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Laboratory Course: Study of Supporting Somponents in Fundamental Chemistry II Lab Course

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Abstract-Laboratory gives contribution for students as place to conduct experiment activity which is part of learning process. This study was aimed to analyze the components that supporting experiment activity in fundamental chemistry II experiment class. Four indicators which used in this research are language of the fundamental chemistry II experiment module (2 statements); content criteria of fundamental chemistry II lab manual (6 statements); role of laboratory instructor in fundamental chemistry II experiment class (7 statements); value from fundamental chemistry II experiment class (5 statements). This research is descriptive qualitative research which describing about percentage of fundamental chemistry II student's response. Data collected using student's response questionnaire with Likert scale. The questionnaire instrument is developed based on four indicators that influence the laboratory class activity. Participants of this research are fundamental chemistry II students (n=15) undergraduate of chemistry education program, Mataram University. The result of student's responses was performed in percentage.

Keywords: laboratory activity, lab activity supporting components, fundamental chemistry II experiment class.

INTRODUCTION

There is a widespread agreement that appropriate pre-laboratory preparation is beneficial to students as it facilitates their learning and understanding (O'Brien & Cameron, 2008; Jones & Edwards, 2008; Chittleborough, Treagust, & Mocerino, 2007; Johnstone & Al-Shuaili, 2001). Laboratory plays role as a place for students to run the experiment activities as part of their learning process. Laboratory work is an integrated part of courses in chemistry in higher education. The original reasons for its development lay in the need to produce skilled technicians for industry and highly competent workers for research laboratories (Morrell, 1969, 1972). According to Reid and Shah (2006) the greater importance is the need to see the 'hands-on' laboratory time as part of a wider process of learning. In short, laboratory is a place where students practice their science skill learning process.

Experiment class is necessary for science because students need more practical activity to help them to understand the theories they have learn in class. The absence of experiment class can affect learner's understanding about their course. The absence of the laboratory experience may leave students with perceptions of chemistry that are very abstract and theoretical (Reid and Shah, 2008). Furthermore, this statement is also supported by Read and Kable (2007) the practical experience also contributes an integral part of chemistry science, the subject consist of many topics that can be verified experimentally with an objective to create an enabling environment to stimulate student learning about chemistry that is commonly presumed as abstract, quantitative, and boring.

The research literature on the laboratory describes the varied purposes that educators have for the laboratory, which echo, nearly verbatim, the purposes for the lecture and science learning in general (Hegarty-Hazel, 1990; Hofstein & Lunetta, 2004; Tamir, 1990). In science education views, laboratory activity aimed to developed student's ability to think scientifically how to solve a problem, analyze the result, and present the result in an experiment report. To make sure that an experiment class going successfully, there are some aspect to be considered such as aims and objectives, pre-laboratory exercise, experimental report, data analysis, and many more. This study conducted to measure the components of laboratory experiment in fundamental chemistry II experiment class of chemistry education class of Mataram University trough questionnaire responses from four indicators that important to support the experiment class itself in our university.

METHODS

Participants of this research are fundamental chemistry II students (n=15) undergraduate of chemistry education program, Mataram University. This research is descriptive qualitative research which described student undertaking fundamental chemistry II response's on the questionnaire. Data collected using student's response questionnaire according to Likert scale 1= strongly disagree; 2= disagree; 3= agree; and 4= strongly agree. The questionnaire instrument was developed based on four indicators that influence the laboratory class activity.

The development of those indicators then constructed to be a questionnaire instrument. Validity of this instrument using *content validity* (Barbera, 2011). Four indicators which used in this research were language use in the fundamental chemistry II experiment module (2 statements); content of fundamental chemistry II lab manual (6 statements); role of laboratory instructor in fundamental chemistry II experiment class (7 statements); value from fundamental chemistry II experiment class (5 statements). The result of student's responses was indicated in percentage.

RESULTS AND DISCUSSION

Response to language use in fundamental chemistry II lab manual

Language as a device for communication takes an essential role, especially in experimental activity. A good arrangement of language must be considered in writing lab manual, because students can do wrong procedure if the statement or language that use is not clear. Fundamental chemistry II class is a bilingual class and using English as main language for study. Students in this class used English as the main instruction in classroom, as well as in the laboratory. Because English is not native to Indonesia, students had problem when they have to do experiment class in English.

