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Application of Virtual Programming Lab (VPL) in E-Learning as the Practicum Learning Media Basic Programming

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Abstract. The COVID-19 pandemic has had a very significant impact on every sector, be it the economic, social, and educational sectors. The Ministry of Education and Culture issued circular letter No. 4 of 2020 regarding the implementation of education during the COVID-19 pandemic. One of the important points in the circular is the implementation of distance learning or learning from home. Online lectures have their own challenges for lecturers and students. The subjects that are not optimal in online lectures are programming practicum courses. An effort to solve this problem is to apply the use of virtual labs as a means of online practicum learning. However, not all campuses already have a virtual lab system that is integrated with an online learning system (E-Learning). To overcome this, it is necessary to make efforts to use the available virtual labs. One of the virtual labs that can be used is the Virtual Programming Lab (VPL). This study examines the use of the Virtual Programming Lab (VPL) in E-Learning as the development of learning media for programming practicum in tertiary institutions. The purpose of this study was to determine the feasibility of virtual programming lab media which was developed as a learning medium for programming practicum in universities. This study uses the Research and Development (R&D) method. The product trial was carried out at the Informatics Engineering Study Program at Samudra University. The results of the VPL implementation survey based on the responses of students and lecturers resulted in a "very supportive response with a score of 98.5% from students and an average score of 3.57 from lecturers.

INTRODUCTION

The Corona Virus Diseases - 19 (COVID-19) pandemic has had a very significant impact on every sector, be it the economic, social, and education sectors [1]. To accelerate the response to the outbreak, the government adopted a policy of implementing large-scale social restrictions through Government Regulation No. 2 of 2020. Following up on this regulation, the Ministry of Education and Culture issued circular letter No. 4 of 2020 regarding the implementation of education during the COVID-19 pandemic. One of the important points in the circular is the implementation of distance learning or learning from home. Following up on the circular, almost most universities implement online learning, whether it's done asynchronously or synchronously.

One of the impacts of this phenomenon occurs in the practical learning of programming. This course is usually carried out in a computer laboratory face-to-face, where students have to come to campus, because of the pandemic the learning process cannot be done directly. Online lectures have their own challenges for lecturers and students. Some of the obstacles in the implementation of online lectures include an inadequate internet network in remote areas. In addition, lecturers must adapt online learning methods, especially for programming courses that cannot be implemented optimally in the Informatics Engineering study program [2].

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Along with the development of technology in the field of education brings new opportunities for the process of learning computer programming [3]. The application of computer technology, for example virtual labs, changes learning from a formal classroom into a virtual space. The virtual world has the potential to provide a new environment that involves students in learning construction activities [4].

Based on the results of research [5], [6] shows that the low value of learning programming is because students experience less effective learning, lack of interest, and motivation. Another problem faced by students in learning programming is during practicum which involves their need to practice extensively to achieve higher programming skills. This is also a problem when conditions change suddenly such as the current pandemic, meanwhile the learning process must continue.

An effort to solve this problem is to implement a virtual lab as a means of online practicum learning. However, not all campuses already have a virtual lab system that is integrated with an online learning system (E-Learning). To overcome this, it is necessary to make efforts to use a virtual lab that can be used, namely the Virtual Programming Lab (VPL).

Virtual Programming Lab is one of the virtual labs that is integrated in the online learning system of E-learning that provides comprehensive and open source programming practicum material. The use of the Virtual Programming Lab is designed interactively so that the practical implementation can be done directly by students virtually. This study examines the use of the Virtual Programming Lab (VPL) as the development of online programming practicum learning media in the implementation of basic programming practicum in the informatics engineering study program. This study uses a Virtual Programming Lab on E-learning aimed at making it easier for students to carry out the stages of virtual programming practicum experiments.

METHOD

The type of research used is research development or Research and Development (R&D) [7]. Data retrieval using a questionnaire with the following data sources: a) media feasibility assessment data by media experts and the substance of the material obtained by providing a questionnaire containing an assessment of the virtual programming lab (VPL) learning media, b) data on lecturers and students' responses to the virtual programming laboratory learning media were obtained from student and lecturer reflection questionnaires at the end of the lesson, and c) data from the evaluation of student practicum simulations after using the virtual programming lab was obtained from student and lecturer questionnaires at the end of the lesson.

