Further, it is a reasonable decision-making process (Wallace & Jefferson, 2015). Pursuant to the above-mentioned definitions, critical thinking is a way of thinking employing logical process and dealing with multi-perspective points.

Students, indeed, are required to possess critical thinking skill. A number of countries have made critical thinking as one of the education goal (Oliver, 2001) and competence within the process of education (Zubaidah, 2010). Critical thinking is not an auto-generated skill. Instead, it requires a training and stimulus to develop the skill within students. To obtain knowledge, students rely on the thinking pattern they have. Hence, it is imperative in improving students critical thinking (Zubaidah, 2010).

When students possess decent critical thinking, they will possess the ability of problem-solving. Critical thinking is a prominent element of the investigation, innovation, and problem-solving (Thompson, 2011; Alatas, 2014). Students who possess critical thinking will be effectively able to solve any problem (Snyder & Snyder, 2008). Critical thinking allows individuals to be able to solve problem exceptionally and able to observe the problems from a different perspective.

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As a result, students with decent critical thinking will be able to find more alternative solutions for a problem. Critical thinking, therefore, is important for students within the problem-solving process.

To begin with, problem-solving is an arduous task consisting cognitive and skill component, attitude, and motivation component, and psychology component (Jonassen, 1997; Docktor, 2014). Besides, problem-solving is also a way of investigating aims at finding new alternative solutions for a problem (Dhillon, 1998).

The ability to solve problems is one of the important competencies students must have (Adeoye, 2010; Greiff et al., 2013). It aims to promote new experience within students by finding solutions and solving problems. The problem-solving activities are integrated into the learning process (Mauke et al., 2013) thus it helps students to build new knowledge (Mukhopadhyay, 2013).

Although the ability to solve problems and critical thinking skills is an important aspect, most students are still weak in that competencies. The weakness of this ability can be seen from the results of PISA (*Program for International Student Assessment*) and TIMSS (*Trends in International Mathematics and Science Study*). The results of TIMSS and PISA show students' ability in Indonesia in solving 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 assessment results of both international institutions provide valuable information to improve the quality of science teaching which currently is oriented to the aspects of knowing and as a result students are not trained to develop thinking skills in the face of problems.

Several studies related to the ability of critical thinking and problem-solving skills were conducted by Raymon and Ryan (2012) revealed that problem-solving activities should be involved in the learning process. Also, it is important to provide sufficient space to students by providing authentic and project issues. Debates and discussions in learning can also be one way to train students to think critically and promote their confidence in solving problems (Tiwari, 2001). Research conducted by Fatmawati (2014) found a significant relationship between critical thinking ability and problem-solving ability of mathematics.

The importance of critical thinking skills and problem-solving abilities in various fields demands various parties including educational institutions to apply them in learning. With the critical thinking skills possessed, it is expected that students can solve problems they faced. However, research dealing with the relationship of critical thinking ability and problem-solving ability in junior high school students is still insignificant. Whereas the correlation between the two competencies is interesting to be studied and examined.

This research aims at describing the correlation between critical thinking and problem-solving ability in junior high school students. This study will deal with ecosystem topic since this topic comprises of global and current issues which often occur in TIMMS and PISA.

METHOD

This research was a correlational design research. Correlational research is an approach dealing with the correlation of tested variables using a correlational statistic (Gal, et al., 2003). The subject of this research was an Eight Graders in the odd semester SMPN 17 Kendari Academic Year 2016/2017. It took 135 students as the respondent from five classes and had learned Ecosystem topic. The data obtained were taken from exercise items. The exercise items consisted of multiple choices questions and 10 essays.

