Explanatory of learning models and vocational teacher perceptions of mechanical engineering during the Covid-19 pandemic

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Abstract. This research aims to explore the implementation of the blended learning model and describe the teacher's perceptions of the constraints and positive impacts of applied learning. This research method uses a descriptive quantitative approach. A total of 41 respondents of mechanical engineering vocational teachers followed the filling of the instruments. Data were collected using a questionnaire in the form of respondent data, learning models used by vocational teachers and perceptions of vocational teachers. The findings of data explanatory research that are different from the implementation of the learning carried out are: (1) online theory learning without practice tends to use the Cooperative Learning of 14.63% and Problem Based Learning of 12.20%, (2) online theory learning with online practice, tends to use the Project Based Learning of 12.20%, (3) Online theory learning with offline practice, tends to use the Project Based Learning of 14.63%, and (4) learning with offline practice tends to choose inquiry learning and Project Based Learning of 2.44%. The main constraints that serve teachers are internet access and limited network availability, the positive impact on the general is the use of ICT. An important finding in this study is that vocational teachers must be able to organize learning evenly.

1. Introduction
The Corona Virus Disease 2019 (Covid-19) pandemic is a situation that has never been predicted before. The Covid-19 pandemic has an impact on all aspects of life [1], [2], including education. The impact of COVID-19 on education requires changes, especially in the implementation of education [3]. The Indonesian government made a policy to close the school activities with the aim of reducing the spread of Covid-19. Based on the Decree of the Minister of Health Number HK.01.07/ MENKES/328/2020 dated May 20, 2020 concerning Guidelines for the Prevention and Control of Covid-19 in Office and Industrial Workplaces in Supporting Business Continuity in Pandemic Situations, this is the beginning of the New Normal period, a number of Ministries/The State Institution has followed up with a number of regulations that are enforced for the area and environment of its work, including for economic, religious and State Civil Apparatus activities. The life order has entered a new chapter during the Covid-19 epidemic, namely the New Normal and the situation must be responded.

An alternative to the policy, so that learning continues is distance learning. Distance learning as a response to the new learning system that is used as an anticipation for the Covid-19 era [4], even though some university has long since the system, but this system becomes a new order for vocational schools. The system is carried out reaping a number of problems due to the absence of certainly new
in distance learning, teachers and students don’t have learning media, such as (smartphones and laptops), are constrained by access to electricity and internet in deficient areas, and understanding the use of platforms and online learning media for teachers, guardians and students [5]. In other cases, vocational schools that provide distance learning also experience high levels of impact on teacher and student psychology. This problem requires a solution so that learning continues in limited situation [6]. With these various cases, mixed learning or what is called blended learning is an alternative to avoid learning in vocational education.

Blended Learning is a learning method that combines two or more methods and approaches in learning to achieve the aim of learning [7]. Blended learning is considered necessary in vocational education, this is because vocational education requires hand-on skills. Hand on skills require off-line learning in the field, while the problems that occur during the COVID-19 pandemic. Online learning alone are not sufficient for students hand-on skills, then the absence of practical tools at home and the lack of students ability to use practical tools results being needed off-line learning. Blended learning as a combination of off-line learning (face-to-face) and on-line learning. Blended learning is learning that is supported by an effective combination [8], [9], of models, methods and learning media between all parts involved in learning.

Vocational education is an educational program that aims to make students have skills that equip students to confront the world of work [10], [11]. It is hoped that these student skills will be able to support their careers in the world of work. Through effective learning, students can have skills that are able to adapt in a situation of change. Learning in Vocational Education does not only focus on theory learning, but it is also important to doing practical learning to hone the student skills that are prepared to work in the industrial world [12], [13]. The ideal vocational education is more proportionate to practical learning. However, during the Covid-19 pandemic, learning was carried out using Blended Learning.

The implementation of blended learning in vocational education is important for application and intensive study. Several researchers have stated that the role of blended learning has made a positive contribution to vocational learning [14]. Pardede states that the Blended Learning model generally has 6 models, namely: Face-to-Face Driver model, Rotation model, Flex model, Online Wipe model, Self-Blend model and Online Driver model. The elements of blended learning-based learning combine face-to-face and e-learning which has 6 (six) elements, namely: (a) face-to-face (b) independent learning, (c) application, (d) tutorial, (e) collaboration, and (f) evaluation [15]. In this case the educator's strategy is to anticipate future instructions that will use Blended Learning. In addition to the learning strategy, another important thing is the learning model which both aims to optimize the implementation of learning. Blended Learning requires an effective learning model in summarizing theoretical and practical learning in Vocational Education.

