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Values – Based Learning for Wonderful Children

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Faculty of Tarbiya and Teacher Training
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STUDY OF INQUIRY BASED LEARNING SCIENCE PRACTICUM MODULE : *META-ANALYSIS STUDY*

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Abstract

Science education aims to improve science literacy for all of students; which is helping students understandthe conceptsof essential science, understanding the character of science, embodying relevance of science and technology in their real live and students are able to continue their research obtained from university. Sciencecurriculumin over the globe emphasizes philosophy Inquiry inscience education. In the context of science, inquiry refers to the development of students' ability to be able to recognize and carry out scientific investigations. Laboratory-based inquiry has been proven to greatly increase students participation in the biological sciences learning process as it can emphasize the importance of the environment of active learning that encourages independent thinking and provides an opportunity for students tobe involvedactively in problem solving and it is not only by applying memorizing concept formed prior to be done a trial but also it is made by conducting a scientific investigation. The iquiry-based teaching methods reported to inspire students for developingtheir curiosity, investigative skills, and teamwork skills.

***Keyword**: Inquiry, Laboratory, Science Education*

Introduction

Learning is essentially a process of interaction between the learners and the environment, so that it happens behaviour alterationtowards better. In learning, especially in science education,the main task of educator is to condition the environment in order to support behavioural change for students, because education is one of the efforts to educate the next generation in order to havelarge knowledge and skills to be able to live in the community.

Recent national reports indicate that U.S. college graduates are becoming less competitive in the global marketplace. Research shows that a large majority of U.S. college graduates lack of essential critical-thinking and problem problem-solving skills, the abilities that directly contribute to academic and professional success. (Association of American Colleges and Universities, 2005) *in* Ian J. Q, et al (2008). Similarly happened in the country of Indonesia, a graduate of the University of Indonesia did prioritize knowledge and experience gained from the university, the knowledge that students gain usually cannot be implemented immediately when they plunge into the community, it is because of several factors such asthe lack of professionalism and abilityof educators (faculty), lack of infra structure and lack of utilization of existing technologies by learners (students).

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According to Ian J.Q. et al (2008) study shows that, university and students think that it is important to think essentially, while only a small proportion of graduates can demonstrate the thinking skills utilized for academic and professional success. Many universities consider of non-traditional teaching methods by using research methods because they are more able to harmonize science with the investigation process.

Bransford and Donovan *(2005) in* Ian J. Q, et al (2008) suggested that the students can be more competitive on the international stage, the higher education as university needs to make changes in instructional practice. Clearnational recommendations, one of them, the science must be learned and taught as a science that can be implemented in the real world. In particular, students must learn how to solve real-world problems and apply their knowledge in a creative and innovative so that students learn about how to predict the involvement of their science, they also have to use the knowledge that they have, as a science that is done by professionals, and they should be aware of how they think more broadly and not only based on their perception.

One approachprobably is proven and it is suitable for courses at the faculty with the integration of larger studies in the classroom. In laboratory and field, faculty deliberately set experience investigations that pushstudentsto structure and create their own knowledge and skills under the guidance of an expert contentnandthe learning process with inquiry-based methods are used to obtain a success (Porta, 2000; DebBurman, 2002; Howard and Miskowski, 2005) *in* Ian J. Q, et al (2008). However, the implementation of a short time in the classroom learning may limit meaningful reform to be used in the long term (Building Engineering and Science Talent, 2003). With regard to recommendations of national teaching methods that focus more on the integration of research experiences that help students build thinking skills willingness in order to enhance their academic and professional success in a way contributing to labor productivity and national competitiveness (National Academy of Sciences et al, 2005 ;. Bybee and Fuchs, 2006; National Science Council, 2007).

Amy R. P et al (2013) in inquiry-based studies, students usually work in teams to explore issues and develop scientific questions solved by applying scientific methods. This activity allows students to learn in an active, rather than passive, teaching methods. In the final stage, the student presents experimental ideas, designs, and the results to their peers, and responding to feedback fromthe questions. These active forms of learning are suspected to increase the depth of understanding.

This study is a meta-analysis research by talking about science education, measures of inquiry, Division of inquiry, the benefits of inquiry, and the development of science lab module. The Sources of this meta-analysis study is to collect 10 articles to be created as a new article. Any discussion of the journal can be seen in Table 1.

