Development of Virtual Science Laboratory as an Alternative Learning Media

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Abstract. One of the skills needed in the elementary science learning process is science process skills. Science process skills will be carried out well if facilitated by a laboratory. As we all know, during the COVID-19 pandemic, it is undoubtedly challenging to make students able to meet face-to-face in the laboratory. To overcome these problems, this research was carried out to develop a Virtual Laboratory for PGSD in the IPA family. This research is development research with an ADDIE-type development design. The content design of the IPA PGSD Vilab content will be developed according to the needs of the IPA cluster courses in PGSD. With this research, it is hoped that it can be designed better to provide convenience in terms of access to Virtual Laboratory (ViLab), types of practicum, and quality of Virtual Laboratory (ViLab) applications. In addition, a Virtual Laboratory (ViLab) can help other institutions carry out practicums without being constrained by laboratory problems.

Keywords: Virtual Laboratory · IPA · PGSD

1 Introduction

Science as a process means that science is a process of gaining knowledge. Science learning is not only a collection of knowledge but also several other aspects, namely attitudes and skills [1]. Science is said to be a product, meaning that in science, there are facts, principles, and theories that have been proven true [2]. Science as an attitude, that is, science includes attitudes like diligence, openness, honesty, and objectivity [3].

The nature of science learning contains attitudes in the form of curiosity about objects, natural phenomena, living things, and causal relationships that cause new problems that can be solved through correct procedures, as well as processes in the form of problem-solving strategies through the scientific method, which produce products. In the state of facts, principles, theories, and laws, as well as applications in applying scientific methods and concepts in everyday life. Science as a process related to the workings of producing a product is what is known as "Science process skills" [4].

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Science process skills are an essential ability to understand science. Science skills are learned that provide learning experiences for students [5]. According to Rustaman [6], Science Process Skills are skills to acquire, develop, and apply scientific process skills in the form of mental, physical, and social skills in the form of concepts, principles, laws, and scientific theories, which are defined as necessary skills. Meanwhile, Aydin (2013) describes science process skills as thinking skills used to create knowledge, solve problems, and formulate results. We can understand that science process skills are process skills possessed by students in solving a problem or development [7].

Science process skills are divided into two groups: basic process skills (basic skills), which consist of observing, classifying, measuring, interpreting data, predicting, using tools, conducting experiments, and concluding. In contrast, integrated process skills (integrated skills) consist of formulating problems, identifying variables, describing the relationship between variables, controlling variables, defining variables operationally, obtaining and presenting data, developing hypotheses, designing research, and conducting experiments [8].

Basic science process skills are fundamental and needed in learning and process formation [9]. While integration is a skill that aims to solve problems and is used for experiments, both are very important to teach because they are related to student development [10]. In addition, science process skills have an essential role where these skills help students to obtain optimal results. It will help students understand, learn, remember, and provide direct experience of experimental learning events [11].

According to Jack, several factors affect the low level of science process skills. These are 1) lack of laboratory infrastructure; 2) books are the only guide in learning; 3) school administration has yet to initiate contextual learning and only emphasizes textual mastery. And 4) learning activities that have yet to explore science process skills [12].

The UNESA PGSD Department has five laboratory rooms. One is the science laboratory, which is in the same room as the mathematics laboratory. However, with the COVID-19 pandemic, laboratory activities at PGSD are unavailable because lectures are conducted online. So, science courses that require the role of a laboratory are less than optimal. A Virtual Laboratory (ViLab) is a learning tool needed to support practicum activities during the pandemic and make the most of the role of the PGSD laboratory.

A Virtual Laboratory (ViLab) is a computer-operated simulation in the form of interactive computer software that lets users try out laboratory activities as if they were in a school laboratory [13]. A Virtual Laboratory (ViLab) prepares you with experimental tools, materials, and equipment on a computer to perform subjective experiments anytime and anywhere. A Virtual Laboratory (ViLab) is needed to increase knowledge about the learning process. In the middle of the COVID-19 pandemic, most students chose the Virtual Laboratory (ViLab).

