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Blended Project Based Learning: Metacognitive Awareness of Biology Education New Students

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Abstract

This study aims to analyse the difference of metacognitive awareness of treatment (using Blended Project Based Learning) and control class. This is a quasi-experimental research with Non-equivalent Control Group Design. This research was conducted at Department of Biology Education, University of Muhammadiyah Malang, in the first semester of the academic year 2014/2015. Metacognitive awareness of treatment class and control class was measured by using Metacognitive Awareness Inventory. Metacognitive awareness difference analysed with One-way ANOVA, processed with SPSS 22 for Windows. The results showed that there were difference Mean values in metacognitive awareness (knowledge about cognition and regulation of cognitive) between treatment and control. Mean value of treatment class was higher than control class. It means that Blended Project Based Learning effectively to develop and stimulation metacognitive awareness of new students (Biology teachers candidates).

Keywords*: biology, blended, learning, metacognitive, project*

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Introduction

Department of Biology Educations has the main task is organizing quality education to produce a Biology teacher professional future vision. The task is very heavy; therefore the learning process that is applied must be appropriate. According to Muhibbuddin (2010) learning to equip prospective teachers must be relevant, to the characteristics, namely 1) the effective learning, students are required actively to explore and process information, 2) help raise and develop the thinking skills to the material being studied, and (3) learning strategies should aim to build awareness of the difficulties of conception, practice skills, cultivate an attitude of curiosity, and build motivation to learn.

Applied learning in the classes of prospective teachers, from the beginning they go to college, must build intellectual curiosity like an expert (Husamah, 2014). Department of Biology Educations should be able to implement the learning process that stimulates all students to develop into a full competence of graduates who have intellectual, professional, social, moral, and personal (Madrid, 2009). One form is the description of the competencies they have a habit of thinking (White et al., 2011; Husamah & Pantiwati, 2014).

The habit of thinking needs to be done because the life of today's society and future marked by the pace of science and technology very quickly. The demands of globalization and the information age will affect many aspects of life, including the purpose and practice of education. Therefore, it is deemed necessary educational goals that emphasize the habit of thinking, which can be used in problem solving, improving reasoning, conceptual ability, and the necessary analysis of future society. At present and in the future habits of thinking to solve the problem is a fundamental aspect which must be the main target of learning (Murtadho, 2013).

Thinking resulting from the process of metacognition and everyone has it. Livingston (1997) fully cites Flavell opinion on the definition of metacognition. Metacognition refers to higher order thinking which involves active control over the cognitive processes engaged in learning. Activities such as planning how to approach a given learning tasks, monitoring comprehension, and evaluating progress toward the completion of a task are metacognitive in nature.

Metacognition affects the learning process of a person. According to experts, although metacognition is not enough to estimate the success in advance, it has an intermediary role in learning. Individuals with higher metacognitive awareness are better at planning, managing information, monitoring, debugging mistakes, and evaluating compared to individuals with low metacognitive awareness (Tosun & Senocak, 2013).

In summary, it can be stated that metacognition is awareness someone on the process of monitoring as well as maintaining, regulating and controlling own thoughts and actions (Flavel & Miller, 1993). Metacognition awareness includes two components: (1) knowledge of cognition, and (2) experience/regulatory cognition or also called metacognition strategies. Cognition knowledge is knowledge about thinking consciousness itself and the knowledge of when and where to use the strategy. (Schraw & Moshman, 1995; Gredler, 2009). Regulation of cognitive consists of five components, namely, planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation (Schraw & Dennison, 1994).

Metacognition awareness is very necessary in the activities of thinking students (prospective teachers) early on, from the beginning of the semester. Through metacognition, the mind can be maintained, planned, and controlled (Flavel & Miller, 1993). Metacognition is an important aspect of human intelligence and higher learning and has been closely linked to critical thinking. Critical thinking is considered to be thinking about thinking and "metacognitive more than cognitive" (Sharma & Hanna fi n, 2004). There is the recognition that metacognition is not just a private internal activity but socially Also situated (Akyol & Garrison, 2011). A proper definition of both terms is required in order to show the difference between cognition and metacognition. Cognition is the mental process through which the user establishes this mental model whereas metacognition considers the mindful engagement of the user in a task, including the knowledge and control the user has over his cognitive processes. In addition it also deals with awareness, observation, reflection and analysis which is needed to become an independent learner (Sart, 2014).