Data on the instrument for assessing the feasibility of virtual programming lab learning media by programming experts by entering answers according to their scores in the following way: Range = largest data-smallest data; Range = 3-1; Range = 2; After obtaining the range, the next step is to determine the length of the class interval (P) [8]. P = range/(desired class); P= 2/4; P= 0.5. Based on the results of the class intervals above, the eligibility criteria for virtual programming lab learning media by experts can be seen in TABLE 1.

TABLE 1. Criteria for Assessment by Experts

Range	Score	Criteria
2,50	$< \text{Score} \leq 3$	Very Good
2,00	$< \text{Score} \leq 2{,}50$	Good
1,50	$< \text{Score} \leq 2{,}00$	Low
1	$< \text{Score} \leq 1{,}50$	Poorly

Data on the responses of lecturers and students to the use of the virtual programming lab were each calculated by tabulating the data and then the answers were entered according to their scores. The same calculation was also carried out on the response questionnaire, a score of 4 for the SS answer, a score of 3 for the S answer, a score of 2 for the KS answer and a score of 1 for the TS answer. In the following, the criteria for the value of the responses of lecturers and students to the virtual programming lab learning media are presented in TABLE 2.

TABLE 2. Criteria for Lecturer and Student Responses

Range	Score	Criteria
2,50	< Score ≤ 3	Strongly agree
2,00	< Score ≤ 2,50	Agree
1,50	< Score ≤ 2,00	Disagree
1	< Score ≤ 1,50	Do not agree

Based on the results of the criteria obtained, the percentage of respondents' responses is calculated using the following formula:

$$P = \frac{n}{N} x\ 100\%$$

Where P: percentage number; n : real score; N : total score

The results of the evaluation of the practicum simulation are declared to have met the individual completeness score if it reaches a score of 75 in accordance with the Minimum Completeness Criteria (KKM). Furthermore, the results of the evaluation were analyzed to determine classical completeness with classical completeness criteria 75% of students have met individual completeness scores. Classical completeness value can be analyzed with the following formula:

$$N = \sum \frac{student\ complete}{student} x\ 100\%$$

Where, N: student classical completeness

RESULTS AND DISCUSSION

The application of the Virtual Programming Lab (VPL) in E-Learning for Basic Programming Courses at the University of Samudra's Informatics Study Program is carried out in several stages, namely:

1. Socialization of the Virtual Programming Lab (VPL) to all students of the Ocean University Informatics Study Program.

FIGURE 1. VPL Introduction Socialization on E-learning

Before the Virtual Programming Lab (VPL) is used, socialization is carried out regarding the introduction and how to use VPL, this aims so that students can better understand the practicum process through the Virtual Programming Lab (VPL).

2. Use of VPL in E-learning for Basic Programming Courses.
   Experiments on using VPL were conducted on 1st semester students in the Basic Programming course on the E-learning page. After the student selects a basic programming course, the course topic page will appear as shown in FIGURE 2.

FIGURE 2. Virtual Programming Lab Display on E-Learning

The basic programming practicum in VPL consists of several stages that must be carried out, namely:

a. Practicum Description

Students see the description of the Practicum, where previously the Lecturer has given a practicum module on the topic of lectures.

FIGURE 3. Display of Practicum Description

b. Practical Test Activities

At this stage the practicum process is ongoing, where lecturers and students can interact and process each other's program code simultaneously, besides that at this stage lecturers and students can also execute programs and correct program code.

