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Facility standards of vocational schools: comparison of existing and modern facility designs

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Abstract. The objective of this study is to compare the facility designs of existing and modern learning environment for vocational schools in accordance with 21st century learning. We begin the study with a comprehensive study on vocational schools that reflects the current condition and best practices. The next step is a comprehensive study of administrative documents and facility specifications needed to support vocational school graduates. Data and information in this study are analyzed and presented using a qualitative-descriptive approach. The method of analysis is carried out in three stages. The first stage is identifying the existing data in the field. The second step is to find the problems that become obstacles to the fulfillment of facilities in accordance with 4.0 industrial revolution. The third stage is to do an analysis between the current and modern conditions of the facilities in vocational schools. The locations chosen for the survey activities include East Kalimantan, Central Kalimantan, Jakarta, West Java, Central Java, East Java, and Yogyakarta. This study finds that the existing facilities in vocational schools are lacking and also concerning. This needs proper attention and handling such that these school facilities may be transformed into modern facilities.

1. Introduction

Education is a determining factor in the progression of a country. A nation that wants its people to develop has to be able to increase the quality of its education standards. Developed countries have a very good education quality because they can produce future generations with good quality of human resources. Hence, education becomes a reference for the quality of human resource in country.

Government Regulation No. 19 of 2005 [1] concerning the National Education Standards states the minimum criteria regarding the education system in all regions of Indonesia, one of which is the standard for the facilities and infrastructures relating to the minimum criteria of classrooms, sports area, places of worship, libraries, laboratories [2], workshop rooms, playgrounds, creative and recreation are, as well



as other learning resources, which are needed to support the learning process, including the use of information and communication technology [3]. Hence, one of the standards of vocational schools is determined by the completeness and quality of the facilities and infrastructures [4].

The lack of learning facilities and infrastructure in accordance with the development of science and technology in vocational schools can make students become less competitive in the industrial world. The condition of vocational schools nowadays is a cause for concern, namely the lack of learning facilities and infrastructure that have an impact on the actual learning process in the school. In view of Prosser & Quigley's (1950) theory, vocational education will be effective if the equipment, machines, and work tasks are in accordance with the needs of graduates where they will work.

At the moment, humans is in the verge of technology revolution which will fundamentally change how we live, work, and communicate with each other. Moreover, entering the era of technology as well as the fourth industrial revolution led to changes in various sectors, including Education and industrial work. In line with the increasingly sophisticated technological developments, the world is now emphasizing on the digital economy pattern, artificial intelligence, big data, robotic, and so on, or known as the disruptive innovation phenomenon. Faced with the aforementioned challenges [5], teaching in vocational schools is also required to change, including providing the appropriate and accurate facilities and infrastructures to sustain and support students [6] and producing good quality teachers for future generations.

The urgency of designing vocational school facilities [7] in the 21st century are (i) to support the implementation of Vocational School Directorate of Guidance (PSMK) programs in providing learning classrooms, industrial classrooms, teaching factory, and improving the competence of teachers [8] and students; (ii) the existence of the 4.0 industrial revolution era, which indirectly affects fresh graduates of vocational schools; (iii) the development of science and technology; (iv) the demand for curriculum that is in accordance with industrial needs; (v) the demands for competent work forces in accordance with the development of science and technology; and finally (vi) the demands for facilities that are in accordance with the development of technology to produce reliable and competent work forces.

An in-depth study is needed in the facilities designing [9] especially for vocational schools in 21st century. So that later on the appropriate standard of facilities can be achieved and can be relevant to the 4.0 industrial revolution era which will also have an impact on the competencies needed in the industry. Hence the objective of this study is to design a modern learning environment [10] for vocational schools in Indonesia which is in accordance with the needs of 21st century learning and 4.0 industrial revolution era.

2. Methods

We begin the study of vocational facilities development with a comprehensive study on vocational schools that can be used as a reflection of the current condition and as best practices so that we can compare between the current and modern pictures. Hence, we may obtain the ideal vocational schools, especially in providing the appropriate facilities and infrastructures for the students and teachers. The next step is a comprehensive study of documents, i.e.: administrative documents and facility specifications needed to support the competence of vocational school graduates in entering the workforce. Equally important, we also conduct a comprehensive study on the needs, literature data, and budgeting format for vocational school facilities through focus group discussions (FGD) with experts, practitioners, academics, and bureaucrats in the Ministry of Education and Culture.

