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Online learning of mechanical engineering subject in the Covid-19 era: strategy, platform and media

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Abstract. The COVID-19 pandemic has resulted in the application of theoretical and practical sessions in Vocational High School being carried out online. The teacher has carried out learning by utilizing information technology in the midst of existing limitations and constraints. This study aims to determine the implementation of vocational education learning in the pandemic era. There were 3 aspects that were the main focus, namely learning strategies, platforms, and instructional media used during the pandemic, both in theoretical sessions and practical sessions. The research method used was quantitative, with a descriptive approach. The research object was 44 Educators of Mechanical Engineering in Vocational High School. The results obtained were: first, the learning strategy that was widely applied in theory learning was 68% independent assignment and in practical sessions was watching video tutorials 27%. Second, Google Classroom was the most widely used as the LMS platform, both in theory sessions at 64% and practical sessions at 27%. Third, material in document form was the instructional media most widely used by educators in implementing 77% theory learning and 57% practical sessions. This research is expected to provide an overview and recommendations for vocational high school educators, especially in the field of Mechanical Engineering in carrying out learning in the pandemic era.

1. Introduction

The COVID-19 pandemic led to the closure of schools in various parts of the world and learning to be carried out from home [1]. Various efforts were made, the OECD made a pocket book for learning in the COVID-19 era [2]. Europe implements blended learning, by implementing health protocols and reducing the number of students in the class [3]. In Indonesia, Director General of Vocational issued a regulation that learning for vocational education is carried out from home or by still implementing health protocols [4]. With these consequences, approximately 5 million Vocational Students will carry out learning from home [5]. To deal with this, online learning readiness needs to be done.

Online learning is an option in implementing learning during a pandemic [6]. In its implementation, there are various ways, either in full, blended learning or using web-based. Blended learning is learning by combining face to face and online [7]. One of the web-based learning by using multimedia in developing learning [8]. However, the application will be different, one of which is in Vocational High Schools.

Online learning for Mechanical Engineering of Vocational High School requires strategy, LMS platform, and media as the important aspects. Strategy is an important aspect of online learning because learning is not only how to convey material, but a strategy is needed to ensure the learning process is effective and efficient in delivering material [9]. The teaching and learning process will be effective and



successful if the teacher is able to create instructional media that is in accordance with the material [10]. In addition, the online learning process in the era of the COVID 19 pandemic must accommodate flexible, interactive, multimedia, and student-centered learning. The technology that supports this is 'Learning Management Systems' (LMS) [11] [12].

A case study on the implementation of online learning during a pandemic in mechanical Engineering of Vocational High School is very needed, especially in these three aspects. Vocational education is the education that aims to prepare students for the world of work [13]. Learning in vocational education consists of theoretical and practical sessions. There are various challenges in implementing vocational education learning during a pandemic. First, the access to the internet reach about 70% [14]. In addition, the ability of teachers to teach uses a variety of Technologies [15]. Therefore, this study will look at the extent to which online vocational education has been implemented in the COVID-19 era.

2. Method

This descriptive research was conducted with a descriptive approach. The research was conducted using a questionnaire with 44 respondents from Vocational High School teachers. This study took the setting of the COVID-19 pandemic because the learning system in Indonesia currently leads to online learning, even though the learning process like this is considered by several parties not yet ready to be applied in several places in Indonesia. The respondents distribution is summarized in table 1.

Table 1. Respondents Distribution

| No | Indicator | Frequency |
|----|--|-----------|
| 1 | Province | |
| | Yogyakarta Special Region | 10 |
| | Central Java | 19 |
| | East Java | 7 |
| | West Java | 4 |
| | South Sumatra | 2 |
| | North Sumatra | 1 |
| | South Borneo | 1 |
| 2 | Institution | |
| | Public School | 28 |
| | Private School | 16 |
| 3 | Subject | |
| | Mechanical Engineering Drawing | 2 |
| | Basic Mechanical Engineering Work | 5 |
| | Basic Mechanical Engineering Design | 2 |
| | Manufacturing Engineering Drawing | 10 |
| | Lathe Machining Techniques | 17 |
| | Milling Machining Techniques | 3 |
| | NC/CNC & CAM | 3 |
| | Creative Products and Entrepreneurship | 2 |
| 4 | Teaching Experience | |
| | 1-5 Year | 24 |
| | 6-10 Year | 5 |
| | 11-15 Year | 6 |
| | > 15 Year | 6 |

