Development of Virtual Lab-Based Practicum on Blood Materials and Blood Components and the Determination of Food Nutritional Substances on Student Learning Outcomes

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Abstract. This study aims to develop a virtual lab-based practicum to improve student learning outcomes. This research is development research. The development model used is the ADDIE model (Analyst, Design, Development, Implementation, Evaluation). The subjects of this study were two classes consisting of 60 students which were carried out by purposive sampling. The research instrument was an interview questionnaire, a questionnaire based on the SNPT test of learning outcomes. The analysis technique used is descriptive data analysis techniques and inferential statistics, namely the t-test (one sample independent t-test) and the correlation test. The results showed that the developed virtual lab-based practicum was feasible following the SNPT(Standar Nasional Perguruan Tinggi) with the acquisition of an average feasibility of 1 material expert of 3.74 (Eligible), an average of 3.55 (Eligible) of 3 media experts, and an average feasibility of 3 media experts. 3 lecturers at 3.83 (Decent). The media expert's assessment is carried out by someone who is an expert and understands the fields of multimedia development, system analysis, and knowledge management. The media expert's assessment focused on the presentation feasibility aspect which consisted of 3 components which included: design/appearance, visual/audio display, and media operation. Based on the data that has been obtained, the development of a virtual lab-based practicum that has been developed is feasible to be used in nutritional biochemistry learning. There are also several suggestions for improvement from the validator for the development of virtual lab-based practicums which are developed including 1) adding to the learning outcomes to be achieved, 2) adding learning indicators before the material, and 3) suitability of the color of the writing with the background, where these suggestions have been included as revision into the virtual lab-based practicum products that have been developed

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1 Introduction

This research includes Research and Development (R&D) research. according to Sugiyono (2016) Research and Development (R&D) is a research method used to produce certain products and test the effectiveness of these products. Meanwhile, according to Zakariah (2020) Research and Development (R&D) is a research method used to produce certain products, and test the effectiveness of these products. To be able to produce certain products, research that is in the nature of needs analysis is used and to test the effectiveness of these products so that they can function in the wider community, research is needed to test these products. The development of the ADDIE model is an approach that emphasizes a multiple of each component that has interaction with one another by coordinating according to the existing phases.[3] For this procedure, development starts from the universals, design, development, implementation, and evaluation stages. Biomolecular learning emphasizes providing hands-on learning experiences through the use of developing process skills and a scientific attitude. In addition, biology learning can be carried out well with interesting learning interactions between lecturers and students.[1] Success in achieving learning objectives is strongly influenced by several factors, namely teaching-learning strategies, learning methods and approaches, as well as learning resources used both in the form of books, modules, worksheets, media and others. The use of media in learning can help the limitations of lecturers in conveying information and the limitations of class hours. The media functions as a source of information on learning materials as well as a source of practice questions.[2] The quality of learning is also influenced by individual student differences, both differences in learning styles, differences in abilities, differences in learning speeds, backgrounds and so on. The benefits of virtual laboratories are also expressed by Imron (2012) as follows:a) Reducing time constraints, if there is not enough time to teach all students in the laboratory until they understand. b)Reducing geographical barriers, if there are students who are located far from the center of learning. c)Economical, does not require laboratory buildings, tools and materials as in conventional laboratories. d)Improves the quality of experiments, as they allow for repetition to clarify doubts in measurements in the laboratory. e)Increase the effectiveness of learning, because students will spend more and more time in the virtual laboratory over and over again.[4] Increases security and safety, because it does not interact with real tools and chemicals.

2 Research Methods

The type of research that will be used is research and development which is modified from the development of the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The ADDIE model is a product development concept. The ADDIE concept applied here is to build performance-based learning. Student-centered learning, innovative, authentic, and inspirational (Branch, 2009).[5] This model is relatively more practical and can be measured in stages or systematically and can be used to design and develop learning activities. This research was conducted at the Biochemistry Laboratory, Department of Chemistry, Medan State University, North Sumatra Province in the even semester of the

2022/2023 Academic Year. The selection of research locations took into account various considerations including the suitability of media content with audiences, then access and other considerations. This time interval includes analyzing, designing, developing, product implementation, and evaluating. The population in this study were students majoring in chemistry class of 2021 who were taking molecular biochemistry courses for the 2022/2023 school year. The sampling technique in this study used purposive sampling, which is a sampling technique with certain considerations. The research sample consisted of 30 students as an experimental class and 30 students as a control class. Procedures and research designs are a reference for researchers to carry out research from the beginning to the end so that meaningful conclusions can be obtained.

