The Correlation between Generic Skills and Metacognitive Skills of Biology Education Students in Tasikmalaya Indonesia Through Problem-Based Learning Model

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Abstract

This research was conducted to investigate the correlation between generic skill with metacognitive skills through Problem-Based Learning model. This is a correlational research studying the correlation of the five indicators of generic skills, namely thinking skill, problem-solving skill, leadership skill, management skill with cooperative skill, and metacognitive skills through problem-based learning model. The population of this research was the biology students taking animal structure course at the teacher training and education faculty of the Siliwangi University Tasikmalaya Indonesia; the sample consisted of 30 students. Multiple linear regressions were used to reveal the correlation regression equation between students' generic skills and metacognitive skills. There is a strong correlation (R= 0.742; R^2 = 0,551) between generic skills and metacognitive skills in learning to implement problem-based learning model; so the contribution of generic skills on metacognitive skill is 55.1%. Among the five indicators of generic skills having a significant simultaneous contribution on metacognitive skills, only the thinking skill and the management skill having bigger contribution, The effective contributions (EC) of management skill and thinking skill are 33,1% and 21,3% respectively. Generic skills and metacognitive skills should be explicitly included in every learning objective, so that various skills needed by the students in the future can be trained and developed as early as possible.
Keywords: Correlation; Generic skills; Metacognitive skills; Problem-based learning.

1. Introduction

The improvement efforts of education quality are continuously done from the elementary and secondary school level until the university level. One way to improve the education quality is by training the students' skills, such as the students' thinking skills or the other skills including the generic skills and metacognitive skills.

Generic skills are believed to be able to empower metacognitive skills. Generic skills are needed by the students to be successful as a learner in the learning process and as a practitioner when they are in the workplace. These skills can be supported and developed during the learning processes. Generic skills can directly or indirectly train and develop metacognitive skills.

This is in line with Gagne (1985) that metacognitive skill is the ability to associate the important messages with the prior knowledge, to draw conclusions, and to monitor or to assess personal performance; furthermore, it is said that metacognition is a high-level cognitive process which is also the ultimate goal of a learning instruction to give knowledge and to develop students' ability to plan, monitor and reorganize the learning strategies (Bars and Oral, 2017). This metacognitive target will only be realized when the generic skills have already been empowered.

The empowerment of the various skills can be done in many ways, one of which is by implementing various learning models. Problem-based learning model was chosen because the previous researches showed that this learning model could empower metacognitive skills and generic skills. Baharom and Palaniandy (2013), concluded that during the process of problem-based learning, many skills were developed, including critical thinking skills, problem-solving skills, learning skills and some others. Martha *et al.* (2014), concluded that, in addition to its use in retention measurement, problem-based learning model could also be used to improve generic skills, such as communication, teamwork, organization and management skill. Downing *et al.* (2011), revealed in his research that the metacognition of the students who learned was improved by using problem-based learning. In addition, the final analysis of the students' learning results which measured at the end of the learning program showed that the

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problem-based learning group significantly achieved score higher in general (Burgaz and Erdem, 2006), including satisfaction obtained during the learning process and their generic skill development.

Carr *et al.* (1989), suggested that students sometimes failed to become active and independent learners because they were not aware of their metacognitive skill. Azevedo (2005), suggested that the students' metacognitive skills could be fostered by using the appropriate instruction. Taraban *et al.* (2004), explored the correlation between metacognitive skills and learning results; their findings showed that metacognitive strategies, especially in reading comprehension activities, could improve students' academic achievement. Some opinions and research findings have found the importance of metacognitive skills for the students, but there are things forgotten; metacognitive skills do not just show up when the generic skills needed by the students are not trained since the beginning, such as, the communication skills, organization skills, management skills, problem-solving skills and some others. Those generic skills must be owned by the students before developing the other skills, and all those skills can be learned and gained during the teaching and learning process (Burgaz, 2008).

