



PROFILE OF STUDENTS' CREATIVE THINKING SKILLS ON QUANTITATIVE PROJECT-BASED PROTEIN TESTING USING LOCAL MATERIALS

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ABSTRACT

The purpose of this study is to obtain a profile of students' creative thinking skills on quantitative project-based protein testing using local materials. Implementation of the research is using quasi-experimental method pre-test post-test control group design with 40 students involved in Biochemistry lab. The research instrument is pre-test and post-test using creative thinking skills in the form of description and students' questionnaire. The analysis was performed with SPSS 22.0 program to see the significance normality, U Mann-Whitney test for nonparametric statistics, N-Gain score, and the percentage of student responses to the practicum performed. The research result shows that the pretest rate in the experimental group is 8.25 while in the control group is 6.90. After attending a project-based practicum with local materials, the experimental group obtained the mean of posttest is 37.55 while in control class is 11.18. The students' improvement on creative thinking skills can be seen from the average of N-Gain in the experimental class with 0.32 (medium category) and in the control category with 0.05 (low category). The experimental and control class have different creative thinking skills significantly different fluency, flexibility, novelty, and detail. It can be concluded that quantitative project-based protein testing using local materials can improve students' creative thinking skills. 71% of total students feel that quantitative project-based protein testing using local materials make them more creative in doing a practicum in the laboratory.

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INTRODUCTION

Creative thinking skill is one of the important cognitive aspects that must be considered in the process of learning science in the classroom. One of the learning process of science in college is realized in the course lab. So far, the assessed cognitive aspect from the practicum course does not cover the creative thinking skills, whereas many phases of practicum in lab require students' creative thinking skills for example when they have to choose the practicum materials. Fatmawati (2016) states that creative thinking

skills are required in science learning especially in Biotechnology. Some other studies have also found the relationship of creative thinking skills to experimental activities in the lab. Experimental activities can make students do a practicum with hands on as well as minds on activity (Bellin, Bruno, and Farrow, 2010; Coleman, 2010; Witherow and Carson, 2011; Trapani and Clarke, 2012).

The students' activities in the practicum include investigation through experiments encourages the students to give questions, propose hypotheses, make predictions, use tools to collect and analyze data, make conclusions, build arguments, discuss findings, and use broad reasoning strategies involving skills in thinking creatively,

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critically, causally, and logically (Chin and Chia, 2005; Hong and Kang, 2009).

One of the ways to realize a practicum that is able to develop creative thinking skills is by choosing the right learning model. Sari (2015) says that students like practicum that can make them free to design and examine. An appropriate learning model with that purpose is a project-based learning model. Project-based learning model (perceived learning) can trigger students' creative thinking skills. The main purpose this learning is to enable students to practice what they learn by integrating theory and practice. Furthermore, students can develop their creative thinking skills to solve life and environmental challenges later (Yilmaz and Cavas, 2007; Holubova, 2008; Yalcin, Turgut, and Büyükkasap, 2009; Bell, 2010; Eskrootchi and Oskrochi, 2010; Treacy, 2011; Bjorner, Kofoed and Pederson, 2012; Lou et al., 2012; Hsieh, Lou and Shih, 2013; Robinson, 2013; and Husamah, 2015).

In this study, the researchers utilize local materials aiming to initiate the students' creative thinking skills in selecting the materials in the lab. The environmental approach in learning can increase students' awareness of the environment (Ashraf, 2013), build creative thinking skills and student creative attitudes (Nuswowati and Taufiq, 2015). The close relationship between creative thinking skills in laboratory activities and learning models makes the researchers interested in looking for the profile of students' creative thinking skills on quantitative project-based protein testing using local materials.

METHODS

The method of this research is quasi-experimental research with pretest and posttest control group design (Fraenkel & Wallen, 1993). The subject of the study are 40 students attending the biochemistry lab, and they are divided into 6 groups.

In this study, there are the control group and experimental group. In the control group, a quantitative lipid analysis is performed as written in the guidebook. At the end of the meeting, the students are given a test in the form of explanation to test the students' creative thinking skills in a practicum.

The practicum of quantitative protein analysis is done in an experimental group. The practicum is done based on the project by using local materials around the students' environment as practicum materials. Students are required to determine titles, local materials, tools, procedures

appropriate to local materials. At the end of the meeting, the students are given explanation test used to test students' creative thinking skills in lab practicum.

Quantitative and qualitative data instruments are used altogether in this study. For quantitative data collection is done by testing the students on their creative thinking skills. 7 tasks of written test instruments are in the form of explanation. The test is used to measure the students' creative thinking skills before and after the class. Each question represents an indicator of creative thinking skill including students' fluency, flexibility, novelty, and detail (Torrance, 1972). Qualitative data are obtained through questionnaire aiming to see students' responses to the implementation of quantitative project-based biomolecule experiments with local materials.

The data are processed using SPSS 22.0 program to see whether it is normally distributed or not. The creative thinking skill test is used to measure the N-gain value by Hake formula (Meltzer, 2002) from the average of pretest and posttest. Qualitative data are used as questionnaires in scale and measured by the percentage of each attitude scale.

RESULTS AND DISCUSSION

In this study, there are the control group and experimental group. In the experimental group which uses quantitative project-based protein testing using local materials, students are required to determine the title, objectives, materials, procedures independently. In the control group, the students in groups performed a quantitative lipid analysis experiment as written in the guidebook. Finally, the posttest is done to see the profile of students' creative thinking skills. A summary of the quantitative practice of protein and lipid analysis can be seen in Table 1.