The Virtual Laboratory (ViLab) function is designed to help students easily understand the basics. By using network software technology, it provides connected access to devices. In addition, during this pandemic, this can be used as practical learning when students cannot directly carry out practicum in the laboratory, where the Virtual Laboratory (ViLab) can be accessed at any time by students [14]. Remote access to

real devices Increases the educational process's flexibility and uses the Virtual Laboratory (ViLab) for fundamental physics. So traditionally, combine them. It's possible with modern learning.

The benefit of the Virtual Laboratory (ViLab) is that access within the Virtual Laboratory (ViLab) can be accessed. The 50% fee is earned with significantly reduced management and maintenance costs. In making laboratories, the costs can be reduced. Of course, learning has been supported to improve the experimental process, which helps carry out skills, knowledge, and experience that can be exchanged.

Digital media, especially in elementary science learning, have been widely developed as a thesis output by PGSD students. Still, there is yet to be a particular place to collect the research results [15]. Therefore, by developing a Science Virtual Laboratory (ViLab) in PGSD, existing applications can be ordered and linked to the PGSD website and later used in science learning during a pandemic or everyday learning. The problems discussed in this study include the following: What are the development design and feasibility of ViLab IPA PGSD?

This study aims to develop a plan for a Virtual Laboratory (ViLab) IPA PGSD and explain how the validation results can be used to determine how well the Virtual Laboratory (ViLab) IPA PGSD works.

2 Method

This research design is development research with the ADDIE type, namely developing a Virtual Laboratory (ViLab) prototype in the IPA PGSD family. Data were obtained from material and media experts to determine the feasibility of the developed ViLab. Validated data using a Likert scale will be analyzed quantitatively, descriptively, and using percentages. The stages in the research are as follows.

a. The first stage is analysis, which involves analyzing the RPS in the science cluster courses and analyzing what media needs are needed. At the end of this stage, members of the research team meet to talk about how to solve the problem.
b. The second stage is designs, starting with creating content and website design. The result is a website concept.
c. The third stage is development, which involves realizing the website concept design, material validation, and product validation, and then making product improvements based on material and media experts' advice. The last stage is product implementation by testing it in elementary science lectures. In this third stage, however, the researcher has only reached the point where the website concept design is being made.

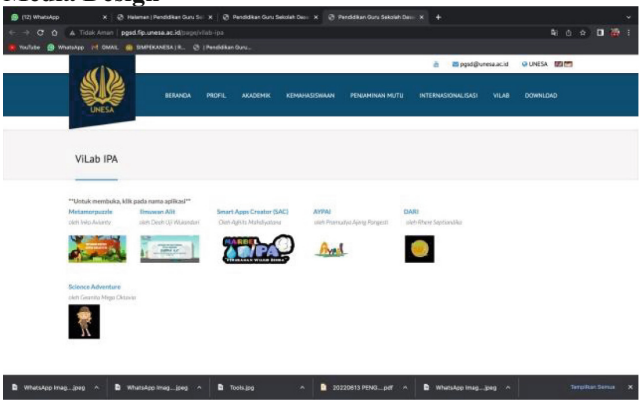
3 Result and Discussion

In the early stages of the research, RPS analysis was carried out on the science cluster courses to see what materials and media were needed and needed in practice. The analysis was carried out so that the Virtual Laboratory (ViLab) could contain all the required practicum. After it was agreed on the RPS for the IPA class, a Virtual Laboratory (ViLab) design was formed from content that was adapted to the RPS in the form of a website

concept needed so that it could attract users to use the Virtual Laboratory (ViLab) while also creating Virtual Laboratory (ViLab) users. It is easy to use. The Virtual Laboratory link also takes you to a page with a sample of a website design firm from the Virtual Laboratory (ViLab). It links to a few science-related applications that students wrote about in their journals (Fig. 1).