There has not been any research investigating the correlation between generic skills and metacognition. In fact, implicitly there is a strong correlation between generic skills and metacognitive skills. Thus, this research was conducted to reveal how strong the correlation between generic skills and metacognitive skills is, and how big the contribution is.

Referring to the research results that have been presented, it is necessary to reveal the correlation between the generic skills consisting of five indicators, namely thinking skills, problem-solving skills, leadership skills, management skills and teamwork skills, as well as metacognitive skills of the students and metacognitive skills through a problem-based learning model. In addition, this research will also reveal the relative contribution and the effective contribution of each indicator of generic skills toward the metacognitive skills through problem-based learning model. For this purpose, this study seeks to answer the following questions:

1. Is there any correlation between generic skills and metacognitive skills through problem-based learning model?
2. To what extent is the contribution of generic skills to the students'metacognitive skills through problem-based learning model?
3. To what extent are the relative and effective contributions of five generic skills indicators namely thinking skills, problem-solving skills, leadership skills, management skills and teamwork skills, as well as metacognitive skills of the students and metacognitive skills through problem-based learning model?

2. Material and Method

This research is a correlational research which was conducted to reveal the correlation between the students' generic skills and metacognitive skills through problem-based learning model in the Teachers' Training and Education Faculty, University of Siliwangi Tasikmalaya, Indonesia. In this research, generic skills were used as the predictor, and metacognitive skills were used as the criterion. This research was conducted for one semester in the 2015/2016 academic year, related to animal structure course which was taught by using problem-based learning model.

The population of this research was the biology students who took the animal structure course at the fourth semester in the teachers' training and education faculty at the University of Siliwangi Tasikmalaya Indonesia, consisting of five classes. Each class consisted of 33 students. Two class used as sample of this research was taken by using random sampling technique.

The instruments of this research were the questionnaire of generic skills and the rubric of metacognitive skills integrated with learning result test. The questionnaire of generic skills consisted of 50 items to measure five indicators of generic skills expected, while the metacognitive rubric used was the metacognitive skill rubric integrated with essay test (Corebima, 2010). The essay test was given to the students after the treatment.

The hypothesis test applied was multiple linear regressions (multivariate). Multiple linear regressions were used to reveal the correlation regression equation between students' generic skills and metacognitive skills. Further, such an analysis can facilitate to identify the directions of the correlation between independent and dependent variables. Each variable can positively or negatively correlate. In this case, it functioned to predict the value of the dependent variable based on the increasing and decreasing occurrences f the independent variables. Before the hypothesis testing using regression linearity, the data were previously tested for the normality and homogeneity as the prerequisite test of analyses. After the regression equation between the generic skills and the metacognitive skills was obtained, the relative contribution (RC) and the effective contribution (EC) of each independent variable to the dependent variable were calculated.

3. Results

The results of the data analysis on the correlation between generic skills and metacognitive skills in problem-based learning were presented in Table 1. The results of the multiple correlation analysis in Table 1 show that there is a correlation between generic skills and metacognitive skills in problem-based learning.

Table-1. Summary of Multiple Correlation Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Statistics R Square	F	df1	df2	Sig. F
1	0.472	0.223	0.158	5.24708	0.223	3.444	5	60	0.008
Predictors: (Constant), cooperation skills, management skills, problem-solving skills, leadership skills, thinking Skills									

The results of the multiple regression analysis in the table with the predictor of five indicators of generic skills (thinking skills, problem-solving skills, leadership skills, management skills and the cooperation skills) shows that R= 0.472. It means that there is a strong correlation between generic skills and metacognitive skills in problem-based learning. While R^2 (determination coefficient) was 0.223 or 22.3%. This shows that the contribution percentage of the effect of generic skills on metacognitive skills in problem-based learning is 22.3%, while the remaining percentage as much as 77.7% is the effect of the other variables which are not included in this research.

The next analysis (ANOVA) was to know whether the predictors simultaneously had a significant effect on metacognitive skills. The summary of the ANOVA test is presented in Table 2.

