Journal of Education and Practice www.iiste.org
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.5, No.36, 2014

The Effect of Program Laboratory Inquiry Practicum Based (PPZI-BIL) to Mastering Invertebrate Zoology Concept

Riki Apriyandi Putra[1] dan Fransisca Sudargo[2]
[1] Mahasiswa Pascasarjana Universitas Pendidikan Indonesia
[2] Dosen Pascasarjana Universitas Pendidikan Indonesia

Abstract
This study aims to determine the effect of applying PPZI-BIL to the mastery of the concept of biology student teachers and student attitudes toward curriculum subjects Invertebrate Zoology. Subjects were students of the University of Pasundan (UNPAS) with a total sample of 52 people (one class), selected by purposive sampling. Student mastery of concepts is measured through tests, while the attitude of students was measured through a questionnaire. The results showed that there was a significant increase in any concept of Invertebrate Zoology. The highest increase was shown in concept annelids with N-gain of 0.70 (high category), and an increase in N-gain low but still in the category of being contained in the concept of Arthropods. Implementation PPZI-BIL also can increase positive attitudes of students related to the student curriculum.
Keywords: Invertebrate Zoology lab program of inquiry-based laboratory (PPZI-BIL), the attitude of students, mastery of concepts.

1. Introduction

Practicum can be interpreted as a way of bringing students to master concepts and process development of positive attitudes, by involving students into a scientific activities, so that the process of construction of knowledge, which in turn will create more meaningful learning atmosphere. Another opinion says that the practice is a method that facilitates a variety of skills that include planning skills, skills found the problem, the skills to collect and process information, interpretation skills, and communication skills (Pabellon and Mendoza, 2000). Tobin (in Kipnis and Hofstein, 2007) also explains that the practice as a way to learn understanding and actively involved in the process of constructing knowledge through scientific progress. Meaningful learning in the laboratory would happen if students are given the opportunity to manipulate the equipment and materials to construct knowledge of a phenomenon and connect with scientific concepts.

Domin (2007) distinguishes practicum into four types: expository, invention (discovery), problem-based and inquiry. The fourth type of practice can be done in the laboratory and in the field. The most suitable type of practice is applied in the course of Invertebrate Zoology is the practice of inquiry. Mohrig (2004 in Taraban et al., 2007) identified several ways to do when carrying out laboratory experiments, related to the activities of inquiry, namely questions or problems should take precedence, and serves as the basis for a trial or investigation, the laboratory should provide the means to collect evidence and find answers to questions, the lab can be a place to check the experimental results and draw conclusions from the data obtained.

Practicum inquiry is central in science learning, when students are involved in the process of revealing the problems and scientific questions, formulate hypotheses, designing experiments, collecting and analyzing data, and draws conclusions about the problems or scientific phenomena (Hopstein & Walberg in Kipnis & Hofstein, 2007). Benefits of inquiry or inquiry lab practicum aplenty, namely: can enhance critical thinking skills and problem solving skills of students (Narayan, 2010), can improve student attitudes and understanding of science and their influence on how science is taught well (Tessier 2010), may increase the scientific skills of students which consists of observing, manipulating, classifying, drawing, measuring, and communicating (Khan and Iqbal, 2011), the application of laboratory inquiry combined with the approach of Science Writing Heuristic (SWH), also can improve the ability of metacognitive biology students in the learning process (Supriyatin et al., 2011), and can increase the positive scientific attitude (Putra and Sri Redjeki, 2013).

Based on research Putra et al. (2014) suggested that the use of laboratory inquiry will be maximized if it follows the following stages, namely: (1) the use of live objects are accompanied by preservation, preparation, and video, (2) submission of critical questions, (3) the answers are verified through lab , and (4) elaborating lab results with existing theories. For more details can be seen in Table 1.

Table 1. Invertebrate Zoology Practicum Program Based Inquiry (PPZI-BIL)

NO	Lecturer activities	Student Activities
1	Introduction/Initial Activity - Lecturer assign students to sit in each group (each group has received an LKM that contains the name of the species will they discuss) - Lecturer explains the introduction of the phylum to be studied, - Lecturer assign students doing practical work independently in accordance with the instructions contained in the LKM	Students conduct a question and answer to the explanation of the phylum lecturers being studied. Students perform in accordance with the inquiry-based lab topics and instructions contained in the LKM
2	**A**sking Questions Lecturer instruct the students to make the critical question of the species will they discuss (contained in LKM), so that the livelihood of these species can be seen	Students make the critical question of the species will they discuss (contained in LKM)
3	**V**erification Lecturer instruct the students to answer the critical questions that they created a way to prove through practice-based inquiry	Students conduct inquiry-based lab (to answer the questions that have been prepared)
4	Elaboration Lecturer assign students to elaborate on their findings based on the theory/ concept	Students complete a task or elaborating on their findings based on the theory/concept, with reference to the journals, books, and people who are experts

