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Integration of Project Activity to Enhance the Scientific Process Skill and Self-Efficacy in Zoology of Vertebrate Teaching and Learning

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ABSTRACT

This study is a quantitative research conducted to analyze the integration of project activity to increase the scientific process skill and self-efficacy. While uncovering the effect of each indicator of every predictor, a descriptive qualitative analysis has been done. Respondents in this research were biology students in teacher. The sample of 30 respondents were taken by random sampling technique. Research instruments were in the form of scientific process skill test and self-efficacy inventory. The hypothesis was tested using Analysis of Variance (ANOVA). Integration of project activity has significant effect towards scientific skill process at 0.038 with F value of 4.524 and also have a significant effect for self effication at 0.018 with F value of 0.018. Based on results analysis, it is concluded that there was an effect of project activity integration in Zoology of Vertebrate teaching and learning on pre-service teachers' scientific process skill and self-efficacy, with significance level of 0.05.

Keywords: project activity integration, scientific process skill, self-efficacy, student-teachers

INTRODUCTION

Teacher is one of main dynamic factor to clarify the educational quality. Teachers' roles in educational system are very important so that in each reformation, teachers should review and document every problem with their solving strategy (Campbell, Zhang, & Neilson, 2011). The new paradigm in educational reform is to call for student preparation through innovative pedagogical strategies (Flores, 2015). To prepare to be an innovative teacher in conveying his learning experiences that impact on the students, transformational candidates are required (Calik, 2013). More aspects are needed to develop the skills that students need. Thus, teachers that are able to assist students in understanding and exploring scientific phenomena, scientific discussions, cognitive structural constructions, skills development and problem-solving improvement are needed (Duran & Dokme, 2016).

Problem solving can also be conducted through empowerment of various skills; one of them is scientific process skill. Scientific process skill is an adaptation of skills that scientists improve to build knowledge, solve problems and make conclusions (Karsli & Ayas, 2014; Ozgelen, 2012). These skills can also be transferred in a multidisciplinary manner (Halim & Meerah, 2012). Scientific process skill is very important for students because it is in accordance with the demand of content standard (inquiry and giving learning experience directly through the usage and development of process skill and scientific attitude), the core activity of science (product, process, technology application, and attitude), and increase the meaningfulness of science learning. The most important dimension of the nature of science is the way of reaching information and the phases of the scientific method. Inquiry can be considered as a strategy to develop various skills and help students to gain new information

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Contribution of this paper to the literature

- Integration of project activities in the learning process can train students' basic and integrated science process skills.
- Integration of project activities also familiarize students to think creatively and critically, be proactive to conduct exploration related to investigation, and strengthen their self-efficacy.
- The roles of the instructor as facilitator, advisors, and intermediaries provide a good contribution to obtain optimal results in accordance with the imagination, creativity and innovation of students.

(Aljaafreh, 2013; Opateye, 2012; Zhao & Wardeska, 2011). Inquiry can also assist students in developing the skills needed throughout their lives (Duran & Dokme, 2016).

Ozyurt (2015) argued that problem solving is one of the main skills that individuals need to keep and improve. In this case, one of the goals of modern education is to prepare individuals who can build their own knowledge. Individuals who have characteristics can find their own information, flexible, open minded, always take different approaches to events and make deductive and inductive conclusions, tend to succeed in problem solving (Kanbay, Aslan, Işık, & Kılıç, 2013).

This research discusses serial discoveries from professional developmental study using a project learning model. This model is considered to have certain value by many researchers when being implemented in combination. Project work helps to bridge technical theoretical education and real-world, so it enriches and supports theoretical with conceptual understanding. Project work emphasizes more on hands-on applications that make students more independent and creative (Osuala & Onwuagbke, 2014; Sababha, Alqudah, Abualbasal, & AlQaralleh, 2016).

Project based learning uses the principle of learning by doing, which is a learning process by doing a particular action. Grant (2012) emphasized that in this learning method, students become more autonomous in developing and presenting their learning results. Tiantong and Siksen (2013) explained that project based learning improves students' creativity and psychomotor skills more. This project-oriented learning was done in the course of Vertebrate Zoology. This course can accommodate the various knowledge of high level animals from low Chordata. If these materials are examined more deeply by using the right learning model, it is very potential to develop and improve the skills of science processes and students self-efficacy. Tantrarungroj and Suwannatthachote (2012), and Habok and Nagy (2016) stated that the success of the project in learning depends on the number of student activities and a good learning environment.

