# Understanding Students' Perception of Quality Lab Learning Experience: An Analysis from the Qualitative Approach

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## Abstract

In this exploratory study, a community of inquiry framework was used to investigate students' perception of the efficacy and quality of lab learning session. It was found that participants valued not only the quality of the equipment, but also the instructor's timely engagement and reflection. Study participants emphasized the necessity of the instructor's frequent engagement through various mode of learning methods, such as virtual and face-to-face explanation before class and review after lab session. Participants' interest in asynchronous instruction was also observed. These findings are in line with previous studies emphasizing the importance of instructor's engagement in lab sessions. This study contributes to understanding students' perception of the quality of learning experience in a lab session.

## Keywords

Learning experience, Lab learning session, Focus group

## Introduction

There are myriad of research (i.e., Parappilly, Hassam, & Richard J. Woodman, 2018) and suggestions (i.e., Yeh & Swinehart., 2017) in regards to the inclusion of students with diverse-learning styles and varied background in more student-centered and hand-on science in the lab session. However, research on tertiary education institutions' students' perceptions of their lab experiences remains underrepresented. With increasing emphasis on hand-on, inquiry-, or investigative oriented learning in lab experience (Hodson, 2014), it is worthwhile to document students' perception of the efficacy and quality of lab learning session.

In this paper, we investigated student-lab learning experience based on students' perceptions of experiences using focus group. Specifically, the focus is on the students' perceptions of the learner-instructor, learner-learner, and learner-content interactions that occurred related to lab-type activities.

The contributions of this paper are twofold. First, it provides premises that guide on how lab instruction can be best delivered based on student reports. Second, the use of focus group as data collection method provides insight beyond that afforded by previous research with survey.

## Literature Review

In examining the literature, there is a long history of ambivalence with regard to student perceptions of lab learning experience (Kirkup, Varadharajan, & Braun, 2016), especially perceptions of an inquiry-oriented tertiary-institution lab (i.e., Nyutu, Cobern, & Pleasants, 2018).

Previous research (i.e., Avi Hofstein & Lunetta, 1982; Nyutu, Cobern, & Pleasants, 2018) showed budgets and economics rather than best-educational practices have guided the implementation of lab. Students are asked to work in groups so that there will be enough space in the classroom to fit all of the necessary equipment. In other words, space and logistics are guiding lab instruction rather than educational imperative to have every student understand every aspect of a lab.

There is increasing recognition that each student brings particular learning style, sources of intelligence and unique coping mechanisms to the classroom (Keengwe, Jared, Onchwari, & Grace, 2017). The emerge of diverse learning environments allow creative and individual expression. However, new techniques in lab require more agility in using lab materials and equipment place extraordinary demand on students.

The diverse learning environment and blended pedagogy allow a more collaborative learning and small-group-lab projects (Weimer, 2015). With this setting, students can utilize representation of experience to better adapt to their environment (Shibayama, Baba, & Walsh., 2015). Students lab experience can be enhancing if individual intellectual differences are allowed to emerge in a properly designed environment and with coaching from lab instructor (Kirkup et al., 2016).

Although there is a strong movement to lab learning inclusive and based on multiple forms of intelligence that may foster creative, little is known about students' perceptions or orientations of current lab learning experiences. The researchers in this research study develop three fundamental research questions for this research study:

RQ1: What are the factors affecting students' lab learning experience?
RQ2: What are the students' perceptions of lab and lecture connection?
RQ3: What are the modifications of the lab lessons that can be implemented to enhance student learning experience?

## Materials and Methods

Lab is hand-on in nature. Skills that learn through lab is intended to motivate students and challenge them through innovative-lab experience. A study done by Burne Johnston and McAllister (2008) shown that lab work improves students understanding of lecture materials and knowledge learned. Based on observations, there are 3 types of lab-learning experience:

1) highly structured and prescribed;
2) less structured, more open-ended experience, including some guiding framework for student responses; and
3) open-inquiry-type-lab experiences.

