Study of students' experiences of air conditioning practices in vocational education

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Abstract. The purpose of this study is to determine the experience of students doing air conditioning practicum in vocational education. Practicum activities which are the focus of this research are practicum objectives, preparation of practicum, conditions and number of practicum tools, practicum time, practicum implementation process, competence of lecturers and laboratory assistants, and practicum evaluations. This study used a qualitative method with research participants being students in the refrigeration and air conditioning expertise at a state university in Bandung. The informants involved in this study were seven students who had carried out the air conditioning practicum for in-depth interviews. The FGD (focus group discussion) interview method is used to get general information and individual interviews to get more specific data. The results of this study are expected to provide accurate information about the practicability of student practicum so that better improvements can be made in the future. The implementation of an ideal practicum will support students to develop hands-on and minds-on.

1. Introduction

Practical learning is an educational process that functions to guide students systematically and directed to be able to do a skill. Practice is an attempt to give students the opportunity to gain direct experience; it is assumed that working in a direct way provides a more realistic and interesting content experience. [1]. Practical activities in the laboratory are the basis for learning science and applied sciences such as engineering, computer science, science and others [2-4]. Practical activities in the laboratory/workshop are very important activities in vocational education [5]. Practical learning can provide students with the first-hand experience in learning, thinking, and solving problems [6]. Practical activities in the laboratory increase student achievement and interest in the subject matter discussed in class and further assist their learning [7]. Practicum based learning strategies can support students to develop hands-on and minds on. Therefore, practicum-based learning can be used as alternative learning that can encourage students to learn actively to reconstruct their conceptual understanding [8].

In developed countries, the teaching and learning process is usually supported by modern learning tools to conduct practicum and experimental processes in ideal conditions. However, in some developing countries such as Indonesia, the availability of learning resources and practical tools has always been an
obstacle in the learning process [9]. Students memorize more concepts without a deep understanding of the problems they face and they often have difficulty in gaining contextual experiences in the learning process [10]. Whereas strengthening student competencies by providing hands-on experience (practice) can help to teach difficult concepts and strengthen students to be able to do comprehensive work that is followed up with an in-depth discussion of relevant theories [11,12]. The experience of applying practical knowledge can facilitate students in overcoming/solving problems in their future work [13].

The air conditioning practicum in vocational education is carried out based on a learning program plan that has been prepared for one semester. The practicum material delivered were: measurement of air temperature, measurement of refrigerant pressure, refrigerant filling, an inspection of refrigerant leaks, measurement of electrical quantities, an inspection of electrical component functions, installation and maintenance of AC units. All practicum activities are adjusted to the real conditions so that students can realize that the material they are learning is relevant to the work that will be done after they graduate. However, some obstacles cause practicum activities to be not optimal, including 1) practicum activities require a long time so it is necessary to arrange a schedule to be able to do it; 2) requires more expensive costs for the supply of tools and practicum materials; 3) Inadequate laboratory facilities so that practicum activities cannot be carried out. Based on these explanations, the purpose of this study is to determine the experience of students doing air conditioning practicum in vocational education.

2. Method
This study uses a qualitative method that describes the experience of students implementing air conditioning practicum in vocational education. The participants of this study were students on refrigeration and air conditioning expertise at a state university in Bandung. This study involved seven informants who had carried out air conditioning practices for in-depth interviews. One informant has refrigeration and air conditioning expertise because he is from a vocational high school and the other has a high school background.

The interview method is used to obtain research data. FGD (Focus Group Discussion) was conducted with six informants with high school background. The data captured in this FGD is their experience in carrying out the practicum. While interviews with informants from vocational high school were conducted individually. Data extracted from this interview is information related to the relevance of practicum material in vocational schools and universities and the availability of practical tools at the two educational institutions. The list of interview questions has been prepared in advance and structured. However, at the time of implementation, interview questions may turn out to be unstructured if in the implementation some information arises that needs to be studied in depth.

3. Result and discussion
3.1. Focus group discussion
The FGD was conducted on experiences in carrying out air conditioning practicum for six students who have high school background. Several questions were asked relating to the activities of the air conditioning practicum, as follows: the purpose of the practicum, the preparation of the practicum, the conditions and the number of practicum tools, the practicum time, the process of practicum implementation, the competence of lecturers and laboratory assistants, and the evaluation of the practicum.

