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Development of a Recitation Program with Feedback and Reinforcement Questions to Improving Students' Concept

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Abstract
This study aims to develop and determine the feasibility of learning media consisting of a recitation program with feedback and reinforcement questions to improve students' mastery of concepts. The research design used ADDIE which consisted of 5 research stages, namely: 1) Analysis, 2) Design, 3) Development, and 4) Implementation. Based on data analysis, the media validity average value was 3.7. Thus, it can be concluded that the recitation program with feedback and reinforcement questions has a very valid (worthy) category. Based on the results of this research, the development of a recitation program with feedback and reinforcement questions can be used in learning to improving students' Physics concept.

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1. Introduction

One of the main goals of physics learning activities is to get a good mastery of concepts from students [1]. The ability of students that can be used to solve the problems they face is also known as mastery of concepts. With good mastery of the concepts possessed by a student, it will be able to increase the chances of the student being able to solve the daily problems he faces [2], [3]. In the end, by practicing solving problems meaningfully, students' mastery of concepts increases [4]. Effective problem-solving means that the student solves the problems he faces using the concepts that have been obtained entirely so that the student can achieve the main goals in physics learning activities [5].

Research conducted by Rahmawati [6] explained that "the most common form of deficiency experienced by students in studying the concepts of momentum and impulse is the lack of ability of students. The ability to translate and the vague concepts obtained by these students affects the process of solving daily problems, resulting in a lack of motivation to explore physics, especially momentum and impulses". In this translation error, the student mistranslated the physics symbols and the meaning of the problem. In contrast, the conceptual error was the student's fault for not understanding the concepts and materials of momentum and impulse. There are other facts derived from research conducted by [7]. The study explained that the error that arises in studying the concepts of momentum and impulse is the lack of concepts possessed by the student.

The concepts owned by the student must be coherent, solid, and intact so that mastery of the complete concept can be used in solving everyday problems. They were related to the concepts of momentum, impulse, the law of conservation of momentum, and collisions. Furthermore, most students need help solving the problems at hand. These students need to become more familiar with giving questions that have various variations (multi-representation), resulting in many errors in determining strategies to solve these problems and misrepresenting a problem [8].

In the learning process, students are not only required to understand the concept as a whole but also be able to apply it in solving physics problems [9]. Multiple representations are required to build mastery of concepts [10], [11] and build mastery of situations in depth [4], [12]. Multi-representation not only helps students learn concepts but can also make them good problem solvers [13], [14]. Multi-representation can also help knowledge formation and problem-solving [15]–[19]. The study's results [20] show that in completing the test, students' abilities are better when students learn through giving more representation formats than through giving fewer representation formats [21]. With multiple representations, it will be easier for students to master concepts that still need to be completed and improve existing but less comprehensive concepts [22].

Recitation is a deepening done after lectures. According to [23], a recitation is a learning approach in which the teacher provides a little information, asks questions, gets student responses, and then provides feedback by praising or correcting students' mastery of certain concepts. The results of research that have been carried out [8] show that students' mastery of concepts has increased by using the recitation method. The results of this study are supported by research results [24], [25], which show that the use of recitation in introductory physics lectures through tutorials outside of lecture hours can improve students' mastery of concepts.

Mastery of student concepts in the form of multiple representations is also essential to solve problems in physics learning [26]. It was further explained that research evidence also showed that using multiple representations could affect the increase in students' knowledge and mastery of concepts. The advantage students can get by using various representations is that they can develop a broader, more profound, and more flexible mastery of concepts than if students only use one representation [27].

Research by providing learning assistance in the form of multi-context-based and multi-representation-based conceptual questions formed in computer programs still needs to be widely used. For example, research that discusses the use of recitation programs [5], [24] seeks to help students learn in-depth but needs to be more focused on momentum and impulse. The use of the recitation program in this study is a development of the recitation program that has been carried out previously. The addition of features such as the use of two types of questions, where the first question is helpful as a test of a student's mastery of concepts, then the second is useful as a question of strengthening the concepts obtained from the first question. In addition, this recitation program has improved from the previous one, making it lighter, more efficient, and easier to use so that students understand its use.

The advantage of using a multi-representation and multi-context-based recitation program is that students also have to learn how to interpret these representations and relate them to the problems they face daily [28]–[30]. In addition, students must be trained to make choices among several presented representations. Based on research conducted by Diyana [24] stated that the conceptual problem training program and its feedback were generally able to improve students' mastery of concepts. However, the success of the recitation program in strengthening mastery of specific concepts also depends on the number of questions, the format of problem representation, and the diversity of contexts presented in the recitation program itself.

Through this research, the recitation program was designed by considering the findings about the strengths and weaknesses of the recitation program developed previously. The designed recitation program contains conceptual practice questions and their feedback. The questions are created in the form of multiple choice, with the answer options determined based on the most significant possible conception built by the student in solving the problem. Feedback will be given according to the answer options and possible concepts in choosing the answer options. Feedback is also offered as soon as possible after students choose an answer option so that students understand their mistakes and correct their conceptual errors.