Metacognitive awareness needs to be stimulated and developed in the learning activities, starting from the beginning of the semester. Habituation or stimulus cannot be accomplished if only in an atmosphere of traditional or conventional learning. Therefore, the necessary process of habituation or stimulus metacognitive awareness through the application of innovative active learning, one of which is Project Based Learning (PjBL).

Husamah (2013) has implemented an integrated cooperative STAD and PjBL. Implementation of the integrated cooperative STAD and PjBL can improve metacognitive awareness in students' semesters 5th at Department of Biology Education, Faculty of Teacher Training and Education,

University of Muhammadiyah Malang. They covered subjects Learning Resources and Learning Media. All indicators or components Knowledge of Cognitive and cognitive coordination has increased.

The integrated cooperative STAD and PjBL applied by Husamah (2013) on the students in semesters 5th. Based on the review andragogy theory, students' semesters 5th are students who are considered well-established and have been able to adjust to the dynamics of the various lectures. Therefore this innovative active learning need to be developed further and simultaneously examined its effectiveness in the early semester students (first semester/new students). Associated with it, we have to develop a model of learning by integrating PjBL with Blended learning.

Blended, hybrid or mixed learning does not have a definite definition, but the common strings connecting various researches on blended learning is the presence of traditional method and use of multimedia (computer, mobile devices, online etc.). It is a formal education program in which a student learns: at least in part through online learning, with some element of student control over time, place, path, and/or pace; at least in part in a supervised brick-and-mortar location away from home; and the modalities along each student's learning path within a course or subject are connected to provide an integrated learning experience (Olayiwola & Alimi, 2015).

Blended learning is mixing between online and face-to-face in an integrated learning. Blended learning also means using a variety of methods that combine face-to-face traditional classroom teaching and online learning to gain objectivity (Moebs & Weibelzahl, 2006; Akkoyunlu & Soylu, 2006). The benefits of blended learning are increasingly being realized as an escalating number of courses demonstrate that the blended format is the most popular mode of instruction (Buzzetto-More & Sweat-Guy, 2006). Meanwhile Graham (2005) says that blended learning is an approach that integrates face-to-face and computer-aided instructional activities in a pedagogical environment. As observed by Powell et al (2014) blended learning is an instructional modality important for the future of learning.

Researcher have developed an integrated PjBL with Blended learning, called Blended Project Based Learning. Blended Project Based Learning is implemented in the learning process Introduction Education courses taken by the students of the 1st semester (new students). This study aims to analyze the difference of metacognitive awareness of treatment (using Blended Project Based Learning) and control class. This research is expected to contribute in the development of habituation oriented learning of students in thinking and consciousness metacognitive. This will be the provision them for future teachers can be globally competitive.

Methods

This research is a quasi-experimental with Non-equivalent Control Group Design. This study is a continuation of research and development carried out previously, aims to look at the effectiveness of the models that have been developed. In the design of this study, both groups of research subjects randomly selected. This study compares only post test scores, while the pre-test was not carried out.

This research was conducted at Department of Biology Education, Faculty of Teacher Training and Education, University of Muhammadiyah Malang. The experiment was conducted in the first semester of the academic year 2014/2015. The subjects were students in the first semester, who take a course in Introduction to Education, class A, B, C, and D. Class IA and IB classes are treatments class (the class that uses Blended Project Based Learning), while class IC and class ID as the control class (the class that uses conventional teaching methods/traditional).

Metacognitive awareness of treatment class and control class was measured by using metacognitive Awareness Inventory (MAI) made by Schraw & Dennison (1994) and developed also by Imel (2002). MAI consists of 52 items as the elaboration of knowledge of cognition and cognition coordination. Each one statement had 3 choices of answers that yes, it is not clear, and no. However, Pantiwati (2010) use 6 answer choices are Always (100%), very often (> 70% - <100%), often (> 50% - 70%), Uncommon (> 30% -50%), Very Rarely (> 0% -30%) and Never (0%).

Typology of metacognitive Components shown in Table 1, while the grille and questionnaire of Metacognitive Awareness Inventory (MAI) as presented in Appendix 1.

