Gaps in automotive laboratory facilities in vocational high schools with vocational technology education colleges

A Asniwaty¹, *, S Sumarto², A G Abdullah³ and A Setiawan³

¹Technology and vocational education Department, postgraduate school, Universitas Pendidikan Indonesia, Bandung, Indonesia
²Electrical engineering Department, Universitas Pendidikan Indonesia, Bandung, Indonesia
³Mechanical engineering Department, Universitas Pendidikan Indonesia, Bandung, Indonesia

*asniwaty@upi.edu

Abstract. The gap in laboratory facilities between tertiary institutions and vocational high schools can hinder the process of learning good practices conducted by teachers and students. The challenge for schools to achieve vocational education goals is to provide adequate laboratory facilities. The purpose of this paper is to first determine the conditions and availability of automotive practice laboratory facilities in vocational high schools and vocational education colleges. Second, knowing the gap between the automotive practice laboratory facilities in vocational high schools and vocational technology education colleges, especially in workshop equipment and special service tools (SST). Data collection was carried out at two public vocational high schools and one public tertiary institution in West Java, using a checklist and interviews with the head of the workshop and head of the vocational high school study program, interviews were also conducted with the head of the automotive college laboratory workshop. This study concludes that the gap in practice laboratory facilities between vocational high schools and vocational technology education colleges can occur in terms of the number and condition of practical tools, while the age of a tool does not affect the practical learning process as long as the tool is still suitable for use.

1. Introduction

One obstacle to achieving educational goals is the lack of facilities owned by a school or educational institution. Lack of facilities in a school results in a gap between schools. All physical facilities including human resources play a role in supporting the teaching and learning process and research in schools and universities [1,2]. The laboratory is an important element in the process of engineering education, science, and related disciplines and is a workplace equipped with the instruments and equipment needed to conduct experiments and research [3,4]. Laboratory practice is important in the education curriculum, without a laboratory will limit motivation and is impossible without practical experience [5]. Experiments in technical laboratories intend to apply theory and provide direct experience [6], evaluate students' achievements and weaknesses [7], actions and reflections related to building individual knowledge, through ongoing retrospective and proactive processes [8]. An adequate number of components of school facilities is important to create a productive learning and teaching environment for teachers and students [9].
Some research on the gap of facilities in schools has been conducted. Previous research shows that there is a gap between secondary school and tertiary education especially in the process of curriculum development, changes in mind set and actions of teachers and students to become more independent, and skills development starts from secondary education [10]. Gaps also occur between rural and urban schools. On average rural students come from a weak economy, learning aids at home are few, parental involvement is low while schools in cities are better prepared in terms of physical and academic resources [11]. Other studies also show that there is a significant relationship between student satisfaction, school facilities and exam results [12].

This study has two main objectives, the first is to find out how the conditions and availability of automotive practice laboratory facilities in vocational high schools and colleges of technology and vocational education. The second objective is to determine the gap between automotive practice laboratory facilities in vocational high schools and technology and vocational education colleges.

However, this research is different from the existing research that examines the gap of automotive engineering laboratory facilities, especially in workshop equipment and special service tools (SST) between vocational high schools with technology and vocational education colleges in automotive engineering basic work.

2. Methods
To investigate the gap between vocational high school automotive laboratory facilities and vocational technology education colleges, a checklist and interview record were used. Findings obtained from the checklist are tabulated in figure 1. The checklist is designed to obtain written information about the practicum facilities in automotive laboratories, especially equipment that is included in the workshop equipment and SST categories. The research object was chosen by two public vocational high schools and one state tertiary educational technology and vocational education program that has an automotive laboratory in West Java. Data collection was carried out from 15 May 2019 to 17 May 2019. Interviews were conducted with the head of the automotive study program and the head of the workshop to obtain information about the condition and availability of workshop equipment and SST equipment. In-depth interviews were conducted in the head office of the study program and the workshop head of the automotive workshop and laboratory in the place of the respective research objects. Interviews using an android cell phone recording device in a span of 1 to 2 hours. All educational institutions selected as research objects are located in the city of Bandung. The reason three schools were chosen was because they had an automotive laboratory and were located in the same area.

This research, on the other hand only covers two public vocational high schools and a public university in the city of Bandung. Therefore, the results of the study may not be relevant for vocational high schools and colleges of automotive study programs throughout Indonesia.

3. Results and discussions
There are two vocational high schools and one state-owned tertiary institution chosen for this study. The research object has automotive laboratory facilities, especially tools that are included in the workshop equipment and SST categories.

The supply of workshop equipment and SST equipment was identified based on the automotive engineering basic work teaching material book for the tenth-grade vocational high school published by the Ministry of Education and Culture of the Republic of Indonesia in 2013. The equipment included in the workshop equipment category was a single post type car lifts, two post car lifts, four post car lifts, crocodile jacks, bottle jacks, jack stands, hydraulic presses, forklifts, ropes / mines, sealing and hooks, hoists / faucets and takel, headlamps adjustment, engine stands, grease gun, oil-collecting. Tools that include SST are Bearing puller attachment, oil seal puller, clutch aligning tool, sliding hammer, ring compressor, piston ring plier, compression tester, diesel injector tester, valve spring compressor, filter strap wrench, disc brake piston compressor, coil spring compressor, ball joint separator, hydrometer, adjustable c spanner / fixed c spanner, telescopic magnetic pick-up tool, screw extractor and tension wrench. Figure 1 shows the workshop equipment and SST checklist.
Figure 1. Comparative list of workshop equipment.