Data collection was done by distributing questionnaires via Google form which were sent to educators. instrument validation was carried out in consultation with experts (expert judgment). The

data obtained was then processed and categorized based on the topics studied. After that, the data were interpreted, dialogued and discussed using theories and previous studies relevant to the research topic. Conclusions and recommendations were based on research results.

3. Result & Discussion

Online learning for basic expertise (C2) and field expertise (C3) subjects in Mechanical Engineering of Vocational High School requires three important aspects in its implementation. The three aspects were the learning strategy, platforms, and instructional media used in learning both theoretical and practical sessions. The research finding is illustrated in figure 1.

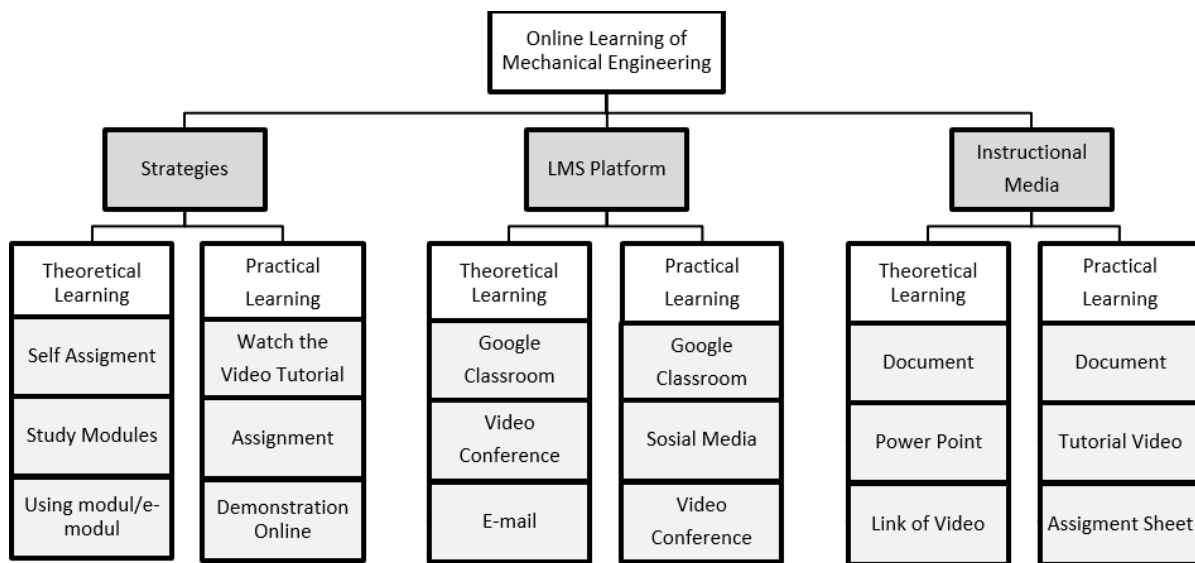


Figure 1. Research finding

3.1. Learning Strategies

One of the learning strategies that can be used in online learning was through video. Videos can be adapted for use, as well as motivating students [16]. The results of the study were in accordance with the survey conducted. In practical sessions, the video was most liked by the teacher, as much as 27%. Whereas in theory learning (online), the independent assignment strategy was the highest choice used by the teacher, as much as 68%. Learning strategies are summarized in table 2.