2. Methods

Research and development are carried out using the ADDIE development model, but only at the implementation stage. The stages of the research carried out are (1) Analysis, conducting needs analysis and performance analysis, (2) Design, designing components needed for product manufacturing purposes, (3) Development, realizing product manufacture and improving the product after going through the product validation stage by the validator, (4) Implementation, conducting limited trials in the form of product readability trials.

This study's data type uses two types, namely research with quantitative and qualitative data. First, the results of quantitative data are obtained through an assessment from an assessment questionnaire using a scale with numbers 1-4 in the column provided for the validator. The other quantitative data is obtained through empirical tests and trials of pretest and post-test questions. This quantitative data shows that the student's mastery of concepts increases and their difficulties when working on the test questions after using the recitation program. Furthermore, the qualitative data in this study were obtained through comments and constructive suggestions expressed by the validator, consisting of two Physics lecturers. The subject of the readability test consisted of 35 students who were teaching introductory physics courses.

Data collection techniques through the distribution of media validation questionnaire instruments and readability test questionnaires. In this study, the types of quantitative and qualitative data were obtained. The type of quantitative data in the form of media assessments received from the results of the validation questionnaire was analyzed using the calculation of the average value.

3. Results and Discussion

This development resulted in a product in the form of a feedback recitation program and reinforcement questions to improve students' mastery of concepts. The resulting product is a file with a .ppsx format and can be used via smartphones or laptops with the latest operating system. Students can use this recitation program directly without going through the installation process because this recitation program is based on PowerPoint. This recitation program has adapted and updated the shortcomings of the recitation program that had been previously made [8]. This recitation program has a video discussion for each number in the practice questions. The discussion video here does not become one with the recitation, so the use of the recitation program becomes lighter and more efficient.

A concept mastery test question trial has been conducted on 120 students to determine each item's level of difficulty, discrepancy, reliability, and validity. Item analysis is based on test scores, as in Nieminen's research [31]. The test instrument used was initially ten multiple choice questions. The average value of the item difficulty level is 0.40 (medium), and the average item difference power of 0.30 (good enough) is presented in table 1.2.

Based on the results of media validation by the validator, the average value of eligibility is obtained, as shown in Table 1. Meanwhile, the results of media testing by students through a recitation program response questionnaire can be seen in Table 1.4.

Table 1. Result of Analysis of Question Instruments

No. Question	Different Power	Difficulty Level	R (Pearson Correlation)	*p*
1	0,41	0,56	0,365**	0,000
2	0,09	0,30	0,271**	0,001
3	**-0,06**	**0,30**	**0,127**	**0,116**
4	0,31	0,40	0,436**	0,000
5	0,38	0,62	0,457**	0,000
6	0,28	0,37	0,325**	0,000
7	0,13	0,08	0,560**	0,000
8	0,15	0,07	0,621**	0,000
9	0,37	0,37	0,351**	0,000
10	0,25	0,24	0,442**	0,000
Average	0,30	0,40	0,406	-

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 2. Media Validation Results

No.	Observed aspects	Validation average	Criteria
1.	Content	3.69	valid
2.	Construct	3,71	valid
	Average	**3,70**	**valid**

Table 3. Student's Response Questionnaire of the Recitation Program

No.	Observed aspects	Percentage (%)			
		SS	S	TS	STS
1.	The recitation program can make it easier for me to understand the concepts of momentum and impulse.	55	45	-	-
2.	This recitation program can help me in strengthening my understanding of the concepts of momentum and impulse.	40	60	-	-
3.	This recitation program provides feedback that can help me understand the misconceptions.	55	45	-	-
4.	This recitation program helped me in correcting the misconceptions I had.	63	37	-	-
5.	This recitation program did not make it easier for me to understand the concepts of momentum and impulse.	-	-	17	83
6.	I feel bored while using the program.	-	-	42	58
7.	I am more enthusiastic and enthusiastic about learning physics when using this recitation program.	55	45	-	-
8.	This recitation program is easy to use and operate.	67	33	-	-
9.	I'm not interested in this recitation program.	-	-	13	87
10.	The questions in this program are too difficult for me.	-	17	83	-

Notes: SS = Strongly agree; S = Agree; TS = Donisagree; STS = Strongly Disagree

The validity test uses the Pearson Correlation test, and the reliability test uses Cronbach's Alfa with SPSS 24.0 for Windows. The validity test results showed that the 15 questions for mastery of concepts had a p-value of < 0.05, which means that the questions used were valid. Meanwhile, there is 1 question (question number 3) with a p-value > 0.05, so the question is invalid and is not used. Furthermore, the average value of the biserial point correlation is 0.406, and the reliability test results show that Cronbach's Alfa coefficient of 0.697 is included in the high criteria. Thus the question instrument is feasible to measure students' conceptual mastery abilities. The summary of the results of the instrument analysis is presented in Table 1. Based on the analysis question instrument results, one item of the question was deleted, and 15 articles were retained. The omitted item is question number 3, considering that it has a different power value in the bad category, the difficulty level in the difficult category, and a Pearson correlation test significance value above 0.05.

