Digital electronic practicum with logisim application using google meet

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Abstract. The focus of this research is to describe the effectiveness and response of students on the use of Digital Electronic Practicum with Logisim Application using Google Meet. The research subjects were 50 Physics Education Students of Lambung Mangkurat University taking the Digital Electronic course. The data of this study were collected by practicum assessment sheets and students’ response questionnaire. The results showed that the mean score of practicum results from digital electronic practicum with Logisim application using Google Meet was 70.58. Thus, the effectiveness of the implementation of the Digital Electronic Practicum with Logisim application using Google Meet is in a good category. Data from the students’ response questionnaire was 3.83 in average, so it was categorized as good. Thus, it is concluded that the Digital Electronic Practicum with Logisim application using Google Meet is effective to implement and obtains a very good response from the students.

1. Introduction
Digital electronics is a course that studies digital circuits and systems both at the basic stage and the application. The objective of this course is that students are able to understand and practice various digital logic circuits [1]. Students need a different mindset to enter into learning because it requires understanding and practice [2]. Electronics is about theory and practicum [3] likewise with this course which consists of theory and practicum.

The digital electronics practicum deals with how to design a digital circuit to analyze and create a truth table. Digital circuits require extra skills from the designer, resulting in abstractions from different designers. The abstraction must be poured in the form of a clear sequence in order to see whether the series is in accordance with what is intended. The circuit design can be described using the logisim application [4].

Logisim is a Free Open Source Software (FOSS), which runs on Windows, Macintosh and Linux operating systems. This Java powered device provides an interactive platform for designing electrical circuits and simulating digital logic circuits [5]. Logisim has been used by students in colleges around the world in a wide variety of classes, from units on logic in computer science surveys to courses in computer organization and architecture [6].

Lectures have now been directed to the online system due to the Covid-19 Pandemic outbreak. Learning innovation is needed along with increasingly sophisticated technological developments [7]. Therefore, both the delivery of material and practicum must be carried out online [2]. Online learning at work from home as a result of the spread of Covid-19 is effective in achieving learning goals [8].
Online learning is able to break down space boundaries in learning [1,9–13]. The Logisim application is the right solution to meet these online learning needs. Practicum students do not have to meet face to face with the lecturer and the practicum assistant. Communication between the lecturer, the practicum assistant, and the practicum students must be maintained simultaneously so that the material and experiments presented can be understood by the practicum students. Therefore, it requires a medium of communication that can help the course of practical digital electronics with Logisim. One of the communication media that can be used is Google Meet. Google Meet makes it easy for practicum students and practicum assistants to join video calls. The implementation is easy. What is needed is preparing what will be done and sharing the Google Meet link to attendees. The meeting is fully integrated with G Suite, so attendees can join meetings from an email invitation. All details of the activity will be available when needed, whether joining from a computer, cell phone or conference room.

The various advantages of Google Meet are expected to be able to support the online practicum. The practitioner is able to participate in observing what is demonstrated by the practicum assistant. The practitioner can also consult directly with the practicum assistant so that the practicum will run effectively and get a good response from students. Therefore, researchers conducted research that aims to describe the effectiveness and responses of students about digital electronics practicum with Logic applications using Google Meet.

2. Methods
This study uses a descriptive research method that aims to describe, analyze, and interpret the effectiveness and response of students to the implementation of digital electronics practicum with the Logisim application using Google Meet. The research subjects were 50 Physics Education Students of Lambung Mangkurat University taking Digital Electronics courses. Data collection techniques in this study were to use practicum assessment sheets and students’ response questionnaire. The practicum assessment sheet is used to describe the effectiveness of the implementation of the digital electronics practicum with the Logisim application using Google Meet. The effectiveness is seen from the final score of the practicum. The final grade will be categorized as very good, good, quite good, poor and not good based on the following Table 1.

| Interval of Score | Criteria     |
|-------------------|--------------|
| 80 < X \leq 100   | Very good    |
| 60 < X \leq 80    | Well         |
| 40 < X \leq 60    | quite Good   |
| 20 < X \leq 40    | poorly       |
| 0 < X \leq 20     | Not good     |

Table 2. Students’ Responses Criteria
| Interval of Score | Criteria     |
|-------------------|--------------|
| 4,2 < X \leq 5   | Very good    |
| 3,4 < X \leq 4,2 | Well         |
| 2,6 < X \leq 3,4 | quite Good   |
| 1,8 < X \leq 2,6 | poorly       |
| 1 < X \leq 1,8   | Not good     |

Students’ response questionnaire is used to analyze students’ responses to the implementation of the Digital Electronic practicum with the Google Meet Assisted Logical application. Students’ response indicators consist of (1) format, (2) quality, (3) clarity, and (4) interest [14]. Students’ response data was analyzed into average scores and will be presented with the help of tables and graphs. Students’ responses will be categorized into: very good, good, quite good, poorly and not good based on Table 2.
3. Result and Discussion

The digital electronic practicum with Logisim application assisted by Google Meet was carried out in six experiments. Figure 1 is an example of a display of the implementation of a digital electronic practicum with Google Meet assisted Logisim application. From the picture, it can be seen that there is an interaction between the practitioner and the assistant practitioner, including a share screen to ensure clarity of the practicum implementation.

