JPF | Volume 9 | Number 1 | 2021 | 46 - 55

p - ISSN: 2302-8939
e - ISSN: 2527-4015

Jurnal Pendidikan Fisika

https://journal.unismuh.ac.id/index.php/jpf

DOI: 10.26618/jpf.v9i1.4069

Development of Basic Physics Practicum Guide 2 for Physics Education Students of the Muslim University of Maros

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Received: September 02, 2021; Accepted: December 03, 2020; Published: January 29, 2020

Abstract *– This research aims to develop a valid, practical and effective basic physics practicum guide 2 used for students of the Physics Education Study Program of the Muslim University of Maros. This research employs a 4-D development model research with 4 stages, namely: Define Phase (Define), Planning Stage (Design), Development Stage (Develop), Dissemination Stage (Disseminate). The practicum guide was tested to 10 students of Physics Education in the even semester, the Academic Year of 2019/2020. The research instruments include validation sheets, observation sheets, and practicum assessment documentation. The results showed that the basic physics practicum guide 2 that was developed had met the valid criteria with a validity value of 0.93. Besides, the practices with the implementation of the device was mostly in category 3 and was found effective as 83% of the students reached scores above 70.*

Keywords: *Basic Physics 2, Practicum Guide, 4-D Model*

I. INTRODUCTION

The Physics Education Study Program is one of the new study programs at the Muslim Maros University (UMMA). It is an obligation for study programs that produce teacher candidates to equip alumni with various competencies needed in the field of teacher training including professional competence, pedagogic competence, personal competence and social competence (Law No. 14 of 2005). Teacher professional competences is a number of competencies related to professions that require a variety of expertise in the field of education and teacher training. One of the skills needed for prospective physics teachers is to carry out practicum activities in the laboratory.

Practicum is a learning method that can provide direct and real lessons to students in gaining knowledge in proving theories and concepts. In the implementation of practicum, guidelines are needed that regulate the course of activities in the form of practicum guides. Learning by using guides results in students being more active in the learning process,

because in the guides they face problems or activities that must be completed. Meanwhile, those without a guide, students only depend on the knowledge provided by the lecturer / instructor without being able to study it again if students do not take notes, because the willingness of students to take notes varies one another. It can be concluded that learning using guides is more effective than conventional learning without using guides (Alqodiri & Grummy, 2013). This is relevant to the results of Kenengsih's research that the practicum guide is one of the supporting facilities in practicum activities. Practicum guides can increase student activity, motivation in learning and can improve student learning outcomes (Kenengsih, 2017).

Basic Physics 2 is one of the compulsory courses for physics education students in semester II and is included in science and skills courses. The scientific process is obtained from giving theory to lecture activities, while the skill process is obtained through practical activities.

Based on preliminary observations, it is known that the Physics Education Study Program is a new study program at the Muslim University of Maros. Entering its 3rd year, the students still found many obstacles in the learning process, especially in practicum activities. The main problem in the implementation of practicum, especially in the basic physics 2 course, is first, adequate tools, materials and laboratories are not available yet. Second, the lack of adequate practicum guides. This causes students to be less motivated and the implementation of practicum activities becomes ineffective. From the students' side, only a very few students who have attended practicum during school so that most students is still lacking of practicum activities.

Based on the explanation above, as a lecturer, it is very necessary to make practicum guides that are easy to understand and in accordance with existing resources through research and development activities so that the resulting guides are valid, practical, and effective for use in the Physics Education Study Program of UMMA.

The benefits of the results of this study are as a guideline for students and lecturers in conducting experiments / practicum and also as a contribution of researchers for the use of the physics laboratory at Maros Muslim University.

II. THEORETICAL BASIS

A. Practicum

Practicum is a learning method that can provide direct and real experience to students in gaining knowledge in proving theories and concepts (Ali, 2017). Practicum plays a role in making students more active in learning because by getting the opportunity directly to see, observe and do, in this case, students will find it easier to remember. things he has

accomplished permanently (Zakiah et al., 2015). In addition, practicum increases student attractiveness or interest, can correct misconceptions, and develop analytical and critical attitudes in students (Maknum et al., 2012).