Multiple choice items aim at measuring critical thinking ability of students while essays aim at measuring problem-solving ability. Within critical thinking skill, the indicators measured are the process in making deduction and evaluating the deduction, the process in posing a question and answering a question with logical explanation, the process of evaluating argument, the process of making and determining the decision, the process of integrating with another individual, the process of defining terms and considering the term definition with an appropriate criteria, and the process of identifying assumption. While problem-solving ability indicator measured through this present study are problem identification and analysis, data and information collection, generating effective solution and answer of an issue and implementing effective solution generated. Multiple-choice questions were adapted from the development issues questions developed by Darmawati (2016) with a reliable level of 0.792.

The data obtained is then assessed using the rubric of critical thinking skills assessment and problem-solving ability. Further, it was processed by determining the relationship between critical thinking skills and problem-solving abilities using the Pearson correlation for-

Table 1. Descriptive Statistic on Students' Critical Thinking Skill

	Mean	Std. deviation	N
Critical Thinking	35,74	14.50	135

Table 2. Descriptive Statistic on Students' Problem Solving Ability

	Mean	Std. deviation	N
Problem Solving Ability	48,18	11,49	135

mula with r xy at $\alpha = 0.01$. The calculations were using SPSS 16 for Windows.

RESULTS AND DISCUSSION

Critical Thinking Skill Description

After the calculation was conducted, it obtained the average score of students' critical thinking skill and it is presented in the following Table 1.

Table 1 above provides information that the average score of critical thinking skill of students is 35.74. This number is still relatively low. There are several possible causes regarding the low score of students' critical thinking skill, namely, the concepts mastery possessed by the students. Mastery of concepts is a basic ability that must be possessed by students to be able to think critically. Therefore, in the process of science learning, students should have mastered the concept because by mastering the whole concept the student will be able to develop his or her thinking ability to solve the problems. Mastery of concept is abstracted as the basis for critical thinking, decision making and problem-solving abilities (Berns & Erickson, 2001).

In addition, the low level of students' critical thinking skill is due to the less exposure to its development within learning. Critical thinking is not a skill which it could be developed automatically without practicing. However, critical thinking is one skill which requires a stimulus for its development and improvement. Zubaidah (2010) argues that critical thinking skill is an intellectual potency which requires being developed since in the early age of students through learning. Students rely on the way they think to obtain particular knowledge. Therefore, the way of thinking of students determines how significant certain knowledge can be obtained.

The low level of students' critical thinking skill is the solitary challenge of the teacher, particularly Junior High School teacher. Students in junior high school, ideally, supposed to be trained a critical thinking skill within the learning process. The teacher should be able to design and develop learning material which encourages students' critical thinking skill.

Problem Solving Ability Description

After the calculation was conducted, it obtained the average score of students' problem-solving ability and it is presented in the following Table 2.

Table 2 provides information that the average score of students' problem-solving ability is 48.18. This number is still relatively low. The probable cause of the low score of students' problem-solving ability is the exposure of problem to the students. Students did not get sufficient exposure of problem within learning and thus students were not habituated to deal with the problem. Carson (2007) argues that even though students understand the concept they studied, they could not apply the concept to solve the problem. Therefore, it is imperative for the teacher to impose problem-solving ability encouragement within the learning process. This encouragement intends to generate new experience by finding a solution and solving a problem. Thompson (2011) states that teacher needs to facilitate problem-solving ability and collecting information ability development to prepare the students in facing complex problem in the near future.

Problem-solving activity supposes to blend with learning process (Mauke et al., 2013) and thus it can help students to generate new knowledge (Mukhopadhyay, 2013). During the learning process, the knowledge will be easily obliviated if students only obtain it through spoken delivery. However, if they are demonstrated by example and given a chance to try, students will assuredly remember what they learn (Steinbach, 2002).

The low level of students' problem-solving ability in Ecosystem topic provides valuable information for the teacher. Having this information, the teacher should be aware of encouraging problem-solving ability in every learning process. Further, it aims at making students as a reliable problem solver who is able to deal with the real problem.

