The validity of the wetlands-based fluid physics practicum module

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Abstract. The availability of a wetland environment-based practicum module as a form of local wisdom in South Kalimantan has not been widely developed, even though the development of a wetland-based practicum module is needed to create more meaningful learning. This study aimed to describe the validity of the fluid physics practicum module based on the wetland environment. The research method used was R&D with a 4D model. The research instrument used was in the form of a validation sheet, assessed by three validators. The results showed that the validity of the practicum module was very valid. This practicum module that was declared as valid can be used in the learning process. At the next stage, the practicality and effectiveness of the fluid physics practicum module based on the wetland environment can be measured.

1. Introduction

During the era of globalization, the development of education, especially science, is developing rapidly, requiring educators to be able to overcome all problems in the learning process [1]. This is in line with the research conducted by Rusilowati, et al [2] which stated that in the time of the 21st century, the progress of science and technology in various countries had greatly increased. The learning process does not only consist of the teaching and delivery of materials, but also through direct experience to students by applying scientific methods within classroom activities such as experiments or practicums. Through a practicum, students can be actively involved in the scientific process, namely observation, investigation, hypothesis, analysis and drawing conclusions from phenomena related to the environment [3,4]. Practicum is closely related to science, in which science itself is defined as a natural science that is related to the effort to interpret various natural phenomena in a structured manner [5].

When constructing a learning process, one must consider internal conditions, significant factors, and external conditions of learners. This encourages a classroom environment which promotes students to actively explore and operate [6]. The learning process occurs because of the interaction between a person and their environment [7] with the hope that the three aspects are expected to be reflected in the learning activity process, namely aspects of knowledge, attitudes, and skills. In science-based learning, students must actively build and discover their own knowledge, not just passively comprehending knowledge because of scientific activities [8]. Science learning is aimed to encourage individuals nurture their science process skills as well as practicing scientific attitudes [9–11].

In addition, learning process is one of the scientific activities utilized to study phenomena which exists in nature to obtain knowledge in the form of facts [12]. Natural phenomena used in wetland environments
were the Riam Kanan dam, floating market, “wantilan” in the Barito river area, etc. These phenomena are closely related to fluid material. Learning is directed at creating a critical, active, analytical, and creative atmosphere in solving problems using science process skills [13]. Science process skills refer to the activities done in a scientific investigation [14–16]. Through science process skills, students can hone their ability in using scientific methods, namely understanding, developing, and discovering knowledge [17].

Physics, one of the science branches, essentially consists of two aspects, namely product aspects and process aspects. In physics learning process, learning activities must not only be emphasized on product aspects, but must be balanced with process aspects. This is also in line with the demands of the 2013 curriculum, in which the learning process must contain aspects of knowledge, skills, and attitudes [18]. In addition to practice science process skills, practicum activities can also train students' scientific attitudes. Students need to be trained to develop science process skills, so that scientific attitudes will follow [19]. Scientific attitudes, in the science dimension that is integrated into learning, can provide meaningful experiences for students so that they understand, actualize, and integrate it through the learning process [20,21].

The implementation of practicum activities may run well if it is equipped with a practicum module. Modules can be interpreted as teaching materials which are structured in a good systematic manner which includes theoretical foundations, methods and evaluations that can be used independently to achieve the expected goals [22]. This is in line with the research results of Syakurni, et al. [23] which stated that practicum instructions were needed when doing practicum to help carrying out practicum as well as giving information to students. This research is in line with Usmeldi's [24] opinion that the use of research-based physics learning modules with the scientific approach effectively improved students' scientific literacy. However, the reality in today’s situation shows that the learning and teaching process still do not integrate the use of learning media well enough, especially wetland-based practicum modules. Referring to the explanation above, a wetland-based physics practicum module was developed with the aim to provide learning references for both lecturers and students in carrying out practicum learning for classroom activities. This study aimed to describe the validity of the fluid physics practicum module based on the wetland environment.

2. Method

The research method used in this research was the Research and Development (R&D) method. The development model used was the 4D (define, design, develop, and disseminate) model [25]. In this article, only the definition, design, and development stages were carried out. At the defining step, the researcher analyzed the teaching material's characteristics, the learning objectives, and students' characteristics. In designing step, the researcher compiled the media used, the practicum module, and the research instruments used, and also identified a wetland environment integrated with fluid physics. At the development stage, researchers developed a fluid physics practice module based on a wetland environment. On the validation stage, the module developed was validated by three validators. The three validators came from academics, namely 3 physics education lecturers.