Table-2. Summary of ANOVA Test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	474.034	5	94.807	3.444	0.008
Residual	1651.911	60	27.532		
Total	2125.945	65			
a. Dependent Variable: Metacognitive Skills					
b. Predictors: (Constant), cooperation skills, Management Skills, Problem-Solving Skills, Thinking Skills, Leadership Skills					

The results of ANOVA test show that generic skills with five indicators (thinking skills, problem-solving skills, leadership skills, management skills and cooperation skills) simultaneously have a very significant effect on metacognitive skills (p=0.008).

Further explanation about the regression equation and the contribution of generic skills on metacognitive skills is presented in Table 3 and Table 4. Table 3 shows that regression equation is as follows Y' = -23.634+ 0.381X$_1$ + 0.300X$_2$ + 0.117X$_3$ + 0.349X$_4$ + 0.053X$_5$. The table also shows that partially only the thinking skills and the management skills which have significant correlation with metacognitive skills.

Table-3. Summary of t-Test

Model	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	-23.634	9.678		-2.442	0.018
Thinking skills	0.381	0.177	0.259	2.148	0.036
Problem-solving skills	0.300	0.230	0.179	1.302	0.198
Leadership skills	0.117	0.224	0.072	0.523	0.603
Management skills	0.349	0.171	0.248	2.044	0.045
Cooperation Skills	0.053	0.186	0.035	0.286	0.776

Table-4. Summary of The Calculation Results of Relative Contribution and Effective Contribution

Generic Skills Indicators	RC (%)	EC (%)
Thinking skills	32.9	7.33
Problem-solving skills	17.2	3.84
Leadership skills	9.1	2.03
Management skills	38.0	8.48
Cooperation skills	2.8	0.62
Total	100	22.31

Based on the analysis results presented at Table 4, it can be viewed that the relative contribution (RC%) given by the thinking skills indicator is 32.9%, problem-solving skills 17.2%, leadership skills 9.1%, management skills 38.0% and cooperation skills of 2.8% on metacognitive skills; the total of relative contribution is 100%. As the effective contribution (EC%) given by the thinking skill indicator are 7.33%, problem-solving skills 3.84%, leadership skill 2.03%, management skills 8.48% and cooperation skill 0.62% on metacognitive skills; the total of effective contribution was 22.31%.

4. Discussion

The results of this research are in line with the results of the previous researches investigating the effect of problem-based learning, on generic skills and metacognitive skills. Hande *et al.* (2015), concluded in his research

that problem-based learning improved the acquisition of knowledge, generic skills, and attitudes, with a positive correlation between the scores of the three domains. Problem-based learning does not only have an effect on the improvement of interpersonal competence and cognitive domains but also have an effect on the generic skills that are considered important in supporting the students' career when they work professionally. Similarly, Tosun and Senocak (2013) in their research concluded that problem-based learning was more effective in developing students' metacognitive awareness whose science background was weak; furthermore, they explained that problem-based learning was very effective in increasing the positive attitude toward chemistry subject of the students whose science background was weak.

In line with the results of the research, Yassin et al. (2008) stated that generic skills should be instilled in students' personality, such as through the explicit inclusion in the curriculum of universities as the learning goals because only graduates having the skills can compete competitively in their work field. Reigeluth and Moore (1999), revealed that the main type of generic skills were problem-solving skills, strategies to memorize particular things, and metacognitive skills. Generic skills are different from the other skills. Generic skills can be developed and implemented upon other skills, but it requires more time to be learnt, and the same also applies to metacognitive skills.

Thinking skills is one of the generic skills that organize a person's mental process. Thinking skills consist of knowledge, cognitive disposition, and metacognitive operation. One type of thinking skills that can help students think better is the critical thinking skills (Schraw, 1998). Previous research has shown that many students can improve their critical thinking skills and scientific thinking through the development of metacognitive awareness and metacognitive skills (Kuhn, 1989; Rogoff, 1990). According to Santrock (2007), only very few schools really taught students to think critically. He believed that many of the students who successfully completed their tasks, did well in their exams and gained good results, did not study in depth or thought critically. Yet, it is clear that critical thinking influences the student's metacognitive awareness. Metacognitive awareness involves monitoring and reflecting on a person's way of thinking, including how and when to use specific procedures to solve problems (Karnain et al., 2018; Santrock, 2007). The results of the research at least confirm that metacognitive skills can be trained and developed by improving the thinking skills.