From the distribution of practicum activities in table 1, the quantitative analysis of student lipids is only done based on the guidebook. Titles, objectives, materials and procedures are included in the guidebook.

Different things can be seen in the quantitative analysis of proteins. The title and the purpose of the practicum are determined by the students themselves. The materials in the practicum are from local materials around students such as pempek, bread, rice, sausage and salted fish. Students want to see if the materials around them are really the protein source and really contain protein. Some ingredients known to contain carbohydrates such as rice and bread are also tested

Table 1. Practicum distribution activities of quantitative analysis of lipids and proteins

	Quantitative Analysis of Lipid	Quantitative Analysis of Protein
Learning Model	Practicum with guidebook	Project-based practicum using local materials
Local Materials	Oil	Pempek, bread, rice, sausage, salted fish
Procedure	Peroxide numbers determination	Formal titration, lowry's method

for quantitative analysis of proteins. Students want to see whether by consuming local materials containing carbohydrates can also fulfill the body's need for protein.

In this practicum, students in groups are free to choose quantitative protein procedures namely formal titration and lowry method. Formal titration and lowry method can be used to measure the amount of protein content in a sample. This thing has been done by Fahmid et al. (2016) and Krishnaveni and Dhanalakshmi (2014) for calculating the total protein content in food by using the lowry as one of the methods.

By using the SPSS 22.0 program, it can be seen whether or not the distribution is normal. The normality test results can be seen in Table 2.

Table 2. Normality Test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
Pre-lipid	.206	40	.000	.825	40	.000
Post-lipid	.191	40	.001	.907	40	.003
Pre-protein	.216	40	.000	.897	40	.002
Post-protein	.175	40	.003	.965	40	.241

The normality test results show p-value which calculated by Shapiro-Wilk test is smaller than $p < 0.05$ which means that the data is not normally distributed. Further data will be analyzed with nonparametric statistics.

Creative Thinking Skill Test

To see the influence of biomolecule quantitative analysis on students' creative thinking skill, the test is done in control and experiment group. Each question represents an indicator of creative thinking skills such as fluency, clarity, novelty and detail (Torrance, 1972).

The average score of pretest and posttest results can be seen in Table 3 and 4.

The quantitative project-based protein testing using local materials gives effect on the improvement of students' creative thinking skill.

The increase has reached a gain of 0.32 in the medium category. It is different from table 4.

Table 3. The average score of pretest and posttest and N-gain in the experimental group

	Pretest	Posttest
Mean	8,25	37,55
N gain	0,32	
Category	Medium	

Table 4. The average score of pretest and posttest and N-gain in control group.

	Pretest	Posttest
Mean	6,90	11,18
N-gain	0,05	
Category	Low	

It can be seen in table 4 that the increase of students' creative thinking skill does present before and after the practicum in quantitative analysis of lipid although the N-gain is 0,05 which means low.

After the data is known not normal, it is then tested using comparative hypothesis known as U-Mann-Withney test on pretest and posttest. A comparative hypothesis test is used to determine whether the data differ significantly or not. The value is seen in this test to search the Sig value (2-tailed). Then compared with the level of trust 5% ($\alpha 0,05$). If the sig. (2-tailed) $< 0,05$, the data are significantly different, if the sig. (2-tailed) $> 0,05$ the data are not significantly different. It can be seen in the following Table 5 as the results of U Mann-Withney pretest data:

Table 5. The U Mann-Withney pretest data results

Kind of Data	Sig. (2 tailed)	α	Decision	Information
Pretest	0,272	0,05	H0 is rejected	Not Significantly different

Table 5 shows Sig. (2-tailed) of pre-test in the control and experimental group is 0,272 with the level of trust 5% ($\alpha 0,05$). The decision is H0 is rejected which means the students in control

and experimental group are not significantly different or having the same basic knowledge

To see the results of *U-Mann-Whitney* test on posttest can be done by looking at Table 6.

Table 6. The test result of U *Mann-Whitney* post-test data.

Kind of Data	Sig. (2 tailed)	α	Decision	Information
Posttest	0,000	0,05	H0 is accepted	Significantly different

Table 6 shows the *Sig. (2-tailed)* of posttest data is 0,000. The decision is H0 is accepted because $0,000 < 0,05$. The data are significantly different, and this means that the students in the control and experimental group have different creative thinking skills.

Project-based practicum with local materials enables students to think creatively in terms of searching materials from their surroundings and also looking for appropriate procedures. This is in accordance with previous researches where project-based models can make students creative (Bjorner, Kofoed, & Pederson, 2012; Husamah, 2015), give clear and better understanding (Treacy, 2011), make the students get involved because the learning activity is centered on students (Bell, 2010) and enable the students to relate the practicum with daily life (Eskrootchi and Oskrochi, 2010; Yilmaz dan Cavas, 2007; and Nuswawati & Taufiq, 2015).

The student's response on the project-based quantitative analysis practicum can be seen on questionnaires. The measured aspects in the questionnaire are positive attitudes and perceptions of the quantitative project-based protein testing using local materials as well as an optimistic attitude to the learning's success. The result shows that 71% of students agreed that the lectures of quantitative project-based protein testing using local materials make them more creative in doing the practicum.

CONCLUSIONS

It can be concluded from the research that:
 1) Quantitative project-based protein testing using local materials can improve the students' creative thinking skills with the N-Gain is 0,32; 2) Students agree that quantitative analysis practicum on biomolecules with local materials makes them more creative for example in choosing the materials and practicum procedures.

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