This study uses literature review and factual data in the field to provide vocational school facilities design [11] in preparing competent workforce relevant to the 4.0 industrial revolution era. The study literature sharpens the design of vocational school facilities through books, articles, modules, regulations, and enrichment of information from other literary sources relevant to the topic of the study. The findings obtained will be the primary source in the study.

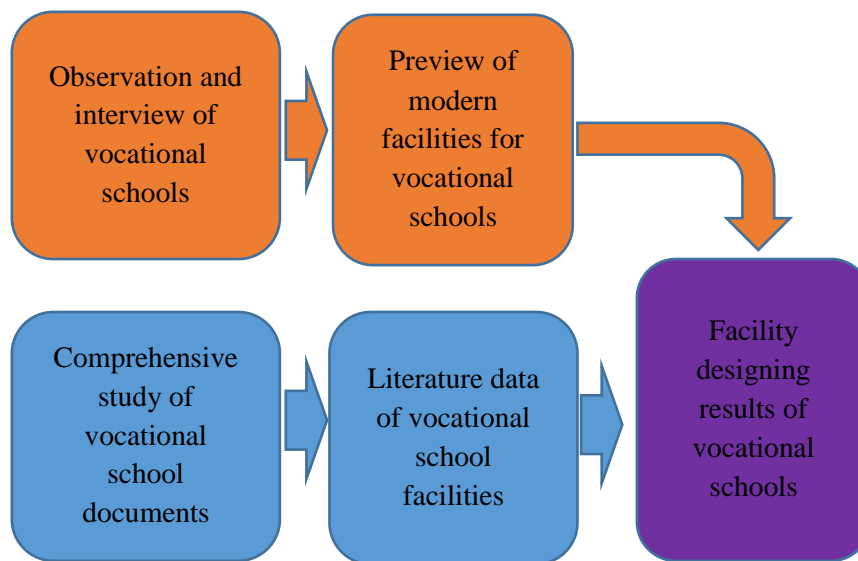


Figure 1. The research procedure in the study.

The data in this study consists of primary and secondary data. The primary data is related to the facility designing in vocational schools which shows the current situation and best-practices. The primary data is focused on the design of facilities relevant to the 4.0 industrial revolution era. Moreover, the secondary data is obtained based on information by industry partners who collaborated with the subject of the study. Information acquisition are done by literature studies, observations, questionnaires, FGD, interviews, and documentation. Observations, questionnaires, interviews, and documentations are carried out to collect facts, data, and actual conditions in various vocational schools in accordance with the objectives of the study. Literature study is carried out by examining documents that are expected to be used as data sources, references, and empirical evidence. This study was carried out in several areas that are considered to represent a general picture of the existing and modern conditions of vocational schools in Indonesia. The locations chosen for the data collection activities from this study include East Kalimantan, Central Kalimantan, Special Region of Jakarta, West Java, Central Java, East Java, and Special Region of Yogyakarta.

Data and information in this study are analysed and presented using a qualitative-descriptive approach (see Fig. 2). The method of analysis is carried out in three stages. The first stage is the identification of existing data assessments in the field. This is done to obtain actual data in the field. The second step is to find the source of the problems that become obstacles to the fulfilment of facilities in accordance with the 4.0 industrial revolution era. The third stage is to do an analysis between the current and modern conditions of the facilities in vocational schools.

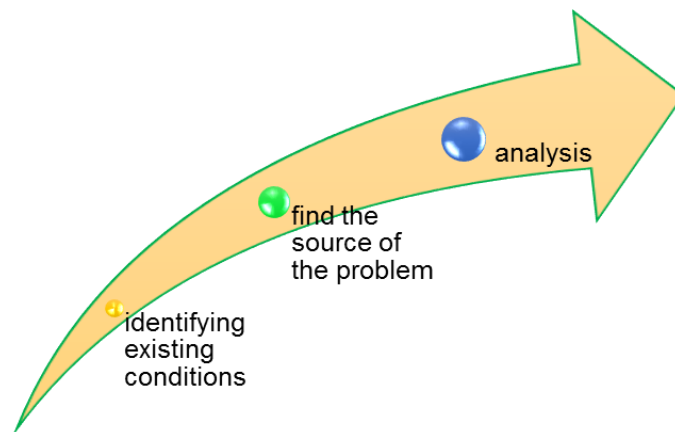


Figure 2. Operational steps in the data analysis.