At the beginning of the FGD, the informants were asked their opinions on the implementation of the air conditioning practicum. In general, all informants stated that the air conditioning practicum was new to them. In this practice, they learn new things that are unique and not widely known by the public. This air conditioning practice material is simple so it is fun to be implemented. Here they come to know how to install an AC unit and understand its working principle. Although they take a long time to complete the practical work, confusion with the type of equipment used, and it takes time to understand the correct AC installation procedures.
In practicum preparation, informants stated that they received preliminary material from lecturers regarding the scope of practicum activities including procedures for requesting tools and practicum materials, work safety procedures, clarification of technical instructions and job-sheets, division of cleaning picket groups and equipment request groups. Figure 1 shows the procedure for requesting tools and practicum materials in the refrigeration and air conditioning laboratory. In addition, students must also prepare theories that are relevant to the practicum material being carried out. Some informants argued that there are still practicum tools whose numbers do not match the number of students doing practicum, so this is a barrier to practicum activities. In addition, there are also tools that have been damaged so those when measuring the numbers are not accurate. These factors trigger the practice time becomes longer because students must take turns using existing tools and good conditions.

**Figure 1.** The procedure for requesting tools and practicum materials in the refrigeration and air conditioning laboratory (Source: Documentation of research).

Figure 2 shows the implementation of the air conditioning practicum. At the time of the practicum process and students find technical problems such as electrical problems, the first solution is to discuss with colleagues and if the problem is not resolved they ask the laboratory assistant and lecturer. Some informants stated that the lecturer and laboratory assistant explanation related to the problem at hand showed their competency capacity in the field of air management. The explanation that was delivered did not directly lead to the desired answers but rather directed students to think and analyze so that the practitioner could find the answers themselves. Solving problems this way can further strengthen the knowledge and understanding of the practitioner so that when you find a similar case in the future you already know what to do.
At the end of the practicum, an evaluation is conducted by lecturers and laboratory assistants for each student. They were asked about the obstacles faced by each group and the solutions they had implemented. Furthermore, the lecturer will provide an explanation and direction in accordance with the theory and conditions in the field. The lecturer also gave several examples of cases that had occurred from the problems that were revealed earlier so that students could better understand and know what actions to take. The results of the practicum evaluation are then used as the basis for the next practicum work.

3.2. Individual interview

The individual interview was conducted with an informant who has an educational background at vocational high school. This informant already has experience in air conditioning practicum. The question raised by this informant is a comparison of the experiences of other informants who do not have experience in practicing air conditioning.

According to the informant, the implementation of air conditioning practicum in universities is mostly not different from what he had done in vocational high school. Practical instructions, job-sheets, tools and materials used are all the same. The slight difference lies in the technical implementation; students must arrange their own schedules and work programs that must be done, while in vocational high school everything is determined by the teacher. Another opinion expressed by the informant was the number and quality of equipment used in the practicum were inadequate and the AC unit was outdated. There are some components that are not suitable for use and some tools need to be calibrated so that the practicum barrier is not in humans but from tools and materials that are not up to standard.

Based on the problems faced during the practicum, the informant explained that he would try to find his own answers if he could not, then he would ask his senior and finally ask the laboratory assistant and lecturer to find a solution to the problem being faced. The practicum time according to the informant needs to be extended because it does not match the amount of work done with the time that has been provided. Practical rules also need to be enforced consistently so that students follow the procedures for practicing seriously. For example, the application of personal safety equipment such as helmets, gloves, and goggles must be emphasized whenever students must wear them. In the final session of the interview, the informant was asked about efforts to improve the competencies of students who already had previous experience in air conditioning practices. His first hope is that the condition of tools and materials can be optimized for quality. The tools that are worn out and damaged are immediately replaced with new ones and practicum materials are equipped according to their needs. Second, there should be an increase in the size of the practice room so that the working atmosphere can be more
comfortable and orderly. Third, setting the practicum schedule can be adjusted to the type of practical activities carried out, so students have enough experience to do a repetition of practice. Fourth, the practical worksheet and technical guidelines can be explained more specifically and systematically so that they do not cause multiple interpretations by the practitioner.

4. Conclusion
Air conditioning practicum activities are able to provide new experiences for students who have high school background. In this practice, students can better understand the working principles of air conditioning (AC) and be able to do the installation, maintenance, and repair of the air conditioner. Although they require a long time for practicum activities everything can be done with fun. Opinions differ for a student who already has air conditioning experience since vocational high school. The air conditioning practicum activities at the university were not much different from what they had experienced before, in fact, there were some things that were lacking according to them such as the condition of outdated equipment and the limited amount. But all of that did not reduce their enthusiasm to be involved in carrying out the practicum and even added value because they could help other students who experienced obstacles when carrying out the practicum.

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