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Virtual Reality (VR) Based Learning Media as a Support of Chemistry Learning Process for Students in Schools

Benny Yanuar Dwi Satrio
Semarang State University, Indonesia

* Corresponding Author: **Benny Yanuar Dwi Satrio**

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Abstract
The rapid technological development in the 21st century has changed the education system by using technology as the student's learning source. The aim of this article writing is to know the eligibility of the development of Virtual Reality (VR) based learning media development based on the validation of material expert and media expert as well as the response from the students which got from the previous research. The writing of this article uses literature study method. The analysis technique used by the writer is content analysis technique where the writer will analyze and evaluate the research's results that have been done based on the previous researches. The results of the previous researches then were evaluated, analyzed and interpreted to get the conclusion from the eligibility based on the validation results from media experts and material experts as well as the responses from the students to the Virtual Reality (VR) based learning media development. The conclusion is that the Virtual Reality (VR) based learning media is very eligible to develop as the learning media which can help to visualize the learning material to the students comprehensively.

Keywords: Learning Media, Virtual Reality (VR), Literature Study

1. Introduction

Rapid technological developments in the 21st century have changed the learning system carried out in schools. Learning that was originally centered on books has now shifted to be broader with the use of technology as a source of learning for students. Students can use the internet and various technology and information *platforms* to support the learning process.

This change will certainly also have an impact on learning media that can be used in the learning process. Teachers and students are expected to be able to utilize more technology and information-based learning media. The hope for this will also demand innovation in the development of technology and information-based learning media so that teachers and students have more references in determining media that are in accordance with existing learning objectives.

The use of technology and information-based learning media will provide benefits to teachers and students when carrying out the learning process. One of the benefits that can be obtained is regarding the accessibility of teachers and students who are no longer limited by space and time to learn. Students and teachers only need computer technology, *gadgets* and other assistive devices to be able to access various learning resources easily and quickly.

Virtual Reality (VR) technology can be used as one of the learning media options that can be used by teachers and students. This VR technology is able to present real learning around students directly without having to visit or present the object in class. The presence of this VR technology can answer one of the challenges faced by students and teachers in class, especially in conducting contextual learning which is often constrained by limited time and objects that can be observed.

Virtual Reality (VR) is a technology that allows the appearance of three-dimensional images created by a computer so that they look real with the help of certain equipment, which makes the user feel as if they are directly physically involved in the environment. The use of *Virtual Reality (VR) technology* will make users feel as if they are one with the virtual world and can interact with the objects available there. This is then called *telepresence* which can be interpreted as the experience of a person's presence in the environment through a media.

Teachers and students can use tools in the form of mobile phones to be able to make observations. Applications that can be used by teachers and students to use *VR technology* include *Google Cardboard*, *Oculus Rift* and *HTC Vive.*
The purpose of writing this article is to determine the feasibility results of the development of *Virtual Reality* (VR)-based learning media based on validation by media experts and material experts as well as student responses from previously conducted research.

2. Method

This study uses a qualitative approach with a literature study method. The instrument used in this study is an observation conducted by the author himself where the author will conduct a literature search that is in accordance with the topic of the problem discussed. The subject of research in writing this article is national journals from the results of research that has been conducted and published previously so that secondary data is obtained from the research. The procedure for this study is as follows:

1. Problem formulation

At this stage, the author determines the problems he wants to discuss according to the issues that occur and the author's interests.

2. Literature search

The author conducted a search for information sources in the form of research journals that discuss this problem.

3. Data evaluation

The author evaluates the contents of the research journal obtained so that the research data to be discussed can be in accordance with what is desired.

4. Data analysis and interpretation

The author analyzes the research data obtained so that it can then be summarized and rewritten in the resulting article.
The data analysis technique used by the author is the content analysis technique where the author will analyze the results of research that has been carried out based on suitability with the topic discussed and the time of implementation of the research.

3. Results and Discussion

1. Results

Based on the results of the literature search conducted by the author, there were 6 research journals found that discussed the topic of developing *Virtual Reality* (VR)-based learning media. The research journals obtained were then evaluated and analyzed based on the feasibility scores from media experts, material experts and scores from student responses. The research data obtained from these journals can be presented in the following table.