3. Results and Discussion

Educational institutions that have adequate facilities are ideal for students and teachers. But in reality, lighting [12] and comfort of space, for example, for teaching and learning processes or other facilities supporting the learning process in vocational schools are currently very underwhelming. The current conditions of many vocational school buildings based on the results in the field do not meet both the quality and quantity of adequate and modern building standards. The conditions of the existing vocational school facilities still needs to be improved, especially instruments and equipment that have not been adjusted to the modern standards. Data in the field shows that vocational school facilities along with instruments and equipment are still inadequate. Many of these building facilities are found with i) less lighting; ii) high temperature (in the room); iii) inadequate toilets; and iv) untidy placement of installation cables. A modern vocational school facility standards are needed to support the performance of students, teachers, technicians, and people who are directly involved in the school.



Figure 3. Existing (a) and modern (b) vocational school buildings.

An existing vocational school building facility may be observed in Fig. 3(a) whereas a modern one is observed in Fig. 3(b). The standard of a modern vocational school building facility according to the 4.0 industrial revolution era is having a building with a stable, sturdy, earthquake and other natural forces resistant construction, and also complying good health standards. Utilization of building roofs as a source of electricity with the use of solar panels can be an option to optimize the space of the building. All existing systems [13] in the building is provided with technological facilities in accordance with the 4.0 industrial revolution era, namely Internet-based technologies of things and data of things. The building is equipped with Internet technology and information systems with a reliable system, security, smart features, flexibility, and mobility, which may be access by students and teachers. Electrical installations [14] must also be flexible, safe, and provide the capacity to support dynamic electricity use.

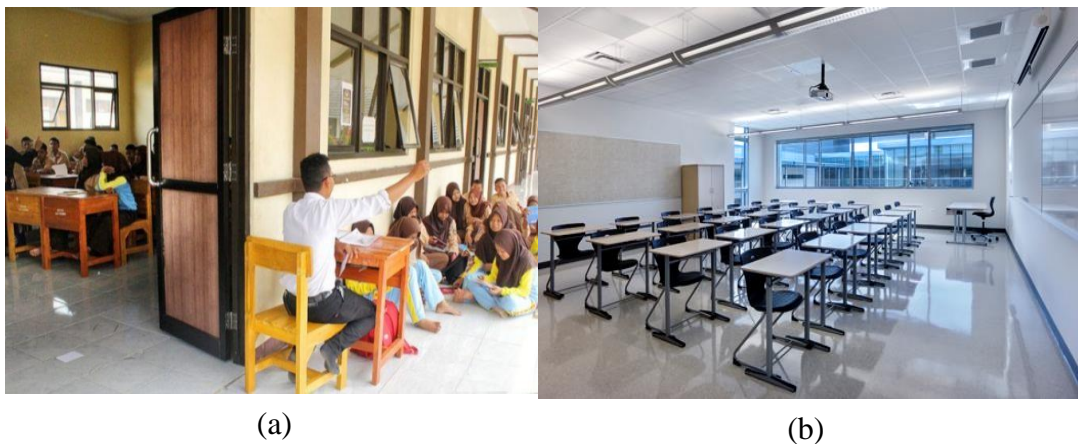


Figure 4. The condition of existing (a) and modern classrooms (b).

The condition of an existing classroom may be observed in Fig. 4(a) whereas a modern one may be observed in Fig. 4(b). Classrooms are part of a school building facility whose quantity and quality need to be considered. According to the Statute No. 28 of 2002 article 23 and 26 [4], classroom lighting and building comfort are facilities that need to be considered. Lighting, comfort, and air conditioning (AC) in classrooms are the main factors to make classrooms comfortable, in addition to provide protection and a sense of happiness for the students and teachers as well. A means to make such space can be conducted by designing classrooms with the principles of (i) unity; (ii) balance; (iii) proportional; and (iv) contrast.

The condition of a vocational school learning space in the 21st century is the division of the types of rooms according to their functions and objectives. The facilities of a classroom as a place for teaching and learning activities must also consist of student desks and chairs, a teacher's desk, classroom cabinets, whiteboards, and other classroom accessories that are in accordance with the size of a common classroom that is 9 x 8 m². Every classroom used for school activities must satisfy health regulations and fully supported by learning and teaching technologies so that in their activities, students feel comfortable and may develop well.