Virtual Laboratories are relevant enough to be implemented as a solution to limited learning resources, especially during the pandemic. Besides that, the Virtual Laboratorium makes it easy for lecturers and students to practice without having to meet face-to-face. Then, with the Virtual Laboratory (ViLab), IPA PGSD can reduce the budget, where the budget can be utilized optimally without having to spend more funds

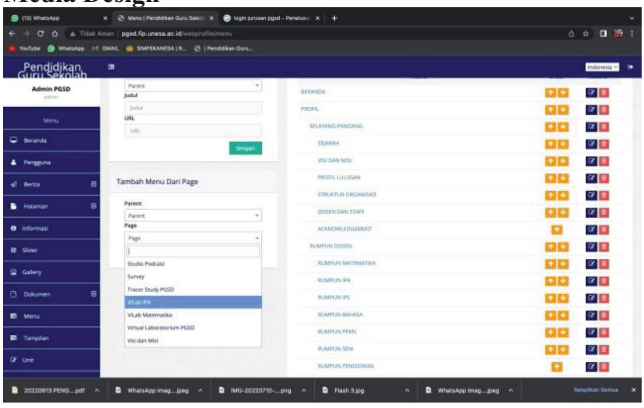
Media Design



Information

View from virtual Laboratory (ViLab) IPA. Loading several applications generated by students

Media Design

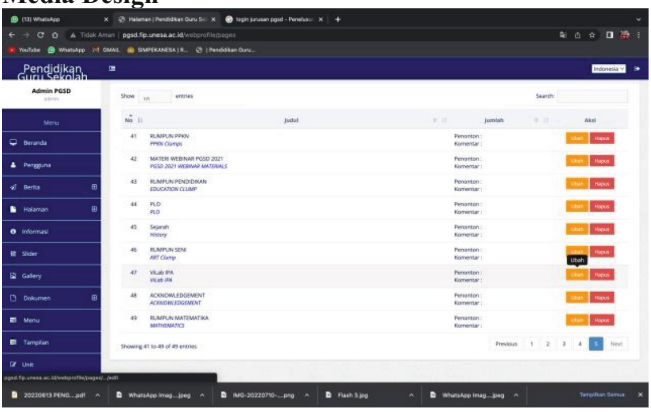


Information

OptionsVirtual Laboratory (ViLab)

Fig. 1. Appearance Virtual Laboratory (ViLab) IPA

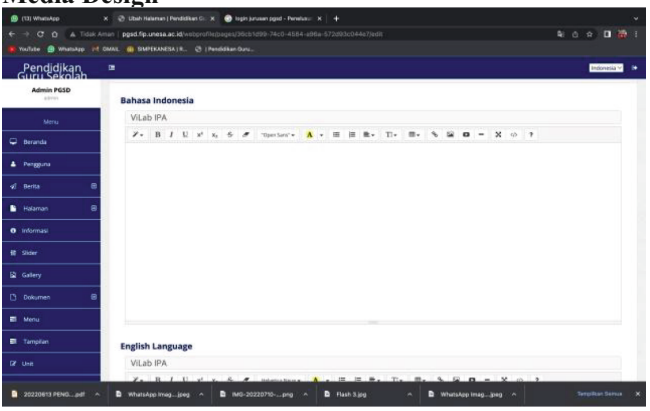
Media Design



Information

Central menuVirtual Laboratory (ViLab)

Media Design



Information

Basic message

Fig. 1. (*continued*)

for laboratory operations by managing the provision of tools and materials. In addition, a Virtual Laboratory (ViLab) can provide security and convenience for lecturers and students because experiments and practices can be carried out online and anywhere without having to think about the risks in practice. However, creating material content in managing the Virtual Laboratory is quite time-consuming, as the material must follow the existing RPS. If there is no available lecturer or responsible person, it must be able to provide or reprogram it to provide an appropriate experience, such as during direct practice. The practitioner can understand this as a guide in completing assignments or uploading learning outcomes. Then it is also necessary for the management of the Virtual Laboratory is also a part that needs to get more attention with regular updates so that

it can provide experiences, such as when doing direct practice, and there must also be good communication between practice officers and laboratory managers.

4 Conclusion

The virtual laboratory is a learning media that is quite effective, considering its function can be done in parallel both as a practitioner and from the laboratory side. Where the Virtual Laboratory (ViLab) provides many conveniences for lecturers and students, there is no place or time limit to try and be creative in practicum.

Suggestion

With this research, it is hoped that it can be developed better to provide convenience in terms of access to Virtual Laboratory (ViLab), types of practicum, and quality of Virtual Laboratory (ViLab) application. It is hoped that it can help to learn in schools to increase students' interest in learning science. In addition, a Virtual Laboratory (ViLab) can help other institutions hold practicals without creating a laboratory, which means the costs for the procurement are not small.

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