A number of arguments and research results that have been stated above show the importance of scientific skill among the students. However, scientific process skill will be more meaningful if the students' self-efficacy had been trained since the early stage, as suggested by Bilgin, Karakuyu, and Ay (2015) argue that self-efficacy is an important concept in Bandura's social learning theory. It is about what to do and how much they can do to solve the problems that may occur. Self-efficacy has been identified as a consistent predictor of experience mastery (Uitto, 2014).

Therefore, it is important that the full skill of the scientific process are also observed. Self-efficacy is considered very essential or the success in the classroom (Krause, Pietzner, Dori, & Eilks, 2017). Although, this factor cannot be regarded solely as predictor for the academic success. The diverse capabilities of students having different characters require better emphasis on each of the competencies of self-efficacy.

To the best of author's knowledge, there is almost no research related to the integration of project activity in Vertebrate course towards Biology pre-service teacher's scientific process skill and self-efficacy. This is what lies behind this research, with the hope that this research could uncover how strong is the effect of project-oriented learning towards Biology pre-service teachers' scientific process skill and self-efficacy. It is also strongly expected that this research can be an effort in increasing the educational quality, motivate and increase the self-efficacy, increase the mastery of skills, enrich the experience, and boost the new spirit of pre-service teacher.

The question proposed in this research are: (1) how project activities in learning can affect the science process skills of biology teacher candidates; and (2) how project activities can affect the self-efficacy of biology teacher candidates. The main purpose of this study is to describe the effectiveness of project activities in vertebrate zoology learning on science process skills and students self-efficacy.

LITERATURE REVIEW

Project Based Learning

Project based learning is a form of constructivism and collaborative learning with a student-centered learning process (Whatley, 2012). While (Chiang & Lee, 2016) defined project learning as a process, in which knowledge is constructed through the transformation of experience. This model is able to construct students' knowledge in the hope of finding important information in constructing their own knowledge. In addition students are able to observe and analyze problems so as to construct more meaningful knowledge.

Bilgin et al. (2015) and Hung, Hwang, and Huang (2012) stated that project learning is a research-based investigation strategy to find solutions in daily life problems. In this approach, students take responsibility for working independently and cooperating with others, improving investigative skills, solving their problems and obtaining final product outcomes. Habok and Nagy (2016) found that PjBL has the ability to develop and manage group dynamics, to assist them in building confidence, and to practice teamwork skills.

Scientific Process Skill (SPS)

Scientific process skills are defined as necessary and needed tools in research, investigation and critical thinking and become lifelong learners (Akgün, Tokur, & Duruk, 2016; Farsakoglu, Sahin, & Karsli, 2012). In addition Ozgelen (2012) defined the skills of the scientific process as the ability to think to solve problems, evaluate and formulate results. They are just parts of the whole science skill set. While to do experiment, it is needed to involve all basic and integrated process skills. Therefore, the full skill of the scientific process is necessary to be given.

Karsli and Ayas (2014) explained that scientific process skills are essential in teaching how to achieve the goal of knowledge in science education. The science process skill is one of the thinking skills used by both scientists, teachers and students while investigating and exploring in the context of science activities. The science process skill consists of basic and integrated science process skills. Basic science process skills include observation, measurement, classification, conclusion, prediction and communication. While the integrated science process involves determining and controlling variables, formulating hypotheses, data collection and operational definitions (Chabalengula, Mumba, & Mbewe, 2012; Erkol & Ugulu, 2014; Ongowo & Indoshi, 2013).

Self-Efficacy

Mauer, Neergaard, and Linstad (2017) and Peters (2013) defined self-efficacy as in Alfred Bandura's social theory, which refers to the nature of individual competence assessment of a person's beliefs needed to be able or unable to overcome obstacles and barriers through effort and perseverance. Can (2015) explains that humans can have high self-efficacy in a different situation. The diverse self-efficacy of the situation depends on the competencies demanded for each activity, the level of competition among humans. The magnitude of individual self-efficacy is also determined when dealing with failure, and physiological conditions, in particular the presence or absence of fatigue, anxiety, apathy or sadness.

Saad and Boujaoude, (2012), Smolleck and Morgan (2011) revealed that self-efficacy is a powerful paradigm that can increase confidence and operate on the basis of motivation. While social theory described four types of information sources which are the main principles for building self-efficacy trust is sourced from the student's self-experience, the experience of others, physical or psychological condition, and from the verbal persuasion of the lecturer (Mauer et al., 2017).