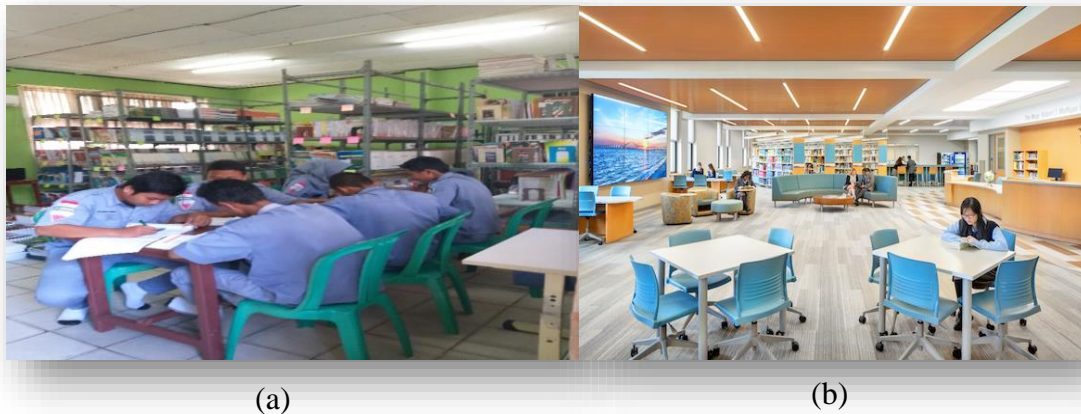


Figure 5. An example of existing (a) and modern library (b).

In addition to classrooms, there needs to be other supporting elements, one of which is the school library. One of the main goals of library facilities is the creation of a flexible and complete media room to enable adaptation and comfort in accordance with the 21st century technological advancements for school communities, i.e.: students, teachers, and library staff in searching for information. The current condition of the library room has not met the established standard [see Fig. 5(a)]. The concept of school libraries must be kept updated with the availability of the latest and continuously un-interrupted flow of information. Construction or renovation of school libraries should pay attention to the demographics of school community in the area. In addition, it is necessary to consider several aspects, namely: i) safe and visually accessible; ii) availability of clean and fresh air; and iii) sustainable and responsive design. The school library must also consist of several elements, including i) open and multi-functional space and facilities; ii) collection of books, digital books, and other information sources to obtain information, conduct training, to development student's potential, or solve current problems; iii) information technology in order to facilitate students in finding and understanding information; iv) visitors (students and teachers) who feel comfortable using the library; v) diverse library services but also up-to-date; vi) collaboration with stakeholders to improve and develop the library for the better; and vii) librarians who are pro-active and friendly. In addition modern interior facilities such as i) flexible and futuristic rack systems; ii) reading tables; and iii) reading chairs, sofas, and bar chairs may be added as well. Modern school libraries must be equipped with discussion rooms, reference rooms, and multimedia rooms.

Furthermore, other supporting facilities such as administration [15] rooms, teacher work-spaces, health care and sanitation facilities, and student service facilities such as counseling rooms and canteens also have a role in the school. The aforementioned existing facilities of education do not meet the standards. As an example, the administration room tends to be mixed and not based on its functionality [see Fig. 5(a)]. Furthermore, a modern administration room should look like Fig. 5(b).

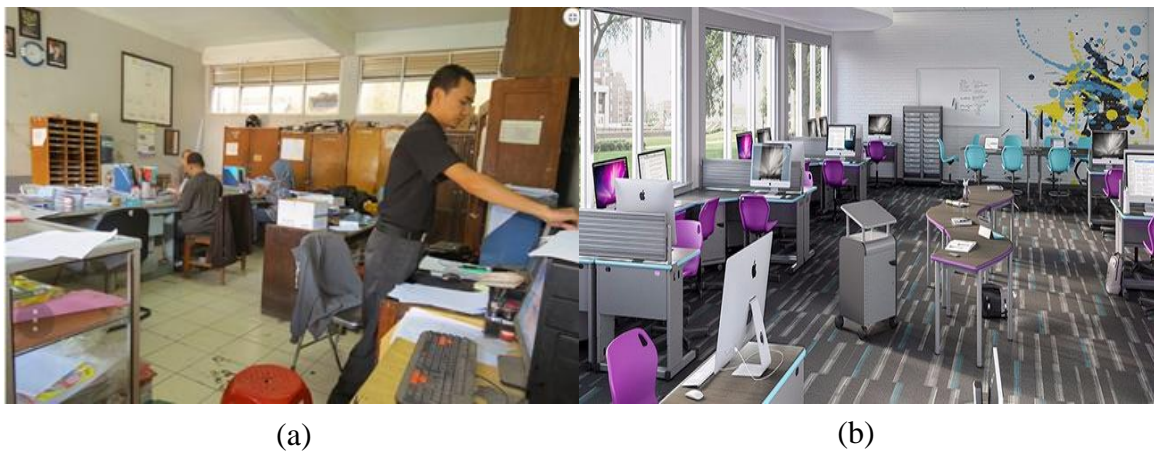


Figure 6. Existing (a) and modern administration rooms (b).

