**Preparing for Vocational High School Learning in the Future: Lessons Learned from the COVID-19 Pandemic**

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**Abstract.** The COVID-19 pandemic had affected vocational high school learning. Schools, teachers and students of vocational high school are forced to adapt to the changes in the learning process that must be done online from home. Learning activities in vocational high schools cannot run optimally during this pandemic, especially in practical learning that cannot be done online. On the other hand, post-pandemic learning activities will undoubtedly change along with the development and adaptation processes that have been carried out. Therefore, anticipatory efforts are needed to ensure that the post-pandemic learning activities do not experience obstacles. This study is a review of the existing literature on vocational high school learning and interventions relevant to COVID-19 pandemic in Indonesia. This study aims to find out the changes that might occur in vocational high school learning after the pandemic and to recognize the required efforts to prepare it. Based on the review, technology adaptation plays an important role in vocational high school learning. New paradigm of the use of technology in vocational learning needs to be understood and some efforts that need to be prepare based on lessons learned from the COVID-19 pandemic should be taken in efforts to provide a good quality vocational high school learning in the post-pandemic future.

1. **Introduction**

The Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by coronavirus (SARS-CoV-2) that was declared as a global pandemic by The World Health Organization (WHO) on March 11, 2020 [1]. In Indonesia, 2 confirmed cases of COVID-19 were reported on March 2, 2020, and had increased to over 175.000 cases on early September 2020 [2]. The increase in the number of cases took place quite quickly and it has become the concern of various sectors including the education sector. Response to the COVID-19 pandemic which requires no physical contact has changed the way students are educated. In Indonesia, education policy requires the learning activities to be carried out as a distance learning [3]. Schools, teachers and students are force to adapt to the changes of learning situations during the pandemic. This changes provides an overview of how education can transform for the better or worse in a long time [4].

Vocational high school is one of the secondary education levels that prepares students to work in a certain fields [5]. Similarly happened in the others, teaching and learning activities in vocational high schools is not running optimally during the pandemic, especially in practical learning that cannot be done through distance learning. However, the problem in vocational high school education is not only in how to deliver the subject matter, but also how vocational education learning adapts to the changing needs of the working world that have occurred due to the pandemic.

The results of recent studies have shown that the labor market is collapsing in all types of jobs, regardless of the work condition [6] [7]. This crisis is a career shock for many people and very influential on career sustainability [8]. In Indonesia, due to the covid-19 pandemic, it is estimated that there will be 10 million people unemployed and in need of new jobs [9]. This condition will make it difficult for fresh graduates of vocational education in the labor market after the pandemic period due to high job competition caused by the increasing demand for good quality workers to meet the changing needs of the working world. Even in a conducive economic situation, finding and maintaining a job is difficult for the young workforce. In the post-COVID-19 pandemic, they are increasingly vulnerable to problems such as job specifications that are not in accordance with education, skills that are not in accordance with the needs of the job market, and lack of knowledge of new job opportunities. Therefore, it is very important to prepare for vocational high school learning in the future to ensure students can survive in the post-pandemic situation.

To prepare for vocational high school learning in the future, we can take the lessons learned from the COVID-19 pandemic. However, obtaining accurate education data in vocational high schools is difficult, learning opportunity in Indonesian vocational high schools before and during the pandemic is unequal. Beside that, information related to the implementation of learning in vocational high schools during pandemic is also limited. This study aims to determine the changes that might occur in vocational high schools learning process after the pandemic and the efforts that need to be made to anticipate them. The results of this study will help schools, teachers and students of vocational high school to make a better preparation to deal with the changes that might occur after the end of COVID-19 pandemic so that the learning constraints that may be encountered in post-pandemic learning can be minimized.

1. **Method**

This article is a review of the existing literature on vocational high school learning. Data of this study are related to vocational learning before, during and possibly after the pandemic based on the existing development trends in Indonesia. The data were collected from several papers with years of range from 2011 until 2020; the papers in the review are conference proceedings, journal articles, book chapters, and copy of Indonesian government policy documents. A search using the search terms “vocational”, “vocational high school”, “learning”, and “COVID-19” in various combinations was undertaken to obtain conference proceeding and journal articles from Sciencedirect (sciencedirect.com) and Garba Rujukan Digital: Garuda (garuda.ristekbrin.go.id) electronic database. These search terms were also was undertaken to obtain the copy of Indonesian government policy documents from National Legal Documentation and Information Network (jdihn.go.id) electronic database and the relevant content from some relevant institution web page. Database searches were combined and duplicates were removed. The categorization of literature is based on the period of pre-COVID-19 pandemic, during the COVID-19 pandemic and post-COVID-19 pandemic. Three themes were identified across papers and were used to organize the review. Those are: (a) Pre-COVID-19 vocational high school learning, (b) Vocational high school learning during the COVID-19 pandemic and (c) Post-COVID19: what vocational high school learning may hold in the future. The number of literary works reviewed in this study were 42 and the distribution of them according to the pandemic periods is as follows:

Pre-COVID-19 pandemic vocational : 14 literature (3 conference proceedings, 10 journal

high school learning articles, and 1 copy of government policy)

Vocational high school learning : 13 literature (5 journal articles, 4 copy of government

during the COVID-19 pandemic policies and 4 relevant content )

Post-COVID-19 pandemic: what vocational : 15 literature (4 conference proceedings, 5 journal

high school learning may hold in the future articles, and 6 books chapters)

1. **Result**

The vocational high school learning process changes mainly due to the presence of a COVID-19 pandemic. Based on several literature reviews, it can be drawn as follows;

* 1. *Pre-COVID19 Pandemic Vocational High School Learning (2011 – 2019)*

The learning implementation in Indonesian vocational high schools refers to the standards of the learning process – parts of the national standards of Indonesian education – which require vocational high school learning to focus on applicable knowledge and skills, and encourage student work readiness. Vocational high school learning consists of theoretical learning and practical learning. Before the COVID-19 pandemic, both types of learning were delivered face-to-face. Theoretical learning are often carried out in classrooms, whereas practical learning occurs in school-based workshops and laboratories and through hands-on experience at workplace (apprenticeship program) [10].

Vocational high school learning uses a variety of sources and helds by utilizing information and communication technology to achieve better learning outcomes. Multimedia learning is the most widely used media in classrooms learning. Multimedia learnings that were used include PowerPoint and computer-based interactive multimedia which are generally used in face-to-face learning [11]. The use of interactive multimedia in learning results in better learning achievement [12], [13] compared to PowerPoint media [11]. However, based on the average competency of students, for students with low academic ability, the use of computer-based media has the same effect as the use of PowerPoint media [14]. The success of learning with interactive multimedia is influenced by the ability of teachers to use ICT [15] and the availability of adequate facilities [16], [17]. To achieved a better teaching result using multimedia learning, teachers need to find the integration points with the traditional teaching methods and learn from the strengths and weaknesses of each other [18].

Meanwhile, the implementation of practical learning is based on the real and authentic work. To improve student competency, practical learning is generally done by learning by doing and utilizing learning media in the form of trainer kits or equipment and original materials needed for work. During practical learning, cultivation of work culture is also carried out to get a habit of thinking and working like at workplace [10]. The use of technology in practical learning is generally related to the technology used in work. This technology does not change the form of learning and the way of teacher and student communication that is carried out face to face.

Along with easy access to technology, several vocational high schools in Indonesia have begun implementing electronic learning (e-learning). The use of e-learning in vocational high school has a positive impact on student learning progress. E-learning can be applied to relatively difficult materials and to quite large number of materials which need more time to study than the allowed school time [19]. By utilizing the e-learning media, students were encouraged to use academic and reliable resources from their teachers in their tasks and homeworks [20]. However, e-learning is not only transferring a curriculum formed paper to the internet, but it also takes more effort and time to do a needs analysis and planning [21]. Teachers need skills for operating and planning e-learning as an instructional media. Teachers are also required to know the model of instructional design which is suitable for the expected e-learning and to understand the indicators which are needed in implementing instructional design for e-learning [22].

Implementation of e-learning was not widely use in vocational high school due to infrastructure limitations and the lack of preparedness of teachers and students in accessing e-learning. In the application of e-learning, technical support including technology and domain pedagogy should be given more attention, and schools must provide a conducive social environment towards the implementation of e-learning. The implementation of e-learning should not merely be considered as voluntary advice, but also be given supports from every principal which is manifested in regulations [23].

* 1. *Vocational High School Learning During the COVID19 Pandemic (2020)*

During the COVID-19 pandemic, the role of technology became important in people's lives. Technology has been used massively and become an important part of human efforts to survive during the COVID-19 pandemic. In the education sector, technology is used for learning and as a medium for teachers and students to stay connected [24]. Online classes at universities and online education for students are now becoming a common thing; these changes may have relatively longer socio-psychological and behavioural implications [25]. Through innovations that continue to be made every day, this period becomes an opportunity to decide how and what we should change in the new era of education.[26].