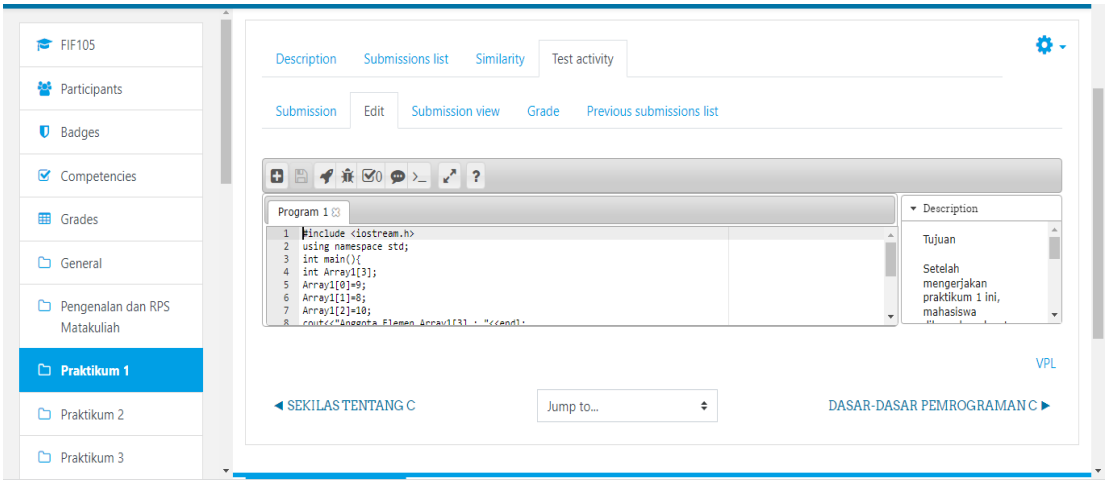

FIGURE 4. Practicum Activities

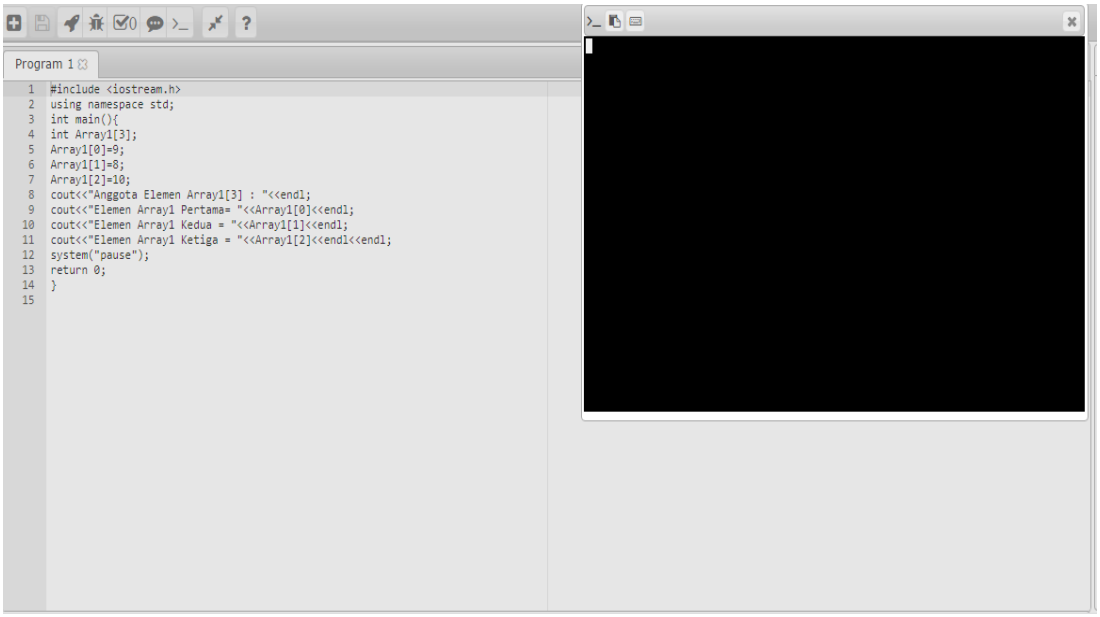

FIGURE 5. Program Execution Process in VPL

c. List of practicum worksheets

At this stage, each practicum worksheet that has been done will be submitted by students. And then it will appear on the list submitted list page. At this stage, the lecturer also easily checks the results of practicum work from students.

