



Analysis of constraints and alternative solutions to the implementation of chemical practicums in several high schools in Medan

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Abstract

The laboratory is a place to train students' skills in conducting demonstration, experimental and scientific development practices. The provision of complete laboratory tools and materials and good laboratory management will make learning chemistry run optimally, but some high schools still do not meet the standards of facilities and infrastructure in the laboratory. Therefore, the researcher tries to collect the problems and constraints in the implementation of the practicum and find alternative solutions to the problem solving based on literature review and expert opinion. This research is a qualitative study which is a case study research in several high schools in Medan. The instruments in this study were student questionnaire, teacher questionnaire, principal questionnaire and observation sheet using Likert scale analyzed using the percentage formula. the results of the analysis of case studies conducted in a number of high schools in Medan, it can be concluded that, the area of chemistry laboratories in several schools in Medan meets BSNP standards, but there are still science laboratories used for chemical laboratories. The results of the analysis of equipment and materials that support the implementation of the practicum after the presentation of X1 schools 76.36%, X2 schools 65.67% and X3 schools 87.27%.

Keywords: Chemistry laboratory; Practicum; Equipment

1. Introduction

Science, especially chemistry, is an abstract science, and is difficult to understand, so chemistry education and teaching must make a practicum or experiment to

explain the abstract theory of chemistry learning. Practicums and experiments conducted by utilizing chemical laboratories to support the fulfillment of curriculum demands that apply in schools. This is also supported by Hofstein's explanation (2004) about practicum activities which have become an important part to support the curriculum and have provided many benefits for teachers. The laboratory is a place for a group of people who carry out various kinds of research activities (research) observation, training, and scientific testing as an approach between theory and practice from various disciplines (Anies et al. 2017). In line with this Rahman et al. (2015) states that the Laboratory is a means of supporting the implementation of learning activities in schools, especially for the process of learning science.

According to Mauliza and Nurhafidhah (2018) laboratory is one of the sources of learning chemistry that is very necessary to provide real experience to students, as one of the supporting factors of learning. The existence of a chemical laboratory in secondary schools is a necessity in modern science education. The use of chemical laboratories in learning will provide hands-on experience to develop competencies to be able to explore and understand the natural environment scientifically and will provide experience to be able to submit and test hypotheses through experiments, design and assemble experimental instruments, collect, process, and interpret data, prepare reports, and communicating experimental results verbally and in writing. So it is necessary to provide tools and laboratory materials and good laboratory management, so that the implementation of chemical learning can run optimally (Darsana et al. 2014).

The laboratory is a place to train students' skills in conducting demonstration, experimental and scientific development practices. In addition, the laboratory has a very important role in science learning in schools because it is expected that laboratory activities can foster student interest in laboratory activities (Munarti and Sutjihati, 2018).

However, there are some studies which state that not all schools have met the standards of facilities and infrastructure in the laboratory. Research conducted by Wiratma and Subagia (2014); Subamia et al. (2014) and Hamidah et al. (2014) explained that in general, the problems of managing a high school chemistry laboratory arise in the procurement process, the use process, and the process of maintaining tools and materials. In the procurement process problems can arise due to inaccurate procurement of tools and materials and the lack of available tools and materials.

Based on the problems above, this research is focused on analyzing the implementation of practicum activities in several high schools in Medan, gathering problems and constraints of practicum implementation and finding alternative solutions to solving those problems based on literature review and expert opinion.

2. Methods

This research is a qualitative study which is a case study research in several high schools in Medan. The instruments in this study were student questionnaire, teacher questionnaire, principal questionnaire and observation sheet using Linkert scale analyzed using the percentage formula. This data was obtained by interviewing and submitting observation sheets.

The steps to obtain the results of the data in this study is to conduct direct visits to schools, then conduct closed interviews with the chemistry teacher concerned. Furthermore, giving questionnaires to chemistry teachers, principals and students. The results of the questionnaire were proved by visiting the laboratory directly in the school.

3. Results and Discussion

3.1 Chemical Laboratory Facilities at the School

The laboratory which has complete facilities is one of the supporting factors in practicum implementation. There are two factors that must be considered in the construction of a laboratory, namely the location of the building and the size of the room. According to [Kertiassa \(2006\)](#) the ideal laboratory for high school level is a laboratory that has a student practice room and a storage room. Details of the Condition of the Chemistry Laboratory Room in Several Schools Around Medan can be seen in [Table 1](#).

