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Perceptions of Pre-Service Teachers to Chemistry Laboratory Activities Based on Learning Experiences in the Laboratory

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ABSTRACT
This study aims to analyze the perceptions of pre-service teacher to chemistry laboratories activities based on learning in the laboratory. Based on the purpose, a questionnaire which contained several statements about pre-service teachers' to chemistry laboratories activities based on learning experience in the laboratory was distributed. The instrument used was a questionnaire with 27 statements of attitude towards chemical laboratory activities using a 5 point Likert scale. The research subjects were selected using convenience sampling technique. The number of undergraduate students of the chemistry education who participated was 108 students in two university in Riau, Indonesia. The results of this study indicated that pre-service teachers have a positive attitude towards the chemistry laboratory. This research can be additional information for lecturers and other researchers to improve the chemistry laboratory for pre-service teachers because attitudes toward the laboratory are also related to pre-service teacher learning interests.

Keywords: *Perception, Pre-service teacher, Chemistry laboratories activities, Chemistry Education*

1. INTRODUCTION

Learning in the laboratory is a core component of the science curriculum so that the laboratory curriculum must be clearly structured. In addition, the goals of science education are not only related to cognition but also student attitudes [1]. However, there was still student dissatisfaction about learning in the laboratory so that many practitioners wanted to improve their laboratory activities [2]. Some educators have also begun to seriously question the effectiveness and role of laboratory activities [3].

The laboratory is specially designed and equipped for science experiments, demonstrations and investigations in a safe environment [4]. However, ample evidence suggests that the lack of clarity about the objectives of laboratory activities, perceptions and experiences of pre-service teachers are not compatible with the objectives [5]. In addition, accidents in laboratories are caused by unsafe conditions such as improperly maintained equipment, damaged equipment, slippery floor surfaces, and improper ventilation or lighting. [6]. Therefore, pre-service teachers need to be instructed on the main types of laboratory accidents that can occur, how to handle them, and what care to take before they occur [7].

The findings from DeCarlo's study indicated that there are many factors inherent in laboratory learning that can increase and decrease the possibility of achieving desired laboratory results [8]. So that every activity that will be carried out in the laboratory there must be a revision of related concepts (theory, law, and principles), procedures and safety rules [7].

Self-confidence is very effective in motivating someone and can change individual behavior [9]. Self-confidence can also make them increase participation,

enjoy the learning process, reduce exams, increase interest in finding goals, and foster comfort with teachers and their classmates [10]. Therefore, pre-service teachers need to be instructed about the rules and things to watch out for when working in the laboratory, so that they can better understand and master the concepts well. Students feel comfortable in the laboratory and underline that laboratory experiments help students to increase their self-confidence [11].

Laboratory activities also have special abilities as learning media that can encourage important learning outcomes for pre-service teachers [3]. Cooperative learning can improve the ability and practical work experience of pre-service teachers. Cooperative learning has a positive influence on the learning experience in the laboratory, especially pre-service teachers who have low understanding [12]. This is because cooperative learning is able to improve attitudes towards laboratory work by encouraging the involvement of pre-service teachers in laboratory activities [13]. So that cooperative learning is very good to be applied to the implementation of experiments in the laboratory to improve the quality of learning [14].

Based on this description, it can be concluded that learning in the laboratory still needs to be reviewed. Designing and specifically complementing experiments and investigations in a laboratory environment is necessary. In addition, self-confidence is very effective in motivating students. Student confidence can also increase student participation and interest during activities in the laboratory. This study links several concepts regarding learning in the laboratory, student self-confidence, and cooperative learning in several negative and positive statements. Information about attitudes towards chemical laboratories is used as a reference for reviewing laboratory learning activities in order to improve attitudes towards chemical laboratories the researcher investigated the perceptions of pre-service teachers at Universitas Riau and Universitas Islam Negeri Sultan Syarif Kasim Riau on chemistry laboratories activities based on learning experience.

2. RESEARCH METHOD

This research a descriptive study that aims to describe perceptions of pre-service teacher to chemistry laboratories activities based on learning experience in the laboratory. The population in this study were undergraduate students of chemistry education study programs at the University in Riau and had taken basic chemistry practicum courses. The subjects of this study were 108 undergraduate students of chemistry education at the Universitas Riau and the Universitas Islam Negeri Sultan Syarif Kasim. The sampling technique used in this study to select respondents was convenience sampling in order to facilitate the researcher. The questionnaire used is an instrument of attitude towards chemistry laboratory in research adopted. The instrument used was a questionnaire with 27 statements of attitude towards chemical laboratory activities using a 5 point Likert scale. All questionnaire items were stated valid and the scale was reviewed by seven educators at different universities. The validity test using Cronbach Alpha with $\alpha = 0.87$ declared to be acceptable. Statistical analysis techniques by means of positive items on the scale are assigned a numerical value ranging from choice (5) strongly agree, (4) agree, (3) doubt, (2) disagree, (1) strongly disagree, and negative items define across. Thus, the maximum value that can be obtained from ATCLS is 135.