Mastery of the concept is an old concept construction process based on prior knowledge into a new concept, in order to obtain a valid explanation. Students said to master the concepts when they are able to describe/explain in general through the charts/graphs, able to provide a statement/ explanation, and is able to predict something (use the power of Putra). According to the Putra et al. (2014) mastery of the concept of a student's ability to understand the concepts, both before learning process, during the learning process, and after the learning process. Mastery of concepts can not be separated from thinking skills. Thinking skills required for each Putra is a high-level thinking skills, which is contributed to the success.

Invertebrate Zoology course is a subject which has many essential concepts, therefore mastery of the concept is the basis of development various competencies. In fact, in some colleges are still visible lecture which tends to bring the students to memorize concepts, less involving students in the process of finding a concept, less formation of meaningful lectures, and low absorptive capacity and memory of students, and therefore required a lecture that can accommodate these constraints and practice-oriented lectures such as PPZI-BIL, lecture deemed suitable in Invertebrate Zoology.

Based on the above explanation, it can be concluded that the mastery of concepts is important for everyone, especially students (scientist). Therefore, researchers are trying to analyze the effect of applying PPZI-BIL towards mastery concept biology student teachers and student attitudes toward the subjects curriculum Invertebrate Zoology.

2. Research Methods

This research is a quasi-experimental study (quasi experiment). The design used in this study is one group pretest-posttest design, which in practice involves a class of students who are taking courses Invertebrate Zoology. This research was conducted at the University of Pasundan (UNPAS) in September 2013-January 2014 with the entire student population of 3 semesters of Biology Department of Education, which sits in the academic year 2013/2014 Odd half the number of approximately 150 people. Of this amount was taken a sample of 52 people (one class), using purposive sampling. This study aims to determine the effect of applying PPZI-BIL to mastery concept biology student teachers and how student attitudes toward the subjects curriculum Invertebrate Zoology. To obtain relevant data, then the instruments used in this study is a test mastery of concepts and student attitudes questionnaire. Concept mastery test composed of 80 questions consisting of 15 questions to the phylum *Aschelminthes*, 15 questions to the phylum Annelida, 15 questions for the phylum Mollusca, 20 questions to the phylum *Arthropoda*, and 15 questions for the phylum Echinodermata. And for the student attitude questionnaire, consisting of 13 statements which consists of 5 basic statement, namely: Purpose Class, Class Content, Material Class, Class Implementation, and Evaluation Tool.

3. Results and Discussion

3.1. Research Results

Analysis of student mastery of the concept includes a mean value of the pretest, posttest, and N-gain obtained from tests mastery of the concept can be seen in Table 1.

Table 1. Value Concept Mastery Test Results

	Pretest	***Posttest***	**N-gain**
N	52	52	
$\bar{x}$	37,52	74,88	0,60
Sd	11,52	7,89	

Based on Table 1, note that the average value of 37.52 student pretest and posttest mean score of 74.88 students. This shows that in general there is an increase student mastery of concepts. The percentage increase in the average score (N-gain) of 0.6 and included in the medium category. Analysis of different test average value of pretest and posttest student mastery of the concept can be seen in Table 2.

Table 2. Statistical Calculation Value Concept Mastery pretest and posttest

N	***Pretest***		***Posttest***		**df**	**Nilai**		**P(sig.)**
	Mean score	Distribustion	Mean Score	Distribution		**t cal**	**t tab**	
52	37,52	Normal	74,88	Normal	51	29.171	2,008	0,000 (significan)

The data in Table 2 explains that the normality test results showed the average value of the pretest and posttest values are normally distributed. T test analysis results obtained p-value of 0.000. The p-value is smaller than the value of α (0.025). This shows that there are significant differences between the mean values pretest and posttest student mastery of concepts. Analysis of the data by subject or phyla can be seen in the paragraphs below.

This research applies Invertebrate Zoology 5 core concept consisting of *Aschelminthes* phylum, *Annelida* phylum, *Mollusca* phylum, *Arthropoda* phylum, and the Echinodermata phylum. Each concept of Invertebrate Zoology analyzed based on the acquisition value of the pretest, posttest, and N-gain. Recapitulation test scores and the mean difference test pretest-posttest control of student concept can be seen in Table 3.