The teacher's work-space so far has been largely unrepresentative to support the development of teacher's capacity and professionalism. This may be observed in Fig. 6(a). It may be observed that the work-space of teachers is not tidy and looks messy without any boundaries of privacy for each teacher. Hence, this may result in an unproductive work environment. A modern design of work-space for teachers may be observed in Fig. 6(b). The design provides a sense of privacy for each teacher, hence making it suitable to prepare for teaching materials. However, the boundary does not totally isolate each teacher, such that teachers may still communicate with each other. The work-space for teachers should be close to the classrooms, and equipped with tables, chairs, cupboards, internet channels, CCTV and washbasins for hand washing.



Figure 7. Existing (a) and modern (b) teacher rooms.

Another school facility concerns health services where not all schools have provided health services according to standards. The condition of health services is still apprehensive and modest. Again this is because the lack of attention from the school concerning to how important health service is to students. Hence the health service facility is provided just to show administratively that there is such a facility in school. This may be observed in Fig. 7(a). It may be observe in the figure that although there are patient beds, a table, and a chair, the surrounding does not show that it is a health service facility. Furthermore, the room looks to be crowded with patients beds which seems to be too large. The condition of a better

health service facility may be observed in Fig. 7(b). We can observed that the room has an appropriate patient bed and the surrounding of a health service center with posters on the wall showing health illustrations.



Figure 8. Existing health service (a) and better health service (b) facilities.

Counseling guidance facility is also an important element of health services in a school. This facility is intended for students that face problems in their study, whether it is personal or academic. A student who is not achieving his or her potential may be referenced to the counseling staff of the school. The counseling guidance facility is used primary to be a space for dialogues and consultations between students and the counseling staff. Hence, this facility needs to be clean and comfortable such that students feel welcomed and may willingly reveal their problems and solve them. Furthermore, the facility needs to have a sense of privacy as well. It may be observed that the current counseling facility seen in Fig. 8(a) is too open hence there is a lack of privacy, which may hamper the consultation process. However, if the facility is prepared as in Fig. 8(b) then students may be willing to conduct consultations.

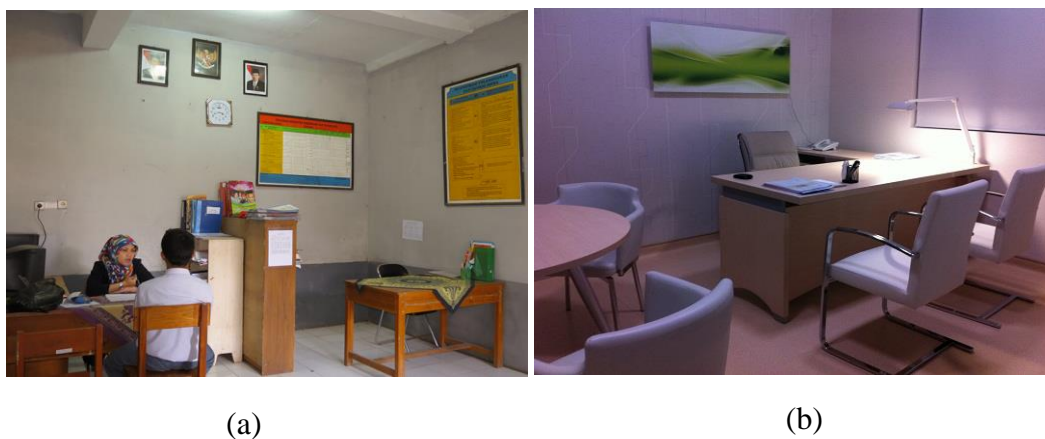


Figure 9. Current counseling facility (a) and modern counseling facility (b).