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Table.1 Topics Journal

Inquiry Articel	Science Education	Inquiry Steps	The division of inquiry	benefits of inquiry	Development of a science lab
International Journal of Innovation in Science and Mathematics Education **Title of** : Scientific Inquiry Skills in First Year Biology: Building on Pre-Tertiary Skills or Back to Basics?	✓			✓	✓
Scientific Research **Title of:** Science Process Skills in the Kenya Certificate of Secondary Education Biology Practical Examinations	✓				✓
Bioscene **Title of:** Inquiry-based Investigation in Biology Laboratories: Does Neem Provide Bioprotection Against Bean Beetles?				✓	✓
Journal of Agricultural Education **Title of:** Inquiry-Based Instruction In Secondary Agricultural Education: Problem-Solving – An Old Friend Revisited	✓	✓		✓	
Journal of Science Teacher Education **Title of:** Reforming Science Teaching: What Research says about Inquiry*	✓	✓	✓	✓	
Journal of College Science Teaching **Title of:** Undergraduate Biology Lab Courses: Comparing The Impact of Traditionally Based "Cookbook" And		✓		✓	✓

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Authentic Research-Based Courses On Student Lab Experiences					
CBE—Life Sciences Education **Title of :** Alternation of Generations and Experimental Design: A Guided-Inquiry Lab Exploring the Nature of the *her1* Developmental Mutant of *Ceratopteris richardii* (C-Fern)		✓			✓
CBE—Life Sciences Education **Title of :** Community-based Inquiry Improves Critical Thinking in General Education Biology				✓	✓
Cell Biology Education **Title of:** Using a Module-based Laboratory To Incorporate Inquiry into a Large Cell Biology Course		✓		✓	✓
Science Education International **Title of:** Moving from structured to open inquiry: Challenges and limits	✓	✓	✓	✓	

Discussion

1. Science Education

Science education aims to improve the scientific literacy of all students; namely to help students for understanding ofimportant scientificconcepts, the nature of science, realizing the relevance of science and technology in their lives by continuing their science studies in school or outside of school (AAAS, 1993) *in* Richard. OO & Francis. CI, (2013).

Application of science learning in the first year of study is two ways: namely to attract generations of biologists next in a significant proportion of students who do not want to be a biologist and can help them to achieve awareness of the underlying biological progress towards the completion of a degree in science (Wood 2009) *in* Mary Familari. et al (2013).

The science curriculum around the world emphasize the teaching of Inquiry philosophy in science education. In the context of scientific, inquiry refers to the development of students' ability

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to be able to recognize and carry out scientific investigations. In the context of the instruction, inquiry refers to the teaching and learning strategies that enable the concept to be mastered through investigation and practical work (National Research Council [NRC], 2000) *in* Richard. OO

& Francis. CI (2013).

2. Inquiry

Inquiry has a history for decades and constantly as an appropriate step is utilized to characterize the teaching of science which is good for learning. Even when a new word has entered the lexicon as constructivism of general education as a descriptor of a good education (Ronald D. A, 2002) the authors of the National Science Education Standards (NSES) still choose to use inquiry and completely ignore the new (Richard, OW & Francis, C. I, 2013).

Inquiry-based learning has been praised for shaping students to be able to do more than just reporting the topic. Students must go beyond the simple fact memorization and regurgitation of information into the realm of creating something new and a deeper understanding of students through the implementation of the identification and then get a solution for a specific topic (Owens,

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Hester, & Teale, 2002) *in* Brian Parr & M. Craig. E (2004).

Inquiry-based teaching methods reported to inspire students to develop their curiosity, investigative skills, and teamwork skills. Inquiry-based method gives students the opportunity to be actively involved in solving the problem that is not only by applying the memorize concept formed before the experiment (Rehorek, 2004). According to Brian P and M. Craig. E (2004), in inquiry-based studies, students usually work in teams to explore issues and develop scientific questions solved by applying scientific methods. This activity allows students to learn actively, rather than passively in teaching methods. In the final stage, the student presents the experimental ideas, designs, and get results for them and the group, and responding to feedback from the questions. The active form of learning is expected to increase the depth of understanding of science for students.

Musheno and Lawson *(1999)* Brian Parr & M. Craig. E (2004) concluded «Inquiry by studies have supported the effectiveness of the learning cycle in encouraging students to think creatively and critically, and to facilitate a better understanding of the scientific concepts to develop positive attitudes, improve science process skills, and progress in the cultivation of reasoning skills «.

David, R. H and Jennifer, A. M (2005), suggests that the type inquiry more relevant to teaching and learning facilities available in schools remains controversial among educators. Some teachers prefer to use structured or guided Inquiry, while others prefer to use open Inquiry. Inquiry Proponents claim that structured and guided while others prefer to utilize opened Inquiry.Some supporters of structured and guided Inquiry by guiding Inquiry-based teaching can help students for learning the content of knowledge, mastering scientific skills, and understanding the nature of scientific knowledge. In addition, the Inquiry structured / guided prevent 'a waste of time,' reduce frustration feeling for students to achieve undesirable results, or a failure, and reduce the fear of the unknown student.