Table 3. The Correlation of Critical Thinking Skill and Problem Solving Ability

Correlations

		KBK	KPM
KBK	Pearson Correlation	1	.310**
	Sig. (2-tailed)		.000
	N	135	135
KPM	Pearson Correlation	.310**	1
	Sig. (2-tailed)	.000	
	N	135	135

**. Correlation is significant at the 0.01 level (2-tailed).

The Correlation between Critical Thinking Skill and Problem Solving Ability

After correlational statistic calculation employing Pearson correlation with r_{xy} on $\alpha = 0{,}01$ between critical thinking skill and problem-solving ability, it obtained the correlational result which is presented in the following Table 3.

According to the Table above, it presents that there is a relationship between students critical thinking skill and problem-solving ability on Ecosystem Topic ($r = 0.31$). This result signifies that the increase of students' critical thinking skills in parallel with the increasing of problem-solving abilities. As the ability to think critically increases, the problem-solving ability increases likewise. Vice versa, if the ability to think critically decreases the problem-solving ability decreases likewise. Pursuant to the value of determination ($r\,2 = 0.0961$), then, it is only 9.61% of problem-solving ability can be explained by critical thinking skills.

Critical thinking demands students to actively explore for alternatives within the problem-solving process and thus it becomes a very important part of problem-solving realization. This is in accordance with Claudette Thompson's (2011) opinion which states that critical thinking is the most important skill for problem solving, investigation and discovery process.

Dewey defines critical thinking as "... essentially problem-solving" and Tiwari (2001) conveys that critical thinking ability trained to students in debates or meaningful discussions will construct students' mental structures, make them confident about their own ability to analyze and solve problems. Therefore, the ability to think critically is the high-level thinking skills needed to solve problems and find the most applicable solutions.

The ability to think critically and problem-solving skills is a competence that must be developed and can be trained in the learning process of science. Each science material is ideally taught by bringing up both competencies. Students are not only presented the material but the students themselves who construct their own understanding. Correspondingly, students' critical thinking skill will be sharpened and they are qualified for exploring the most applicable solution in both classroom situation and real-life context. Teachers should provide students with complex and diverse issues related to real life context, challenging and motivating issues (Mauke et al., 2013). Through the problems given, students are expected to construct new ideas of science with critical thinking skills possessed. Gagne (1970) suggests that learning by solving problem-solving skills can develop high-level intellectuals. One of the high-level intellectuals is the ability to think critically.

Several previous studies have considered at the relationship between critical thinking skills and problem-solving ability, i.e research conducted by Fatmawati (2014) by providing problem-solving tests to students. The test aims to analyze students' critical thinking skills related to mathematical problem-solving abilities. The result presents that the relationship between critical thinking skills and problem-solving abilities is proven. The students' critical thinking skills are determined in their ability to address and solve problems. The results obtained by Friedel et al. (2008) discover a relationship between problem-solving and critical thinking in students. Also, research conducted by Kim (2014) indicates that the problem-solving skills are positively correlated with critical thinking ability and self-professional concepts.

Although in this research the correlation between critical thinking ability and problem-solving ability is low, it is expected that this capability should be improved and trained in the process of science learning. Through learning by presenting problems, students are motivated by their thinking to be critical and improve their ability to solve problems. Critical thinking skills with problem-solving ability within content and discipline are related (Zoller & Pushkin, 2007).

CONCLUSION

In accordance with the findings and discussion above, it can be concluded that critical thinking skill ($\bar{x} = 35{,}74$) and problem solving ability ($\bar{y} = 48{,}18$) are correlated with correlation coefficient of 0.31. The correlation is relatively low. Only 9.61% of problem solving ability can be explained by critical thinking skill.

In this study, an analysis of the relationship between critical thinking skill and problem-solving ability

was based on students' answer scores. Therefore, it needs further exploration regarding students' critical thinking skill and problem-solving ability to improve the exposure to learning. Problem-solving is an approach that teachers can use to teach students how to think (Carson, 2007). Thus, problem-based learning is one of the most applicable alternatives to improve and develop the students' critical thinking skill and prob-lem-solving ability.

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