In Indonesia, vocational high schools were completely closed for learning activities due to the prohibition of face-to-face learning and distance learning policies during the pandemic [27]. Vocational learning activities including theoretical learning and practical learning have been delivered through distance learning using online platforms [28]. Schools, teachers and vocational high school students are forced to adapt to these changes. However, learning activities in vocational high schools cannot run optimally during this pandemic, especially in practical learning that cannot be done online. Not all practical learning that is usually done in school-based workshops or laboratories can be done through online learning. In some competency subjects such as animation and software engineering, the practical learning activities can be carried out remotely by teachers giving practical assignments that can be done by students at home by sending the results to the teacher through online. But in learning that requires hands-on practice and teacher guidance such as automotive and electrical engineerings, online learning is difficult because it requires equipment and materials that are usually not found at home. In addition, the delivery of work-based learning including industrial work practices (apprenticeships) is facing problem from the lockdown imposed on enterprise [29].

COVID-19 pandemic also impacts the process of monitoring learning outcomes and assessments. During pandemic, vocational high school exams and assessments is carried out with adjustments, including, the use of online assessments, cancellation of national exams and skills competency tests, and determination of graduation and grade progress through achievements that previously obtained. The new student enrolment process is also carried out by online approach [28].

Indonesian government, through the Ministry of Education and Culture also facilitates online learning policies by providing a portalcalled *Rumah Belajar* which can be accessed through the website address belajar.kemdikbud.go.id. The main features of the *portal Rumah Belajar* are learning resources, digital classes, exercises, and virtual laboratories. All content in this website can be accessed and utilized free of charge by students and teachers at all levels of schools including vocational high school level[30]. The Ministry of Education and Culture also organizes home learning programs through the national television broadcast TVRI as an alternative to distance learning that has limited internet access due to economic constraints and geographical location, but for vocational high schools, this program only covers general subjects such as math and language lessons [31]. Financial support is also provided through policies to adjust the use of school operational assistance (BOS) to meet the needs of schools during the pandemic [32], and provide school operational assistance to private schools in dire need [33].

However the availability of online learning facilities, utilization of facilities and online learning processes in public vocational high school is better than those in private vocational high school [34]. The limitations of infrastructure such as internet connectivity, platforms and resources and the lack of preparedness of teachers and students are the main obstacles in the implementation of distance learning. Access to distance learning through digital technology is also identical to inequality, especially for marginalized communities [35]. In addition, distance learning activities and the economic crisis during the pandemic can also trigger students to drop out of school. Teachers and schools have an important role in maintaining contact with the students to maintain the continuity of learning during confinement and reduce dropouts thereafter [36].

* 1. *Post-COVID19: What Vocational High School Learning May Hold in The Future*

There is no doubt that in the future this world will be different. The presence of the technological revolution has quickly changed the way of human life, and COVID-19 pandemic is forcing us to accept these changes. The COVID-19 pandemic has forced education to re-evaluate how organizations and systems are run [37]. Various technological innovations have been developed to support learning activities. These technological developments and innovations will affect how post-pandemic COVID-19 learning takes place. However, the use of technology in learning is about using the right tools at the right time and for the right purpose [38].

In the context of vocational high school, the purpose of learning is to prepare students to work and develop their careers. Vocational high school students are generation Z who have different characters from the previous generation [39], while the working world is entering an era of digital transformation that applies various industrial 4.0 technologies and causes disruption. The new learning after the COVID-19 pandemic requires the right tools that can connect the characteristics of generation Z with the characteristics of the digital transformation era to support learning activities and achieve learning outcomes.

Vocational high school learning that connect the characteristics of students and digital transformation era requires new cyber-based learning habits, which every student easily connect his intelligence to cyber technology in their learning activities. *Cybergogy* involves cyber technology that works actively to compute learning processes and outcomes, controls planning and learning processes and communicates learning outcomes [40]. Therefore, the use of technology in vocational high school is not to replace face-to-face learning, especially in practical learning that need teacher guidance and hands on practice, but to improve the quality of learning [41] and to support students to have the skills needed in the 21st century, including life and career skills, skills in learning and innovating, and skills in utilizing information, media, and technology [42].

One of the alternative learnings to apply cybergogy is blended learning. Blended learning is a mix of physical and online activities and experiences [43]. Integration of technology in blended learning led to several changes in teacher responsibility, including the role of teachers who are no longer as a source of information [44]. To achieve successful learning in blended learning, student self-autonomy or self-directed learning is essential [45]. Self-directed learning is defined as the process in which students take initiative, with or without the help of others, in diagnosing their needs, formulating learning goals, identifying human resources and materials for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes [46].

However, the success of learners who undertake self-directed learning through digital-based forms of learning cannot be seen as a trend that can be generalized broadly and replicated. When some students can develop by being freed through independent learning, many other students do not [47]. Although students today are the first generation to grow in information and communication technology (ICT) culture, digital gap is still found among those who regularly use ICT. So, socio-cultural interventions are still needed to minimize the effects of inequality caused by the use of the technology [48].