Table 1
The Condition of Chemistry Laboratory Room in Several Schools in Medan

No	School	Room Size (m ²)	Information	Lab Type	Information
1.	X-1	9 x 9	In accordance with BSNP	Lab. Chemistry	In accordance with BSNP
2.	X-2	9 x 8	In accordance with BSNP	Lab. IPA	Not in Accordance with BSNP
3.	X-3	9 x 9	In accordance with BSNP	Lab. Chemistry	In accordance with BSNP

Based on [Table 1](#), it was found that the three schools had a laboratory room area that was in accordance with the standards set by the BSNP, which was an area of 2.4 m² with student participation. Whereas based on the category of Lab type, only 2 schools have independent chemistry labs, and 1 school is still included in the science lab type.

Complete laboratory facilities in the form of complete tools and materials strongly support the implementation of practicum with the conditions of equipment that is suitable for use and materials that are not contaminated. Details of Availability of

Laboratory Equipment and Materials can be seen in [Table 2](#) and explained in more detail in [Figure 1](#).

Table 2
Percentage of Availability of Laboratory Equipment and Materials

No	Item Type	Percentage of Findings (%)		
		X1	X2	X3
1	Furniture	71.87	65.6	81.25
2	Educational Equipment	83.57	55.5	67.85
3	Educational Media	100	100	100
4	Other Equipment	50	41.6	100
	Percentage of Total	76.36	65.67	87.27

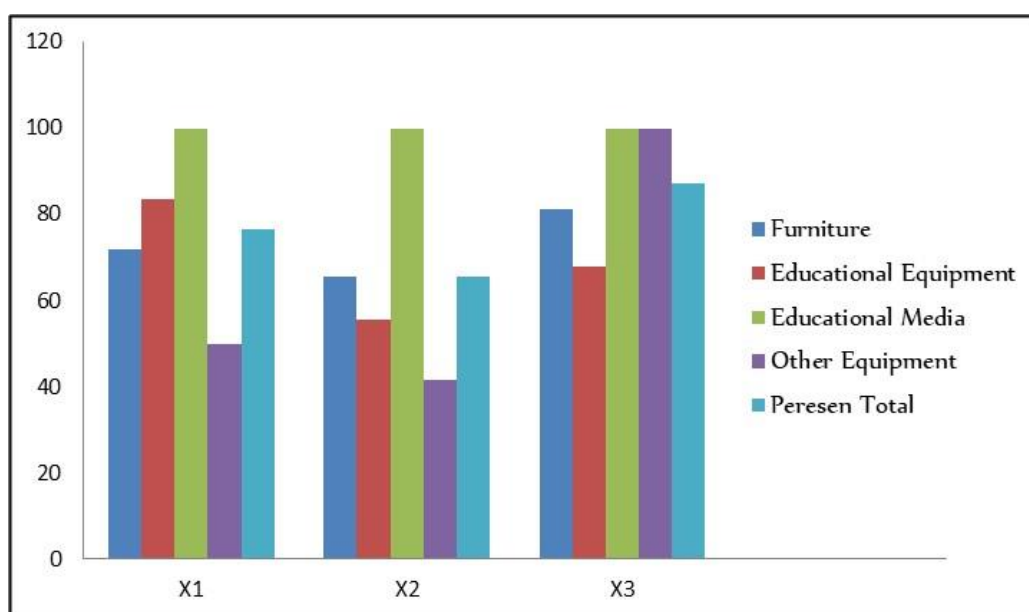


Fig 1. Percentage of Availability of Laboratory Equipment and Materials

The results of observation of tools and materials available in chemical laboratories in several schools are known that there are still some practical tools that are not yet available in laboratories such as, Burette, Analytical Balance Sheet, Separate Funnel, Distillation Equipment, and Barometer. In addition, there are also a number of tools which are still not available in laboratories based on BSNP, such as beakers, measuring flasks, test tubes, glass vessels, thermometers and others.

Based on [Table 2](#) it is known that X3 schools have the highest percentage of availability of tools and materials 87.27% and X2 has the lowest percentage of 65.67%. According [Hudha \(2011\)](#) states that the use of tools and materials that origin will have an impact on the learning process that is less effective which will produce graduates who are not in line with expectations.