Unlike their colleagues that use the strategy of teaching inquiry which are structured or guided, educators who prefer opened inquiry claims that this method reachs higher level investigation, in which students become more familiar with nature scientific knowledge, develop skillsinquiry the greater one and practice, and involved in high-levelthinking (Berg et al, 2003;. Chinn & Malhotra, 2002; Krystyniak & Heikkinen, 2007). Corresponding function student close to effort teacher to facilitate scientific literacy, student creativity, initiative,responsibility and motivation (Michal Z, Ruthy M. (2012).

3. The inquiry-based lab module

Some students find an accurate depiction that science was boring and intimidating and unfriendly, In addition, the capabilities and low student involvement in the laboratory due to students not directly involved in the design or interpretation in each experiment. Students are given the minimum capability in designing the study, they are encouraged to use the instructor as a crutch, not emphasize on skills, strength, and basicknowledge that they have.

Researchers want to revise the work processes in the laboratory, including by:

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- Increasing student interest in courses required this
- Involving the intellectual students in the lab.
- Exposing students to the techniques that are relevant today.
- Requiring students to analyze the data deeply and draw the conclusions accurately

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- Helping students to see the 'big picture' 'and making the connection between concepts.
- Improving students' ability to communicate effectively to their findings.
- Providingmore experiences in a research laboratory.
- In connection with the course material, but beyond the verification of the course material

According to Mark D. S and Karin I. K (2008) over the last decade, there have been steps to replace the traditional expository laboratory exercises with active laboratory, an interdisciplinary laboratory that promotes student involvement in the process of the invention. Students are challenged to use the scientific process to solve realistic problems, increase participation and generate a sense of ownership in learning, increasing the understanding and retention of content, and helping students to develop critical thinking and research skills.

Inquiry-based laboratory has been shown to greatly increase student participation and learning in the biological sciences. One challenge is to develop effective laboratory exercises within the limitations of the introductory laboratory.

In the context of the university, scientific inquiry-based teaching approaches, including the activities of 'hands-on', as found in science lab classes. It is widely accepted that laboratory practices not only motivate and engage students but provide opportunities for students to experience how knowledge is generated in a scientific context. Students consistently appreciate this experience and they have proven positive impact on their achievements in science courses. Often students can develop these skills along with their communication skills through the production of written assignments including lab reports and essays. Laboratory experience also provides an opportunity to build team-working skills, a highly-regarded by educators (Tytler & Symington, 2006) in Mary Familari. et al (2013).

Several reports have recommended a shift in biology undergraduate laboratory courses of traditional structured which is often described as a "guide book," by usingexperience based on authentic research. Recent publications, including BIO 2010: (National Research Council [NRC], 2003) in Sara E. B, et al (2012), a vision and Change Biology Graduate Education), and the New Biology for the 21st Century (National Academy of Sciences [NAS], 2010), highlighting the changes needed for biology undergraduate, including a shift from the traditional lab classes structured to experience more authentic research in biology undergraduatelaboratory.

Traditionally structured practicum provides students with step-by-step instructions that are used to conduct the investigation, productive laboratories with guide books that will be used next. Laboratory with guidebooks usually involve the students in the low intellectual level. activities with a guide as it can create a student to not be able to realize the importance of experimental results. Perhaps most disconcerting, laboratory classes with guides often expose students to an accurate representation of scientific research.

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How scientists develop modeling and followingthe guidelines of laboratory with a guidebook often reflect how well the student can follow directions with little regard for the conceptual understanding and procedural of an investigation. Committee following academic and publications have given recommendation on this case, emphasizing the environmental importance of active learning that encourages independent thinking and solving in scientific investigation, In accordance with this recommendation Universities have tried to implement a variety of laboratory experience, In the laboratory experience active by describing laboratory investigations based on the Inquiry. The study found that students in inquiry-based labs have a more positive attitude towards

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authentic research, higher confidence in tasks related to LAB, and increased interest in pursuing research in the future compared with students in structured laboratory.

Over the past decade, there have been steps to replace the traditionalexpository laboratory exercises with active laboratories, interdisciplinary laboratory promote student involvement in the discovery process, students are challenged to use the scientific process to solve the problems that often occur in the community by increasing the participation and generating a sense of ownership in learn, improving understanding and retention of content, and helping students to develop critical thinking and research skills. The Inquiry-based laboratory Open has been proven to greatly increase student participation and learning in the biological sciences.

4. InquiryLearning Programming

Based on Brian Parr & M. Craig Edwards (2004) curriculum consists of several components, which allow students to progress gradually from structured inquiry, guided inquiry, and up to the level of an open inquiry.