Table 1. Typology of Metacognitive Components

Metacognitive Component	Type	Terminology
Cognitive knowledge	Knowledge about oneself as a learner and factors affecting cognition	Person and task knowledge Self-appraisal Epistemological understanding
	Awareness and management of cognition, including knowledge about strategies	Declarative knowledge Procedural knowledge Strategy knowledge
	Knowledge about why and when to use a given strategy	Conditional knowledge
	Identification and selection of appropriate strategies and allocation of resources	Planning
Cognitive regulation	Attending to and being aware of comprehension and task performance	Monitoring or regulating Cognitive experiences
	Assessing the processes and products of one's learning, and revisiting and revising learning goals	Evaluating

(Source: Adapted from Lai, 2011).

Metacognitive awareness difference in treatment and control analysed with One-way ANOVA, processed with SPSS 22 for Windows. Data of Metacognitive awareness obtained beforehand tested prerequisites, namely normality test and homogeneity test.

Results and Discussions

Metacognition consists of two components: knowledge and regulation. Metacognitive knowledge includes knowledge about oneself as a learner and the factors that might impact performance, knowledge about strategies, and knowledge about when and why to use strategies. Metacognitive regulation is the monitoring of one's cognition and includes planning activities, awareness of comprehension and task performance, and evaluation of the efficacy of monitoring processes and strategies (Lai, 2011). Metacognitive knowledge and metacognitive regulation is also known as Knowledge of Cognition and Regulation of Cognition (Schraw & Dennison, 1994; Schraw, 1998; Murphy, 2008).

Typical representations of metacognitive are based on the argument that it is comprised of two components or dimensions. In experiments with an inventory of metacognitive, Schraw and Dennison found that the experiments "strongly supported the two component view of metacognition". Schraw emphasized that knowledge of cognition and regulation of cognition are interrelated. Furthermore, he argued that both components span a variety of subject areas and are not domain specific. Schraw and Dennison reported that the two components were "strongly inter-correlated, suggesting that knowledge and regulation may work in unison to help students self-regulate". Brown's early work on metacognitive also emphasized the two components, which, she noted, are closely related and feed recursively off each other (Murphy, 2008).

Result of One-way ANOVA of Metacognitive awareness (Knowledge about Cognition and Cognitive of treatment) using SPSS are showed at Table 2 and Table 3.

Table 2. One-way ANOVAs Result of Knowledge about Cognition

Class	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Treatment class	47	62.0213	5.94079	0.86655	60.2770	63.7656
Control class	48	52.6979	5.98557	0.86394	50.9599	54.4359
Total	95	57.3105	7.55940	0.77558	55.7706	58.8505

Table 2 shows that Mean for Knowledge about Cognition in treatment class is higher than control class (non-treatment). Mean values of Knowledge about Cognition in treatment class was 62.0 while the Mean values in control class (non-treatment) was 52.7. Its means there is difference in the mean value of 10.7. This shows that the students in the treatment class a change for the better in Knowledge about Cognition.

Table 3. One-way ANOVAs Result of Regulation of Cognitive

Class	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Treatment class	47	128.6809	13.93792	2.03305	124.5885	132.7732
Control class	48	111.8333	13.40583	1.93497	107.9407	115.7260
Total	95	120.1684	16.01970	1.64359	116.9050	123.4318

Table 3 shows that Mean for Regulation of Cognitive in treatment class is higher than control class (non-treatment). Mean values of Regulation of Cognitive in treatment class was 128.7 while the Mean values in control class (non-treatment) was 111.8. Its means there is difference in the mean value of 16.9. This shows that the students in the treatment class a change for the better in Regulation of Cognitive.

Based on the data in Table 2 and Table 3, we can say that Mean of Metacognitive Awareness (Knowledge about Cognition and Regulation of Cognition) in the treatment class is higher or better than the control class. Mean of treatment class have better metacognitive awareness or higher than the control class because treatment class using combines learning of PjBL and Blended Learning.

This is in accordance with Gerlach (2007) statement and research that the overall findings in this study suggest that students had success in using metacognitive processes to self-monitor the development of their self-regulatory skills. The self-monitoring process was a deliberate approach used to teach students to self-identify their weaknesses and strengths in terms of three self-regulatory skills: learning strategy use, goal setting and time management. These skills are instrumental in students' achieving success by independently completing a project. The outcomes of the study imply that students need scaffolding support in project-based learning in order to facilitate the development of self-regulatory skills. As students completed the social studies class project, they required careful guidance to learn to sift through and to synthesize information from a variety of resources. It was important to design a collaborative learning environment where students were encouraged to share in the decision-making process of the project outcomes and the curriculum.