3. Results and Discussion

Development practical media based virtual labs started with stage analysis Which covers analysis need, analysis media learning. Activity analysis This need done as data beginning For develop practical media based virtual labs . Based on the results of the needs analysis done, practical media very suitable made Wrong One media in learning biochemistry molecular . Use of media practice based virtual lab on blood matter and components blood as well as determination substance nutrition in ingredients food assisting lecturers in conveying a lot of material but a lot of time available is limited, in addition to the application of practical media based virtual lab will make student motivated For Study because media practice based virtual lab has never been applied to biochemistry learning at Medan State University .

Practical media based virtual labs developed use Flutter 3.10.5 software assistance . Advantages of using Flutter 3.10.5 software as tool help development practical media based virtual labs is easy For used without need must understand Language programming and the resulting product is also very good and very easy to implement. While the drawback is that it can not make orders to get out of products that have been developed directly when use it on a smartphone , so you need the help of the back button on the smartphone to exit the practicum media application based virtual labs results development Which currently walk.

Results test appropriateness practical media based virtual labs Which has developed obtained average test appropriateness from 3 person expert material as big 3. 95 which are declared Valid (Appropriate) to be used with some suggestions and input Which given, whereas average appropriateness media obtained as big 3. 9 which are declared Valid (Appropriate) to be used with some suggestions and the input given, as well as the average due diligence of 1 lecturer chemistry of 3.95 which is declared Valid (Decent) for use with several suggestion And input Which given. After revise a number of suggestion And input given by experts, then the practical media based virtual lab can be deployed to every student For implemented in learning bio chemistry nutrition .

Dissemination of practical media virtual lab- based is done in a way send media files practice based virtual lab in apk form . With capacity 24 MB use bluetooth or send files apk with via Telegram or via WhatsApp that has been made before learning begins, then students install the media themselves practice based virtual lab with assistance by researcher. Implementation practical media based virtual labs on biochemistry learning nutritional blood matter and

components blood as well as determination substance nutrition in ingredients food can improve student learning outcomes as well can motivate students to learn.

Based on figure 1, average test appropriateness from two lecturers material expert for aspects appropriateness content is 3.94 and 3.41 Which including in category Worthy.

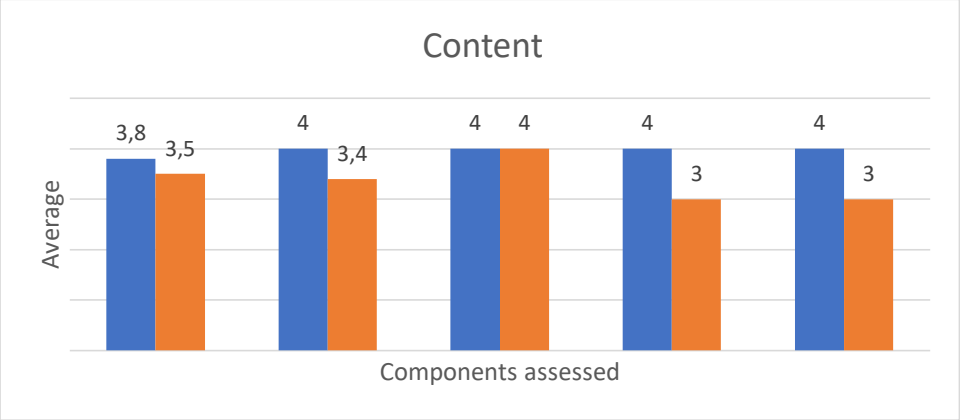

Fig. 1. Content Adequacy Test Results by Material Experts

Based on figure 2, average test appropriateness by Material Expert for aspect appropriateness language is 3.92 and 3.67 Which including Eligible category

