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Developing based discovery learning physics practicum guidebook for simple harmonic motion with character value

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Abstract
This study aims to develop and produce a product in the form of a based discovery learning practicum guidebook that can be used as practicum media. This research is categorized as development research. The research sample is students of second grade of 7th Manado senior high school. The number of examined students was 39 students of the experimental class. This research has developed guideline for discovery learning models that will help students learn to understand teaching subjects and working at lab in fascinating way. It using the learning devices development of 4D according to Thiagarajan, Semmel and Semmel. The development of this model has four stages which is defining, designing, developing and disseminating. Researcher only reaches the development stage. The results of the study concluded that the practical guidebook consisted of three parts, namely the front section consisting of the front cover, introduction, table of contents, student identity, and laboratory rules, then the contents sections contained the title, introduction, purpose, tools and materials, observation activities, applications and reference / library. The experimental steps have six stages according to discovery learning model. Character values are contained in the experimental steps and typed in bold. The manual is classified as valid criteria according to expert validation reaching a score of 93.75%. It is reliable for using in learning according to student responses through small-scale trials achieve a score percentage of 90.50%. Physics practicum guidebook based on discovery learning for simple harmonic motion material developed effectively for student learning outcomes are increase, students are more active and the noble character of students is more visible.

Keywords: developing practicum guidebook, discovery learning model, character education, simple harmonys motion

Introduction

Physics Learning requires an approach by real activities in everyday life. Physics studies the cause and effect of a phenomenon that runs on a scientific study process. The problem found in its implementation when students are immediately given theory, principle, or law without any experience to find it. The allocation of narrow learning time does not allow the creation of a learning atmosphere with a scientific approach. As a result learning often appears with teacher-centered methods. Students do not feel motivated to be active in classroom learning. Class activities only refer to skills training to solve questions. Students is found lack or even do not understand the difficult subjects that is given by the teacher (Munir, 2010) [1]. But the teacher is not only an educator, but also as a teacher, mentor, coach, communicator, administrative worker and manifestation of loyalty to the institution (Ahmadi, 2011) [2]. The results of observations in Manado 7 High School showed that most students in the class tended to be passive so that the learning experience was limited.

The learning process rarely perform in laboratory even though laboratory facilities are available. The implementation of practicum activities requires a practicum guidebook. In implementing learning in Manado 7 Public High School, practicum guidebooks are usually found in textbooks. The teacher multiplies it with a rough look, when it will be used in learning. The table has not enough space to write down the observed data. Practicum guidebook from the government is only for certain subjects as a complement to the lab tools given to the school. This guidebook does not have a basic theory for students to learn before starting practicum. But none of these manuals have the stages in scientific learning. The practicum guidebook should be able to assemble the stages of each predetermined learning model into a easy sequence to understand to execute. Starting from the step of observation to communicating and creating, collaboration between students is highly preferred (Kosasih, 2014) [6]. Discovery learning model gives students the role to make discoveries. This model can be performed in a laboratory by positioning students as scientists who conduct an experiment in an effort to find relationships between natural phenomena that have been engineered first by the teacher. In its implementation, there needs directions or instructions for students to run the trial efficiently.

Presidential Regulation Number 87 of 2017 about strengthening on character education defining the strengthening of character education is the education movement under the responsibility of educational units to strengthen the character of students. This kind of learning was not found in the learning of Physics in the laboratory because the practicum guidebook does not have clues that can direct the character of students to be more noble. The focus of learning is the achievement of specific observation goals and the fulfillment of basic general competencies in developing character values is neglected. Character values such as critical thinking, responsibility, cooperation,

listening to other people's opinions, and respecting the opinions of others are rarely practiced. Laboratory space should be a workshop for occupying students' attitudes both in self-development, their relationship with God (spiritual), even their relationships with others (social) and the natural environment.

Based on the background above, a research will be conducted with the title "Developing Based Discovery Learning Physics Practicum Guide for Simple Harmonic Motion with Character Value" with a hope that practicum can improve learning outcomes, active skills and instill good character in students. This research aims to develop and produce a product in the form of a Physics based Discovery Learning practicum guidebook in the character of simple harmonic motion learning which can be used as a practicum media.

Research methods

This study uses "research and development" (R & D) method following the research stages of 4D development model according to Thiagarajan, Semmel Semmel (Sutopo, 2009; Puslitjaknov, 2008; Trianto, 2008; Prasetyo, 2012) [7]. This research was conducted in August 2017, taking place in Manado 7 Senior High School, Wanea sub-district, Manado City. The target population is all students of Manado 7 High School and the affordable population are all XI MIPA 4 classes in SMA 7 Manado. Criteria for sample (inclusion): 1) active status of SMA Negeri 7 Manado students; 2) age 15-18 years; 3) have a healthy body and do not have physical abnormalities. The reasearch subjects were Physics practicum guidebooks, Physics teachers and students. Practicum guidebook only consists of subjects due to the limited time of the study. The object of the research is the validity, reability, and effectiveness of the Physics practicum guidebook.