Table 3. Summary of Test and Test Values Mean Difference

Concept	***Pretest***	***Posttest***	**N-gain**	**t cal**	**t tab.**	**P(sig.)**
1. *Aschelminthes*	27,95 (Normal)	65,9 (Normal)	0,53	20.98	2,008	0,000 (significan)
2. *Annelida*	35,77 (Normal)	80,51 (Normal)	0,70	24.77		0,000 (significan)
3. *Mollusca*	40,13 (Normal)	73,85 (Normal)	0,54	13.75		0,000 (significan)
4. *Arthropoda*	44,13 (Normal)	73,46 (Normal)	0,49	12.92		0,000 (significan)
5. *Echinodermata*	37,44 (Normal)	80,77 (Normal)	0,69	22.73		0,000 (significan)

Based on Table 3 it can be concluded that a significant increase in any concept of Invertebrate Zoology. The highest increase was shown in concept annelids, which has a number of N-gain of 0.70 (high category), and an increase in N-gain low but still in the category of being contained in the concept of Arthropods. Effect of application-BIL PPZI related to student attitudes Invertebrate Zoology curriculum can be seen from the attitude scale data before and after implementation PPZI-BIL presented in Table 4.

Table 4. Summary of Test Data Analysis Results of the Student Attitude Scale

No	Measurenment Aspect	Before Implemetation				After Implementation	
		Number of Item		Response		response	
		Per. Positif	Per. Negatif	Agree (%)	Not agree (%)	Agree (%)	Not agree (%)
1	Objective Class	12	-	88,46	11,54	100	-
		14	-	75	25	100	-
2	Content	15	-	71,16	28,84	98,08	1,92
3	Learning Material	13	-	44,23	55,77	53,85	46,15
		17	-	32,69	67,31	63,46	36,54
4	Implementing	10	-	82,69	17,31	100	-
		22	-	94,23	5,77	98,08	1,92
		-	11	7,69	92,31	73,08	26,92
		-	16	100	-	100	-
		-	18	78,85	21,15	90,38	9,62
		-	19	46,15	53,85	92,31	7,69
5	Evaluation tools	-	20	3,85	96,15	100	-
		-	21	13,46	86,54	82,69	17,31

Changes in student attitudes before and after the implementation PPZI-BIL tend to be positive. Problems were found at the beginning of the course materials and tools such as evaluation has increased.

3.2. Discussion

The results of data analysis showed that the average increase (N-gain) are the most dominant in sequence is the phylum *Annelida*, *Echinodermata*, *Mollusca*, *Aschelminthes*, and *Arthropods*. The high mastery of concepts students in the phylum *Annelida*, due to the implementation process PPZI-BIL already be clearly understood by students, so that curiosity about the concepts of annelids easily absorbed, it is proved that the value of N-gain is highest in the phylum *annelids*. In addition, the phylum *Annelida* phylum gathering place for those species whose existence is easy to find, structure morphology, anatomy, physiology, and ecology easy to understand, and has a number of species (familiar) are relatively less, so it is easier to use for practice, so that students no difficulty in understanding between species contained in the phylum Annelida. The high mastery of concepts students in the phylum *Annelida* not independent of the implementation process PPZI-BIL which uses a combination of live objects, preservation, preparation, and media (video or image). Putra et al. (2014) also confirms that the practical implementation of laboratory inquiry would be optimal, if the combination of live objects, preservation, preparation, and media.

Low mastery of concepts students in the phylum *Arthropoda* phylum indicated because this is a phylum that has the most number of species and very extensive study of all phyla, including invertebrates. Borror et al. (1996) explained that it was found to be approximately 1.956 million or 67.4% of the total species of arthropods that exist in the world, and approximately 59.5% is dominated by insects. The number of students who are very much cause it difficult to understand the concepts contained in the phylum *Arthropoda*. The level of difficulty in understanding the concepts of Arthropods evident from the compare Putra between classes, almost every class has very different characteristics, ranging from the level of diversity to the stage structure.

Influence PPZI-BIL implementation of the attitudes of students in the curriculum of Invertebrate Zoology showed a positive trend change in attitude. Problems were found at the beginning of the course materials and tools such as evaluation has increased. Increased response to the lecture material is indicated because of the use of media tools (video) in the implementation of the course, while for tool evaluation of this increase occurred as a result of the use of questions that can stimulate students' critical thinking skills. Overall Invertebrate Zoology lecture can be interpreted very expected and loved by students. The increase due to the implementation of student attitudes PPZI-BIL in line with the results of research and Sri Redjeki and Putra (2013), which explains that in general lectures Invertebrates inquiry-based science labs can increase positive attitudes of students.