RESEARCH METHOD

This research involves a quantitative research aiming to analyze the effect of the integration project activity in Zoology of Vertebrate course of Biology for pre-service teachers' in scientific process skill and self-efficacy. While uncovering the effect of each indicator of every predictors, a descriptive qualitative analysis was done. Indicators of science process skills include observing, inferring, measuring, communicating, classifying, predicting, controlling variables, defining operationally, formulating hypothesis, interpreting data. While self-efficacy includes magnitude, strength and generality.

This study was conducted for 4 months from February to May 2017. There were nine material topics that students studied during this study, namely hemichordata, urochordata, sefalochordata, agnatha, pisces, amphibia, reptiles, aves and mammals. The experimental class and the conventional class all studied the nine topics. Project activities are independent variables, while science process skills and self-efficacy are the dependent variables. Class meetings are held once a week and each lesson lasts 150 minutes.

The implementation of project activities in the experimental class is carried out gradually in accordance with the project learning steps referring to Sumarni, Wardani, Sudarmin, and Gupitasari (2016), Grant (2012) includes stage (1) student orientation on project issues; (2) organization of teaching and learning activities; (3) project guidance; (4) development and presentation of project results; and (5) analysis and evaluation of learning process and project result reflection. As for the conventional class during the last five years apply conventional lab work. The application of a conventional practicum is based on a complete experimental instruction containing objectives, basic theories, tools and materials, work procedures and presentation data tables.

Respondents in this study are future biology teachers who attended Vertebrate Zoology in 6th semester academic year 2016/2017 at Siliwangi University Tasikmalaya Indonesia consisting of 210 students. A sample of 30 students taken with cluster random sampling technique. The design used was quasi-experimental, posttest only design group control (Creswell, 2012).

The research instrument is a test of science process skill and inventory for self-efficacy. The science-process skills test consists of 20 items that have been validated by a science expert and tested against a student who is not a research sample. The test is given in the form of an essay test as indicated by Erkol and Ugulu (2014), Ongowo and Indoshi (2013), and Chabalengula et al. (2012) as mentioned above. The questions consist of two questions for each skill. For example, the question of observing and classifying skills refers to the scenario of specimen morphology observed. From the observation will get any characteristics that can be used as the basis of taxon level grouping. As an example, a sample problem is presented.

- Based observation result by video on the slide show and some original specimens from the Pisces class, it is known that the Pisces class has a moving ability that is influenced by several factors.

Question: If you are given the opportunity to research the Pisces population whose distribution is large enough, what do you do to distinguish between Chondrichthyes and Osteichtyes class?

- Observe as the frog jumps, the frog's longer legs are longer and stronger than the front legs. While his body is short.

Question: Can you explain why?

The self-efficacy inventory was adapted from the general self-efficacy (GSE) by Luszczynska, Gutiérrez-Doña, and Schwarzer (2005), which was then adapted to the indicators to be measured in the study. These indicators refer to Bandura (1997) about self-efficacy. The inventory consists of 30 statement items with alternate subject responses on a scale of 11 with 1 - 100 intervals starting from 0 - 49 (not sure of being able to do), 50-89 (pretty sure capable of doing), and 90-100 (very confident of being able to do) at intervals of 10. To explain the effect size, d-Cohen effect size is used (Gravetter & Wallnau, 2004). For example, questions are presented to the respondent to choose an alternative answer by circling the numbers corresponding to the perceived experience.

- When given a critical analytical task by a lecturer, I am sure I can do it well.

0 10 20 30 40 50 60 70 80 90 100

- I can communicate it back to my friends based on my learning experience

0 10 20 30 40 50 60 70 80 90 100

- When I am going to do a presentation regarding to group project results, I am more confident about doing it myself

0 10 20 30 40 50 60 70 80 90 100

Validity and reliability test were determined based on the results of the trials on 32 biology teacher candidates who were not research samples. Reliability test results with Crocbachs Alpha showed a result of 0.847 for science process skills and 0.914 for self-efficacy. Problems of science process and self-efficacy have been tested for validity using Pearson Correlation test which shows all items valid.