A preliminary study was conducted in vocational education on the competency of Mechanical Engineering Expertise found several problems, including the existence of students not having computers or laptops and smartphones as media used in learning [16]. Meanwhile, the offline learning theory that has been implemented in during the Covid-19 pandemic has been hampered due to limited learning time, the strict application of health protocols, distance, and undisciplined student attendance. The on-line and off-line learning assessments are difficult to implement because of the limited space and time in the learning process. In learning practice, teachers are constrained by online learning boldly because the competencies expected from learning are not achieved [17]. In addition, other problems are caused because there are no tools available at each student's house, students cannot operate the machine off-line, students do not get a real picture of the practice that has been given by the teacher. Whereas in practical learning that attracts many students who do not attend school and the learning time is too short, the students practice hours are very lacking. The lack of platforms that can be used in learning also results in not achieving learning objectives [18]. International teachers are very difficult to carry out the service process in practical learning, especially in the Mechanical Engineering Skills Competency.

The obstacles experienced by vocational teachers of mechanical engineering expertise have been widely felt. There is even confusion and worry which are categorized into four quadrants, namely, vocational teachers only conduct online theory learning due to high anxiety and risk-taking actions.
Furthermore, theoretical and practical learning is carried out online. This condition considers the skills that students have acquired so that teachers have empathy in any situation, they are still given practice remotely or done at home. The problem arises that not all competencies can be carried out remotely. So there are teachers who choose to do online theory and offline practice. This condition is allowed as long as the limits in the health protocol are adhered to, on the other hand, the number of participants is not more than 20 people in the practical class. However, the concern of parents, teachers, and students is very high. Remembering their control in behavior cannot be controlled. The fourth awareness in industrial apprenticeship learning that is done with offline practice.

With this research, it is necessary to map the concept of the learning model carried out by vocational teachers of mechanical engineering expertise. [19] The important problem that exists is that teachers are confused or worried about being able to have an analysis of the phenomena carried out by vocational teachers. In addition, the learning model mapping provides a recommendation that the model chosen by the teacher with the grouping that is in great demand provides a recommendation that the model is considered jointly. The grouping of perceptions by constraints and positive impacts provides a recommendation that the main obstacle can be given a solution and is not at high risk. The researcher decided to conduct an exploratory study of learning models and teacher perceptions in the implementation of learning during the Covid 19 pandemic.

2. Research Methods
2.1. The research approach used
This research uses quantitative methods with a descriptive approach [20]. Researchers use quantitative methods based on data obtained in the form of ordinal data, which then changes the amount of data into proportions and direct statements about teacher perceptions of learning. The approach to this research is descriptive to describe blended learning model that has been used by teachers in during Covid-19 pandemi. Participants in this study were 41 teachers of the mechanical engineering expertise program. Distribution participants can be seen in table 1.

2.2 Respondent Distribution.

| No | Data of Respondents                  | Frequency (f) | Percentage (%) |
|----|--------------------------------------|---------------|----------------|
| 1  | Province                             |               |                |
|    | Central Java                        | 18            | 44             |
|    | Special Region of Yogyakarta        | 8             | 20             |
|    | East Java                           | 5             | 12             |
|    | West Java                           | 4             | 9              |
|    | North Sumatra                       | 2             | 5              |
|    | South Sumatra                       | 1             | 2              |
|    | South Borneo                        | 1             | 2              |
| 2  | Background Education                |               |                |
|    | Bachelor                             | 33            | 80             |
|    | Magister                            | 7             | 18             |
|    | Doctor                              | 1             | 2              |
| 3  | Institution                         |               |                |
|    | Public Institution                  | 21            | 51             |
|    | Private Institution                 | 20            | 49             |
| 4  | Teaching experience                 |               |                |
|    | 1 – 5 Years                         | 24            | 63             |
|    | 6 – 10 Years                        | 5             | 11             |
|    | 11 – 15 Years                       | 6             | 13             |
|    | >15 Years                           | 6             | 13             |
| 5  | Subjects                             |               |                |
|    | Basic Mechanical Engineering Expertise Program (C2) | 7 | 18 |
|    | Mechanical Engineering Competency (C3) | 32 | 78 |
Table 1 shows the distribution of participants categorized based on a place, background education, institution, teaching experience, and subject. Meanwhile, the speed of the participants educational background is an undergraduate alumni with 1-5 years of teaching experience.