Figure 2. Comparative list of special service tools.

Figure 1 shows that the equipment included in the workshop equipment category not owned by the three research objects was a single post car lift. This is caused by the rarely used tool and can be replaced by other tools but has the same function which is to lift the vehicle as a whole. The type of equipment owned is two post car lifts and four post car lifts. The use of two post car lifts and four post car lifts to keep safety safe from unexpected loads and consider the lifetime for such systems [13]. The specifications of the equipment used are generally the same, namely the general type. The difference in
the equipment of the three research objects is in terms of the age of the workshop equipment owned by state universities which are older than state vocational high schools. Figure 3 is one of the workshop equipment owned by the three research objects, namely two post car lifts.

![Figure 3. Two post car lift.](image)

Figure 2 shows that the equipment included in the SST category owned by the three research objects in terms of quantity and specifications is a diesel injector tester which functions to determine the pressure of spraying nozzle, nozzle leakage and spraying pattern (pattern), while the clutch aligning tool and screw extractor only owned by A public vocational high school. Figure 4 is one of the SSTs owned by the three research objects namely diesel injector tester.

![Figure 4. Diesel injector tester.](image)

In general, most of the facilities included in the equipment and SST workshops are sufficient and in good condition or suitable for use. Some laboratory facilities are not in good condition and are not available such as four post car lifts, forklifts are not in good condition. The availability of laboratory facilities is seen in terms of numbers, 93% workshop equipment is owned by A public vocational high school, 50% is owned by B public vocational high school and 86% is owned by public university. Availability of SST in A public vocational high school, B public vocational high school and public university laboratory in the order of 100%, 83% and 78% respectively.

4. Conclusions
The findings show that not all laboratory facilities included in the workshop equipment and SST are owned by schools even though adequate laboratory facilities will create an effective and productive learning environment for students and teachers. Some laboratory facilities included in the workshop equipment and SST are not available in schools because these tools are not often used and are not in good condition, but they can be replaced by other tools for the same work. Gaps in laboratory facilities can occur between one school and another school in terms of the number and condition of the equipment. In this study, the age of a device does not affect the practical learning process in the laboratory as long as the equipment is suitable for use.
Acknowledgments
Thank you to Mr. Sumarto, Mr. Ade Gafar Abdullah and Mr. Agus Setiawan as supervisors, for head of study program and head of workshop at public vocational high school, for head of workshop at Universitas Pendidikan Indonesia, as well as friends of the 2018 Postgraduate School of Education and Vocational Education at the Universitas Pendidikan Indonesia who participated in research.

References
[1] Kärnä S and Julin P 2015 A framework for measuring student and staff satisfaction with university campus facilities Quality Assurance in Education
[2] Kapinga O 2017 Assessment of school facilities and resources in the context of fee-free basic education in Tanzania International Journal of Education and Research 5(6) 93–102
[3] Mahmoud A S, Sanni-Anibire M O, Hassanain M A and Ahmed W 2019 Key performance indicators for the evaluation of academic and research laboratory facilities International Journal of Building Pathology and Adaptation
[4] Lowe D, Dang B, Daniel K and Murray S 2015 On the viability of supporting institutional sharing of remote laboratory facilities European Journal of Engineering 37–41
[5] Murali S S, Achuthan K and Diwakar S 2016 Comparative study of laboratory education in disparate institutes of India. In 2016 International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) (pp. 3678-3683) IEEE
[6] Nandana W R and de Mel W R 2016 Integrated laboratory experiment setup to empower the engineering education in distance mode Asian Association of Open Universities Journal
[7] Lal S, Lucey A D, Lindsay E D, Sarukkalige P R, Mocerino M, Treagust D F and Zadnik M G 2017 An alternative approach to student assessment for engineering–laboratory learning Australas. J. Eng. Educ. 22 81–94
[8] Kara A M, Tanui E and Kalai J M 2016 Educational service quality and students’ satisfaction in public universities in Kenya
[9] Ibrahim N M, Osman M M, Bachok S and Mohamed M Z 2016 Assessment on the Condition of School Facilities: Case Study of the Selected Public Schools in Gombak District Procedia - Soc. Behav. Sci. 222 228–34
[10] Yashwantrao Ramma Martin Samy Ajit Gopee 2015 Creativity and innovation in science and technology: Bridging the gap between secondary and tertiary levels of education International Journal of Educational Management
[11] Tayyaba S 2012 Rural-urban gaps in academic achievement, schooling conditions, student, and teachers’ characteristics in Pakistan Int. J. Educ. Manag. 26 6–26
[12] Decarlo T, Roy T, Barone M, Decarlo T, Roy T, Barone M, Chen A, Peng N, Hung K, Chetty S, Ojala A, Nairn A and Spotwood F 2015 Does student satisfaction with school facilities affect exam results? An empirical investigation Eur. J. Mark. 49 1484–504
[13] Crivelli D, Ghelichi R and Guagliano M 2011 Failure analysis of a shaft of a car lift system. Procedia Engineering 10 3683-3691