Sanitation [16] is another element which is very important in facilities procurement in schools. The availability of hand washing, toilets, and the clean water aims to train and maintain habits of students in healthy living behavior. Toilet facilities must be sufficient, easily accessible (not more than 30 m from student and teachers), provide privacy, safe, clean (hygienic), and in accordance with the culture that

exists for students and teachers. Toilet facilities must be equipped with convenient and closed hand washing materials, and furthermore they must be cleaned and maintained to ensure clean a functional toilets every time [16]. The usual existing toilet facilities may be observed in Fig. 10(a), whereas modern toilet facilities is given in Fig. 10(b). It may be observed from the figure that there is not so much different between the existing and modern toilets, however, additional equipment, such as hand dryer should be installed in the existing toilet facility. The cleanliness of existing toilets in schools are usually very poor and this problem needs serious solutions.



(a)

(b)

Figure 10. Current toilet facilities (a) and modern toilet facilities (b).

Vocational school facility where students can eat and drink, i.e.: canteen, is compared between existing and modern conditions in Fig. 11. The main problem with existing canteen in schools [see Fig. 11(a)] is the lack of air circulation. This causes the canteen to become hotter as more students enter it, and hence tends to be unpleasant for eating and drinking. The cooking equipment are not separated from the eating area which contributes to higher temperature of the canteen. Most of existing school canteen today only rely upon the outdoor air to provide the air circulation, which is not sufficient in this case. Furthermore, the roof material of the canteen, especially the eating area is made of materials that do not absorb heat, which resulted in a higher temperature. It may be observed in Fig. 11(b) that a modern canteen may be indoor but installed with sufficient air circulation system and spacious area. The lighting is also set such that the canteen looks bright inside.

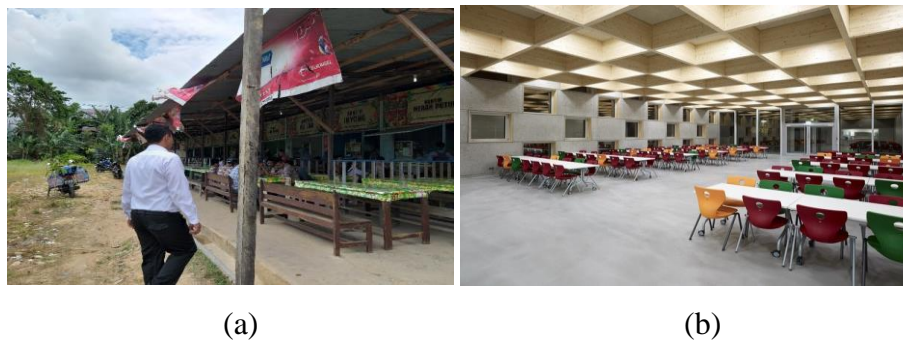


Figure 11. Current condition of a school canteen (a) and a modern one (b).

Other supporting facilities, one of which is the layout of the school, is another factor in needs to be standardized. Schoolyard must have safe and controlled access (entrance and exit) system by separating pedestrians and vehicle traffic lanes [see Fig. 12(a)]. In addition, parking spaces also become a necessity for students who use vehicles, especially motorcycles. Hence, a large parking lot is needed, which is based upon the number of residents in the school. Water drainage system must be able to supply, drain, and dispose water properly.



Figure 12. Outdoor study room and schoolyard of modern school.

The learning environment outside the classroom [see Fig. 12(b)] is one of the important aspects of learning and gets more attention to the paradigm of modern education. The learning environment outside the classroom in principle gives a variety of learning situations to support the development of physical, psychological-emotional, social, and cognitive skills of students. In addition, a school park is also needed as a natural supporter for the health of students, especially from the biogeochemical cycle function of the availability of oxygen and water resources. Physical activity in a short period of time can have a major influence on the stability of health which can be realized by the presence of a fitness area. In addition, exercise can also reduce levels of the hormone cortisol that triggers stress so that it can suppress the potential for saturation or even depression. With the availability of fitness area facilities,

cafeterias are also needed to become a place to eat and drink as a basic human need to meet energy needs and nutritional intake during school activities.

4. Conclusion

Good physical or non-physical facilities that meet the standards are one important aspect of vocational schools that aims to make students and teachers to reach their goals. The existing facilities in vocational schools are still lacking and also concerning. This needs to get proper attention and handling. The existence of a technological revolution is now forming the fourth industrial revolution where this technology should be adopted in vocational school facilities that are at the moment very concerning. This technology combines sophisticated physical and digital worlds so that schools with modern facilities may be created to produce competent vocational school graduates.

Acknowledgments

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