2.3. Collecting data
2.3.1. Questionnaire
Collecting data in this study using a questionnaire in the form of ordinal data and direct statements. Ordinal data is used to determine the learning model that has been used by teachers in during the Covid-19 pandemic. Direct statements in this study are used to determine teacher perceptions of obstacles and positive impacts in the learning that has been implemented.

2.3.2. Data analysis
Data analysis in this study was carried out in two stages: (1) categorization based on the implementation of learning presented in quantitative data; and (2) grouping based on constraints and positive impacts presented in descriptive data. The distribution of learning models used by teachers to conditions and subjects is the key to presenting research findings. The recommendations of this study provide information to vocational teachers on which learning model machining techniques to use.

3. Results and Discussion
3.1. Mechanical Engineering Learning Models in the during Covid-19 pandemic
The learning model used by vocational teachers on the expertise of classification machining techniques is in three conditions, namely (1) theoretical learning is carried out online; (2) practical learning is carried out online; and (3) practical learning is carried out in an offline. Based on the three conditions for implementing learning, there are several findings, namely (1) theory (online) and practice (online), and (2) theory (on-line) and practice (off-line). The findings of the research findings show that in this situation, four learning models were selected during covid-19 pandemic learning on machining engineering expertise, namely Problem Based Learning (PBL), Project Based Learning (PJBL), Cooperative Learning (CL), and Inquiry Learning (IL), Figure 1. Exploration of data generated from this study is a learning model for the subject of machining techniques. This data describes the number of vocational teachers with mechanical engineering expertise carrying out learning with an approach model. The number of models chosen identifies that the distribution model is an important consideration for vocational teachers as instructors in these subjects.

![Figure 1. Research Findings](image_url)

A total of 41 vocational teachers with mechanical engineering expertise were sampled in exploring the learning process. Subjects are grouped based on expertise program, program skill and other competencies. A total of 8 respondents were selected, providing information related to basic programs including: (1) the two respondents in the Mechanical Engineering drawing; (2) the four
respondents in mechanical engineering jobs; and (3) the two respondents in basic mechanical engineering design. The characteristics of this area of expertise are the scientific basis of machining techniques before learning the core competencies. Basic areas of expertise given to classes X and XI. Based on the field of learning interaction expertise practice is not yet fully implemented. The learning model for the implementation of learning in the Covid 19 era is an important reference for other vocational teachers. In the expertise program, the expertise involved 25 respondents consisting of: (1) pictures of 4 manufacturing techniques; (2) Technique of machining a lathe as many as 12 people; (3) the milling machine technique consists of 3 people; and (4) NC, CNC and CAM machining techniques for 6 people. The characteristics of practical learning are more prioritized in the competence of the expertise program. The implementation is carried out in class XI and XII. This condition, interpreting that implementation that is not carried out in practice because of Covid 19 makes vocational teachers ambiguous. Another data source for students in the field of mechanical engineering, as many as 8 respondents actively contributed to exploring the implementation of the learning being carried out.

Important findings from the research, also based on the learning model applied by vocational teachers. These findings include (1) vocational teachers carry out online learning; (2) vocational teachers carry out online learning and online practice; (3) vocational teachers carry out online learning theory and offline practice; and (4) vocational teachers carry out offline practices. The data distribution is presented in table 2.

![Table 2. Implementation of Learning Model for Mechanical Engineering Expertise](image)

| Codes | Implementation of Learning | F  | %    |
|-------|---------------------------|----|------|
| M1    | Learning is carried out in theory | 14 | 34,15|
| M2    | Learning is carried out in theory and online practice | 13 | 31,71|
| M3    | Learning is carried out in online theory and offline practice | 12 | 29,27|
| M4    | Learning is carried out in offline practice | 2  | 4,88 |
| Total |                           | 41 | 100  |

