Interactive recitation methods as a solution to the students’ deepening physics material during the Covid-19 pandemic

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Abstract. The spread of Covid-19 in Indonesia has an impact on the implementation of learning at various levels of education, including higher education. During the Covid-19 pandemic, the implementation of learning is conducted by online learning. Students should be able to learn independently to understand learning material. This research purposes to describe the interactive recitation method as a solution for the students’ deepening of learning material during the Covid-19 pandemic. This research was conducted in odd semester 2019/2020 in the general physics course at Universitas Negeri Padang involving 141 students. Data were collected through survey, observation, interviews, and document analysis. The results showed that students’ understanding of the concept was still low for each lecture material. This can be seen from the mistakes of students’ answers to the questions given during lectures. Students have difficulty to memorize the physics concepts for a long term memory. So, an interactive recitation method needs to be developed as an solution to deepen lecture material. The interactive recitation method is loaded with various conceptual questions for each lecture material including feedback, and its makes easier for students to learn physics concepts independently during the Covid-19 pandemic.

1. Introduction

At the end of 2019, the Corona virus (Covid-19) was first discovered in Wuhan, China. It didn’t take long time for this virus to spread in various parts of the world, including Indonesia. World Health Organization announced this as a pandemic [1]. For the first time, the Indonesian Government announced that there were 2 positive confirmed cases at the beginning of March 2020. This continued to increase until 113,000 positive cases in Indonesia within 5 months [2][6]. The spread of this virus has caused a variouse damage in Indonesia. Not only related to the public health, the spread of Covid-19 also has impact to the social, education, and economic sectors [3][4][6].

The Indonesian government continue to make a serious efforts to break th echain of spreading Covid-19. Various policies have been set, such as Large-scale social restrictions, social distancing, physical distancing, work from home, learning from home, and other policies [5]. In the education sector, the policy of learning from home refers to information letter Number 3 of 2020 by the Indonesian Minister of Education and Culture about the prevention of Covid-19 in education unit [6]. The letter clearly states that during the Covid-19 pandemic, learning that was originally face-to-face was transformed into distance learning or online learning [5][6]. This online learning is considered to be one of the solutions that can be break the chain of the spread of Covid-19 and applies to all levels of education in Indonesia, including universities.
Universitas Negeri Padang (UNP) is one of the institutions affected by the spread of Covid-19. UNP follows the instructions of the Indonesia Minister of Education and Culture to implement online learning for the rest of the 2019/2020 even semester, which is for 3 months. The implementation of online learning has controversy in society. For lecturers, online learning is effectively used for student assignments [7]. For students, the implementation of online learning is difficult to understand the lecture material. Moreover, sudden instruction that must change face-to-face lectures into non-face-to-face learning without any preparation. From a student perspective, most of them have not economic and technological abilities in taking online learning [7]. For example, most of the problem, they can’t access the internet network in their hometown, besides that, there are also limited devices that are less supportive, insufficient internet quota, all of that becomes an obstacle in participating in online learning. However, learning must still be continued. Several institutions also provide internet quota support for students and lecturers for the implementation of online learning [8], including at Universitas Negeri Padang.

Various studies on online learning have been carried out. Several research results related to online learning show that online learning can increase knowledge, provide new experiences, and increase student creativity compared to face-to-face learning [5][9][10]. Other studies have also found that online learning is also able to increase student academic achievement compared to offline learning [11]. Online learning is effective in increasing student interest in learning and reading [5][12]. In order to the advantages of online learning, there are also weaknesses, such as limited learning interactions, lack of in-depth understanding of learning materials, and learning environment that cannot be felt compared to face-to-face learning [12].

In fact, before online learning was implemented, students still had difficulty to get a good achievements. One of them is in the general physics course taken by physics students. This course is for first-year students and often be a frightening course for new students. As the result, at the end of the semester, students get unsatisfy grades. This unsatisfy achievement is not only caused by student difficulties in understanding the concepts of physics during the lecturing. But the difficulties experienced are because students do not have knowledge that is stored for a long-term memory. So, when they faced with a physics problems, students often use the wrong knowledge. This long-term memory has a very important role in storing information, including the concept of physics [13].