3.2 Implementation of Chemistry Practicum in Schools

The laboratory is a place where practicum activities take place. The teacher has an important role in practicing practicum as a planner of practicum activities and also preparing tools and materials needed by students in conducting practicum. The results of student responses about the implementation of chemical practicum in schools can be seen in [Table 3](#).

Table 3
Percentage of Student Response Questionnaire

No	Item	Description of Choice		Percentage (%) Choice	
		Yes	No	Yes	No
1	Do you have/ often participate in practical activities in the laboratory?	60	22	73.17	26.82
2	Have you ever experienced "no material" in practical activities?	34	48	41.46	58.53
3	Are practicum tools available in all practicum activities?	71	11	86.58	13.41
4	Has your teacher ever dealt with the unavailability of materials or practical tools by replacing them with other tools and materials?	64	18	78.04	21.95
5	Is the time allocated for practicum sufficient?	38	44	46.34	53.65
6	Does your teacher often use practical methods in teaching?	40	42	48.78	51.21
7	Does your teacher often explain the learning objectives before practicum begins?	81	1	98.78	1.21
8	Do you feel difficulty in participating in practical activities?	15	67	18.29	81.70
9	Does the teacher provide guidance when you have difficulty doing practical activities?	77	5	93.90	6.09
10	Do you find it difficult to understand work procedures and theory in Student worksheet (LKS)?	34	48	41.46	58.53

Constraints that lie behind the implementation of practicum can be seen from the teacher's response, because the teacher has a major role in arranging the schedule of practicum activities, planning tools and materials, preparing tools and materials, and people who manage, control, supervise and maintain the availability of tools and material at the practicum. Teacher responses to the implementation of practicum activities can be seen in [Table 4](#).

Based on the results of the teacher and student questionnaire it is known that chemical practicum in the laboratory is very rarely done. The obstacle that lies behind the implementation of chemical practicum is the lack of allocation of learning time. Based on the results of interviews with chemistry teachers, this is the biggest

complaint because the teacher does not have enough time in the preparation of practical tools and materials because there is no special laboratory that provides tools and materials. Laboratory assistants have a very important role in the laboratory manager, who is in charge of providing laboratory equipment and materials, checking regularly, and maintaining and storing materials (Indriastuti et al. 2013; Manalu et al. 2016; Manalu et al. 2018). Besides the lack of time allocation for practicum, it was found that laboratory space was often functioned for other purposes.

From the problems described above, alternative solutions offered to overcome the inadequacy of practicum are teachers taking the initiative to use practical tools and materials so that they do not require a long time in preparation. Besides that, it can also be used as learning media such as Virtual Lab to support students' understanding of practicum activities. According to Rahman et al. (2015) the offered solution is to apply a demonstration method or field trip that can be used as a substitute for experimental methods and practicum in the classroom. By using the principles of demonstration and demonstration of a process.

Table 4
Percentage of Teacher Responses

No	Order of Problems	School response		Percentage (%) of Responses	
		Yes	No	Yes	No
A Facilities					
1	The condition of the laboratory room is inadequate	0	3	0	100
2	The unavailability of practical tools	0	3	0	100
3	The unavailability of practical materials	1	2	33.33	66.67
4	Supporting facilities (water, ventilation, gas, etc.) are inadequate	2	1	66.67	33.33
B Curriculum					
5	Time allocation for practicum is insufficient	2	1	66.67	33.33
6	There is no practice exam in the national exam, so practicum is considered not important	0	3	0	100
C Implementation					
7	Lack of readiness of laboratory assistant in preparing tools and lab materials	2	1	66.67	33.33
8	Lack of teacher readiness in guiding practical activities in the laboratory	0	3	0	100
9	Lack of teacher readiness to carry out practical activities	0	3	0	100
10	The teacher is not able to arrange worksheets for practical activities	0	3	0	100

4. Conclusion

Based on the results of the analysis of case studies conducted in several high schools around Medan, it can be concluded that, the area of chemistry laboratories in several schools in Medan has met BSNP standards, but there are still science laboratories used for chemical laboratories. The results of the analysis of equipment and materials that support the implementation of the practicum after the presentation of X1 schools 76.36%, X2 schools 65.67% and X3 schools 87.27%. The obstacle that becomes a factor in the inability of practicum is the lack of time allocation to carry out the practicum, the absence of laboratory assistants and laboratories are often used for other purposes.

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