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Research article

Design of a Virtual Laboratory Based on Virtual Reality for Learning Resources in Early Childhood Learning

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Abstract.

The COVID-19 pandemic has had a significant impact on the world of education and universities, including the Open University's Early Childhood Education study program. Because the number of students taking this course is very large at all levels, at the beginning of the pandemic, there were problems in the online learning media courses and kindergarten learning resources. It was recognized that there was a need to create a forum in the Early Childhood Education study program, namely a virtual learning laboratory program for the pandemic and post-pandemic period. It was identified that this program should use virtual reality, so that students can surf the lab in cyberspace as if they were there, with media and learning resources that are adapted to the culture of the Indonesian people and others, so that students are more independent in their learning. The ADDIE R&D model was used in this study (analysis, design, develop, implementation and evaluation). The needs were first analyzed and then the virtual reality lab product was developed, which included media for kindergarten courses and other learning resources, especially about educational game tools. This was validated by learning material experts and learning media experts with scores of 91 and 94, respectively.

Keywords: design, virtual laboratory, virtual reality, independent learning

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1. Introduction

During the current pandemic, there are various kinds of problems in the world of education, one of which is how to package media learning and kindergarten learning resources that require student visits directly in the laboratory, when there is still no Covid-19 disaster, students are required to use media course guide books and sources. study kindergarten and come to the Early Childhood Education laboratory, based on interviews with several students of the Early Childhood Education study programe open university and other study programs revealed that virtual learning is needed to help students understand the media course material and kindergarten learning resources in theory and practice, then the next problem is students The Early Childhood Education study program Universitas Terbuka is weak in mastering media materials

and kindergarten learning resources, this is shown by the results of the Final Semester Examinations for the 2020-2021 academic year which show that 70 percent of students have not mastered the theory and practice of making renewable learning media well and true, this makes our concern as educators to provide the best solution so that they are able to master the media materials and kindergarten learning resources properly and correctly so as not to be influenced by foreign media and culture that erode the personality of the Indonesian nation, one solution is to provide learning tools that are capable of improve their learning independence in studying media materials and kindergarten learning resources, the device in question is the early childhood education virtual laboratory media material and kindergarten learning resources that are well packaged, displaying 3D objects of all media elements and learning resources for kindergarten children in Indonesia so that students' learning independence become better and the spirit of nationalism becomes more.

In Indonesia, there are not many who use virtual labs in learning in Early Childhood Education study programs, usually those who already use virtual labs are the world of medicine and science, while for Early Childhood Education learning, especially learning media materials and kindergarten learning resources, so far no one has developed a virtual Early Childhood Education lab with using virtual reality, even though abroad there have been many campuses that create and use virtual labs in cultural learning, therefore it is necessary to try to make virtual reality applications that are able to show real virtual reality based, this needs to be tried in Indonesia so that learning media and resources Kindergarten learning which has been a compulsory subject at all undergraduate levels in all public and private universities in Indonesia has become something interesting, as educators are really required how to package learning that can be accessed by students anywhere, both online and offline. s The goal is to create a Early Childhood Education virtual lab application that is able to display virtual world objects such as the real world on media materials and kindergarten learning resources properly and correctly. The urgency in this research is to produce Early Childhood Education virtual lab products which are presented online and offline by preparing applications that can be played with VR cameras, sticks and smartphones or computers connected to Virtual lab applications on media materials and kindergarten learning resources

Domestically, there are already virtual labs for science or health lessons conducted [1], which shows that mobile virtual reality can improve students' analytical skills in studying physics material, strengthened [2] which shows that virtual reality packaged in the form of games can increase student motivation and learning outcomes in studying biology, and [3] explained that virtual reality-based virtual labs can improve cognition of

kindergarten children in Bali in learning a variety of fish for children, while [4] explained that by learning geometry-based material based on mobile-based augmented reality can improve students' spatial abilities, then [5] Explaining again that mobile augmented reality is very effective in learning geometry at the college level.