Data was obtained on the practicum guidebook development of Physics based discovery learning model with characters by the following data collection tools (instruments).

1. Interview method, Interviews used in this data collection are guided interviews. Guided interviews are interviews conducted by the subject of evaluation by asking questions that have been prepared in advance (Suharsimi, 2007) [9]. This interview method is used to analyze the media needs used in learning
2. The questionnaire method is used for the reability test and the validity test of the practicum guidebook, expert and student responses. The type of questionnaire for the reability test and the validity test of the practicum guidebook is a checklist that is a series of statements (which are usually short) where the respondent just needs to put a checklist (√) in the place provided (Suharsimi, 2007) [9].
3. Observation method is used to observe the character of students during learning. Observations are carried out using observation sheets that contain observational instruments and refer to the prepared observation rubric.
4. Test method: The tests given are in the form of pretest and posttest which will later measure the comparison of students' mastery of concepts before and after using the developed practicum guidebook product.

Analysis techniques used are as follows: (a) Descriptive analysis (qualitative); (b) Average difference test (comparison).

Descriptive analysis to describe the response of students and reviewers to the reference to practicum observed. In addition, it is also describe the science process skills and character changes directed by students after using the developed practicum form. The mean difference test is held to test the research hypothesis. The data analyzed are as follows.

The validity of the practicum guidebook is processed from the assessment questionnaire and expert validation which consists of 2 aspects, which is material and language aspects and physical aspects or presentation. The data obtained were analyzed by comparing the number of answers from respondents with the ideal number multiplied by 100%.

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

(Arikunto, 2006) [5]

The feasibility of the practicum guidebook is determined through students' responses to the initial (small scale) trial. This test was carried out on the 10th grade XI student of SMA 7 Manado. This class is not used for the control class or the experimental class. The effectiveness of the practicum guidebook is determined by 3 aspects, namely the enhancement of students' mastery of concepts between the control class and the experimental class which is measured using a test instrument, achieving student activeness obtained from observation, and appereances of student character obtained from observation.

a) Student concepts mastery enhancement

Assessment on this aspect can be seen from the learning outcomes in pretest and posttest. The success that you want to see is how much the mastery of the concept of students increases between the control class and the experimental class which is measured using a test instrument against the material. These values are processed and analyzed by the gain-test formula.

$$g = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

(suharsimi, 2007) [9]

With:

g = normalized gain from

Spost = final test score

Spre = initial test score

Smaks = maximum score from the initial test and the final test

Test items that have low and very low validity will be revised and the test items are said to be valid if they have sufficient validity, high or very high. he test instrument is said to be reliable if it has sufficient reliability, high, or very high.

b. Achievement of student activeness scores

Assessment of student activity is seen from data or activity records during learning which is held through observation using instruments that have been prepared. Observation data were analyzed using a descriptive percentage system by Ali (1993) [3] using the following formula:

$$\% = \frac{n}{N} \times 100\%$$

With:
% = percentage score
n = score obtained
N = Number of all scores
c. Achievement of student character scores
To find out how far the character of students achievements through the observation during the practicum using instruments that have been prepared. Observation data is processed using the following formula:

$$\% = \frac{n}{N} \times 100\%$$

With:
% = percentage score
n = score obtained
N = Number of all scores

Criteria for percentage scores obtained from expert validation, student responses, teacher responses, activity observations and character observations are shown in Table 2.

Table 1: Criteria for percentage assessment scores (Sofiana, 2011) [8]

Interval	Criteria
81,25% < score ≤ 100%	Very good, very active, very visible
62,50% < score ≤ 81,25%	Good, active, visible
43,75% < score ≤ 62,50%	Poor, less active, less visible
25%< score ≤43,75%	Not good, no active, invisible

The indicators of success in this study are: a) The results of the expert / expert validation reached the score percentage > 62.50%, b) The results of students' responses reached score > 62.50%. c) Effectiveness of practicum guidebooks: 1) Average results of posttest > pretest. 2) The activeness observation results reached a score score> 62.50%. 3) The results of student character observation reached a score percentage> 62.50%.