On another dimension, lab experience may vary in the amount of equipment used and requirements of skills. In this study, participants' lab experience is fall under group 2. These experiences were deemed to be an adequate subset to examine how students responded to lab experiences since it emphasizes lab skills rather than traditional classes that emphasize memorization, drill and practice, and cook-book-type of labs (Robert Douglas Mirchin, 2012).

## Methodology

This study aims to evaluate students' perceptions of their lab learning experiences with the aim of understanding factors impacting their lab learning experiences. The sample size comprised of 23 students from undergraduate students. The researchers decided to use quantitative data collection (i.e., focus group) and analysis (i.e., content analysis and triangulation), because the researchers seek to understand the factors causing students' perception of positive lab learning experience. A pilot interview conducted with three undergraduate students and two minor modifications were made to enhance the clarity of focus group interview questions. There are a total of seven questions:

(1) Have you liked attending your laboratory courses in the past? Why or why not? **(RQ1)**
(2) Do you feel that you understood the purpose of the lab in your courses in the past? **(RQ2)**
(3) What do you think was the purpose of the lab in your course? **(RQ2)**
(4) What is the most memorable lab experience you have? **(RQ1)**
(5) What are some modifications that could be made to make the lab a more enjoyable experience for you? **(RQ3)**
(6) If you were to design a lab class that suited your needs as a student, what would that course look like? **(RQ3)**
(7) How can IU academic staff re-design lab sessions that are student-centered (i.e., promote active learning), engaging (i.e., fun), and thought provoking (i.e., promote critical thinking among students)? **(RQ3)**

The researchers gave the students freedom to discuss their lab experience from positive and negative viewpoints, so that the findings from this research study can be more comprehensive. The focus group sessions were video-recorded and the researchers viewed the recorded video a few times in order to code the students' comment into several emergent themes. After preliminary categories were formed from the emergent themes, the researchers compared summaries of each

category and refining them to capture all the students' perspectives of positive lab learning experiences.

## Results

In this qualitative study, the respondents comprise Malaysian and international students enrolled in undergraduate programs in a private university in Malaysia. Table 1 shows the students (i.e., respondents) from faculty of business, communication and law, information technology and science, engineering and quantity surveying, and health and life sciences in this research study at a glance.

Table 1: Number of students participated in the focus group study from various faculties. In this group of respondents, there are 22 Malaysians (96%) and one international students from Maldives (4%).

| Faculty | Number of Students |
|---|---|
| Business, Communication and Law | 6 |
| Information Technology and Science | 4 |
| Engineering and Quantity Surveying | 6 |
| Health and Life Sciences | 7 |
| Total | 23 |

Based on research question 1 (RQ1 – What are the factors affecting students' lab learning experience?), the researchers discovered the following factors contributed to the students' positive lab learning experience:

(a) Lecturer's confidence, engagement, and support (Faculty Member Support, n=18)
(b) Personalized attention attentions from the lecturers (Faculty Member Support, n=20)
(c) Having hands on experience to develop practical skills (Self-Efficacy, n=12)
(d) Overcoming fears of using the equipment (Self-Efficacy, n=15)
(e) Exposure and ability to use new lab equipment such as FABLAB, 3D printer, video camera, etc. (Self-Efficacy, n=14)

On the other hand, the researchers discovered the following factors contributed negatively to the students' lab learning experience:

(a) lab sessions either too early or too late during the day (Lab Schedule, n=17)
(b) lab sessions are too long (Lab Schedule, n=16)
(c) poor lab devices (e.g. computer hardware/software) and facilities, and insufficient apparatus (Lab Facility, n=19)
(d) lecturer spending too much time explaining experiment procedures (Faculty Staff Members, n=5)
(e) lack of clear lab learning outcomes (Curriculum Design, n=9)
(f) media studio too small (Lab Facility, n=4)
(g) under-utilization of Blackboard to support lab learning experience (Curriculum Design, n=11)

The researcher noticed the negative lab learning experiences shared by the students outweight the positive lab learning experiences, and this concern will be further discussed in the discussion section. The emergent themes (that impact students' lab learning experience) include faculty member support, self-efficacy, lab schedule, lab facility, and curriculum design.