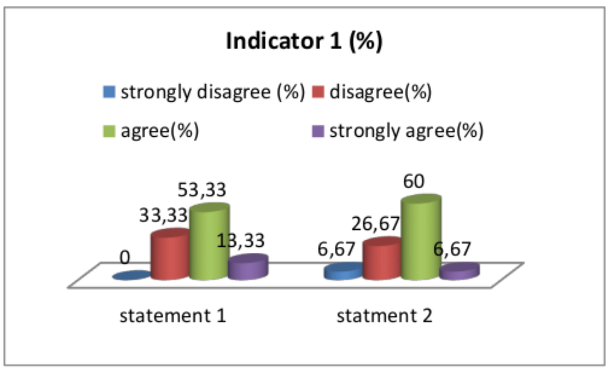

Figure 1. Responses to indicator 1. Students were asked whether the lab manual is difficult (Statement 1) and whether they have problem to understand the lab manual (Statement 2)

Figure 1 shows student's response to indicator 1, which consisted of two statements. Statement 1 about difficulties of language in the lab manual shows 53.33% student's responded that language in lab manual was difficult. This result gives information that students found difficulties to understand the instruction in the lab manual. The language used in the lab manual maybe too high to understand by the students, since they are not familiar to read manual in English. Accordingly, as response to statement 2, 60% students said that they have problem to understand the lab manual since it use English.

Response to the content of fundamental chemistry II lab manual

Indicator 2 discuss about the content of fundamental chemistry II lab manual. Content criteria analyzed were basic theory, aims and objective in lab manual, tools and materials, procedure, and data analysis.

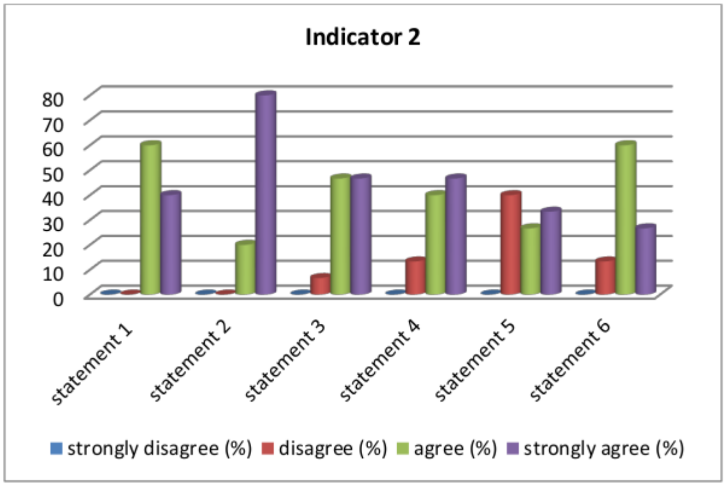

Figure 2. Responses to indicator 2: the content of lab manual

First statement in indicator 2 asked about basic theory. Student's response show 60% students agreed that the lab manual contain basic theory which can be used as references for study prior to experiment day. Basic theory is an essential component of lab manual. It contains some explanation about the experiment especially about concept and hence, helpful for the students to understand about the experiment overall.

The aims and objectives of lab exercise were found clear by 80% of students (statement 2). Clarity in the aims and objectives in every experiment are important, since they determine final result that is expected from an experiment activity. According to Reid and Shah (2006) it is important to think about goals, aims and objectives in the context of laboratory work. Moreover, Boud et al. (1986) stressed that, when planning a course it is important to state clearly the course aims, goals and objectives: what to be taught, who is it to be taught to, by what means, and most importantly, what are the intended outputs? The issue is to find some agreement about what these aims and objectives might be. Therefore, it is also important to note the outcomes from such work in that the university classes are drawn from those who have experienced laboratories at school before they arrive at university.

In regard to experimental procedure (statement 3), 46.67% student's responded they had an opinion that the procedure is written clearly in the lab manual. Procedure explains about the step of working in an experiment activity. It helps students to do the experiment. Procedure plays a role not only to provide the step of working process, but also prevent errors in laboratory. Procedure must be written clearly and be easy to understand, because typographical error or unclear instruction can make error in experiment activity, or even can lead to an accident. Procedure in lab manual could be changed depending on the condition of tools and materials that are available in laboratory. In addition, a good lab manual also should state the list of tools and materials that used in an experiment. For this question (statement 4), 60% student's agreed that tools and materials are written clearly in the lab manual. The preparedness of tools and materials must be ensured in order to have the best outcome from experiment activity.