![Table 3. Learning Models based on the Application of Learning in during Covid-19 pandemi](image)

| Codes | Learning Models                        | f (%) |
|-------|----------------------------------------|-------|
|       |                                        | M1    | M2    | M3    | M4    |
| CL    | Cooperative Learning                   | 14,63 | -     | -     | -     |
| PBL   | Problem Based Learning                 | 12,20 | 7,32  | 4,88  | -     |
| PJBL  | Project Based Learning                 | 2,44  | 12,20 | 14,63 | 2,44  |
| IL    | Inquiry Learning                       | -     | -     | -     | 2,44  |
| PBL-  | Problem Based Learning - Project Based | 2,44  | 4,88  | 9,76  | -     |
| PJBL  | Learning                               | -     | -     | -     | -     |
| PBL-IL| Problem Based Learning - Inquiry Learning | 2,44  | 2,44  | -     | -     |
| PBL-CL| Project Based Learning-Cooperative Learning | -    | 4,88  | -     | -     |
| Total |                                        | 34,15 | 31,71 | 29,27 | 4,88  |

The learning model for the Mechanical Engineering Expertise Program (Table 2. and Table 3.) explains that the theoretical learning carried out by most of the vocational teachers has a tendency towards the CL (14.63%) and PBL (12.20%) models. The implementation of online and practical theoretical learning is more likely to be a PJBL model (12.20%). The implementation of learning in online theory and offline practice tends to be PJBL (14.63%), while offline practice tends to be PJBL and IL, but cannot be interpreted broadly, because of limited data. The learning models that may be applied to machining techniques are PJBL and PBL. In line with Hodges' research recommendations, that learning in situations should be able to solve problems creatively [21]. The PJBL and PBL models are relevant in this study.
| No | Competency Skills                          | Online Theory | Online Practices | Offline Practices |
|----|--------------------------------------------|---------------|-----------------|-------------------|
| 1  | C2.1. Mechanical Engineering Drawing       | CL            | -               | PBL               |
|    |                                            | IQ            | -               |                   |
| 2  | C2.2. Basic Mechanical Engineering Work    | CL            | -               |                   |
|    |                                            | PJBL          | PJBL            |                   |
|    |                                            | PJBL          | -               | PJBL              |
|    |                                            | PBL-CL        | PBL-PJBL        | -                 |
| 3  | C2.3. Basic Mechanical Engineering Design  | CL            | -               | PBL               |
|    |                                            | IL            | -               |                   |
| 4  | C3.1. Manufacturing Engineering Drawing    | PBL           | -               | PJBL              |
|    |                                            | PBL           | -               |                   |
|    |                                            | PBL-CL        | PBJL-CL         | -                 |
|    |                                            | PBL           | PBJL            | -                 |
|    |                                            | PBL           | -               | PJBL              |
|    |                                            | PBJL          | -               |                   |
|    |                                            | CL            | -               |                   |
| 5  | C3.2. Lathe Machining Techniques           | PBL           | PBJL            | -                 |
|    |                                            | PBJL          | PBL-PBJL        | -                 |
|    |                                            | PBL-CL        | PBL-IL          | -                 |
|    |                                            | PBL           | -               | PBJL              |
| 6  | C3.3. Milling Machining Technique          | PBL           | -               |                   |
|    |                                            | PBJL          | PBJL            | -                 |
|    |                                            | CL            | -               |                   |
| 7  | C3.4. NC / CNC and CAM Machining Techniques| PBL           | -               | PBL-PBJL          |
|    |                                            | PBJL          | PBJL            | -                 |
|    |                                            | PBL           | -               | PBL-PBJL          |
|    |                                            | -             | -               | PJBL              |
| 8  | Others                                    | CL            | PBL             | -                 |
|    |                                            | PBL-PBJL      | -               | PBL-PBJL          |
|    |                                            | PBL           | -               | PBL               |
|    |                                            | PBL-PBJL      | PBL             | PBL               |
|    |                                            | PBL-PBJL      | -               | PBL-PBJL          |
|    |                                            | PJBL-CL       | PJBL-CL         | -                 |
|    |                                            | PJBL          | -               | PJBL              |
|    |                                            | PBL-IL        | -               |                   |
The distribution of the learning model distributed based on the program of expertise and subjects (Table 4.) describes that the characteristics of the model chosen by the teacher in the learning process in theory, online practice, and offline practice are not the same. Thus, further research is needed to see the determinants of vocational teachers in choosing learning models. Important information in the distribution of the data is that each subject has the application of the learning model in pairs. These data indicate that blended learning has been applied to machining engineering expertise.