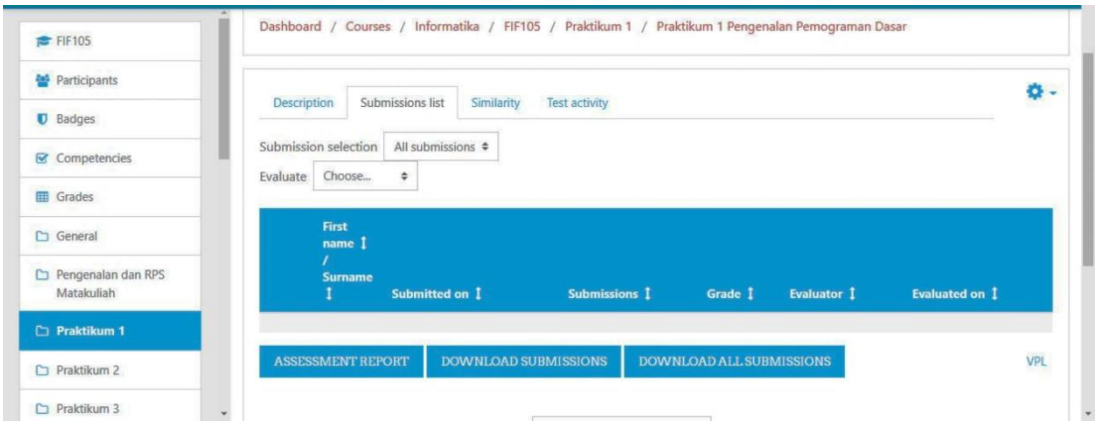

FIGURE 6. List of Submitted Practicum Worksheets

3. Survey on the results of VPL Implementation for Students and Lecturers

   All 1st semester Informatics Engineering students and lecturers who are involved in researching the use of VPL in basic programming courses will be invited to answer the survey. The survey used in this study used a Likert Scale survey with the highest scale value, namely strongly agree and the lowest score strongly disagree. The order of the Linkert scale consists of, Strongly Agree, Agree, Disagree, Strongly Disagree.

   a. Student survey

      The results of the VPL implementation survey on E-Learning in the Basic Programming course for Semester I students were obtained through filling out the questionnaires that had been distributed previously. This survey aims to find out how much support students have for the use of VPL in basic programming practicum learning. The results of student responses are shown in the TABLE 4.

TABLE 3. Responses Criteria

Response Criteria	Score Range	Student who gave feedback	Percentage
Very supportive	3.25< Score ≥ 4	57	83,8
Support	2,50 < Score ≥ 4	10	14,7
Not supportive	2,50 < Score ≥ 4	1	4
Very unsupportive	2,50 < Score ≥ 4	0	0
The number of students the criteria are very supportive and supportive		67	98,5

TABLE 4. The Students Responses

Response	Average Score	Criteria
Interest in using media	3,68	Very supportive
Media according to learning objectives	3,49	Very supportive
Media Easy to operate	3,62	Very supportive
Media helps understanding the material	3,62	Very supportive
Attractive media display	3,57	Very supportive
Media accompanied by practice questions and information	3,62	Very supportive
Media increases college motivation	3,50	Very supportive
Media is used independently	3,40	Very supportive
More effective and efficient media	3,54	Very supportive
Interest in using media in other materials	3,62	Very supportive
Total average score	**3,57**	**Very supportive**

b. Lecturer Survey

The lecturers' responses in this study also played an important role in the implementation of the Virtual Programming Lab (VPL) as a learning medium for basic programming practicum with a score of 2.51. Lecturers gave very supportive responses to the implementation of VPL with an average score of 3.82. The results of the lecturer's responses can be seen in the TABLE 5.

TABLE 5. The lecturer's Responses

Response	Average Score	Criteria
Lectures with Virtual Programming Lab (VPL) are interesting	4	Very supportive
VPL makes it easier to deliver lecture material	4	Very supportive
Interest in using VPL on other materials	3,5	Very supportive
Motivated to make learning media innovations	3,5	Very supportive
The use of VPL increases student activity	4	Very supportive
Attractive VPL display	4	Very supportive
Presentation of logical and systematic material	3,50	Very supportive
Practicum of basic programming with effective and efficient VPL	4	Very supportive
Total average score	**3,57**	**Very supportive**

CONCLUSION

From the results of the study, it can be concluded that the application of the Virtual Programming Lab (VPL) as a learning medium for basic programming practicum is feasible to be used as a practicum learning medium in the informatics engineering study program at Samudra University. The results of the VPL implementation survey based on the responses of students and lecturers resulted in a "very supportive response with a score of 98.5% from students and an average score of 3.57 from lecturers.

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