The research data were tested statistically by using ANOVA which aims to explain the difference between more than two groups of samples with significance level of 5% ($p < 0.5$) (Mertler, & Reinhart, 2016). The data obtained were first tested on the prerequisite of the analysis including the Kolmogorov-Smirnov normality test and homogeneity of variance using Levenes-Test. The hypothesis tested is that there is no effect of project activity integration to improve the science process and self-efficacy skills. All data testing is done by using Program SPSS version 23.0 for windows.

RESULTS AND DISCUSSION

Project Activity Implementation

Descriptive data analysis on the integration of project activities in the learning process is presented in **Table 1**.

Table 1. Results of Analysis of Project Activity Integration Activities

Project Syntax	Activity (value in %)						
	1	2	3	4	5	6	7
Student orientation on the problem	66.67	77.78	88.89	77.78	77.78	77.78	88.89
Organize students to learn	88.89	66.67	77.78	77.78	77.78	88.89	88.89
Guide students to carry out project activities	83.33	83.33	83.33	83.33	83.33	66.67	66.67
Develop and present the project results	66.67	66.67	83.33	83.33	66.67	83.33	83.33
Analyze and evaluate the process activities	66.67	66.67	66.67	83.33	83.33	83.33	83.33
Average	74.45	75.56	80	77.78	80	80	82.22

Table 2. Analysis summary of project activity integration on biology prospective teacher's scientific process skill

	Sum of Squares	Df	Mean Square	F	Sig.
Between groups	35.267	1	35.267	4.524	0.038
Within groups	452.133	58	7.795		
Total	487.400	59			

The learning process by integrating the project activities gives good results when it is seen from **Table 1** data presentation. Projects conducted by students in some activities still require direction and guidance during the learning process. Students are still less critical in investigating and analyzing the data required to complete the project, therefore, it should be emphasized repeatedly. In addition, with various activities and repeated emphasis it can improve the students' skill. Students can also work cooperatively and collaboratively with their groups so that the projects created during some activities can produce the expected products. To achieve a habituation in exploring through learning investigation, problem organizing, data organization, hypothesis making, and reflection during project activities need to be improved.

Integration of Project Activities to the Process Skills of Science

The data analysis was carried out to explain the effect of project activity integration in Vertebrate course of Biology pre-service teachers' scientific process skill. The result are presented in **Table 2**.

The result of ANOVA test shows that the effect of the integration of project activity to the pre-service teachers' scientific process skill in Vertebrate course was very significant. It can be seen from the calculation result (0.038) with the F value of 4.524.

This result is in accordance with a number of previous researchers that have studied the relationship between project-based learning as a learning model or strategy and scientific process skill as well as self-efficacy. Project-based learning serves a feasible way to combine learning activities in the classroom. A study of literature showed that project-based learning can promote the development of higher cognitive level and offer various forms of performance assessment (Grant, 2012; See & Rashid, 2015). Other result showed that students who have difficulties in conventional learning obtained significant benefits through project-based learning experience (Cooper & Kotys-Schwartz, 2010). Thus, project-based learning can develop better performance skills (Demir, 2013). More importantly when students do project work, their abilities increase due to experience in performing complex skills (Kibirige & Hodi, 2013; Lee, Lai, Yu, & Lin, 2012; Owolabi & Oginni, 2012). This finding is becoming even more important for the students who study through project-based learning. Therefore, this learning strategy can be an alternative to place them as a student in better position (Tiantong & Siksen, 2013).

Based on the study conducted by See and Rashid (2015) it was explained that project-based learning showed positive results with the creation of active learning that was interesting and meaningful. Opateye (2012) explains that the mastery of science process skills allows students to conceptualize at a deeper level. In addition, he also classified this scientific process skill into the skill of information processing, reasoning, inquiry, and creative thinking skills. Lattimer and Riordan (2011) and Bédard, Lison, Dalle, Côté, and Boutin (2012) stated that project-based learning is a learning where the students respond to the questions around the real world or solve a problem through inquiry process, develop their thinking skill, creativity, and encourage them to cooperate in a team. Chiang and Lee (2016) explained that project-based learning can also create an environment that helps the students to build a meaningful knowledge and become active in student-centered learning, and encourages them to collaborate and solve the problems on relevant knowledge and skill.