In addition, vocational high school post-pandemic learning needs to pay more attention to the skills needed to survive in the workforce after the pandemic [49]. One of the main challenges is to increase access to skills and qualifications for all in changing socioeconomic situations, especially when technological developments tend to benefit highly skilled people and thus increase social economic inequality in the society [50]. Given the possibility of global economic transformation, vocational education needs to be part of the response to the economic crisis through strengthening entrepreneurial learning and digital skills for all students. It is important for young people to learn to adapt, be creative and innovative, in addition to developing skills that are taken from traditional subjects. Moreover, the integration of technology in effective learning also depends on important conditions such as adequate funding and current resources [51]. Thus, support from various related parties is needed so that the vocational high school post-pandemic learning can be carried out effectively.

1. **Discussion**

Vocational high school learning activities emphasize applicative knowledge and skills and student work readiness. Before the COVID-19 pandemic period, vocational high school learning was delivered face-to-face in classrooms and in school-based workshops or laboratories. The use of distance learning using e-learning is not widely used due to infrastructure limitations and the lack of ability of teachers and students to implement e-learning, especially in schools in areas with limited internet access. This problem also result in distance learning during the pandemic that can not run optimally, especially in practical learning that requires hands on practice and teacher guidance. Meanwhile, the process of technological adaptation that has been carried out during the pandemic will never return. This requires schools, teachers and students to immediately adapt to the changes.

Based on the developments of learning that occurred before, during and will occur after the COVID-19 pandemic, technology adaptation plays an important role in vocational high school learning. Before the pandemic, technology integration in learning was used to improve learning outcomes. During the pandemic, technology is used to ensure the continuity of learning. Meanwhile in the post-pandemic period, technology integration in learning will be needed to meet the needs of the evolving workforce. The current learning constraints are also generally related to the application of technology that is not optimal, such as infrastructure limitations, the lack of preparedness of teachers and students and inappropriate use of learning technology.

Along with the development of technology, in the post-pandemic COVID-19 technology adaptation in vocational high school learning has entered the cybergogy generation. Learning is not only a psychological and sociological processes, which students experience changes in social interaction and then build their learning experiences, but learning enters *the psycho-socio-technological* era where learning is computed, controlled and communicated using cyber technology. Student's mindsets are built through social processes and technological processes. The use of technology in learning is used to build student self-reliantlearning and to build collective intelligence that is accommodated by cyber networks [40]. This new paradigm of the use of technology in vocational learning needs to be understood by schools, teachers and students to prepare for the post-COVID-19 learning in vocational high schools.

However, the success of learning through digital-based learning cannot be generalized broadly and replicated. The use of digital technology in learning must be adapted to the needs and conditions. Digital-based learning is also prone to inequality. In digital-based learning, it requires more attention to ensure all students have the same opportunity to get a good quality education. Meanwhile, the use of digital technology in vocational high school learning in the future also needs to pay attention to the skills needed to survive in the workforce that change after COVID-19 pandemic, students need an understanding of technology in the context of people’s lives and in the context of their work.

New paradigm of the use of technology in vocational learning needs to be understood by schools, teachers and students to prepare the post-COVID-19 learning in vocational high schools. Based on this study, some efforts that needed to prepare vocational high school learning in the future are as follows:

1. Teachers need to improve their teaching skills and ICT skills in accordance with the new learning paradigm.
2. Students need to increase awareness of independent learning and collaborative learning with peers.
3. Schools in coordination with the education office and other relevant parties need to prepare strategies for implementing post-pandemic learning, including the provision of the right facilities and learning system, training for teachers and supporting policies.
4. In addition, to prepare the next crisis, experience on learning by vocational high school teachers and students during COVID-19 pandemic should be well recorded and compiled [29].
5. **Conclusions**

Vocational high school learning in the future may be different from learning in the period before and during the pandemic. Based on the developments of learning that occurred before, during and will occur after the COVID-19 pandemic, technology adaptation plays an important role in vocational high school learning. New paradigm of the use of technology in vocational learning needs to be understood by schools, teachers and students to prepare the post-COVID-19 learning in vocational high schools and some efforts that need to be prepare based on lessons learned from the COVID-19 pandemic should be taken in efforts to provide a good quality vocational high school learning in the post-pandemic future. Papers reviewed in this article reflect the outline of what was published so far, but naturally this is not a complete review of all the papers published. In addition, obtaining accurate education data in vocational high schools during this pandemic situation is difficult. The factors of inequality of vocational high schools in Indonesia and limited information related to the implementation of vocational high school learning during the pandemic are the main obstacles in this study. The results of this study can be useful as a reference for the next study.

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