Based on the results of media validation in Table 2, the average value of media validity is 3.70, which is included in the very valid category. Therefore, this recitation program's content and construct aspects are very valid because they are the criteria for making a good recitation program. The recitation program created here is an aid learning media that students can use outside learning hours. The recitation program prioritizes the content of the recitation program itself (practice questions and feedback). This recitation program provides two types of practice questions, namely the first is to test the extent of mastery of the student's concepts. In contrast, the second question reinforces the first question, which will build the concepts obtained by students to be even more perfect.

Referring to the data in Table 3, the response questionnaire for using the recitation program on the topic of momentum and impulse shows (1) 55% of students strongly agree and 45% of other students agree that the recitation program makes it easier to understand the concept of momentum and impulse, (2) 40% of students strongly agree and Another 60% of students agree that the recitation program can strengthen their mastery of the concept of momentum and impulse, (3) 55% of students strongly agree and 45% of other students agree that the feedback given can show misconceptions experienced by them, (4) 63% of students are very agree and 37% of other students agree that the discussion provided improves mastery of the concept of momentum and impulse, (5) 17% of students disagree and 83% of other students strongly disagree that the recitation program cannot help master the concepts of momentum and impulse, (6) 42 % of students disagree, and 58% of students strongly disagree that the recitation program can cause boredom during use , (7) 55% of students strongly agree, 45% of students agree that they can be more enthusiastic in learning physics by using the recitation program, (8) 67% of students strongly agree, 33% of students agree that the recitation program is easy to use, (9) 13% of students disagree, and 87% of students strongly disagree that they are not interested in the recitation program, and (10) 17% of students agree, 83% of students disagree that the questions presented in the recitation program are difficult.

In general, the allocation of time for giving a recitation program to deepen the concept of momentum and impulse is two weeks with two weekly meetings. In addition, the deepening of material with this recitation program is continued independently by students outside lecture hours. In the recitation of momentum and impulse topics, each meeting held by students was asked to work on conceptual problems without feedback.

Students are given one week to explore the topic of momentum and impulse through a recitation program containing conceptual practice questions and feedback. The activity was carried out for two weeks with the provision of a recitation package containing 8 and 10 practice questions, respectively.

At the first meeting, students were introduced to the recitation program that would be used; there were several opening questions on the introduction recitation without feedback that students had to do to find out the extent to which students mastered the concepts of momentum and impulse. In the introduction stage of the recitation program, students are asked to record the choice of answer options in working on the questions in the recitation program. After that, students are given a recitation program containing conceptual practice questions that they are working on, complete with feedback and discussion. After one week, to deepen the discussion of momentum and impulse, students were asked to submit a logbook to see when they used the recitation program, what difficulties they encountered, and which questions helped them understand. Although from the notes in the logbook, only a few students felt a little confused with the explanation given, they found it easier to understand the discussion of questions only in written form. However, all students thought they had no difficulty or failure when operating the recitation. At the second and third meetings, which were conducted in the same way, students encountered no obstacles both in understanding the program content and operating the recitation program. On the contrary, during the recitation program, students felt facilitated by the feedback provided by the recitation program. Still, some students complained that the video discussion was only on one question, namely the first question, while the second question was only in sentence form. The two questions are the same but only in different contexts that the displayed questions ask.

The recitation program is divided into two, namely packages 1 and 2, containing eight questions and ten questions to be used in learning at the second and third meetings, then packages 3 and 4, including eight questions and ten questions in each package by students individually. Independently in their respective homes, this aims to make researchers more aware of the efficiency of the recitation program when accessed anywhere; furthermore, with the use of the recitation program. Students can maximize their independent study hours, different when in learning that takes place on campus. Students can ask some questions along with the feedback they get without entirely using the recitation program. Each initial answer option chosen by the student is recorded on the sheet provided. In addition to recording answers, students are asked to assess the feedback and discussion. Students assess whether the feedback displayed on the questions is by their thoughts when answering them. For the discussion, students are asked to assess whether or not the discussion can help their understanding.

4. Conclusion

Based on the analysis results, it can be stated that it is valid (feasible); overall, the media obtains an average value of 3.7 and is included in the very valid category so that it can be used as a supporter of students in independent learning. However, even though the recitation program is valid, some students still need help doing the test questions with a decrease in correct answer choices at the end of the test (posttest). Response questionnaires and interviews were also conducted after the recitation, resulting in a positive response that students felt was helpful in understanding momentum and impulse. The recitation program gave feedback and reinforcement questions based on multi-representation and multi-context. Suggestions for other researchers who want to research further should provide questions with various representation formats and contexts of various questions so that students' knowledge is more in-depth in a broad context. In addition, if the discussion is delivered in the form of a video, it should be quick to explain a solution to solving problems so that students can understand the concepts presented.

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