Generally, Hung et al. (2012) revealed that project-based learning can improve students' motivation in learning science, ability to solve problems and improve learning achievement. Recent study of Mayer (2013) showed that well-designed project process can help the students to reach better knowledge and skills than lectures in engineering education. Other findings in laboratory work project work can help students visualize abstract concepts into real, develop student performance directions and easily understood by students (Pekbay & Kaptan,

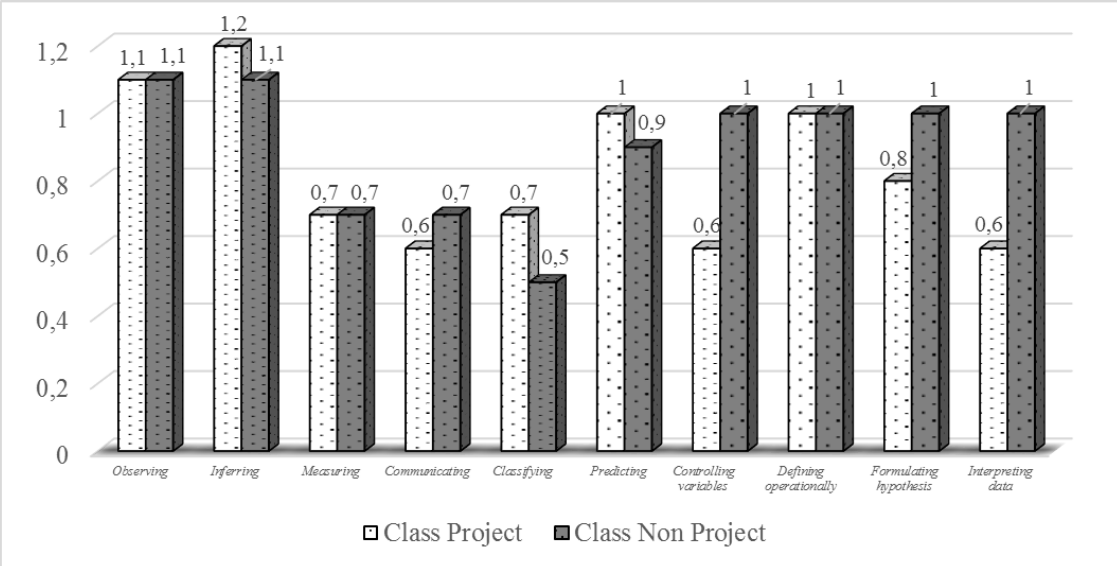

Figure 1. Average score of scientific process skill in project class and non-project class

2014; Tafa, 2012). These findings confirmed that scientific process skill can be trained and developed through integration of project in learning process, project-based learning, or combination of project-based learning with other learning strategies.

Further explanation related to each indicator's position on scientific process skill is shown in **Figure 1**. Based on the research result, the project class and non-project class have the same ability on observing, measuring, and making operational definition. Observation is the most basic process in science (Duran, Işik, Mihladiz, & Özdemir, 2011; Feyzioglu, Demirdag, Akyildiz, & Altun, 2012). Measurement is a quantitative representation of observation, which can be conducted by making operational definition of variables, that will vary according to the facts, phenomena, and related variables which cannot be measured directly. This measurement can be done using standard and non-standard sizes to illustrate each dimension (Ongowo & Indoshi, 2013).

The ability of making conclusion, classifying, and predicting of project class is higher than those of non-project class. The ability of making conclusion refers to the development of observation and previous knowledge, leading to the ability of classifying. Someone can categorize an object surely based on the similarity, difference, and relations between objects. Therefore, classification has an exclusive role in developing various conceptions. This is because facts and generalization must be gathered and arranged to form a concept. Predicting is an important part of science, which refers to how someone make a specific statement about what will happen. An accurate prediction needs thorough observation and correct measurement Prediction also states the stating of the outcome of a future event based on a pattern of evidence (Chabalengula et al., 2012; Ongowo & Indoshi, 2013).

The result also showed that students of non-project class have higher ability to communicate, control variable, make hypotheses, and interpret data than the students of project class. Communication is important as human's fundamental effort in making argument. Communication can be done through using words or symbols to describe an action, object or event. Variable controlling is also an important skill to increase the data validity and reliability as well as managing a scientific investigation (Chabalengula et al., 2012; Ongowo & Indoshi, 2013). Making a hypothesis or statement about the possibility of variable's relationship is another fundamental skill which is based on observation. Data interpretation is related to data analysis which are organizing, concluding from data and making sense of data. Hence, people can easily find a pattern that leads to the conclusion or hypothesis (Erkol & Ungulu, 2014; Ongowo & Indoshi, 2013).