4. Conclusions And Recommendations

4.1. Conclusions

Based on the results of research and discussion, it can be concluded that a significant increase in any concept of Invertebrate Zoology. The highest increase was shown in concept annelids, which has a number of N-gain of 0.70 (high category), and an increase in N-gain low but still in the category of being contained in the concept of Arthropods. Arthropods concept is a broad concept, therefore, students are still having problems in

understanding it. As a whole can be interpreted that the implementation PPZI-BIL can increase student mastery of concepts. Implementation PPZI-BIL also can improve the attitude of the student curriculum related student.

4.2. Suggestions

Lecturers should be as early as possible to implement a program of lectures Invertebrate Zoology inquiry-based laboratory (PPZI-BIL) and apply PPZI-BIL to measure skills or other abilities, such as science process skills, critical thinking skills, and problem solving ability of students.

REFERENCES

Borror. D.J., Triplehorn, C.A., dan Norman F.J. (1996). *Pengenalan Pelajaran Serangga*. Yokyakarta: UGM Press.

Domin, D.S. (2007). "Students' Perceptions of When Conceptual Development Occurs During Laboratory Instruction". *Journal of Chemistry Education Research and Practice*. 8(2), 140-152.

Khan, M. dan Iqbal, M.Z. (2011). *Effect of Inquiry Lab Teaching Method on the Development of Scientific Skills Through the Teaching of Biology in Pakistan*. Language In India. Vol. 11. (169-178). 1 Januari 2011.

Kipnis, M. dan Hofstein, A. (2007). "The Inquiry Laboratory as A Source for Development of Metacognitive Skills". *International Journal of Science and Mathematics Educations*. 5(2), 169-187.

Pabellon J.L. dan A. B. Mendoza. (2000). *Sourcebook on Practical Work for Teacher Trainers. High School Physics Volume 1*. Science and Math Education Manpower Development Project (SMEMDP) University of The Phillipine, Quezon City.

Putra, R. A., Sudargo, F., Redjeki, S., dan Adianto. (2014). The Analysis of Concepts Mastery and Critical Thinking Skills on Invertebrate Zoologi Course. *International Journal of Science and Research (IJSR)*. Volume 3 Issue 3. March 2014.

Putra, R. A. dan Sri Redjeki. (2013). Analisis Sikap Ilmiah Mahasiswa terhadap Perkuliahan Sistematika Invertebrata Berbasis Inkuiri Laboratorium. Prosiding: Seminar Nasional "*Arah Pendidikan MIPA Masa Depan; Antara Harapan dan Kenyataan*", FKIP Universitas Mataram. Mataram.

Narayan, R. (2010). A Comparative Study Of Verbal Discourse Practices In Traditional And Inquiry-Based Undergraduate Biology Labs For Non-Science Majors. *Educational Research and Review*. Vol. 5 (10), pp. 604-617.

Stork, N.E. (1988). Insect Diversity: Facts, Fiction, and Speculation. *Biological Journal of the Linnean Society*. 35: 321-337. 1988 The Linnean Society of London.

Supriyatin, Hurhaida Hafni, L., dan Yulia Irnidayanti. (2011). Pengembangan Kegiatan Praktikum Berbasis Inquiri *melalui Implementasi Science Writing Heuristic* (*SWH*) untuk *Meningkatkan Kemampuan Metakognitif Siswa. Jurnal Biologi FMIPA Universitas Negeri Jakarta, Vol. VII Nomor 2, 2011.*

Taraban, R. *et al*. (2007). Effects of Active-Learning Experiences on Achievement, Attitudes, and Behaviors in High School Biology. *Journal of Research in Science Teaching*. Vol. 44, No. 7, PP. 960–979 (2007).

Tessier, J. (2010). An Inquiry-Based Biology Laboratory Improves Preservice Elementary Teachers' Attitudes About Science. *Journal of College Science Teaching* July/August 2010.

Author Pofile

Riki Apriyandi Putra is a candidat doctoral education science education at the University of Indonesia. He was concentrating on the study of Invertebrate Zoology field, Class-Based Inquiry Invertebrate Systematics Laboratory, critical thinking skills of students.

Prof. Dr. Fransisca Sudargo Tapilouw, M.Pd. She is a professor and Graduate Program Lecturer, Department of Science Education University of Indonesia-Bandung Indonesia. She teaches courses: Biology Education Research, Research Methodology, Planning Learning Biology, Evolution, Biodiversity, Zoology vertebrates. Concentration is the Learning Sciences research.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar