STUDENTS' PERCEPTIONS OF SCIENCE LABORATORY LEARNING EXPERIENCE TO ACQUIRE INTEGRATED SCIENCE PROCESS SKILLS AMONG UNDERGRADUATE STUDENTS AT UPSI

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PROJECT PAPER SUBMITTED IN FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF EDUCATION (BIOLOGY) (MASTER BY COURSE WORK)

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ABSTRACT

The aim of this study is to identify the perception of undergraduate science students' towards laboratory learning experience in enquiring integrated science process skills (ISPS). A combination of survey and experimental research design are used in this study. The instruments used in this study are the Inventory of Student Laboratory Experience and the Integrated Science Process Skills, which divided into three parts which are Part A (demographic information), B (Likert's scale survey) and C (multiple choice questions test). This study was done on 209 undergraduate sciences students from three programmes namely Physics, Chemistry and Biology Education in the Faculty of Science and Mathematics, UPSI. The data was analyzed using one-way ANOVA and Pearson correlation coefficient. The findings of this study show that a significant difference between the students' perceptions towards science laboratory learning experience. The motivators and assessment factors show a significant difference between physics-biology and chemistry-biology courses. There is a significant difference between students' acquisition on ISPS. Hypothesising skills shows a significant difference between biology-chemistry and physics-chemistry courses. Defining operationally and designing experiment skills show a significant difference between biology-chemistry courses. This study gives an important implication to the educators on how to improve in developing laboratory learning strategy to enhance students' interest in laboratory learning experience and to increase students' acquisition of integrated science process skills.

PERSEPSI PELAJAR TERHADAP PENGALAMAN PEMBELAJARAN DI MAKMAL SAINS UNTUK MEMPEROLEHI KEMAHIRAN PROSES SAINS BERSEPADU DALAM KALANGAN PELAJAR PRASISWAZAH DI UPSI

ABSTRAK

Tujuan kajian ini adalah untuk mengenalpasti persepsi pelajar sains prasiswazah terhadap pengalaman pembelajaran di makmal sains, penguasaan kemahiran proses sains bersepadu. Kajian ini telah menggunakan reka bentuk kajian yang menggabungkan soal selidik dan kajian eksperimen. Instrumen yang digunakan dalam kajian ini iaitu Inventori Pengalaman Pembelajaran di Makmal Sains dan Kemahiran Proses Sains Bersepadu telah dibahagikan kepada tiga bahagian iaitu Bahagian A (maklumat demografi), B (soal selidik skala Likert) dan C (ujian soalan aneka pilihan). Kajian ini telah dijalankan ke atas 209 pelajar prasiswazah sains dari tiga program iaitu Pendidikan Fizik, Kimia dan Biologi di Fakulti Sains dan Matematik, UPSI. Data dianalisis menggunakan ANOVA sehala dan Pearson pekali korelasi. Dapatan kajian ini menunjukkan bahawa terdapat perbezaan yang signifikan di antara persepsi pelajar terhadap pengalaman pembelajaran di makmal sains. Faktor motivasi dan penilaian menunjukkan perbezaan yang signifikan antara kursus fizik-biologi dan kimia-biologi. Terdapat perbezaan yang signifikan di antara tahap penguasaan kemahiran proses sains bersepadu pelajar. Kemahiran membuat hipotesis menunjukkan perbezaan yang signifikan antara kursus biologi-kimia dan fizik-kimia. Kemahiran mendefinisi secara operasi dan mereka bentuk eksperimen menunjukkan perbezaan yang signifikan antara kursus biologi-kimia. Kajian ini memberikan implikasi penting kepada pendidik untuk memperbaiki dan membina pembelajaran makmal yang lebih menarik untuk meningkatkan minat pelajar terhadap pembelajaran di makmal sains dan meningkatkan tahap penguasaan kemahiran proses sains bersepadu pelajar.

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ANOVA	analysis of variance
ASELL	Advancing Science by Enhancing Learning in the Laboratory
ASLE	ASELL Student Laboratory Experience
B(number)	biology course (id of respondent)
BSPS	basic science process skills
CDC	Curriculum Development Centre
df	degree of freedom
ISLEnISPS	Inventory of Student Laboratory Experience and Integrated Science Process Skills
ISPS	integrated science process skills
n	number
p	p-value (calculated probability)
P(number)	physics course (id of respondent)
r	Pearson correlation coefficient
SAPA	Science - A Process Approach
SD	standard deviation
Sig.	significance level
SPS	science process skills
SPSS	Statistical Package for the Social Science
TIPS	Test of Integrated Process Science
UPSI	Universiti Pendidikan Sultan Idris

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The rapid development of science and technology in the 21st century was resulting in increasing of knowledge and new discoveries. In addition, generally peoples' belief higher education institutions should equip all graduates with the proper skills necessary to achieve success in the workplace.

According to Robinson and Garton (2008) and Ministry of Education Malaysia (2012), employability is a job readiness skills and an ability for an employee to be marketable in the industry. Those core competencies necessary for getting, keeping and doing well on a job and they can be divided into three categories: basic academic skills, decision making, and higher order critical thinking. A statistic studies showed

the average employability from the year 2006-2009 among first graduate student in Malaysia only about 70.1% (UNESCO Bangkok, 2012).

Aware of these shortcomings in our current students in developing 21st-century skills, the laboratory science practice today needs to help students to develop their scientific skills to support the 21st-century skills. Edy Hafizan, Lilia, and Meerah (2012) mentioned in their study, it is difficult for science students to acquire all the knowledge in the science field. Therefore, teachers should teach students to gain experience and not just learn all knowledge. In science subject, science process skills are skills that allow students to gain knowledge and understanding of the knowledge gained.

According to Ministry of Education Malaysia (2006), inquiry and problem solving are emphasised in science. In research and problem-solving processes, scientific and thinking skills are practiced. Scientific skills are essential in any scientific investigation such as conducting experiments and carrying out projects. Scientific skills include manipulative skills and science process skills.

Manipulative skills in scientific enquiry are psychomotor abilities that allow students to use and handle laboratory apparatus, substances, chemicals and specimens correctly, accurately and safely (Hidayah & Rohaida, 2014; Ministry of Education Malaysia, 2006).

While science process skills allowed students to create their questions and find out the answers systematically and scientifically. There are many science process skills included when carrying out of scientific inquiry such as observing classifying, predicting, hypothesising and more. Science process skills (SPS) are also divided into two groups which are basic science process skills (BSPS) and integrated science process skills (ISPS) (Ango, 2002). The details of both groups could be found out in Chapter 2.

Students usually gain scientific skills through learning experience especially when carrying out scientific research in the laboratory. Laboratory learning experiences an important part of science courses. Laboratory experience becomes the most important element of science courses, and they have also been shown to inspire and encourage students to learn more about science (Hofstein & Lunetta, 2004).

This study aimed to investigate perceptions of undergraduate science students from various science fields on science laboratory learning experience to acquire ISPS.

1.2 Problem Statement

According to the Ministry of Education Malaysia (2012), there are many problems that employers face in hiring fresh graduates. Among problems identified among them are skills that do not match, unable to solve problems and lack of depth of skill knowledge.

Therefore, it becomes crucial to help educators to guide students to develop their problem-solving skills, scientific and thinking skills in order to prepared students who are the future workforce.

This study will identify science students' perceptions on their current laboratory learning experience either it can develop their ISPS which is related to problem-solving and critical thinking in 21st-century skills area. Based on this study, educators can improve their developing laboratory learning strategy to enhance students' interest in laboratory learning experience and to increase students' acquisition of ISPS.

1.3 Research Objectives

1. To identify undergraduate science students' perceptions of science laboratory learning experience.
2. To measure undergraduate science students' acquisition on ISPS during laboratory learning experience.
3. To identify the relationship between undergraduate science students' perceptions of science laboratory learning experience and their acquisition levels on ISPS they acquire during laboratory learning experience.

1.4 Research Questions

1. What are the perceptions of undergraduate science students on laboratory learning experience?
2. What are the acquisitions levels of undergraduate science students' on ISPS during laboratory learning experience?
3. Is there a significant relationship between undergraduate science students' perceptions of science laboratory learning experience and science students' acquisitions on ISPS during laboratory learning experience?

1.5 Research Hypothesis

This study tested several hypotheses that related to ISPS and laboratory learning experience;

Ho_1: There is no significant difference between the students' perceptions towards science laboratory learning experience.

Ho_2: There is no significant difference between students' acquisition on ISPS towards science laboratory learning experience.

Ho_3: There is no significant relationship between undergraduate science students' perceptions of science laboratory learning experience and their acquisition on ISPS during laboratory learning experience.

1.6 Significance of the Study

The significant of the study is to find out undergraduate science students' perceptions of their current science laboratory learning experience. Besides, from the laboratory learning experience that they had done, evaluation of their acquisition levels on ISPS will be done. This study is vital for the instructors and students to know either their laboratory learning experience are useful to obtain scientific skills or not. The significant relationship between undergraduate science students' perceptions of science laboratory learning experience and their acquisition on ISPS during science laboratory learning experience also could be seen in this study.

1.7 Scope and Limitations of the Study

The extent of this survey using questionnaires and tests as instruments and will be conducted on undergraduate students majoring in science, including physics, chemistry and biology at Universiti Pendidikan Sultan Idris (UPSI). The questionnaires of this study consist of three parts which are A, B, and C. Part A is the demographic factors of respondents, section B includes item features students' perceptions of science laboratory learning experience and part C consists of series of questions to measure acquisition levels on ISPS.

It is become a limitation to getting perceptions from all science students in West Peninsular Malaysia Higher Institution. Thus, cluster random sampling would be chosen to run the research. The group sample will represent the population of science students in UPSI.

1.8 Research Conceptual Framework

The model for the inventory to assess students' perceptions of laboratory learning experience adopted from the conceptual model (Klein, Noe, & Wang, 2006). The model explains that course outcomes are a direct result of factors. Thus, this conceptual model suitable to observe factors motivators, assessment and resources affect the perceptions of science laboratory learning experience in this study.

While the ISPS referred from the Curriculum Development Centre (Ministry of Education Malaysia, 2006). The ISPS examine in the test including making a hypothesis, controlling variables, defining operationally, interpreting data and designing experiments.

Base on the model Klein et al. (2006) and ISPS Ministry of Education Malaysia (2006), a conceptual framework for this study was developed. Figure 1.1 shows conceptual research framework adopted from Richardson (2006) general theoretical model and Norhaiza (2015) research conceptual framework.

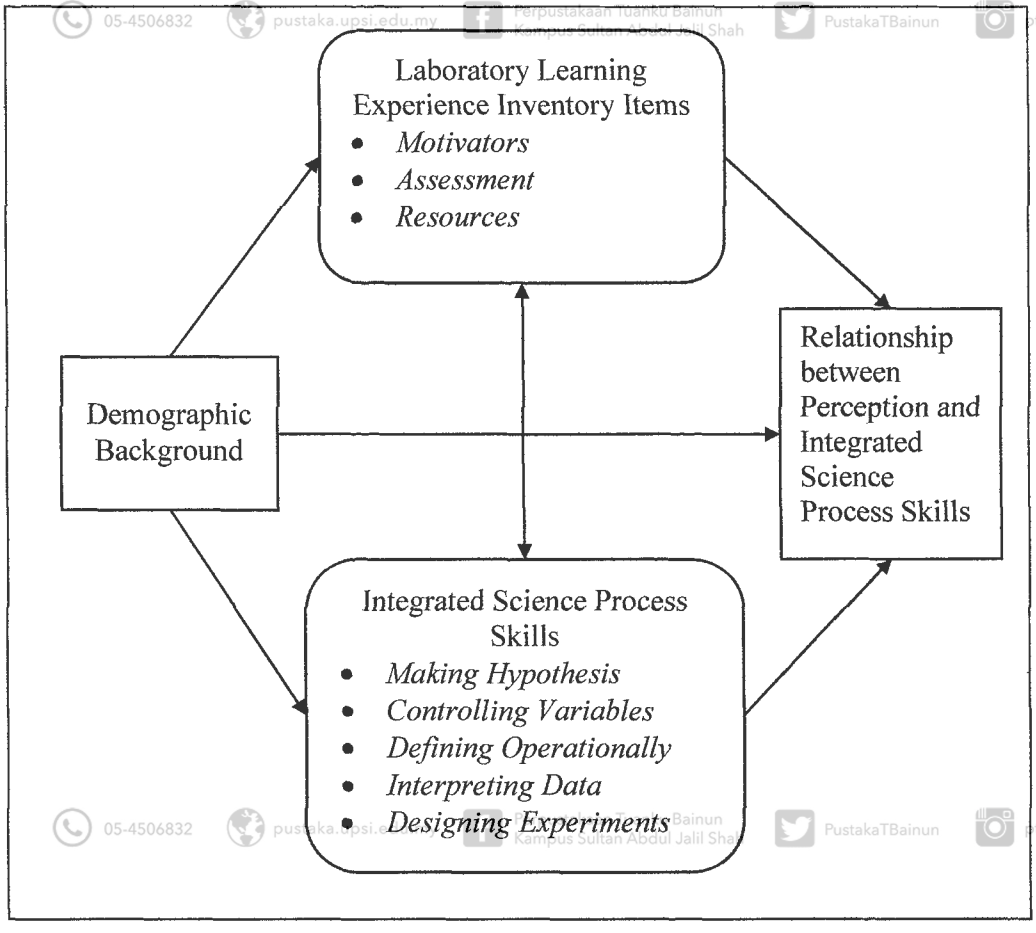

Figure 1.1 Research Conceptual Frame Work

1.9 Operational Definition

The following are some operational definition used in this study:

1.9.1 Students' Perceptions

According to Lewis (2001), perception is a presumption against an object, event or person. He also added perceptions process occurs naturally commenced with stimuli experienced by the senses and ended with the formation of perceptual.

While term perceptions in this study focus on undergraduate students' acuity or thought on laboratory learning experience, they have done. Students' perceptions will be evaluated by using Likert scale questionnaires.

1.9.3 Laboratory

Hodson (1993) mention in his study, science laboratory is a place to learn specific scientific processes or particular laboratory procedures. Students could use the methods and procedures of science to investigate phenomena, solve problems, and pursue inquiry and interests in the laboratory (as cited in Hofstein & Lunetta, 2004).

Laboratory in this study is a place equip with scientific apparatus for science students to do teaching and learning experience or scientific experiment.

1.9.4 Science Process Skills

Scientific thinking, scientific method, and critical thinking terms have been used at by many scholars to describe science skills. Nowadays term science process skills (SPS) are generally used. Science - A Process Approach (SAPA) curriculum project had introduced SPS term as to define abilities and behaviour of scientists (Padilla, 2011).

SPS in this study meaning scientific skills of science student acquires during science laboratory learning experience while doing the scientific experiment. SPS divided into two groups which are BSPS and ISPS.

1.10 Summary

In conclusion, this study is designed to study undergraduate science students' perceptions of their science laboratory learning experience. This study also will evaluate students' acquisition levels on ISPS. This study is crucial for the instructors and students to know the relationship between undergraduate science students' perceptions of science laboratory learning experience and their acquisition levels on ISPS.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will discuss some aspects of past studies related to perceptions and attitudes toward laboratory learning activity and the acquisition of science process skills. This chapter will also review the previous studies include inside and outside of Malaysia, particularly for all science subjects at either the school or higher education.

2.1 Laboratory Learning Experience

Although laboratory learning experience is common practice and becoming the important part of science learning by science students, most laboratory studies had been done by researchers are focusing on particular learning topics or teaching methodology. Besides, the most common researches could be found were laboratory

learning environment. However, fewer studies conducted to investigate about science laboratory learning experience covering all science fields including physics, chemistry, and biology.

Hofstein and Lunetta (2004) had done review regarding science laboratory in the 21st century. From their review, it understands that the purpose of laboratory had been changing over the century. Besides, they also describe science laboratory experience as a study, observation and understanding the natural world with students interacts with laboratory equipment, materials, models and more. Besides, they also added laboratory experience are as a means to enable students to engage in the process of building knowledge and understanding through science and at the same time learn science.

Science learning process of students comprises of inquiry-based and lab-related experience. Investigation practice during laboratory practice can develop students' skills in frame research quotations, design experiment, execute the experiment, gather and analyze data, construct arguments and conclude through investigations strategies. Besides, laboratory works encourage students to study scientific investigation of the natural world and improve their scientific knowledge (Bell, 2005).

Laboratory experiences were carried out either in a large or small group setting to engage students with the learning process. Learning process in the laboratory has a varied range of construction from structured–learning to student-centered learning. However Hofstein and Mamlok-Naaman (2007) argued in their review, even the science laboratory becomes a distinctive role in science education; many studies failed to show a relationship between science laboratory experience with student scientific skills.

2.1.1 Students' Perceptions of Science Laboratory Learning Experience

A quantitative study by Russell and Weaver (2008) shows students' perceptions of the purpose of the science laboratory. In the traditional laboratory, all experiment base on instruction and student need to follow the instruction to complete their laboratory work. Students think this type of laboratory work will limit them to participate and perform well in their experiment. Some students' thinks it will make them become robot because they just follow the instruction. This situation will make students limit their creative thinking. Some educators argue the lecture and laboratory should be separate apart. However, most students in the study think laboratory should become a place for them to connect between lectures and laboratory practices and for learning visually or kinaesthetically.

Research on 500 undergraduate physics students by Sneddon, Slaughter, and Reid (2009) shows perceptions and opinions of students regarding their science laboratory practical. This study observed either laboratory practical stimulate interest and students motivations, developing their scientific inquiries, assisting in skills