Table 1: Results of the Eligibility Score and Student Responses to the Development of *Virtual Reality* (VR) Based Learning Media

No	Title	Year	Writer	Research result
1.	*Virtual Reality* Technology in Chemistry Learning	2024	Ananda Awaliya Fransiska, Aida Fitriyani	The results of the tests conducted showed a significant increase in students' understanding of molecular structures and chemical reactions. Students also felt more involved and motivated when learning using VR compared to traditional methods.
2.	Educational Simulation *Game for Introduction to Chemical Element Reactions with Virtual Reality Based Environment*	2024	Muhammad Fadil Hasan, Fathorazi Nur Fajri, Muafi	This study has explored the use of *Virtual Reality (VR) technology* in chemistry learning in schools, with the aim of overcoming barriers in conventional chemistry learning, increasing students' interest and understanding, and ensuring safety in chemistry practical activities. Students' responses to this *VR*- based chemical experiment educational *game* were generally positive or good.
3.	Effectiveness of Molecular Geometry Learning Using *Mobile Virtual Reality* (*MVR*) to Improve Visuospatial Abilities	2024	Ainun Nisa, Kusumawati Dwiningsih	The use of MVR-based molecular geometry learning media is declared effective because it can improve students' *visuospatial skills* so that it can help students to represent molecular geometry sub-material comprehensively.
4.	*Virtual Reality* Technology in the Development of Applied Chemistry Virtual Laboratory	2023	Issa Arwani, Tri Afirianto, Muhammad Aminul Akbar, Sativandi Putra	The majority of respondents felt the ease of using *the prototype* independently and virtually without having to get help from others and can be accessed *online*. Respondents also felt that various features on *the prototype* ran properly and facilitated understanding in the implementation of practicums as an interactive learning medium.
5.	Development of Petroleum Chemistry Learning Media Based on *Green Chemistry* Assisted by *Articulate Storyline*	2022	Julia Mardhiya, Nurul Atsna Qonita, Wiwik Kartika Sari,	This study aims to determine the feasibility and student responses to petroleum chemistry learning media based on green chemistry assisted by *articulate storyline.* The results of product validation were carried out by experts using Aiken's V data analysis. The validity results obtained a value of 0.82 with a very high category. The results of small-scale trials received a good response from students with an average percentage of 71%.
6.	Development of Virtual Laboratory as Learning Media	2022	Devi Qurniati	This study aims to produce virtual laboratory learning media on macromolecular chemistry material. The data from the validation results of media experts obtained media expert assessments with a percentage of 87% in the very feasible category, material expert 1 with a percentage of 92% in the very feasible category, material expert 2 with a percentage of 85% in the very feasible category. Thus, virtual laboratory learning media has been feasible for use in

				chemistry learning with good criteria. The student response to the use of virtual laboratories in small group trials was 81.33%, and in field trials it was 81.41%.
7.	Development of *Smartphone* -Based *Virtual Reality* as a Supporting Media for Environmental Pollution Material	2022	Iis Sugiharti, Ana Yuniasti Retno Wulandari, Eva Ari Wahyuni, Badrud Taman, Nur Qomaria	The results of this study indicate that: (1) the average validity result is 87.50% with a very valid description in the media aspect. In the material aspect, the average validity value is 85.16% with a very valid description. (2) Student responses to *smartphone*- based *virtual reality* are categorized as very good based on the percentage value of student responses of 75.46.
8.	Chemistry Atom *Virtual Reality* Application at *Seamolec*	2020	Inna Novianty, Walidatush Sholihah, Yudawan Aditama	*VRChemistry* application has been successfully created using the IMDSS method. Based on the results of testing respondents, quite satisfactory results were obtained between the interactivity, color, and design of the application that had been created.

4. Discussion

Virtual Reality (VR) based learning media has been successfully developed and tested in previous research. The learning media was then tested to determine the characteristics of the developed media as well as expert assessments and student responses.