Table 2. Learning strategies

| Learning Strategies in Theoretical Sessions | | | |
|---|-----------------------|-----------|------------|
| No | Learning strategies | Frequency | Percentage |
| 1 | Module/E-module | 23 | 52% |
| 2 | Video conference | 6 | 14% |
| 3 | E-learning | 18 | 41% |
| 4 | Discussion | 9 | 20% |
| 5 | Presentation | 6 | 14% |
| 6 | Group Assessment | 8 | 18% |
| 7 | Individual Assessment | 30 | 68% |
| 8 | Learning Module | 23 | 52% |

| Learning Strategies in Practical Sessions | | | |
|---|-------------------------|-----------|------------|
| No | Learning strategies | Frequency | Percentage |
| 1 | Online Demonstration | 5 | 11% |
| 2 | Watch Video or Tutorial | 12 | 27% |
| 3 | Assessment | 11 | 25% |
| 4 | Using Module/E-Module | 5 | 11% |
| 5 | Face to Face (Online) | 1 | 2% |
| 6 | Discussion | 1 | 2% |

3.2. LMS Platform

Learning uses a platform to support learning. Some of them were Google Classroom, Google Meet, Social Media, and others. Social media creates a digital culture. It helps in the online learning process. Other platforms such as zoom can be used to discuss with students [17]. Based on a survey conducted on mechanical engineering teachers summarized in table 3, google classroom was the most widely used, namely 64% for theoretical learning and 27% for practical learning. Other categories got a percentage of 25%, in which there were lessons such as teacher-made websites, Jogja Learning, Google Forms. Platforms such as google meet or zoom were also widely used by teachers, as seen from the respondents who each filled 23% for theory and 7% for practical learning.

Table 3. Platforms Used

| Learning Platform | Theoretical Sessions | Percentage | Practical Sessions | Percentage |
|-------------------------------------|----------------------|------------|--------------------|------------|
| Google Classroom | 28 | 64% | 12 | 27% |
| Video Conference (Google Meet/Zoom) | 10 | 23% | 3 | 7% |
| Social Media | 5 | 11% | 7 | 16% |
| Email | 8 | 18% | 1 | 2% |
| WebEx | 1 | 2% | 0 | 0% |
| Webinar | 2 | 5% | 0 | 0% |
| Others | 11 | 25% | 2 | 5% |

3.3. Instructional Media

Supporting instructional media were documents, handouts, assignment sheets, PPT shows, learning videos, material links, video links, job sheets, voice ppt. The use of instructional media is expected to increase learning activeness in online learning [18]. Based on the survey that has been conducted and summarized in table 4, the use of documents was mostly used in both theoretical learning and practical sessions. The percentage of using documents as the instructional media in theoretical learning was 77% and in practical sessions was 57%. Other categories according to the number of percentage levels in the instructional media in theory, namely Power Point shows, video links, learning videos, assignment sheets, material links, and handouts. Whereas in the practical sessions, instructional media according to the percentage results, namely the use of learning videos, material links, assignment sheets, video links, Power Point shows, worksheets, Power Point with voice, and handout. The use of instructional media can be applied if the design has been neatly arranged in the form of a learning implementation plan [19].

Table 4. Instructional media

| No | Instructional Media | Theoretical Sessions | Percentage | Practical Sessions | Percentage |
|----|---------------------|----------------------|------------|--------------------|------------|
| 1 | Document | 34 | 77% | 25 | 57% |
| 2 | Hand Out | 12 | 27% | 14 | 32% |
| 3 | Assignment sheets | 20 | 45% | 19 | 43% |
| 4 | Power Point | 28 | 64% | 18 | 41% |
| 5 | Instructional video | 22 | 50% | 22 | 50% |
| 6 | Link of material | 17 | 39% | 19 | 43% |
| 7 | Link of video | 26 | 60% | 18 | 41% |
| 8 | Job sheet | | | 17 | 39% |
| 9 | PPT with speaker | | | 15 | 34% |

4. Conclusion

Vocational education online learning requires some adjustments, especially in the theoretical and practical sessions. The results of a survey that has been conducted on vocational education online learning were divided into 3 categories, namely strategy, platform and media. Learning strategies that were widely applied by educators during online learning were independent assignments with a percentage of 68% for theoretical sessions and watching tutorial videos of 27% for practical sessions. The most used platform was Google Classroom with a percentage of 64% in theoretical sessions and 27% in practical sessions. Material in document form was the most widely used as the instructional media at 77% for theoretical sessions and 57% for practical sessions.

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