Various learning methods have been carried out during general physics lectures, including lectures, discussions, questions and answers, practice questions, and experiments. All these things are done to achieve the maximum possible learning goals. During lectures, the lecturer does not only focus on student’s understanding concepts but how these concepts can also be reused when students face physics problems. Based on research, students often fail to solve problems due to incorrect knowledge. Students usually use other knowledge that is doesn’t appropriate to solve problems, even though that knowledge is not in accordance with the context [14]. It’s means that face-to-face learning has not been able to produce a good understanding of student concepts, how if it is done by online. Where there is a lack of interaction between lecturers and students, so it might lead to misconceptions during online learning. In addition, online learning is only done by giving assignments without any feedback or interaction with students [7].

Learning needs to be designed taking at several aspects, including aspects of student ability, time, and costs. General physics course material includes a lot of physics material from simple to complex. For this reason, it takes more time to transfer the concepts, while face-to-face lectures have limited time. Therefore, we need an alternative method that can be used by students outside lecture hours that can help students to understand the concept.

One of the method that can be used is the method of assignment (recitation). This recitation method is a method of giving assignments so that students can learn independently [15]. However, for effectiveness, this recitation method is designed practically using a computer. So that this interactive recitation method can be accessed offline. The recitation given to students is in the form of conceptual questions and based on higher order thinking accompanied by direct feedback [16]. Giving feedback is intended so that students get a correct understanding and know their weaknesses when solving
problems [17]. Based on the explanation above, it is necessary to develop an interactive recitation method that can be used as a solution to deepening physics material for students during the Covid-19 pandemic.

2. Research Method

This research is a descriptive study with a survey method. The research was conducted in the odd semester of 2019/2020 in a general physics course at Universitas Negeri Padang. A total of 141 physics students contributed to this research. Data collection was carried out by distributing questionnaires, observations, interviews, and document analysis related to the implementation of general physics courses.

The questionnaire purpose to analyze the student’s needs in general physics courses, such as lecture assignments, the level of understanding of the material, and what kind of student characteristics are expected during lectures. This analysis is useful for the process of selecting and designing interactive recitation which will be developed so that the results are in accordance with student characteristics. The questionnaire uses the Guttman rating scale. The Guttman scale is used to get the right answer according to the problem [18].

In observation activities, researchers observe the learning process during one semester. Observation data are in the form of notes describing the implementation of lectures. Furthermore, interviews are carried out formally and informally with students and lecturers who are teaching the same subjects. Interview questions related to the implementation of the learning methods applied during lectures. In addition, it is also to explore the difficulties experienced by students while attending lectures. Next, the document analysis is meant to analyze student learning outcomes during lectures. This includes test results, assignments, student activeness during lectures.

All data were analyzed quantitatively and qualitatively. Student needs analysis data were analyzed quantitatively using descriptive statistics. Data observation, interviews, and document analysis were analyzed qualitatively, by collecting data, reducing data, and conclusions.

3. Results and Discussion

The results of the study were obtained from a questionnaire analysis for general physics lectures in the odd semester 2019/2020. The results of the student’s needs analysis consist of teaching materials used during lectures, the assignments given, the level of student understanding the course material, lecture implementation, and student characteristics.

General physics courses have a weight of 4 Semester Credit System. General physics lectures are conducted twice a week with a weight of 3 credits each. Three credits per meeting are differentiated to explain theories or concepts and 1 credit to carry out experiment activities related to the theory. At the beginning of the semester, the lecturer provides a variety of teaching materials that students can use during lectures. The teaching materials include text books, jobsheets, experiment modules, and presentation slides.

Each lecture meeting, students are given structured assignments related to the material that has been studied. The results of the lecture assignment analysis can be seen in Figure 1.
Based on the picture, it can be seen that as many as 86.5% of students are motivated to complete the given assignment. The assignments given also help students to understand physics concepts (91.5%) and practice higher order thinking skills (95%). However, the weakness is, as many as 67.4% of the assignments given were reviewed by the lecturer, while the remaining 32.6% did not have time to be reviewed due to limited lecture time. This is also suggested by the results of the study that the limited time for lectures makes lecturers have to be able to develop learning methods as an alternative solution [14].