Learning media gets a feasible category if it has an average score from experts of 76% ≤ x ≥ 100%. Validation by material experts on *Virtual Reality (VR)-based learning media is carried out to measure the feasibility of the media developed according to the assessment of aspects of suitability of objectives, suitability of curriculum, content of material, and media in learning. Validation by media experts on Virtual Reality (VR)* -based learning media is carried out to measure the feasibility of the media developed based on aspects of media appearance, content feasibility, and object appearance.

Assessment of student responses to *Virtual Reality* (VR)-based learning media is carried out to measure respondents' interest in the products that have been developed. The greater the percentage value obtained by the researcher, the better the product developed for use by students as learning media. Learning media is declared very good based on student responses if it obtains an average score of 76% ≤ x ≥ 100% (Arikunto, 2010). The results of the assessment can then be described as follows:

1. *VR* technology on molecular structure and chemical reactions developed by Ananda Awaliya, *et al*. showed that there was a significant increase in students' understanding of molecular structure and chemical reactions. In addition, students also felt more motivated when learning because of clearer interactions compared to traditional methods. This shows a positive response to *VR technology* used in chemistry learning.
2. The development of an educational game about the introduction of chemical element reactions with the environment by Muhammad Fadil Hasan, *et al*. showed a positive response from students. Based on these results, it can be concluded that VR technology can overcome obstacles in conventional chemistry learning, increase student interest and understanding, and ensure safety in chemical practice activities.
3. The use of *Mobile Virtual Reality* (*MVR*) to improve visuospatial abilities in molecular geometry material by Ainun Nisa and Kusumawati Dwiningsih showed positive results where the technology can help students represent molecular geometry sub-material more comprehensively.
4. *VR* technology in the development of virtual applied chemistry laboratories shows positive results where the majority of respondents feel the ease of using *prototypes* independently and virtually without having to get help from others and can be accessed *online*. This also makes respondents feel easier in understanding the practicum carried out with interactive learning media.
5. The development of petroleum chemistry learning media based on *green chemistry* assisted by *articulate storyline* by Nurul Atsna Wonita, *et al*. received a very high response from experts, namely 82%, so it was declared very suitable for use in the learning process. In addition, the results of student responses showed a percentage of 71% so that it got a good category for use in the learning process in the classroom.
6. The development of a virtual laboratory as a learning medium by Devi Qurniati on macromolecule material received a percentage of 87% in the very feasible category from media experts. The validation results from material expert 1 obtained a percentage of 92% in the very feasible category and material expert 2 with a percentage of 85% in the very feasible category. Thus, the virtual laboratory learning media is suitable for use in chemistry learning. The student response to the use of virtual laboratories in small group trials was 81.33%, and in field trials it was 81.41%. These results indicate that the student response to the use of virtual laboratories is very positive. Based on these results, it can be concluded that the learning media developed received very positive results from both validators and students.
7. The development of *smartphone* -based *virtual reality* as a supporting medium for environmental pollution material by Iis Sugiharti, *et al*. showed that validation from material experts and media experts showed a very feasible category. The assessment of student responses also received a very good category. This shows that the use of smartphone-based virtual reality as a supporting medium for environmental pollution material is feasible to use in learning.
8. *Virtual reality* application developed by Inna Novianty, *et al*. has been successfully created. The developed application was then tested on respondents and obtained quite satisfactory results between the interactivity, color, and design of the application that had been created.

5. Conclusion

Based on the results of previous research, it can be concluded that the development of *Virtual Reality* (VR)-based learning media is very feasible to be developed as a learning medium that can help visualize learning materials comprehensively to students.

6. Thank-You Note

The author would like to thank previous researchers for their

contributions in conducting research on the development of *Virtual Reality* (VR)-based learning media. Thanks to the research results obtained by previous researchers, I and other readers can obtain complete information on the development of *Virtual Reality (VR) -based learning media*. This information will certainly be very useful as a basis for further research to create innovative and useful learning media for students. I hope that the results of writing this article can provide a broader picture of the feasibility and response of students to the *Virtual Reality* (VR)-based learning media that has been developed.

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