Next statement related to data analysis. Over 40% students responded that our lab manual contains relevant data analysis (statement 5). Data analysis should be stated within lab manual as guidance for students to process the data from experiment, thus data analysis also should be arranged clearly step by step what need to count and how to count it. Data analysis usually explained by lab co-assistant before the end of experiment class. Lab assistant explain what should students do for their data analysis. In this regard, similar number of students found that data analysis explanation by lab assistants was difficult to understand (statement 6). It is could be a problem because unclear explanation will result in misunderstanding among students and they perform wrong data analysis. In short explanation about data analysis should be highlighted and lab assistants have to explain it in easy way, especially for quantitative analysis experiment.

Response to the role of co-assistant in fundamental chemistry II experiment

The third indicator analyzes the role of lab co-assistants. Lab co-assistants (or simply referred to as lab assistant, lab technicians in literatures (Blease and Busher, 1999)) have responsibilities to guiding the experiment activity, and prepare tools and materials for experiment. Statement 1, 2, and 3 are related each other in that they analyze the role of co-assistant in experiment activity.

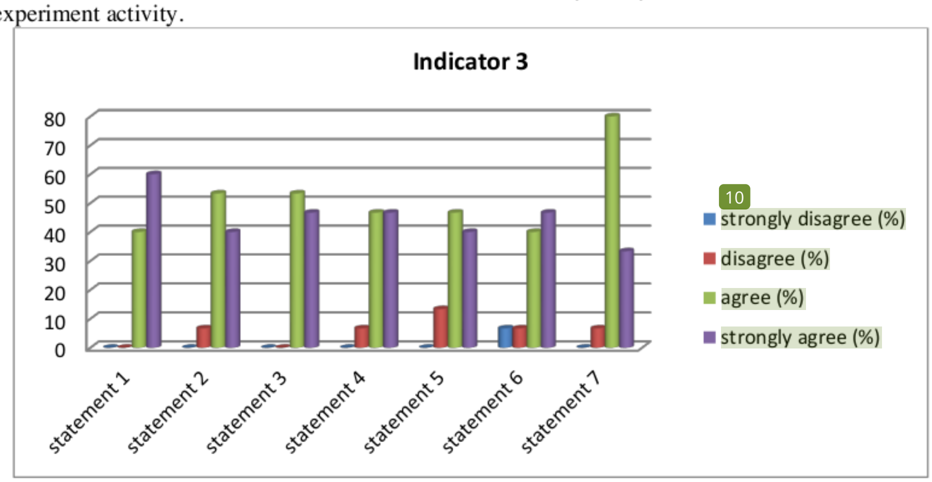

Figure 3. Responses to indicator 3

Co-assistants give significant influences to the successful of an experiment activity. Co-assistants have job not only to prepare tools and materials, but also responsible to explain the procedure. In addition, co-assistants have responsibilities to guide the students during experiment activity, in order to make sure students do the experiment correctly. Because of their important role, capable lab co-assistants are always demanded.

Statements 4 and 5 are linking each other. Statement 4 quests about lab assistance and statement 5 about guidance for writing lab report. 46.67% students perceived lab co-assistants are helpful for them, and the lab co-assistants give a clear explanation for writing lab report. At chemistry education department, lab assistance is by the end of individual experiment class. The purpose of lab assistance is to explain data analysis or provide additional hints should something found unclear. Thus, the role of co-assistants becomes an essential activity because detail information about data analysis will be explained on this session.

Co-assistants role in guiding lab report writing was responded positively by student. This activity was done after experiment class which aims to explain about points that must be discussed in the lab report, such as supporting basic theory, chart, data analysis and discussion. As Ismin, et.al (2013) wrote, a good lab report does more than merely present data; it demonstrates the student's comprehension of the concepts behind the experiment and the data obtained. To record and reproduce expected results is not enough; students should be able to identify how and why differences occur, and be able to explain how the data was affected by the experiment. Students are also expected to show their understanding of the principles that the experiment is designed to examine, all of which require students' organization of thoughts and ideas. Hence, it is very important in writing lab report to explain about what students do in their experiment activity so that the experiment activity can be more valuable in their learning process.

Next statement was about pre-lab exercise (statement 6). Reid (2006) explained pre-lab exercise is a short task or experience to be completed before the laboratory starts. It can take around 15-30 minutes to complete, depending on the experiment and on the background knowledge of the individual student. Pre-laboratory exercises were introduced as a means to reduce the information overload on students. It was found that these can have a major effect (Johnstone et al., 1994; Johnstone et al., 1998). The purpose of pre-lab exercise is to measure student's knowledge about the experiment as primary knowledge before the real experiment activity. Pre-lab exercise usually contains 2 until 5 questions about the experiment.