Metacognitive skill is one component of metacognition (Java, 2014). Metacognitive skill is regulation activities related to problem-solving that include planning, monitoring and evaluating metacognition (Brown, 1987). Another term is metacognition regulation which refers to the activities and actions done by individuals to control their own cognition (Cooper and Sandi-Urena, 2009). On the other hand, problem-solving is the process by which a student/person getting a solution to the problem by integrating their thinking skills, planning, reasoning, and implementing the plan (Delvecchio, 2011; Wilson, 2000). The results of this research were also supported by the research results by Java (2014), which revealed that there is a correlation of problem-solving learning strategy in improving students' metacognitive skills, although problem-solving was not the main factor in improving students' metacognitive skills. It proves that only to the high academic ability students does this skill have a significant effect.

The relative contribution and effective contribution of the leadership skills indicators on metacognitive skills were 9.1% and 2.03% respectively, while the relative contribution and effective contribution of cooperative skills are 2.8% and 0.62%, respectively. Both of these skills show small contribution compared with the other skills. Leadership and cooperation are identical with how to organize and manage an organization, to get along as a person belonging to a group or to cooperate with others to achieve a particular goal. De Fazio et al. (2015), stated that one of the skill required from a learner is cooperative skill. It could help a learner to grow and to develop his metacognitive skill. Teacher can train the skill by familiarizing learners with a group or collaborative work.

The other metacognitive skills indicator studied is the management skills. This skill gives the biggest relative and effective contribution to metacognitive skills, 38,0%, and 8.48% respectively. Management skills in this research referred to the students' abilities in managing themselves to acquire the knowledge during the learning process and applying it in various contexts of life which they will encounter after graduating from the university, especially in their working lives.

Self-management, self-managing, self-directed, or self-regulated are several terms often used interchangeably with management skill. Paris and Winograd (1990), stated that it was generally recognized that metacognition had two important features, namely the self-assessment and cognition management. Self-assessment is a reflection of the knowledge and a motivational statement to solve the problems, while the self-management is the orchestration of metacognition in solving the problems. Pintrich (2004), regarded self-regulated learning as active construction processes where learners set their learning goals and attempted to monitor, manage, and control their cognition, motivation, and behaviour, guided and constrained by the objectives and contextual features in their environment. Paris and Winograd (2003), stated that self-regulated could be taught through explicit instruction, directed reflection, and metacognition, although sometimes the explicit instructions in some cases were not always necessary; without explicit instruction, many students would not understand the importance of metacognition and self-regulation. Based on the results of this research, it can be concluded that management skills, particularly self-regulation, has a correlation and an effect on metacognitive skills.

5. Conclusion

Based on the results of this research, two conclusions will be stated further.
1. There is a correlation between generic skills and metacognitive skills in learning to implement problem-based learning model. The correlation is categorized as strong with R= 0.472, while R^2 (coefficient

determination) is 0,223. It means that the contribution of generic skills on metacognitive skills is 22.3%, and the remaining part as much as 77.7% is influenced by other variables not examined in this research.

2. Although the five indicators of generic skills have a significant simultaneous contribution on metacognitive skills, only the thinking skills and the management skills which have a significant contribution.

According to the findings of the study, it is suggested that generic skills and metacognitive skills should be explicitly included in every learning objective, not only positioned as *hidden curriculum* so that various skills needed by the students in the future can be trained and developed as early as possible. Further researches can investigate the correlation between the other indicators or other types of generic skills on metacognitive skill so that a wider conclusion can be made about which indicators or which types of generic skills have a significant correlation with metacognitive skills.

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