With the virtual laboratory, it is expected to be able to increase students' learning motivation and independent learning, this is in accordance with [6], which shows that students are very enthusiastic in using virtual reality-based animal material educational games that have been packaged online and offline so that during a pandemic can be used by Early Childhood Education UT students, then [7] shows that the relationship between attitudes, learning independence, and learning styles with student cognitive learning outcomes is determined by using learning media that is in accordance with the child's level of thinking. , then [8] shows that there is an effect of make a match cooperative learning and conventional learning on Civics learning outcomes in terms of student learning independence at MTs N in Kudus Regency then [9] shows that the relationship between Independence and Active Learning with Civics Learning Outcomes has a very large influence , if students' independence is high in learning, the learning outcomes also increase, then [10]. Explaining that there is an influence of 85% of learning independence and students' perceptions of teacher teaching on PKN learning achievement at SMK Negeri 5 Sukoharjo students, from the reference above it shows that learning independence is influenced by learning media and learning strategies applied by teachers or lecturers. From the problems and solutions offered based on the conditions of learning educational game tools in the current pandemic, research was carried out on the development of virtual laboratories for media courses and virtual reality-based kindergarten learning resources to increase student learning independence.

2. Research Methods

This type of research is research and development. The population in this study were graduate students of educational Early Childhood Education programme Open University. Data collection techniques used are tests validation expert judment, questionnaires and documentation. The material in this learning media is Kindergarten learning media and resources especially educational game tools Data analysis techniques in this study were analysis questionare. The development model used is the ADDIE model which includes analysis, design, development, implementation, and evaluation. **The ADDIE model can be shown in Figure 1.**

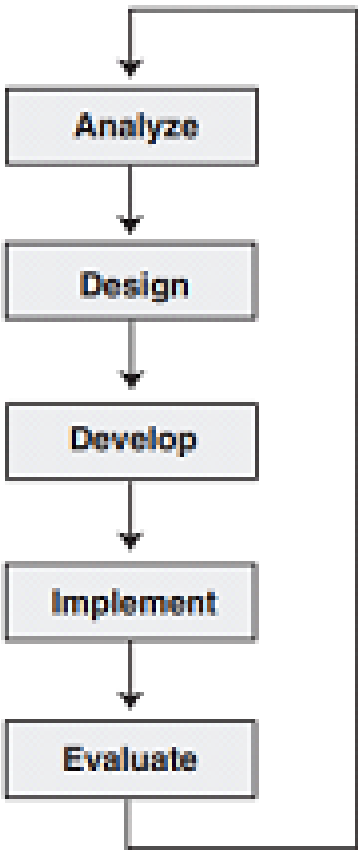

Figure 1: ADDIE Model [11].

3. Results And Discussion

3.1. Analysis

The analysis step consists of two stages, namely performance analysis and needs analysis. The first stage, namely performance analysis, is carried out to find out and clarify whether the performance problems faced require solutions in the form of program implementation or management improvements. In the performance analysis, an in-depth study has been carried out on the performance of lecturers at open university who teach Nature of Early Childhood Learning Resources which shows that so far there have been no open university lecturers who have used VR-based Virtual laboratory during the covid-19 pandemic, so it is very necessary to have media. This Virtual laboratory is to help students practice VR in understanding educational game tools material and its types.

In the second stage, the needs analysis is a necessary step to determine the abilities or competencies that students need to learn to improve learning achievement [12].

What is clear is that learning media is needed that is able to produce Nature of Early Childhood Learning Resources that are packaged in virtual reality and make students able to practice recognizing other differentials in an interesting and systematic way.

3.2. Design

This step requires a clarification of the learning program designed so that the program can achieve the learning objectives as expected. In product design, what is done is the next stage of the ADDIE model, namely design. At this step, it is necessary to clarify the learning program designed so that the program can achieve the learning objectives as expected [11].

In making augmented reality-based mobile education products, the material for ordinary differential equations has been made in a team by the Open University research team and assisted by IT experts outside Universitas PGRI Semarang so that there is good collaboration with the Open University research team to create a material framework and design that is expected in making The Nature of Early Childhood Learning Resources based on VR, then executed by IT experts who are competent in their fields, after the design of the VR-based mobile education is approximately 3 months according to expert judgment advice, the product is continued in the third stage, namely development.

Figure 2: Design of Virtual Laboratory about educational game tools material after revision.

3.3. Development

This development step includes creating, buying, and modifying learning media to achieve predetermined learning objectives. The development step, in other words, includes the activity of selecting and determining the appropriate methods, media and learning strategies used in delivering personal material [10]. In this development stage, the framework that has been designed will be realized so as to produce a product that can be implemented. In this development stage, virtual reality based virtual laboratory products for produce Nature of Early Childhood Learning Resources are usually validated first to experts, namely material experts and media experts, so that virtual reality-based virtual reality products are feasible to be used before being tested limitedly at open university. . At the development stage, VR-based virtual laboratory will be made according to the material, after the print-based and VR-based media are complete, they will be validated by media experts and material experts by the validator to get input and evaluate according to the input given by the validator. Furthermore, the android-based media is revised according to the input given by the validator to improve the product.