Based on research question 2 (RQ2: What are the students' perceptions of lab and lecture connection?), the researchers discovered the following linkages between lab and lecture based on the students' comments:

(a) There is a connection between lecture and lab for most of the courses, but they are not always clearly defined. Sometimes, the students have to figure it out themselves (Unclear, n=14)

(b) Educational video can help bridge the gap between lecture and lab (Supplementary Learning Aids, n=15)

(c) It will be better if lecturer can spend about 15 minutes at the end of lecture to explain about the lab, if the lecture and lab are conducted by same lecturer (Curriculum Design, n=13).

Based on the students' comments, the researchers propose the linkages between lab and lecture learning experiences can be further enhanced using supplementary learning aids and outcome-based curriculum design.

Based on research question 3 (RQ3 – What are the modifications of the lab lessons that can be implemented to enhance student learning experience?), the researchers in this research study discovered the following themes after the focus group sessions:

(a) Lecturers wait 30 minutes for lab session to start because some students not present (Faculty Staff Members, n=12)
(b) Lecturer using Kahoot to start the lab session (Supplementary Learning Aids, n=12)
(c) Video analysis of human movement (Supplementary Learning Aids, n=4)
(d) Touching use the video equipment for the first time and understand ways to use it (Self-Efficacy, n=5)
(e) Shorten lab briefing and moving the briefing to online platform (Supplementary Learning Aids, n=12)
(f) Faculty designated computer lab such as IT Lab for IT students only computer lab (Lab Facility, n=8)
(g) Sufficient and updated equipment and software (Lab Facility, n=12)
(h) Assessment correlating with the time spend in the lab (Curriculum Design, n=14)
(i) Music in lab (Lab Facility, n=3)

Based on the students' comments, the researchers suggest students' may gain positive lab learning experience if higher education providers can focus on the monitoring faculty staff members, introducing additional supplementary learning aids, improved lab facility, and outcome-based curriculum design.

## Discussions

Based on the results gathered from the qualitative data collected for this research study, the researchers in this research study discovered the following linkages:

(1) RQ1 - faculty member support, self-efficacy, lab schedule, lab facility, and curriculum design can have impact on students' lab learning experiences
(2) RQ2 - supplementary learning aids and outcome-based curriculum design can assist to improve students' lab learning experiences.
(3) RQ3 – faculty staff lab lesson planning, additional supplementary learning aids (especially online learning tools), well-managed lab facility, and well-designed curriculum (using outcome-based education approach) can potentially improve students' lab learning experience.

The findings from this research study should be further developed into research hypotheses and tested using quantitative approach. Future research should also focus conducting the data collection at multiple higher education institutions (i.e., public and private higher education institutions). Finally, the findings from this research study can help higher education institutions' administrators and leaders to prioritize the strategic organizational development plan. Additionally, higher education institutions' administrators and leaders should take a proactive approach to improve students' lab learning experiences (i.e., strategic lab improvement initiatives), rather than reacting to students' complaints about their lab experiences.

## Conclusions

Lab work is a very important component of tertiary education. For the student to have a good rewarding educational experience in the lab, this experience must be properly designed and integrated with the lecture. Furthermore, engagement and timely reflection from the instructor will enhance the good experience.

The purposeful sampling technique and focus group transcripts as the primary data source does not allow us to generalize the finding to larger group of students. To address such issues, we need to validate students' reporting through quantitative research design (i.e., survey). Nevertheless, the research design of this study allow us to delve deeply into issues that impact students' perceptions of lab experience and help us to identify the effective practices that can enhance lab experience.



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