General physics course material consists of 10 physics topics spread over 15 meetings and added 2 meetings to carry out the midterm and final semester exams. The distribution of general physics subject topics per meeting is presented in Table 1.

| Meeting | Lecture Materials                                     |
|---------|-------------------------------------------------------|
| 1       | Quantities and units                                  |
| 2-3     | Kinematics of particle                                |
| 4       | Dynamics of particle                                  |
| 5       | Work and energy                                       |
| 6       | Linear momentum                                       |
| 7-8     | Angular momentum and rigid body equilibrium           |
| 9-10    | Fluid                                                 |
| 11-12   | Heat and Temperature                                  |
| 13-14   | The 1st law of thermodynamics                         |
| 15      | The 2nd law of thermodynamics                         |

Based on the results of interviews with students, as many as 75% of students still have difficulty understanding the topics of angular momentum and rigid body equilibrium, and the easiest materials are quantities and units. Only 0.7% thought the material was difficult. Angular momentum and equilibrium are considered difficult because they are a combination of translational motion and rotational motion. For this material, there has also been no practicum due to limited tools. In addition, it is difficult to describe this material contextually and can only present pictures to demonstrate it [19].

The results of the analysis of the level of student understanding of the lecture material are presented in Figure 2.
Figure 2. Analysis of the level of understanding the material

Based on Figure 2 above, it shows that the level of understanding of students is still around 61% and as many as 35.5% think the material being taught is still abstract. This is the cause of the students' low ability to solve physics problems. The concepts that students already have have not been well embedded so that students find it difficult to re-call existing knowledge because knowledge is not stored for a long-term memory[13]. The results of interviews with students also explained that the difficulties experienced were not only not knowing the concept, but also not knowing which equation use to solve the problem. The large number of physics quantity notations in the problem also makes students confused about which one is the right one. The low understanding of students' concepts is the cause of the low academic achievement at the end of the semester. To solve material problems that are still abstract, it is necessary to present contextual problems in lecture teaching materials [20].

Furthermore, an analysis of student characteristics is carried out to see the obstacles and potentials that students have in taking general physics courses. The results of the analysis of student characteristics are shown in Figure 3.

Figure 3. Analysis of student characteristics

Based on the picture, it can be seen that as many as 88.7% of students have difficulty remembering physics equations. Its caused student to solving problems [21] [22]. Only 22.7% can answer physics
problems quickly and correctly. This shows a lack of confidence in students' ability to solve problems. Not believing in one's own abilities will also affect one's thinking ability [23]. This also has an impact on students feeling anxious when facing exams. It appears that 92.9% experience anxiety when facing exams.

The results of lecture implementation observations also show that students actively ask questions if they do not understand the topic. This has an impact on a communicative lecture atmosphere so that as many as 85.8% of students are enthusiastic about attending lectures. But, the independence of students to repeat material outside lecture hours, it is still not optimal. As many as 38.3% of students only heard material explanations from the lecturers and studied only during exams (41.1%). This has an impact on self-efficacy to re-explain the material that has been learned to others (64.5%).

During the Covid-19 pandemic, students were forced to study from home for the new semester of the school year. This has made Universitas Negeri Padang policy to instruct all lecturers to make lecture teaching materials that can be accessed online. One alternative solution that can be used during this pandemic is the implementation of the assignment method (recitation). This recitation is packaged practically with computer and it easier for users [14]. Interactive recitation contains various conceptual questions that are complemented by feedback on each question answer choice, either the correct answer or the wrong answer choice. Giving feedback is intended to provide reinforcement to students [15]. So this makes it easier for students to understand the concept well and find out their weaknesses when solving physics problems [15]. An interactive recitation design is presented in Figure 4.

![Interactive recitation design](image)

**Figure 4.** Interactive recitation design

4. Conclusion
Based on the results of the research and discussion described above, several conclusions were obtained including: 1) the assignment given has been able to help students understand the concept but has not been able to fully review it during lecture hours, 2) students still have difficulty understanding physics concepts and still have fragmented knowledge so that it is difficult to solve physics problems and lead to achievement low academic, 3) most students still have a low level of confidence in their ability to solve physics problems.

Based on the conclusions, it is necessary to develop an interactive recitation method which is useful for facilitating the deepening of student physics material independently during the Covid-19 pandemic. So, students can mastery the concepts of physics and increase their confidence in their ability to solve problems from the feedback given.

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