Project based learning is kind of learning to take place violates this quasi-need because the aim is to bring about conceptual change (Vosniadou, 2007). Clearly, it can be said that there is need to explore further the effectiveness of scaffolding and feedback of learning. Educators should become increasingly aware of the need and expectation for students to develop nontechnical skills (such as independent learning) in order to exploit educational resources (Cassidy & Weinberg, 2005).

This is in accordance with Sart (2014) that as a result, project based learning cases in which everyday challenges are solved develop better environments for the development of metacognition due to the fact that the highest 'meta-level' of cognition is implicated. In the project-based learning, by solving different problems it is possible to develop creative ideas while improving highly developed skills. Sart analyzed that the results show that most (86%) participants agree that the project-based learning environment by solving different problems in cases is much better (32%) than traditional environment. As most (81%) of the participants point out that their awareness is markedly improved (68%) in the training comparing to those of the participants in the traditional courses. As a result, cases in which everyday challenges, including social, economic, cultural, and environment are solved in the projects develop better environments for the development of metacognition due to the fact that the highest 'meta-level' of cognition is implicated. In the project-based learning, by solving different problems it is possible develop creative ideas while improving highly developed skills. According to the findings above the following results might be expected.

Students' metacognitive need to be strengthened in PjBL environments and metacognitive knowledge is best supported in social settings for learning (McLoughlin & Hollingworth, 2001). Accordance with that's opinion, Papanikolaou & Boubouka (2010) further investigates the orchestration of collaboration in order to enhance metacognitive knowledge in a PjBL context. They conducted an empirical study using a collaborative learning script combining individual and collaborative activities at specific phases of a project as an additional scaffold. They used "MyProject model" in an e-learning context where all the interactions take place online and the life cycle of a project is inherent in the environment. This work combines research from the areas of PjBL, metacognition, and computer-supported collaborative learning.

"My Project model" is a blended learning (Papanikolaou & Boubouka, 2010). Integration of ICT in teaching and learning (we called blended learning) contributes in the improvement of skills and all potencies, included metacognitive awareness, among teachers and students. The 21st century needs new innovation in education, especially in relation to teaching and learning process with the application of technology (Kamsin & Din, 2015). That is accordance with Collis (2003) opined that blending learning gave opportunity for development on educational applications prevailing in both computer-

centered and face-to-face learning environments. Blended learning environments might help increase the student-centered strategies and activities.

Research by Yaniawati (2013) shown that in the blended learning group, in solving the problems that requires analysis, students relatively have wider concepts compared to students in the other group. Different than the other groups (full e-learning and conventional), the majority of student did not answer completely (emptied) the types of this analysis. Based on these facts, it could be seen that blended learning could widen the student's concept and cultivated a creative way of thinking. This not too different with Lynch & Dembo (2004) that there are significance relationship that *self regulated* and *online learning* in blended learning context.

Positive effects of blended learning to metacognitive awareness are presented by Zhu *et al* (2013). They investigate 120 Australian university students' attitudes toward online learning in a blended course. They were found that the students became more positive toward online learning by the end of the course.

The findings of positive attitude changes in the present study accorded with the research by White *et a*l (1994). They concluded that computer lab usage correlated significantly with changes in the students' general attitude toward computers. Jung et al (2002) also found that the learning experiences in an online environment brought about a positive attitude change concerning the use of the Web for learning among the students, regardless of the type of interaction. López-Pérez *et al* (2011) found that the use of blended learning environment had a positive effect in reducing the students' dropout rates and improving their exam marks. Lei (2010) indicated that blended learning experiences could be beneficial to reinforce students' understanding of the subject and enhance and support their learning process.

Conclusions

The results showed that there was difference in metacognitive awareness (Knowledge about Cognition and Regulation of Cognitive) between treatment and control. Mean value of Knowledge about Cognition of treatment (62.0) was higher than control (52.7). Mean value of Regulation of Cognitive of treatment (128.7) was higher than control (111.8). It means that Blended Project Based Learning effectively to develop and stimulation metacognitive awareness of new students of Biology Education Department, Faculty of Teacher Training and Education, University of Muhammadiyah Malang (Biology teachers candidates). This model need to implemented in big scale and other courses.

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