When it is examined from the point of view of behavioral theory, Schunk, Meece, and Pintrich (2012) stated that learning behavior can affect the learning process. Some things suggested in behavioral learning theory including emphasize on stimulus presentation and response reinforcement (Thorndike's learning theory), habituation (Pavlov's theory), and reinforcement (Skinner's theory) were not yet attached to some indicators in project class. Students' ability in exploring themselves are still less so that meaningful learning concept as in Ausubel's theory needs to be emphasized as a challenge and have a positive opportunity to be better.

A number of research findings supported that the scientific process skill is related strongly to the cognitive development, supports the students' thinking, reasoning, investigating, evaluating, problem solving skill, and creativity (Özgelen, 2012). Moreover, there is a strong relationship between students' achievement and learning

Table 3. Analysis summary of project integration on biology teacher on student's self-efficacy

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	380.017	1	380.017	5.952	0.018
Within Groups	3703.233	58	63.849		
Total	4083.250	59			

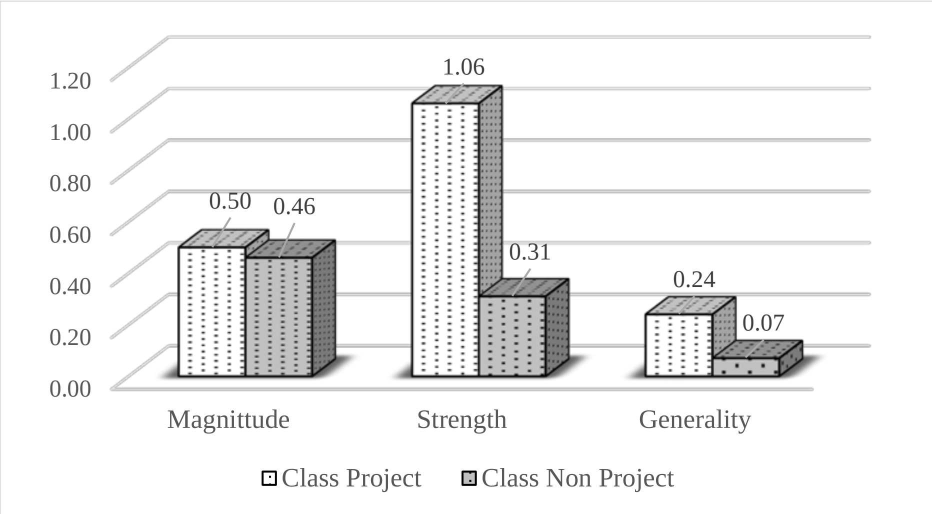

Figure 2. Average score of self-efficacy in project and non-project classes

process skill. Previous study suggested that scientific process skill is another important factor that is necessary for problem solving and live functionality (Jack, 2013).

The researchers believe that a positive attitude toward science makes students more interested in focusing on the process of science. In other words when students understand the skills of the science process, it becomes more interesting to them, so as to enhance a positive attitude toward science (Zeidan & Jayosi, 2015). Al-rabaani (2014) investigated the acquisition of science process skill by teachers. The results showed that they had a moderate acquisition of science skills and showed no differences in outcomes by sex).

Integration of Project Activities to the Self-Efficacy

The analysis of the project activities on the self-efficacy of Biology student teacher is shown in **Table 3**.

The analysis results related to the effect of project on biology prospective teacher's self-efficacy is shown in **Table 3**. There is a significant effect of project integration on biology teacher on student's self-efficacy, which is indicated by calculation result significance as much as 0.018 with the F value of 5.952.

Project-based learning is also affecting biology pre-service teachers' self-efficacy based on the result of data analysis. English and Kitsantas (2013) explained that in order to succeed in a project, students must be responsible to their own learning process, including the process of self-regulation to maintain motivation, specify the goals, and progress on self-reflection. A number of research findings revealed that significant learning results in engineering design have direct relationship with project experience and show the development of self-efficacy (Chen, Hernandez, & Dong, 2015). The process of project experience can help students improve their self-efficacy and sustainable learning process (Al-Amous, et al., 2011; Demir, 2013). Various research findings that had been explained confirm that self-efficacy can be trained and developed through habituation of project-based learning process.