![Figure 1](image_url)

**Figure 1. Implementation of the Digital Electronic Practicum with the Google Meet-assisted Logisim Application**

3.1. Effectiveness

Effectiveness is seen from the total score obtained by students in digital electronic practicum with the Logisim application assisted by Google Meet. The results of the accumulated calculations can be seen in Table 3.

| Indicator | Statement | Average of Score |
|-----------|-----------|------------------|
| Format    | The digital electronics practicum with the Logisim application uses Google Meet is in accordance with the objectives of the lecture. | 3.92 |

Based on Table 3 and Figure 1, the practicum students’ lowest score is 63.1 and the highest score is 75.20. The mean score is 70.58. Thus, the effectiveness of the implementation of digital electronic practicum with Logisim application using Google Meet is in a good category. Therefore, the implementation of digital electronic practicum with Logisim application using Google Meet is effectively used to help student communication run smoothly in completing digital electronic practicum. The results of previous research indicated that logistic can improve student learning outcomes in the cognitive domain [15].

3.2. Students’ response

Table 4 shows the students’ responses to the following indicators: (1) format, (2) quality, (3) clarity, and (4) interest.

| Indicator | Statement | Average of Score |
|-----------|-----------|------------------|
| Format    | The digital electronics practicum with the Logisim application uses Google Meet is in accordance with the objectives of the lecture. | 3.92 |
The total mean of the questionnaire was 3.83. This shows that the student response has a good category. Based on the responses to the questionnaire, there are students who think that the digital electronics practicum with the Logic application using Google Meet can help to get to know technology better. Digital electronic practicum using Google Meet can carry out practicum with fun, and it still feels like a common practicum even though it is online. Although sometimes there are constraints with the signal. Digital electronic practicum using Google Meet helps students understand digital electronic material.

Students also think that in this situation, according to him, the digital electronic practicum with the meet-assisted logistics application is very helpful. However, there must be more and less. The drawback is that it is difficult to reach stable network so that it becomes an obstacle when practicing online, and it is also more wasteful of quotas. The Google Meet application is also very helpful in the practicum process where the impressions and sounds produced are clearer but very wasteful of quotas. Besides that, Google Meet is also more secure. According to the students, practicum with Logisim application using Google Meet is also good to be applied during the Covid-19 pandemic because it can be easier to understand the practicum, but the drawback is that using the Google Meet application requires more internet costs.

Logisim is an educational medium for designing and simulating digital logic circuits. Logic interface is very simple, so it can facilitate students in learning the most basic concepts related to logic circuits [6]. Logisim has been used in many schools, colleges and universities to teach and learn a variety of subjects related to digital [5].

Logisim shows how to structure simple to complex digital logic circuits, including the small 16-bit processing unit and its control unit [16]. The main advantages of Logisim are: 1) Free; Logisim is open-source (GPL). 2) Logisim is supported by Java 5 or later; a special version was released for MacOS X and Windows. 3) The drawing interface is based on an intuitive toolbar. Color coded cables help simulate and debug circuits. 4) Cables are easy to stretch both horizontally and vertically, and automatically connect to components and to other cables making it very easy to draw circuits. 5) The finished series can be saved to a file, exported to a GIF file, or printed. 6) The circuit layout can be used

| Indicator   | Statement                                                                 | Average of Score |
|-------------|---------------------------------------------------------------------------|-------------------|
| Quality     | The systematic presentation and implementation of practicum is easy to understand. | 3.9               |
|             | The emphasis on cognitive and psychomotor skills is clear.               | 3.88              |
|             | Logisim application using Google Meet is easy to understand.             | 3.92              |
|             | Practicum is very interesting.                                           | 3.98              |
|             | The use of Google Meet supports digital electronics practicum with Logisim applications. | 3.9               |
| Clarity     | The material presented and practiced is easy to understand.             | 3.82              |
|             | Communication using Google Meet when the practicum runs smoothly.       | 3.62              |
| Interest    | Digital electronic practicum with Logisim application becomes easier when using Google Meet. | 3.76              |
|             | Digital electronic practicum with Logisim application becomes more interesting when using Google Meet. | 3.76              |
|             | The digital electronic practicum with the Logisim application becomes more fun when using Google Meet. | 3.74              |
|             | The digital electronic practicum with the Logisim application becomes more motivated when using Google Meet. | 3.76              |
|             | The digital electronic practicum with the Logisim application using Google Meet can help me get to know more about technology. | 3.94              |
| Total       |                                                                           | 3.83              |
as a "subcluster" of other circuits, allowing for hierarchical circuit design. 7) The circuit components include input and output, gates, multiplexers, arithmetic circuits, flip flops, and RAM memory. 8) The "combinational analysis" module provided allows for conversion between circuits, truth tables and Boolean expressions [6].

4. Conclusion
This study revealed the mean score of practicum results from digital electronic practicum with Logisim application using Google Meet is 70.58. Thus, the effectiveness of the implementation of digital electronic practicum with Logisim application using Google Meet is in a good category. Data from the student responses is 3.83, so it was categorized as good. Thus, it is concluded that the digital electronic practicum with Logisim application using Google Meet is effective to be implemented and gets a very good response from the students.

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