Effective pre-laboratory preparation contributes to improvements in prerequisite knowledge leading to a more contextualized learning environment in the laboratory (Llorens-Molina, 2008; Winberg & Berg, 2007). Various methodologies have been used to help students to prepare in advance for laboratories including but not limited to pre-laboratory exercises in chemistry and biochemistry courses (Chittleborough et al, 2007; Pogacnik & Cigic, 2006; Schmid & Yeung, 2005), pre-laboratory instructions and assignments on the web in an engineering undergraduate course (Powell, Anderson, Van Der Spiegel, & Pope, 2002). Raid and Carnduff (2006) sited that a pre-laboratory exercise may be able to:

1. Stimulate the student to think through the laboratory work, with a mind prepared for what will happen.
2. Encourage students to recall or find facts such as structures, equations, formulae, definitions, terminology, symbolisms, physical properties, safety hazards or disposal procedures.
3. Check that the experimental procedure has been read and understood and it can offer practice in data handling, drawings or calculations of the kind to be used in the write-up.
4. Lead the student into thinking about the procedure or the concepts and may encourage the student to connect and revise prior knowledge, thus providing some reassurance about the grasp of the topic.
5. Offer experiences in planning (the apparatus, the procedure, the quantities and the data presentation).
6. Bridge the (common) gap between laboratory and lecture, experiment and application.

Last statement for indicator three is about student's response for overall experiment activity. 80% students stated that fundamental chemistry II experiment activity is interesting. It means students are enjoying their lab activities and they didn't feel bored or feel such frustrated for this lab activity. Good response from students about this lab activity can support their learning process and produce good learning experience for them.

Response to the overall benefit of fundamental chemistry II experiment

The fourth indicator discusses about the overall advantages of fundamental chemistry II lab activity. Student's responses are shown on chart below.

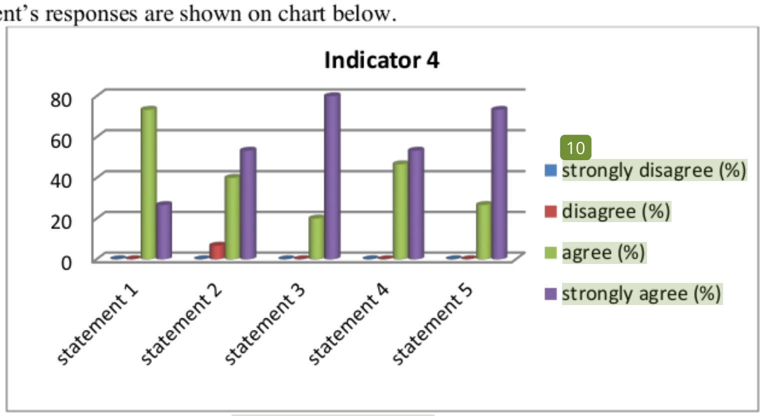

Figure 4. Responses to indicator 4

Statement 1 and 2 are related. 73.77% students agreed that trough the experiment activity they got experience to do work at laboratory. Thus experiences they get from lab activity inspire them to do such a research (statement 2, by 53.33%). Experience is important because from experience students get the true value about what they learnt in classroom. Moreover, experience that they got from lab activity can lead them to work scientifically (Ismin et.al, 2013. Meaningful learning can be made possible in the laboratory as students construct understanding based on the findings, critically evaluating data and supporting claims with evidence. According to Reid and Shah (2006), the need for laboratory work for higher education in three main areas; (a) practical skills, – with consideration on safety, hazards, risk assessment, procedures, instruments, observation of methods; (b) transferable skills, – as well as team work, organization, time management, communication, presentation, information retrieval, data processing, numeracy, designing strategies, problem solving; and (c) intellectual stimulation, – with elements related to the real world, promoting interest for Chemistry.

The last three statements are also related in that they link theory and experiment activity in laboratory. Student's response show 80% students agreed the experiment is related to theory thay learned in the class. This result followed by 53.33% student's agreement that experiment activity help them to linking theory and practice. Additionally, 73.33% students agreed that experiment activity help them to understand theory they had learned in the class. Experiment activity plays a role as a way for students to practice their skill in working at laboratory, and help them to understand theories they learned through the experiment. Izzet and Ahmed (2010) sited an essential characteristic of the effective chemistry education is to support theoretical explanations with actual practices in the laboratory. When properly developed, laboratory activities have the potential to enhance student's achievement, conceptual understanding and understanding of the nature of science, as well as their positive attitudes and cognitive growth (Hofstein, et al, 2001; Lazarowitz & Tamir, 1994; Izzet, 2010). Since the atmosphere of laboratory is less formal when compared to the classroom atmosphere and presents the opportunities for more interaction between students and teacher, students and their peers; it naturally has the potential to promote positive social interactions and thus create a constructive and positive learning environment (Hofstein et al., 2001). Finally good laboratory activity developments are needed to help students gain their experiment activity and linking between theory and practice, then their learning process will be successful.