The feasibility of the practicum module was assessed through the validity of the practicum module. Validity is the suitability of the measurement with what is being measured. The development of the practicum module in this study used construct validity to test the validity of the opinions of experts [26]. The validation of the practicum module was used to assess the extent of the validity of the practicum module which was developed. The validation of the developed practicum module was tested by three expert validators. The validity of the practicum module in this research included aspects of substance, language, and construction, each of which was assessed by the respective experts in their fields. Whether or not the
practicum module is valid is determined by comparing the results of the assessment score obtained with the validity criteria of the learning instruments [26,27].

| No | Average Score | Category       |
|----|---------------|----------------|
| 1  | 81% - 100%    | Very valid     |
| 2  | 61% - 80%     | Valid          |
| 3  | 41% - 60%     | Valid Enough   |
| 4  | 21% - 40%     | Less valid     |
| 5  | 0% - 20%      | Not valid      |

3. Results and Discussion

The physics practicum module, which was developed to practice students’ science process skills and scientific attitudes, was systematically arranged by following the suggestions of the validators. The presentation of the resulted data of physics practicum module development was based on the steps of research and development of the practicum module in the research procedure. This fluid physics practical module consisted of 6 experiments, namely: (1) pressure variations in static fluids; (2) closed fluid pressure and force; (3) the mass density and buoyancy of the fluid; (4) viscosity and fluid flow experiments; (5) the flow rate in the pipe; and (6) fluid pressure and velocity. At the beginning of each practicum, facts/information related to the wetland environment was presented, such as the right cascade dam, floating logs around the Barito river, etc. In some practicum activities, PhET media were also used.

Based on the results of the validation of the validators, the practicum module developed was declared as fit for use in learning activities. All aspects of the assessments received a percentage of more than 75% which meant that the module could be categorized as feasible to use. The contents of the practicum module used were front cover, table of contents, theoretical frameworks, experimental objectives, student worksheets, and bibliography. The following is an example of the display of the practicum module that has been developed.

![Figure 1. Front cover, theoretical frameworks, and experimental objectives](image-url)
The validation results assessed by the validator are presented in Table 2 below.

**Table 2. Validation results of the practicum module**

| No. | Validation Aspects | Average Score | Category   |
|-----|--------------------|---------------|------------|
| 1   | Substance          | 92%           | Very valid |
| 2   | Language           | 89%           | Very valid |
| 3   | Construction       | 86%           | Very valid |
|     | Validity average score | 89%     | Very valid |

The validity results as obtained in Table 1 show that for the average score of each aspect, the validity gained a score of 89% which belonged in a very valid category. The substance aspect obtained a score of 92% with a very valid category. This shows that the content of the wetland-based practicum module that has been developed is in accordance with the research objectives. Thus, it can further train students’ science process skills and hone their scientific attitudes. This can be seen from the use of several steps in learning science to produce concepts, theories, principles, laws, and facts [28]. The language aspect obtained a score of 89% with a very valid category, which shows that the language structure, such as the use of sentences, dictions, and conformity to the level of students’ understanding, was considered appropriate and feasible to use. Additionally, in the construction aspect, the validation received a score of 86% with a very valid category. It indicates that the practicum module used has met the standards in making a good practicum module, seen from the numbering system and module layouts which were in accordance with the research objectives. In addition, the practicum module was claimed to be good if its construction contained learning theories that could support the achievement of learning competencies [29].

Practicum module is one of the learning resources that can be used in learning activities. It is also considered as a learning medium because it can be used side by side with other learning sources. Practicum module can act as a learning medium or learning resource, depending on the planned learning activities [28]. Surachman [30] stated that the use of practicum modules for students was to assist students learn in a directed manner.

The practicum module compiled was categorized as very valid; even though the feasible criteria were met, but there were some input and suggestions from the validators. Thus, the researcher made several revisions to the practicum module to get a better practicum module. Some suggestions given by the validator were:

- a. The numbering system was unclear. It was recommended that each experiment title was given a numbering system.
- b. The section of theoretical frameworks should have been placed at the beginning of the experiment (before the experiment was explained).
- c. It was suggested that the Pascal’s law be prior to Archimedes’ law.
- d. Completed with bibliography.
- e. It was recommended to add elements of South Kalimantan local wisdom within the Pascal’s Law, viscosity, and Bernoulli’s law.

Referring to the advice of the experts, the practicum module that was developed had several parts that must be improved in its presentation. The improvements to the practicum module are shown in Table 3 below:
Table 3. The module before and after the experts’ advice

| Before | After | Before | After |
|--------|-------|--------|-------|
| Front cover | Numbering and theoretical framework placement | Bibliography | South Kalimantan local wisdom integrated within the topic of viscosity |

Referring to the results for the developed practicum module, the practicum module was categorized as good. The existence of a practicum module can contribute a significant influence on the learning process in campus, which is also in accordance with a research conducted by Widodo [28] that stated that the improvement in mastery of materials by students who learned using modules was better than the improvement in mastery of materials by students who learned without the use of modules. The integrated wetland environment in this module is expected to increase students' interest in studying physics. Students can improve their ability to connect physics material with the life around which students live, resulting in meaningful learning. This is consistent with some of the research results on wetland environment-based teaching materials, which positively impact the learning process—both in terms of interest, good response from students, learning outcomes, effectiveness, and others [31–37].

4. Conclusion

Based on the results of the development and product testing that have been carried out, it can be concluded that the wetlands-based physics practicum module is declared as feasible according to the average validity score obtained. Therefore, this wetlands-based physics practicum module can be used as a learning resource for students. Through this developed practicum module, students do not only learn fluid physics material through practicum activities, but also train their scientific attitudes and science process skills. Moreover, students can get to know phenomena related to the wetland environment.
Acknowledgement
Researchers would like to thank the Universitas Lambung Mangkurat (ULM) and LPPM ULM for funding PNBP University in 2020.

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