Result and discussions
Practicum guidebook pages are intentionally not made back and forth with the aim that students have many spaces provided to add notes needed when practicing. The front cover design and guidebook back page are created using Adobe Photoshop CS6. Examples of page layouts for practicum results of development can be seen in the following picture:

Fig 1: Front cover

Practicum guidebook experts validation analysis
The practicum guidebook draft then gets validation by 4 experts. In this validation, a practical guidebook book draft was given to 2 UNIMA Physics lecturers and 2 Physics Teachers at Manado 7 Senior High School. Experts assess the two components: the book design component and the material presentation component. To validate the practicum guidebook draft, it was given to 2 UNIMA Physics lecturers as validators. In addition to providing value, the validator also fills in the suggestions needed to improve each component.
Expert validation shows that four validators provide an assessment of 93%. Based on the level of validity criteria means the components in the practicum guidebook is categorized as valid criteria. The validator concludes that the practicum guidebook can be used with several things that must be corrected based on the validator's suggestion.
The first revision of the practical guidebook was carried out after seeing suggestions for improvement from the validator.

Practicum guidebook reliability analysis
This trial is a reliability test conducted by the questionnaire method. Questionnaires were given to students and teachers in Manado 7 Public High School. The questionnaires analyzed were student response questionnaires and teacher response questionnaires. The initial trial was carried out before the field test. At this stage, a practical guideline draft was given to 10 respondents who were randomly assigned to grade XI of SMA Negeri 7 Manado. The average results of the percentage score obtained in the initial trial of the practicum guide the results of the development are 90.50%

with very feasible criteria. The second revision of the practical guiding prototype was carried out after the researcher carried out an evaluation of the results of the initial trial.

Practicum guidebook effectiveness analysis

This effectiveness is measured by 3 aspects, namely increasing student understanding, achieving student activeness scores and achieving student character scores.

1. Increased understanding of student concepts

Increasing students' understanding of the material in the theme of Simple Harmonic Motion can be seen based on the results of the pretest and posttest. The pretest and posttest consisted of 6 questions. The question is given to the control class and the experimental class. The questions given are valid and reliable based on the calculation of validity test and reliability test. The number of questions used as a test instrument is six items. Two numbers including numbers 1 and 4 have validity of 0.77 and 0.65. In the feasibility test of the item, the entire instrument has a feasibility value of 0.65. These results indicate that the instrument used has high reliability because it has $0.60 \leq r \leq 0.80$.

Learning outcomes between the control class and the experimental class showed a significant increase.

Table 2: Analysis of t-test between Gain score of learning outcomes among the control class and the experimental class using SPSS

	Class	N	Mean
Gain	Experiments	39	5.,0256
	Control	41	32.7317

Table 3: Independent Samples Test using SPSS

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	T	Df
Gain	Equal variances assumed	1,364	0,246	6,778	78
	Equal variances not assumed			6,670	53,560

The experimental group (M = 52, 0256) had a higher change compared to the control group (M = 32, 7317). The results of the analysis show that the data is homogeneous (F = 1.364; p> 0.05). This means that there is no variance between the experimental and control groups. In other words the data variation in the two groups is the same. Because the data is homogeneous, Equal Variances Assumed shows that there is a difference at the level of 1 percent (t = 6.778; p <0.01). This means that the experimental group has a significant change compared to the control group.

2. Student activity

Observations were carried out to determine the activity of students conducted in two meetings by the head of each experimental class group. Each group leader was given a questionnaire containing several instruments filled in with each practicum. Based on the results of the analysis, the experimental class has increased the achievement of the activeness of each meeting. Activity percentage analysis showed that at the first meeting the percentage of class activity was 80, 22% in active criteria. While in the second meeting the percentage of class activity reached 86.081% in very active criteria.

3. Student character achievements scores

The characters studied in this research are critical thinking, mutual respect and responsibility in practicum. To find out the improvement of this character, the researcher was assisted by a teacher of physical Physics at Manado State Senior High School and one of the research students' friends. Each observer observed 2-3 groups. The observation results showed that each group experienced an increase in character at the next meeting. The character score achieved by all students has increased at each learning meeting.

Conclusion

Based on the results of the study the conclusions are as follows

1. Practicum guidebook consists of three parts, namely the front section consisting of the front cover, introduction, table of contents, student identity, and laboratory rules, then the contents section contain the title, introduction, objectives, tools and materials, learning activities, application and reference / library. The experimental steps are six stages in the discovery learning model. Character values are contained in the experimental steps and typed in bold.
2. Practicum guidebook is classified as valid criteria according to expert validation
3. Practicum guidebook is classified as reliable criteria in accordance with student responses through reaching small scale trials
4. Physics practical guide based on discovery learning for simple harmonic motion developed effectively because student learning outcomes are increase, students are more active and the noble character of students is more visible.

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