1. The first component includes a series of lab exercises structured inquiry. Students should follow the guidance given, the investigation report written in the form of scientific papers, with a theoretical introduction, details of the method, the table of data collected by students and discussion of the results. Students do / methods for collecting and analyzing data, building hypotheses, and drawing conclusions. Students also become familiar with the epistemology of scientific research. The teachers have extensive databases against the practice. They chose the right to a course where they navigate the process of teaching to knowledge of scientific content that they want to emphasize. Teachers emphasize the relevant substantive knowledge in combination with procedural knowledge. Because the task is done in a controlled laboratory conditions by guides with previously tested, teachers know what results to expect. For this reason, this task is considered exercise structured Inquiry. The students were evaluated by their ability to handle structured tasks with external evaluation system operated by the Department of Education

2. After developing the procedural and substantive knowledge in a structured investigation stage, the second component of the curriculum including supervised field Inquiry. The students were given different tasks, whose goal is to be the method identifies some aspects of the environment (physical, chemical, biological, geological). Teachers provide students with questions of investigation and workingmethods. Master scientifically informed about student results as expected. However, given that the field is a changing environment, could be a surprising result. Although teachers create methods, students are involved in the management process of collecting data in accordance with the conditions specified field, in the process of drawing conclusions and discuss the conclusions reached. For this reason it is considered the guided inquiry. Kirschner et al. (2006) *in* Ronald D. A (2002) found learning in an environment with minimal guided less effective than direct instructional guidance and maintain that changes in long-term memory necessary for effective learning and just guided instruction in such changes. According to Kirschner et al., Approach to inquiry guided, where students are presented with a scientific question, which is tasked to develop an experiment

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to examine the question, and then lead as a class for experimental design effective through leading questions, provide a more structured process of inquiry from the inquiry that is clearly opened. In addition, our experience and others support the idea that a student may be able to learn the knowledge of scientific content, but have little or no experience in actual scientific process

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3. The third component of the curriculum is a project open Inquiry. In this project, students are engaged in the process of Inquiry on the stage of choosing an interesting phenomenon, and through inquiry asked and so on. This project requires the students asked two questions of Inquiry that is logically related. The second question related to the results of the first question. Alternatively, questions can lead to the understanding of Inquiry in the different aspects of the problem examined, in parallel. Inquiry Project open takes six to twelve months. The project results are not determined by students and teachers that do not know the results in the future. During the investigation process, students plan an investigation and make a lot of changes during the process of the investigation until the student is capable and powerful about Inquirysetting.

4. The fourth component of the program consists of encouraging metacognitive awareness. "Research shows that students, who have awareness of meta-cognitive, more strategically oriented and do better than those who lack of meta-cognitiveawareness (eg, Garner & Alexander, 1989). Awareness of metacognitive, thus, tend to make students more systematically in their thinking, and help them to identify mistakes before they go too far in the wrong direction of the investigation process (Keselman, 2003). The more accurate the students can explain their own thinking, which is more effective when they are able to organize themselves in the learning process of inquiry, and be experts in the inquiry (Loh et al., 2001). In addition, teachers train students to reflect on their learning, and then teachers also introduce Regulations Cognition (RC) questionnaire to students. questionnaire refers to five categories: planning, process management, monitoring, debugging, and evaluation. The teachers manage RC-questionnaire at the end of each stage of learning, and students must reflect and regulate their learning in writing to the tasks that they have completed.

5. Group learning is a component of the fifth program. Regardless of the level of the investigation, it is advisable to allow students to carry out their investigation tasks in small groups. Extensive research has shown that collaborative learning has the potential to develop well both the skills of inquiry, students can also learn from one another, exchange expertise and ideas, and build their collective knowledge.

Conclusion

1. Science education aims to improve the scientific literacy of all students; namely to help students for understanding importantconcepts of science, the nature of science, realizing the relevance of science and technology in their lives in a way to continue their science studies at school or outside school

2. Inquiry with studies have supported the effectiveness of the learning cycle in encouraging students to think creatively and critically, and to facilitate a better understanding of the scientific concepts for developing positive attitudes, improve science process skills, and progress in the cultivation of reasoning skills.

3. Working processes in the laboratory, including by:

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a. Increasing student interest in courses required this
b. engaging Intellectualstudents in the laboratory.
c. Exposing students to the techniques that are relevant today.
d. Requiring students to analyze the data in depth and draw accurate conclusions.
e. Helping students to see the 'big picture' 'and make the connection between concepts.

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f. Improving students' ability to communicate effectively to their findings.

g. Provide a better experience in a research laboratory.

h. In connection with the course material, but beyond the verification of the course materials

4. Component, which allows students to progress in stages is that of structured inquiry, guided inquiry, and up to the level of an open inquiry.

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