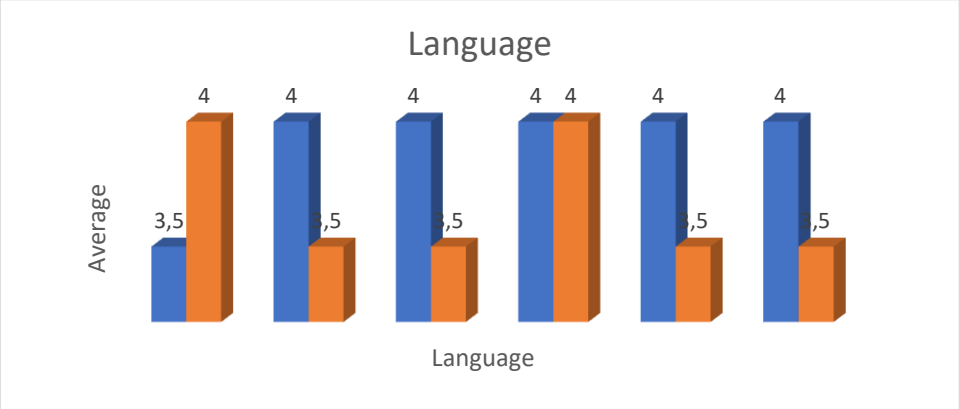

Fig. 2. Results of the Language Feasibility Test by Material Expert

Based on figure 3, average test appropriateness by two experts For aspect appropriateness presentation is 3 .85 and 3.70 Which including in category Worthy.

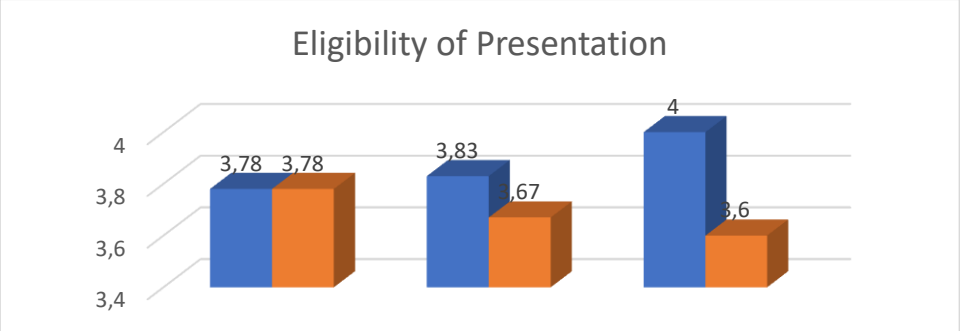

Fig. 3. Results of the Feasibility Test for Presentation by Material Experts

Based on Figure 4, the average presentation due diligence by media experts for the whole component has an average of 3.94 with category Worthy. Based on the data that has been obtained, the practicum media based virtual labs which has been developed is suitable for use in chemistry learning. There is Also a number of suggestion repair from validator to practical media based virtual labs developed include 1) adding goals learning to be achieved, 2) adding cpmk(capaian pembelajaran mata kuliah) , and 3) suitability text color with background , where the suggestions have been entered as a revision into an Android-based interactive multimedia product that has been developed.

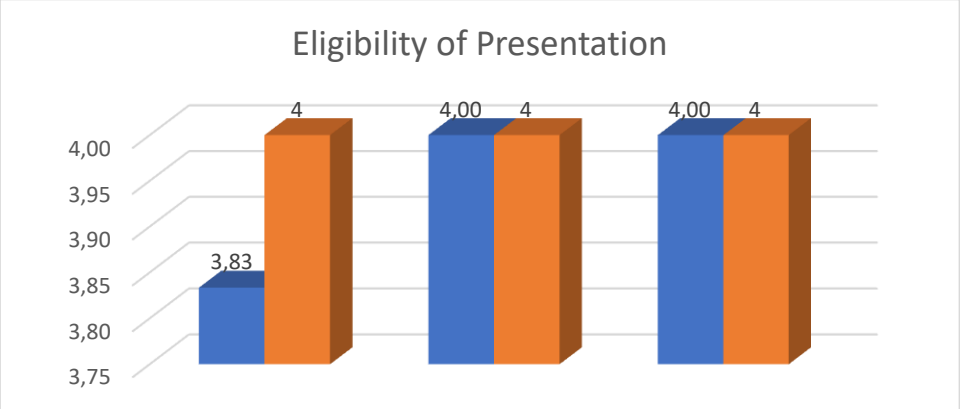

Fig. 4. Results Test Appropriateness by Expert Media

4. Conclusion

The results of the needs analysis show that the learning process has been used media learning, However media Which often used is practice direct as well as the results of media analysis that is often used at Medan State University already meets the criteria according to SNPT(Standar Nasional Perguruan Tinggi) however Still necessity media development solutions because use media learning can help lecturer / laboratory assistant in finish delivery biochemical material lots of nutrients but limited learning time and learning becomes more interesting . Media practice based on virtual lab development results have complied standard of feasibility of SNPT(Standar Nasional Perguruan Tinggi) with the results of the average

feasibility of 2 material experts as big 3.95 , average appropriateness expert media as big 3.90 , And average appropriateness from 1 lecturer for 3.95 with category Worthy.

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