3. RESULT AND DISCUSSION

In chemistry studies there are many abstract concepts. Difficult and complex chemical properties make some concepts difficult to explain by either analogy or models [16]. So that in learning chemistry it is not enough just learning in the classroom with explanation of concepts, but also requires learning with experiments or practice in the laboratory.

Table 1. Domain of attitudes to chemistry laboratory

Aspect	Sum of Items	Mean of The Domain	Percentage
Laboratory environment and using equipment	4	4.15	83%
Experimental process in the laboratory	10	3.68	74%
Assessment in the laboratory	9	3.87	77%
Cooperative learning in the laboratory	4	4.47	89%

Experimental chemistry learning will stimulate the mindset of pre-service chemistry teachers as well as their skills directly. Table 1 shows that the attitude towards the chemistry laboratory has 4 aspects consisting of 27 statement The findings in this study that the aspect that received the highest score was the

" Cooperative learning in the laboratory " aspect with an average of 4.47 and the aspect that received the lowest score was the "Experimental process in the laboratory" aspect with an average of 3.68.

3.1. Laboratory Environment and Using Equipment

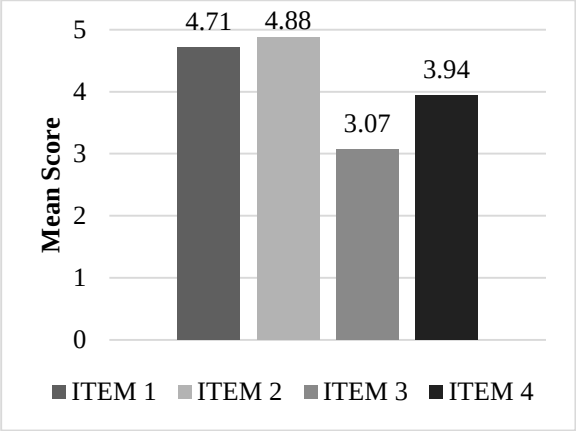

Figure 1 Laboratory environment and using equipment

Domin said that his opinion regarding the failure so far in laboratory learning was recognized as coming drom a lack of in-depth understanding of the constraints applied by different laboratory teaching methods to the learning environment and learning process [17]. However there is sufficient data to show that learning in the laboratory is an effective and efficient learning medium to achieve several goals of teaching and learning science [18].

In the first aspect, namely the laboratory environment and equipment use, pre-service chemistry teachers believe that safety and comfort in the laboratory are important factors when they are in the laboratory. If they are informed about the use laboratory equipment, their likelihood of harm, laboratory safety, their self-confidence will increase and their fear of breaking the equipment in the laboratory or crashing into glassware will be reduced [11].

The average result in the first aspect is 4.15 and compared to the undecided choice which has a weighting value of 3, it is obtained if the pre-service chemistry teachers have a good picture of the laboratory environment. This can be proven by as many as 90.7% or 98 pre-service chemistry teachers (mean 4.88) strongly agree that the laboratory environment must be safe for the experiment to be carried out experiments. If they have a good attitude about the laboratory environment and using equipment then they can carry out learning in the laboratory properly.

3.2. Experimental Process in The Laboratory

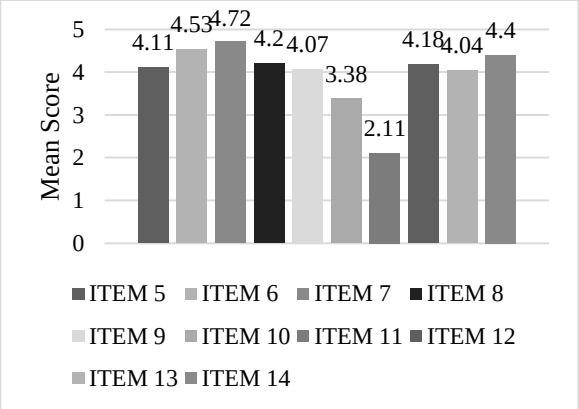

Figure 2 Experimental process in the laboratory

Laboratory learning in science education has long been a belief that it has the potential to be a place where theory and practice come together for students [20]. In addition, an important component of the science education program is activities in the laboratory, because they spend most of the time in the laboratory [19].

Students also said that they felt the purpose of the laboratory was to repeat and strengthen understanding of the lecture material [20]. According to this study, 98.1% of pre-service chemistry teachers (average 4.53) thought that conducting experiments would increase their attainment and strengthen theoretical understanding of a material.