According to Wahyuni (2015), to master science, a learning activity needed is the one that involves a process activity to produce certain products, not only obtained by learning from books or simply listening to explanations from other parties. Practical activities are experiments performed by the teacher in the form of demonstrations, cooperative demonstrations by a group of students as well as experiments, and observations by students. These activities can take place in the laboratory or in other places. Based on the description above, the meaning of a practicum guide is a guide or guideline for carrying out an activity or experiment to test the correctness of the theory obtained from the learning results.

According to Sutikno & Sobry (2014), practicum is a learning activity that gives students the opportunity to conduct experiments to prove their own hypotheses or concepts that have been learned by observing the process and results of the experiment. In principle, practicum is a series of experiments conducted by experimenters in a laboratory or a certain room.

Practicum activities have an important role in devolving ways of thinking and activities to obtain data through the discovery process. Practical activities will provide a very big role, especially in building concept understanding, verifying the truth of concepts, fostering process skills of students, fostering motivation for lessons learned and training psychomotor abilities (Muslim et al., 2017).

Practicum can be used to train the skills needed by students, namely: (1) giving students the opportunity to apply and integrate their knowledge and skills in real terms. practice; (2) prove something scientifically; (3) respect the knowledge and skills they have (Rustaman, 2013).

Practical learning is also expected to develop students' scientific process skills, this is because scientific process skills are not given much attention. Learning through practicum allows students to achieve learning targets as a whole and in accordance with the demands of the characteristics of science.

B. Practicum Guide

In studying natural science, there needs to be a guide containing the objectives of practicum, practicum procedures, observation sheets, tools and substances, observation sheets for practicum activities or usually called practicum manuals (Wijayanto, 2013).

Practical instructions can be classified as teaching materials that are arranged systematically in order to improve the quality and quantity of teaching and learning according to the desired instructional objectives. Practical instructions as teaching materials in addition to containing

instructional explanations are also arranged based on student needs, accommodate student difficulties and have a mechanism to collect feedback from students. The preparation of teaching materials must assume that students have quite high heterogeneity. Teaching materials designed must also be accompanied by guidelines for students and teachers or coaches.

Besides, teaching materials can partially replace the role of lecturers and support individual learning. This will have a positive impact on lecturers, because part of the time can be devoted to guiding student learning. The positive impact for students is to reduce dependence on lecturers and get used to independent learning according to their level of education, this also supports the principle of lifelong learning (lifelong education). In addition, teaching materials can help students understand concepts, and can direct students to prepare themselves before face-to-face lectures (Murniati & Muslim, 2015).

The practicum module is one of the visual media that can help teachers by activating students in learning scientific literacy which can be done for an activity of the learning process (Nursamsu et al., 2020). Practicum activities will run smoothly if there are teaching materials in the form of practicum guides (Nengsih, 2016).

The benefits of practicum instructions are that they can help students achieve learning completeness, foster scientific work habits, and provide feedback to teachers in developing more varied and meaningful learning designs (Meyhandoko, 2013). This is supported by the results of research conducted by Nurussaina (2016) which explains that the use of practical guides can increase students' critical thinking skills.

According to Tobing (2011), the practicum guide developed must at least contain a theoretical basis, clear experimental objectives, the tools and materials used are explained in detail, the steps for activities are easy to carry out, questions about practicum to control student knowledge.

The function of the practicum guide is a teaching material that can minimize the role of lecturers, make students more active and gain meaningful knowledge, make students acquire creative thinking and handcraft skills so that it makes it easier for educators to carry out teaching in the laboratory (Andi, 2011).

III. RESEARCH METHODS

This research employs a 4-D development model research developed by S. Thiagarajan in (Trianto, 2011) with 4 stages, namely: define, planning, development, dissemination.

The guidance that was made was tested on 10 students of physics education in even semester in the academic year of 2019/2020. Research instruments used include validation sheets, observation sheets and practicum assessment documentation.