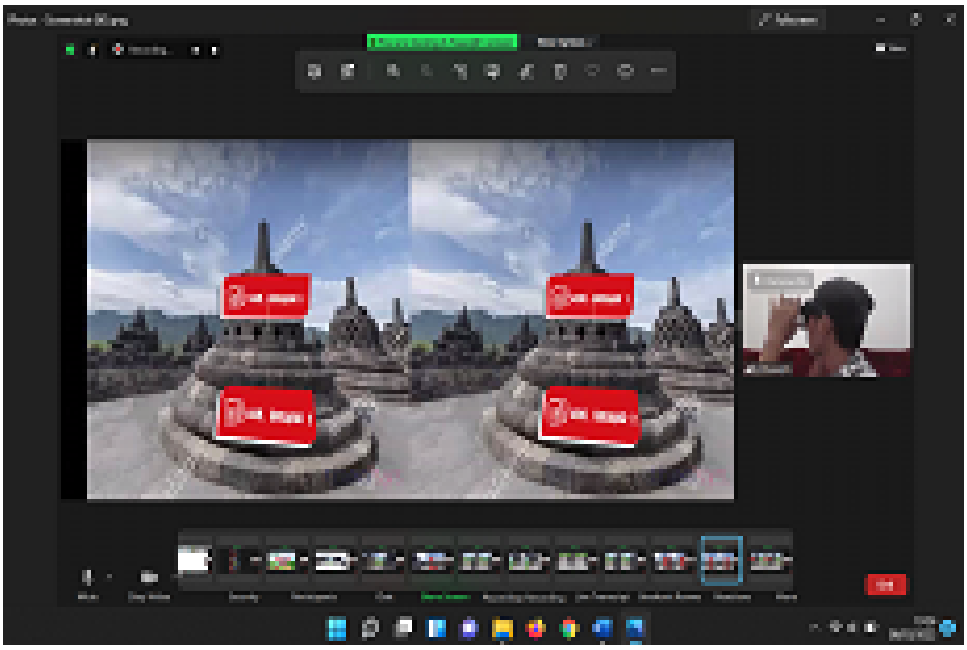

Figure 3: Product validation of AR-based elementary thematic mobile educations by experts.

Based on 2 validators who are experts in the field of technology education from Elementary Education Unissula Semarang and learning media expert and material expert from Universitas PGRI Semarang, the following data were obtained:

Table 1: Validation of learning media experts.

Media expert	Application aspect	Creativity aspect	Innovation aspect	Visual communication aspect
Score validation	94%	95%	93%	94%

From the table above, an average score of 94% means that this virtual reality-based virtual laboratory is very suitable to be used in learning educational game tools material of education courses at Open University and partner campuses.

Then continued with the validation of learning media experts, it was obtained data that virtual reality-based virtual laboratory media was feasible to use, so that VR-based virtual laboratory media products in educational game tools material could be used optimally.

Table 2: Validation of learning material experts.

Material expert	Material substantion aspect	Language aspect
Score validation	90%	92%

From the table above, an average score of 91% means that the material in the Virtual Reality based virtual laboratory media in the educational game tools material is very suitable for use in learning in universities, especially the Early Childhood study program. Then by using a virtual laboratory in pharmacy analysis practicum learning is very effective for pharmacy students during the covid-19 pandemic because it makes it easier for students to understand the material. [13], then by using a STEM-based virtual lab it is able to improve students' scientific literacy [14], In the Exploring virtual reality as a platform for distance team-based learning can make student flexibility to learning any where and any time [15], so Integration of Virtual Reality in Secondary STEM Education can make student yunior high school enjoy with combination science and mathematic [16], then in the use of 3D virtual reality technology in elementary school level mathematics learning, the influence is felt, especially in increasing students' learning motivation [17].

Then continued with material expert validation so that the suitability of the material content can be accounted for, so that virtual reality based virtual laboratory media products can materially be used.

4. Conclusion

Based on the results of the study, it can be concluded that the application of virtual laboratory based learning media with virtual reality in graduate meets the very visible criteria. This is indicated by validation of learning media experts an average score of 92,5% means that this virtual reality-based virtual laboratory is very suitable to be used in Early Childhood Learning of education courses at graduates open university

5. Authors' Contributions

The author hopes that the results of this study can be an alternative for lecturer to using virtual laboratory media with different materials. So it is expected to improve motivation college student learning outcomes.

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