

# Development of Virtual Laboratory Media Based on Construct Application on Acid-Base Material

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## Abstract

The purpose of this study was to examine the quality of virtual laboratory media utilized for developing applications on acid-base materials. This is a development study that employs the 4 D approach, which consists of the steps of define, design, develop, and disseminate. The instruments used to assess the quality of the virtual laboratory media developed were open and closed questionnaires using a Likert scale. Virtual laboratory media products that have been developed are assessed by media experts, material experts, and field trials on a limited and small scale. The limited and small scale trial samples were Jambi University Chemistry Education Study Program students consisting of 5 students in the limited scale test and 15 students in the small scale trial. The results of this study consist of qualitative and quantitative data. Qualitative data in the form of input and suggestions from media experts, material experts, and field trials who have stated that the virtual laboratory media developed has been declared suitable for use. Quantitative data is converted into a level of quality of virtual laboratory media based on assessments from limited and small-scale field tests. The results of the quantitative assessment on a small scale obtained an average of 87.26%, while on a limited scale obtained an average of 91.84%.

*Keywords:* Virtual laboratory media, the construct application, acid-base material

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## 1. Introduction

The development of the era resulted in the use of technology is very inherent in helping human life. Technology makes the dissemination of information can be done quickly and easily (Fuldiaratman et al., 2023). The application of technology in education is needed to improve learning. The quality of learning can be improved through the development and use of technology (Sanova et al., 2022). The use of learning media is needed to bring meaningful learning. Students can be directly involved in the learning process through the technology used.

Curriculum adjustments must be made with the times (Hendra et al., 2023). In the current independent curriculum, the use of learning media must be adjusted to the characteristics of students, so the role of lecturers in using interactive learning media is needed. The ability to produce meaningful learning makes teachers required to continue to develop their competencies (Haryanto et al., 2023).

Based on observations in the field in the Chemistry Education Study Program, interactive learning media have not been widely developed, especially virtual laboratories. Not much virtual laboratory media has been developed due to the manufacturing process which requires a long and detailed time. Not many virtual laboratory media make students' readiness to follow lectures, especially practicum activities, less. This makes students' understanding only based on the theory that has been studied before. Therefore, the availability of virtual laboratory-based learning media is needed to support the theory that has been learned and can be used as a support for practicum activities that will be carried out in real life.

The use of virtual practicum-based learning media can increase learning activities carried out (Ekaputra, 2022). The use of virtual laboratory media can not only be used as a substitute for practicum in a real laboratory but can be used

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to prepare and improve practicum activities through virtual laboratory media. Students can practice using virtual laboratory media so that the real practicum can run effectively and efficiently.

Based on this background, this research will develop virtual laboratory media based on the construct application. The virtual laboratory media developed is focused on acid-base material. Acid base is a basic material that must be understood in depth by students of chemistry subjects. The purpose of this study is to determine the quality of virtual laboratory media used for construct applications on acid-base material that has been developed.

## **2. Literature Review**

### *2.1. Virtual laboratory*

Virtual laboratory is a simulation of practicum activities in the virtual world that is used in the learning process (Muhajarah & Sulthon, 2020). Virtual laboratories can reduce the limitations found in real practicum (Hikmah et al., 2017). The limitations of facilities and infrastructure supporting practicum, the high cost of activities and the high risk in practicum activities can be overcome by virtual practicum activities (Sukenti, 2021). The use of virtual laboratory media in learning activities can increase students' interest and learning outcomes (Dewa et al., 2020).

### *2.2. Construct 2*

Construct 2 is an application used to develop HTML 5-based games (Yustin et al., 2016). The use of the construct 2 application in media development is because it is easy to develop because no complicated programming language is needed and can present material in an attractive way (Arisandy et al., 2021). The construct 2 application can not only insert text, but can insert images, sounds, and videos into the application (Anggendari et al., 2020). The construct 2 application has a variety of visual effect features so that it can make the developed media more attractive and interactive (Nirwana et al., 2023).

## **3. Research Method and Materials**

This research is a type of development research in accordance with the 4D model which consists of four stages of development, namely definition, design, develop, and disseminate. Media experts from Yogyakarta State University's Educational Technology Study Program and material experts from Jambi University's Chemistry Education Study Program reviewed the virtual laboratory media. The virtual laboratory medium was then evaluated in field testing, which included limited and small-scale tests conducted by students from Jambi University's Chemistry Education Study Program. The subjects of the limited scale field trial were 5 students, while the subjects of the limited scale field trial were 15 students. Data regarding the development of virtual laboratory media in the form of qualitative and quantitative data. Qualitative data is in accordance with the 4D product development procedure in the form of input and suggestions from media experts, material experts, and field trials to improve the quality of the virtual laboratory media developed. The quantitative data obtained was then analyzed using percentages to show the quality of the virtual laboratory media developed.

## **4. Results and Discussion**

The development of virtual laboratory media uses the construct 2 application. The developed virtual laboratory media consists of developer bios, learning materials, virtual laboratories, and practice questions. The virtual laboratory media that has been developed is then assessed by media experts and material experts to get input to produce better virtual laboratory media. After being declared feasible by material experts and media experts, the next stage is an assessment to obtain quantitative data. Quantitative data regarding the virtual laboratory media developed were obtained from limited and small scale field tests. The assessment of the laboratory media developed was carried out to 5 students in the limited scale test and 15 students of the Jambi University Chemistry Education Study Program in the small scale test.

The quantitative data obtained was then analyzed using the average test to show the quality of the virtual laboratory media developed. The virtual laboratory media quality test aims to determine the level of quality of the learning media developed. The results of the virtual laboratory media assessment in the limited and small scale tests are presented in Table 1.

The results of the virtual laboratory media quality test assessment from the limited and small-scale trials obtained a score in the excellent category. The results of the assessment of laboratory media developed are expected to improve

student learning outcomes. The use of virtual laboratory media in learning activities can increase motivation and learning achievement (Ekaputra, 2020). Good learning outcomes can be caused by the use of interactive media in learning activities (Novita et al., 2019). The use of virtual laboratory learning media can make students active in learning activities, thereby improving student learning outcomes (Ekaputra & Hasanah, 2021).

**Table 1.** Virtual Laboratory Media Quality Assessment

Field Trial	Aspect	Value	Value Maximum	Percentage
Limited Scale Trial Learning	Design	244	280	87.14 %
	Material	142	160	88.75%
	Media Presentation	258	300	86.00 %
	Software Engineering	122	140	87.14 %
	Average			87.26 %
Small Scale Trial Learning	Design	768	840	91.43 %
	Material	446	480	92.92 %
	Media Presentation	820	900	91.11 %
	Software Engineering	386	420	91.90 %
	Average			91.84%

The high value of media quality obtained is due to the easy operation of the media, and the clear sequence of learning steps. The easy use of learning media because the sequence of menus displayed is easy to understand (Rosdiana et al., 2019). Virtual laboratories can make the flow of learning more systematic (Nugroho, 2021). Based on the data that has been obtained, in this study it can be concluded that the virtual laboratory media that has been developed has been declared feasible by media experts and material experts, and obtained virtual laboratory media based on assessments from limited and small-scale field tests stating that the virtual laboratory developed has very good quality.

## 5. Conclusion

This study's findings include both qualitative and quantitative data. The qualitative data consists of input and suggestions from media experts, material experts, and field trials who have stated that the virtual laboratory media generated is fit for usage. Based on assessments from limited and small-scale field tests, quantitative data is translated into a degree of quality of virtual laboratory material. The quantitative assessment obtained an average of 87.26% on a small scale, and an average of 91.84% on a limited size.

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