Figure 2 shows the effect of each indicator on self-efficacy. The existence of self-efficacy in learning process with different level which is charged to individual produce a challenge with different level as well. The magnitude level for project class of 0.50 can be explained that the effect of project work on self-efficacy is in the medium category. So is the case for the non-project class of 0.46 with the explanation that the magnitude of influence is in the medium category. For higher project grade strength level with d-value of 1.06, it can be explained that the project work has a significant effect on self-efficacy and non-project grade with a d-value of 0.31 medium effect on self-efficacy. Generality level of project class is higher with d-value of 0.24 with moderate effect conclusions for project work on self-efficacy and non-project grade of 0.07 with the conclusion of project work has little effect on self-efficacy.

Can (2015) described that understanding the source of self-efficacy is expected to shape the right behavior and value of results. Therefore, more direct activities, research projects, laboratory experiments, and an active learning environment will be influential in assisting candidate of biology teachers to find solutions in teaching problems. Therefore, Bilgin et al. (2015) explains that self-efficacy is an important target for individuals to be able to make their own decisions about how much effort they need to make in achieving their personal goals.

Studies by Ekici, Fettahlıoğlu, and Çıbık (2012) showed that experience can increase self-efficacy. Experience also maintains the effectiveness of individual self-efficacy (Flores, 2015). The success of an individual in facing a life problem can build a positive feeling; even more when self-efficacy has not been strongly established in individual. Another finding showed that self-efficacy is a reliable predictor for prominent results such as motivation and academic achievement (Richardson, Abraham, & Bond, 2012).

Magnitude aspect represents one's ability to accomplish a task with different level of difficulties. Individual with high level of self-efficacy will have high confidence about his/her ability to do a particular work or task. Otherwise, individual with low level of self-efficacy will have low confidence about his/her ability to do the task. Self-efficacy can be shown in different level charged to individual, in which there will be challenges in different levels for each individual to reach the success. In this research, students of project class as well as non-project class were provided with the same level of difficulties of given task. It can be reflected to each student's self-efficacy, as written by Flores (2015), that self-efficacy effectively affects student achievement.

Strength is the stability of confidence referring to the degree of individual's stability on their confidence or hope. Ones have strong confidence and perseverance in their efforts, although there are difficulties and hindrances. By empowering self-efficacy, the power of bigger effort can be achieved. The stronger self-efficacy and perseverance the students have, the higher possibility of success they get. In accordance with this research, students of project class received higher challenge in the accomplishment of their project. It is in line with Louis and Mistele (2012) explanation that self-efficacy affects one's choice and the amount of effort that will be done.

Generality is the discretion of one's self efficacy to be used in other different situations. Individual with high self-efficacy will be more adaptive to situations. The ability of individuals to work on particular field and context reveals the general description of their self-efficacy. In this research, students tend to be less revealing about their experience during the accomplishment of the project, so that it affected the generality. The existence of progress report in project-based learning became a new environment that caused a little awkwardness among the students. Therefore, habituation in project-based learning process is really necessary. This statement is supported by Uitto (2014) that self-efficacy is positively correlated with academic ability. Research results showed that self-efficacy can be taken into consideration in determining how well the learning result that can be achieved by individuals.

CONCLUSIONS

Based on the above discussion, it is concluded that the integration of the project activity has a significant effect towards the scientific skill process at 0.038 with F value of 4.524 and also has a significant effect for self-effectiveness at 0.018 with F value of 0.018. Based on the results analysis, integration of Zoology of Vertebrate teaching and learning process on pre-service teachers' can improve the scientific process skill and self-efficacy, with significance level of 0.05.

The integration of project activities in the learning process tends to have a higher potential in improving the skills of science process skills and self-efficacy of biology teacher candidates. Statistical analysis shows that project activities significantly influence the skills of the science process and self-efficacy of biology teacher candidates. It is believed that the integration of project activities has the proper learning stages required by students in improving their achievements. Students engage in various skills and foster their self-efficacy.

This study contributes to the biology teacher candidates and lecturers to apply project integration projects involving multiple skills in training and developing science process skills and self-efficacy. Another thing of self-efficacy provides reinforcement during the learning process. The implications of this study include that the higher education curriculum should pay more attention to small research activities, especially those that directly impact on improving learning and improving the performance of biology teacher candidates in science learning.

Limitations of this research are the number of samples less representative in representing research. Another thing is the limited concept of discussion in research on low chordata material in the absence of original specimens as samples during the learning process. For further research it is suggested to add number of samples to represent the respondent representation and to expand the study material study.

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