They (86.1% of pre-service chemistry teachers with a mean of 4.11) felt that conducting experiments made them feel like scientists. However, there were also some of them (with a mean of 1.82) felt that doing the experiment made them feel stressed and unnecessary. When they cannot understand the theoretical information conveyed during laboratory experiments, they will memorize it and consequently they can fail to understand the concept [21]. This may be due to pre-service chemistry teacher candidates having difficulty communicating the material they learn with what they do [22].

Overall in the aspect of the experimental process in the laboratory, prospective chemistry teachers have a good picture of the experimental process in the laboratory, with an average aspect score of 3.39 which is above the neutral choice with point 3. Then, there is a correlation between the experiments carried out in the laboratory with their academic achievements [23].

They can also get a pretty good self-confidence through emotional feelings when they take an action.

3.3 Assessment in The Laboratory

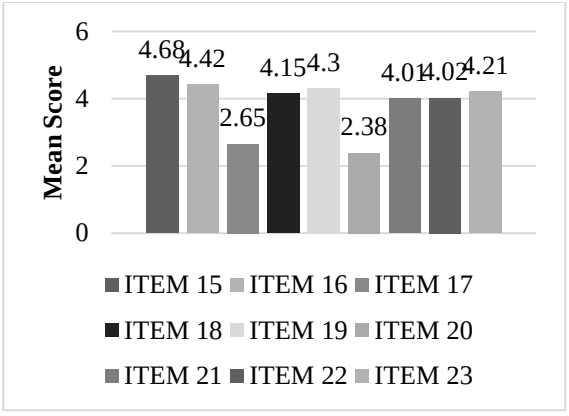

Figure 3 Assessment in the laboratory

Overall, the assessment in the laboratory aspect received the highest average compared to other aspects, namely 4.08. Pre-service chemistry teachers agree that laboratory studies are important. By proving scientific laws in learning, they agreed (97.2% with mean 4.42) that it would increase their self-confidence.

Motivation is one of the important conditions that can encourage students to behave in learning [24]. When they are motivated, they will find out the causes of mistakes made during experiments in the laboratory. In accordance with this study they agreed (as much as 90.9% with a mean of 4.15) or the equivalent of 98 pre-service chemistry teacher candidates that investigating the reasons for experimental errors performed in the laboratory could increase their interest.

Analytical thinking skills are important for students because with these analytical thinking skills they will be able to identify the closest incident, connect and combine data obtained from various sources then draw logical conclusions [25]. In accordance with this study as many (with a mean of 4.30) agree that conducting experiments in the laboratory and understanding the results can improve their analytical thinking skills.

3.4. Cooperative Learning In The Laboratory

Cooperative learning is a strategy that is getting more and more attention in the academic field [26]. Cooperative learning can also develop students' social skills such as communication, presentation, problem solving, leadership and organization [27].

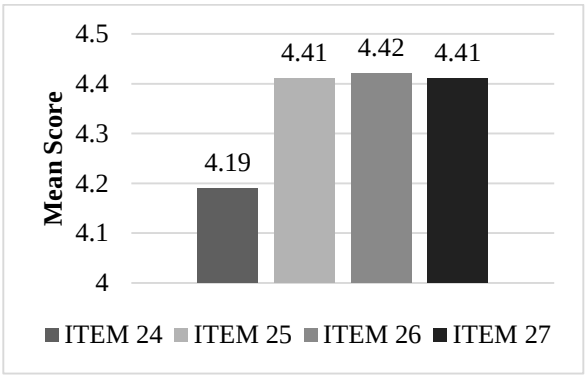

Figure 4 Cooperative learning in the laboratory

It can be said that cooperative learning can provide valuable experiences which can further develop student learning and academic achievement. So that it is important to apply cooperative learning when conducting experiments in the laboratory. Cooperative learning has a good influence on the learning experience [12]. Obtained an average of 4.08 which means that the prospective teacher strongly agrees with cooperative learning in the laboratory. Group work made them happy (95.3% and average 4.41) in experimenting in the laboratory. They considered (93.6% and mean 1.81) teaching their peers about their experiments to be important and increased solidarity of friends (96.3% and average 4.42).

4. CONCLUSION

The results of this study indicate that the perception of pre-service chemistry teachers is in the very good category (total average of the average for each aspect is 4.10) regarding attitudes towards the laboratory. Pre-service chemistry teachers like activities in the laboratory, and added that cooperative learning has a good effect on their learning experience in the laboratory. The review needs to be done on the aspect of "Assessment in the laboratory", because pre-service chemistry teachers are still worried about their experimental findings. And Further studies, should be carried out to better understand instructional design in chemistry laboratories.

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