To state that an assessment instrument has a high degree of validity, the results of the assessment of the two validators must have a strong relevance (3 or 4). If the coefficient of validity is high (> 75%) it can be stated that the measurements taken are valid. The formula for determining the validation coefficient according to Gregory in (Ruslan, 2009).

		Validator 1	
	Item	Irrelevant score (1-2)	Relevant skor (3-4)
Validator 2	Irrelevant score (1-2)	A	B
	Relevant skor (3-4)	C	D

Figure 1. Model agreement between two validators

Content validity coefficient = $\frac{D}{(A+B+C+D)}$

Information:

A = number of statement items that get an overlap value between the weak relevance of the first validator and the weak relevance of the second validator.

B = number of statement items that get an overlap value between the strong relevance of the first validator and the weak relevance of the second validator.

C = number of statement items that get an overlap value between the weak relevance of the first validator against the strong relevance of the second validator.

D = number of statement items that get an overlap value between the strong relevance of the first validator and the strong relevance of the second validator.

The analysis of practicum data in the form of data on the results of the assessment tool implementation was carried out on the assessment of the observers who observed the implementation of the tool. From the results of the observer's assessment, the average value of T was determined. The T value was then confirmed by the interval determining the category of the assessment tool implementation, namely:

$T \leq 1$ = Not Implemented

$<T \leq 2$ = Only a small part is done

$<T \leq 3$ = Mostly implemented

$<T \leq 4$ = Implemented Overall

The criterion used to decide that the guide has adequate compliance is the minimum T score in the Mostly Implemented category.

Effectiveness analysis is carried out by looking at the final score of the practicum, where the practicum guide is said to be effective if 85% of students pass with a passing criterion of at least 70.

The flow chart of this research can be seen in Figure 2.

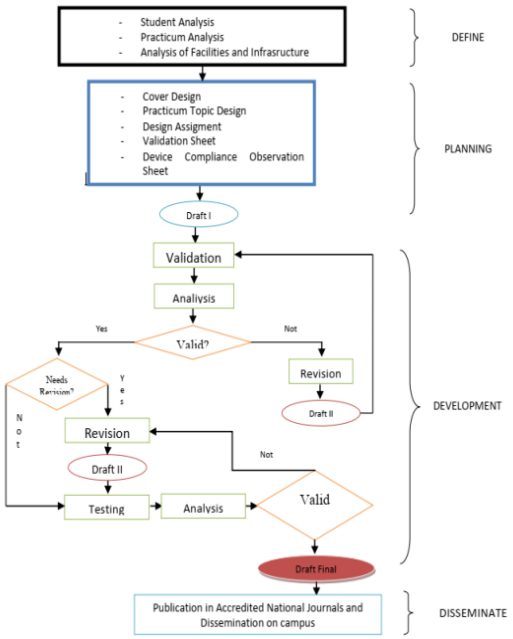

Figure 2. Research flow diagram

IV. RESULTS AND DISCUSSION

A. Define Stage (Define)

1). Student's Analysis

Based on the results of observations, there are some problems the students had in the implementation of basic physics practicum 2. Students did practicum without guidance, only in the form of simple experimental activity sheets. In addition, there are some students who come from the social studies department at school and still lack of experience in physics practicum.

2). Practicum Topic Analysis

Based on the results of observations, it was known that students had done basic physics practicum 2 at another campus with a more complete laboratory. This is certainly different from the resources on the Muslim University of Maros. For this reason, researchers took the initiative to maximize practicum activities with practicum topics that are suitable with the conditions of the physics laboratory of the Muslim University of Maros.

3). Analysis of Facilities and Infrastructure

As a study program that has only been run for 3 years, the availability of facilities and infrastructure is still very limited. In addition, the laboratory is dirty because it is rarely used and the physics education laboratory is still joined by the other study programs' laboratories. Also, based on the results of observations, it was found that the practicum in the physics education laboratory of the Muslim University of Maros using practicum guides was rarely done.

B. Planning and Development Stage (Design)

At this stage, the researcher designed a practicum guide. The steps taken include designing cover guides, practicum topics and preliminary assignments that are in accordance with the syllabus of basic physics courses 2.