3.2. Perceptions of Vocational Teachers in Implementing Learning Models in the during Covid-19 pandemi

Vocational teacher perceptions are assessed based on the obstacles to learning carried out and the positive impact of the implementation of learning. The instrument for filling out questionnaires that have been carried out by the teacher will be categorized based on the implementation of learning (Table 2.). The opinions of teachers from their construction experiences are as follows:

| Learning Implementation       | Barriers                                      | Positive impact                                      |
|------------------------------|----------------------------------------------|------------------------------------------------------|
| Online theory learning [M1]  | - Limited internet access                     | - Independence                                      |
|                              | - Network unstable                            | - Strengthening technology and ICT                   |
|                              | - The task is not completely completed        | - Teacher creativity                                 |
|                              | - Family education background                 | - The emergence of a technology literacy movement in all elements of education |
|                              | - Low student motivation                      | - Ability to simplify learning                       |
|                              | - Limited discussion opportunities             | - Some students enjoy learning                       |
|                              | - Low student discipline                      | - Train student responsibility                      |
|                              | - Device facilities are not available         | - New cultural habits                                |
|                              | - Control of student behaviour                | - Efficiency of study time                           |

| Learning is carried out in theory and online practice [M2] | - Limited internet access | - Tech literate students |
|                                                           | - Practice facilities are not available | - Explore skills with limitations |
|                                                           | - Device facilities are not available | - Student independence is formed |
|                                                           | - Very high explanation misconception | - Creative |
|                                                           | - Hand on cannot be felt off-linely | - Do it anywhere |

| Learning is carried out in online theory and offline practice [M3] | - Fear catches up | - It's easier to understand |
|                                                                  | - The number of students is limited | - Focus more optimal practice learning |
|                                                                  | - Learning is not optimal | |
|                                                                  | - Not all participate | |
|                                                                  | - Short execution | |

| Learning is carried out in offline practice [M4] | - Distance resistance | - Ease of understanding the material |
|                                                 | - Short learning time | |

Source: Primary Data

However, the implementation of vocational learning generates many teacher perceptions. This condition is a common thing, especially the number of teachers who have various characteristics. In addition, each region has a different area status. The results of the study (Table 5.) have interrelated problems. The researcher concluded in two conditions, namely online learning [M1 and M2] and offline learning practice [M3 and M4]. In online learning, the biggest obstacle is the availability of internet access and areas that are not covered by the internet. The skills of vocational teachers when applying online need to collect data on the conditions of students. Furthermore, vocational teachers
must provide the same treatment in various ways according to the situation of students [22]. Whereas in offline practical learning the impact felt by the teacher was limited time and the fear of transmission, but the positive impact felt was the limited number of students making learning more optimal. Research exploratory learning in during Covid-19 pandemi is expected that vocational teachers will be able to take the right and effective attitude for equitable learning in emergencies.

4. Conclusion

This exploratory study, research resulted in two findings, namely the learning models of machining techniques used by vocational teachers to consider four conditions, namely (a) the implementation of learning that was carried out was limited to the online theory using cooperative learning and problem-based learning models; (b) learning is carried out with a theory and practice online using a project-based learning model; (c) learning with online theory and offline practice using a project-based learning model; and (d) offline practical learning recommends the inquiry learning and project-based learning models. The project-based learning model is a model in vocational learning that is most widely used by vocational teachers. The second finding is that the constraints of limited internet access and network affordability are the main factors that are difficult to control, and the positive impact of implementing learning in during Covid-19 pandemi is that understanding of technology has increased rapidly. The recommendation of this study is that vocational teachers must be able to determine the appropriate model with the characteristics of students in a pandemic situation to reduce constraints in learning. So that learning equality can be felt by vocational students.

References

[1] R. Djalante et al., ‘Review and analysis of current responses to COVID-19 in Indonesia: Period of January to March 2020’, Prog. Disaster Sci., vol. 6, p. 100091, Apr. 2020, doi: 10.1016/j.pdisas.2020.100091.

[2] M. Nicola et al., ‘The socio-economic implications of the coronavirus pandemic (COVID-19): A review’, Int. J. Surg. Lond. Engl., vol. 78, pp. 185–193, Jun. 2020, doi: 10.1016/j.ijsu.2020.04.018.

[3] S. Burgess and H. H. Sievertsen, ‘Schools, skills, and learning: The impact of COVID-19 on education’, VoxEU.org, Apr. 01, 2020. https://voxeu.org/article/impact-covid-19-education (accessed Oct. 01, 2020).

[4] B. Mulyanti, W. Purnama, and R. E. Pawinanto, ‘Distance Learning in Vocational High Schools during the COVID-19 Pandemic in West Java Province, Indonesia’, Indones. J. Sci. Technol., vol. 5, no. 2, Art. no. 2, Sep. 2020, doi: 10.17509/ijost.v5i2.24640.