CONCLUSION

In summary, laboratory activity as the way for students to gain their scientific process should be developed. Based on student's responses, components that support laboratory activity must be increased. In preparing a lab manual, the use of language should be considered carefully to prevent misunderstanding among the students. Description of basic theory in lab manual should be written clearly, since from the basic theory students can learn background of the experiment. Procedure, also tools and materials, must be clear and specific. Guidance in data analysis helps students to process raw data they get from experiment. Aims and objective of individual experiment are important to be described, since they determine final results that are expected from an experiment activity. Co-assistant must be capable to understand procedure of the experiment and help the students for data analysis. Finally, lab report writing helps the students to link their experiences in laboratory with theory they learned in class.

REFERENCES

Barbera, J.; Jessica, R.V. *J. Am. Chem. Soc.* **2011**, *1074(11)*,177-193. doi: 10.1021/bk-2011-1074.ch011

Boud , D.; Dunn , J.; Hegarty-Hazel, E. *Teaching in laboratories*; Milton Keynes Open University Press: Milton Keynes., 1986.

Blease, D.; Hugh,B. *School Sci Rev*. 1999, 80, 293

Chittleborough, G.; Treagust, F.; Morecino, M. *J. of Chem. Edu*. 2007. 84, 884-888.

Hegarty-Hazel, E. In E. Hegarty-Hazel (Ed.); Routledge: New York, U. S. A., 1990, p. 3- 26.

Hofstein. A.; Levy. N, T.; Shore, R. *Learning Environments Res*. 2001, 4, 193–207.

Hofstein, A.; Lunetta, V. N. *The laboratory in science education.* 2004, 8, 28-54.

Ismin, I.Z.A,; Sharifah Fauziah, H.S.Z,; Farah, E.M,; Saheera, K. *J. of College Teach & Learn – Third Quarter*. 2013, 10, 203-212.

Izzet, N.K,; Ahmed, A. *Aus J. of Sci Edu*. 2010, 35, 48-59.

Johnstone, A; Al-Shuaili, A. Learning in the laboratory: Some thoughts from the literature. University Chemistry Education, 2001, 5, 42-51.

Johnstone, A.H.; Watt, A.; Zaman T.U. The students' attitude and cognition change to a physics laboratory, Physics Education, 1998, 33, 22-29.

Johnstone, A.H.; Sleet, R.J.; Vianna J.F An information processing model of learning: its application to an undergraduate laboratory course in chemistry, Studies in Higher Education. 1994,19, 77-88.

Jones, S.; Edwards, A. *International J. of Innovation in sci and Math Edu*. 2010, 18, 1-9.

Lazarowitz, R., & Tamir, P. In D. Gabel. Ed; Handbook of research on science teaching and learning. Macmillan : New York, U. S. A., 1994 , p. 94–128.

Llorens-Molina. *J. of the Research Center for Edu Tech*, 2008, 15-31.

Morrell J.B. The chemistry breeders, the research schools? of Liebig and Thomas Thomson, AMBIX, 1972, 19, 1-47.

Morrell J.B., (1969), Practical chemistry at the University of Edinburgh, 1799-1843, AMBIX, 26, 66-80.

O'Brien, G., & Cameron, M. In K. Placing. Ed.; Proceedings of the Visualisation for Concept Development Symposium, UniServe Science : NSW, Sydney, 2008, p. 80-85.

Pogacnik, L.; Cigic, B. *J. of Chem Edu*, 2006, 83, 1094-1098.

Powell, R.; Anderson, H.; Van, D. S. J.; Pope, D. *Computer applications in Engineering Education*, 2002, 10, 204-214.

Reid, N.; Iqbal, S. Chemistry Education Research and Practice, 2007, 8 , 172-185

Read, J.R.; Kable, S.H. *Chem Edu Research and Practice*, 2007, 8, 255-273.

Schmid, S.; Yeung, A. The influence of a pre-laboratory work module on student performance in the first year chemistry laboratory. (2005) (pp. 471-479). Sydney, Australia: Proceedings, HERDSA Annual Conference. 3-6 July.

Tamir, P. In E. Hegarty-Hazel.Ed.; The student laboratory and the science curriculum. New York: Routledge, 1990, p. 242-266.

Winberg, T.; Berg, C. *J. of Research in Sci Teach*, 2007, 44 , 1108-1133.

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