The practical guide cover is designed using the Picsart application using a magnifying glass theme with a background of book titles and symbols used in basic physics practicum 2. The cover is designed as attractive as possible in order to motivate and attract the attention of readers, especially students.

For the practicum topic, the researcher adjusted the existing facilities and infrastructure in the Physics Education

laboratory of the Muslim Maros University and referred to the syllabus for basic physics an courses 2. The topics for the guiding practicum that were developed were as follows:

1. Electrical Circuit
2. Ohm's Law
3. Kirchoff's Law
4. Heat of Melting Ice
5. Mirror
6. Focus Distance Convex Lens
7. Scale

Table 1. Validator's assessment of basic physics practicum guide 2

No	Aspects that are assessed	Validator 1	Validator 2
1	Format		
	a Has appeal	4	4
	b Clear numbering system	4	4
	c Room / layout arrangement	3	3
	d Appropriate font size and type	3	4
2	Languages		
	a Use of language in accordance with EBI	3	3
	b Clarity of instructions / directions, in carrying out practicum activities	3	3
	c The language used is communicative	4	4
3	Contents Construction		
	a Clarity of distribution of materials	3	4
	b The title of the practicum matches with the curriculum	3	2
	c The theoretical basis is suitable to support information on practicum implementation	3	3
	d The objectives of the practicum are in line with the learning objectives	4	3
	e Practicum tools and materials are clear and can be measured	4	4
	f Flow or systematic practicum procedure	4	4
	g Availability of observation results page	4	4
	h Availability of assignments that help students draw conclusions	4	4

The content validity coefficient = $\frac{14}{(0+0+1+14)}$

Based on the data presented in table 1, it can be calculated that the content validity value is 0.93. This means that the product of the practicum guide developed falls into the criteria of strong relevance and is declared valid. The conclusion that can be drawn according to the validator is that the practicum guide can be applied by making a few revisions.

After making the revision suggested by the validator, a practicum guide was produced, hereinafter referred to as draft 2. This product was then tested on a limited basis to students of the Department of Physics Education at the Muslim University of Maros to find out practicality by looking at the implementation of learning tools in class, and for practicality seen from the practical

response and assistant which ends in student practicum scores.

The learning implementation was assessed by 2 observers through the observation sheet at each meeting. Based on the analysis of the results of the observations made by the observer, it is known that the practicum guide developed has a T value equal to the three which are in the mostly implemented category. This is because there are still some indicators of device implementation that are not optimal. As in meetings 1 and 2, the assistants did not convey the objectives of the practicum and did not provide motivation to students before starting the practicum. The rest went well according to the procedure and the existence of a practicum guide makes it easier for students to achieve the goals of practicum learning. This is in line with Prasetyo (2016) who argued that the practicum guide provided makes it easier for students to understand concepts through real experiences.

After all the practicum activities are tried out, the practitioner collects the results of the practicum in the form of a practicum report which is then analyzed. Based on the results of the analysis of the results of the practicum, it is known that 80% of students passed with a value above 70. Therefore, it can be concluded that the basic physics practicum guide 2 that was developed was effectively used. According to (Siagian, 2012) the effectiveness of the product in the form of a practicum guide is measured by paying attention to the final score of the practicum.

C. Dissemination Stage (Disseminate)

After passing the development stage and producing a valid, practical and effective practicum guide, then the final product of the basic physics practicum guide 2 is used within the scope of the Physics Education Study Program of the Muslim University of Maros. The results of this study were presented in the dissemination activities held by LPPM of the Muslim University of Maros and published in an accredited journal, namely the Journal of Physics Education.

V. CONCLUSION AND SUGGESTION

Based on the results of the research that has been done, it can be concluded that the basic physics practicum guide 2 which consists of 4 stages, namely: the define stage, the planning stage (design), the development stage (develop), the dissemination stage (disseminate) is valid, practical, and effective.

ACKNOWLEDGMENTS

Special gratitude goes to the Ministry of Research, Technology and Higher Education (Kemenristek-Dikti) who has funded this research through a novice lecturer research grant (PDP) for the 2020 Fiscal Year.

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