[5] H. Wijoyo, Panduan Pembelajaran New Normal dan Transformasi Digital. 2020.

[6] H. Timperley, Teacher professional learning and development: best evidence synthesis iteration (BES). Wellington (New Zealand): Ministry of Education, 2007.

[7] A. Sutisna, ‘Pengembangan Model Pembelajaran Blended Learning pada Pendidikan Kesetaraan Program Paket C dalam Meningkatkan Kemandirian Belajar’, JTP - J. Teknol. Pendidik., vol. 18, no. 3, pp. 156–168, Dec. 2016, doi: 10.21009/JTP1803.2.

[8] S. Hrastinski, ‘What Do We Mean by Blended Learning?’, TechTrends, vol. 63, no. 5, pp. 564–569, Sep. 2019, doi: 10.1007/s11528-019-00375-5.

[9] M. J. Kintu, C. Zhu, and E. Kagambe, ‘Blended learning effectiveness: the relationship between student characteristics, design features and outcomes’, Int. J. Educ. Technol. High. Educ., vol. 14, no. 1, p. 7, Feb. 2017, doi: 10.1186/s41239-017-0043-4.

[10] Z. Arifin, M. Nurtanto, A. Priatna, N. Kholifah, and M. Fawaid, ‘Technology Andragogy Work Content Knowledge Model as a New Framework in Vocational Education: Revised Technology Pedagogy Content Knowledge Model’, TEM J., vol. 9, no. 2, pp. 786–791, May 2020, doi: 10.18421/TEM92-48.

[11] M. Nurtanto, Z. Arifin, H. Sofyan, W. Warju, and S. Nurhaji, ‘Development of Model for Professional Competency Assessment (PCA) in Vocational Education: Study of the Engine Tune-Up Injection System Assessment Scheme’, J. Tech. Educ. Train., vol. 12, no. 2, Art. no. 2,
[12] J. Wrenn and B. Wrenn, ‘Enhancing Learning by Integrating Theory and Practice’, *Int. J. Teach. Learn. High. Educ.*, vol. 21, no. 2, pp. 258–265, 2009.

[13] S. Billett, ‘Learning in the circumstances of work: the didactics of practice’, *Éducation Didact.*, vol. 5, no. 5.2, Art. no. 2, Sep. 2011, doi: 10.4000/educationdidactique.1251.

[14] A. K. Amin, ‘Kajian Konseptual Model Pembelajaran Blended Learning berbasis Web untuk Meningkatkan Hasil Belajar dan Motivasi Belajar’, vol. 4, no. 2, pp. 51–64, Jul. 2017, doi: 10.30734/jpe.v4i2.55.

[15] P. Pardede, ‘Blended Learning for ELT’, *JET J. Engl. Teach.*, vol. 2, no. 3, p. 165, Oct. 2012, doi: 10.33541/jet.v2i3.54.

[16] M. K. Foti and J. Mendez, ‘Mobile Learning: How Students Use Mobile Devices to Support Learning’, vol. 15, no. 3, p. 21, 2014.

[17] T. Mutlu, *Understanding Students’ and Teachers’ Approaches to Tablet Use in Turkish Secondary Schools*: 2016.

[18] Y.-T. Sung, K.-E. Chang, and T.-C. Liu, ‘The effects of integrating mobile devices with teaching and learning on students’ learning performance: A meta-analysis and research synthesis’, *Comput. Educ.*, vol. 94, pp. 252–275, Mar. 2016, doi: 10.1016/j.compedu.2015.11.008.

[19] S. Munadi, ‘Transformasi Teknologi Pada Pendidikan Kejuruan’, p. 18.

[20] M. Webster, ‘Research Methods’, *J. Bus.*, vol. 5, no. 3, p. 8, 2007.

[21] C. Hodges, S. Moore, B. Lockee, T. Trust, and A. Bond, ‘The Difference Between Emergency Remote Teaching and Online Learning’, p. 12, 2020.

[22] R. Rasmitadila *et al.*, ‘The Perceptions of Primary School Teachers of Online Learning during the COVID-19 Pandemic Period: A Case Study in Indonesia’, *J. Ethn. Cult. Stud.*, vol. 7, no. 2, p. 90, Jul. 2020, doi: 10.29333/ejecs/388.