The Effectiveness of The Implementation of Virtual Reality-Based Era 5.0 Learning in Building Materials Practice Courses

Liana Atika[1], Dwiki Muda Yulanto[2], Siti Ulgari[3]

{liana_atika@unimed.ac.id[1], dwikimudayulanto@unimed.ac.id[2], siti_ulgari@unimed.ac.id[3]}

Universitas Negeri Medan, Jl. Willem Iskandar V. Medan Estate[1] , Universitas Negeri Medan, Jl. Willem Iskandar V. Medan Estate[2] , Universitas Negeri Medan, Jl. Willem Iskandar V. Medan Estate[3]

Abstract. Era 5.0 educators are required to be a planner and designer of a learning system that is oriented to technology. Coexisting with technology makes us as educators able to utilize technology that can be used as a student learning medium to improve the quality of learning. It is necessary to develop teaching materials based on virtual reality era society 5.0. This research was conducted using the Research and Development approach, this research method uses the ADDIE development model which stands for Analysis, Design, Development, Implementation and Evaluation. This study produced three effective test scores, namely one with a percentage of 89.73%, a small group test of 78.65%, and an increase in student learning outcomes of 87.77%. It can be concluded based on the effectiveness of implementing virtual reality-based learning that developed, showing a good presentation of results to apply to the learning process of building material practice courses.

Keywords: Virtual Reality, Society 5.0, Development.

1 Introduction

The global revolution that occurs in human life causes many lifestyle changes in human life, especially in education. Education plays an essential role in the progress of the times, namely in using technology as a teaching medium; education contributes greatly to educating the nation. This, of course, requires us as educators to make the best use of technology. Especially in the era of society 5.0, it has a characteristic, namely humans as a medium who utilizes technology to design teaching materials. Technology, which, of course, is very influential on students and the progress of the nation's technology [1]. In the era of society 5.0, technology has become the lifestyle of each human being, and for that, there is no reason for an educator to be able to adapt to developing technology [2]

[1] Discussing research that implements technology used to face the Society Era 5.0, this article was published online on September 14, 2023

[2] The background of this study is to test the effectiveness of AI technology in the 4.0 and 5.0 eras; this article was published in January 2022.

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In the past, in the era of 4.0, humans used internet services or data-based to access information and store data through the internet. This is very different from the 5.0 period, where humans are prepared to become a planner and media makers through services on the internet. Where people in the world will be able to access the things we create through technology and utilize internet services [3]. In this era, things that have not happened can also be known through Artificial Intelligence technology. Future information we can get with this technology is data on the internet. This certainly makes it very easy for us to find information. Today's industry is technology-based, something we cannot achieve now, but we can see it as accurate through virtual reality media spending supendi [4]. A situation that we cannot achieve but educators as planners are able to turn the unreal into real and capable things as they can be touched. This is a situation that we cannot complete, but educators as planners can turn unreal into honest and capable things as can touch them. Most humans choose to do activities or work in virtual space. One that is relatively high in addition to performing arts and investment, education is also one of the biggest desires of society today to do metaverse technology, where metaverse is a virtual space technology innovation, one of which is Virtual Reality media[5].

Virtual reality is an application that connects planners and users with certain media by displaying educational simulations planners make so that students can explore and practice educational activities that planners or educators have compiled. Virtual reality, of course, dramatically supports practical learning in the Building Engineering Education study program. Practical understanding needs practicum media to support the success or achievement of the system. Virtual reality can help lecturers and students practice efficiently and conduct discussions or FGDs without meeting face-to-face [6]. Virtual reality technology is an alternative to bring up images or practical activities in real-time in three-dimensional form, commonly called 3D, which is a design by users or educators according to the needs of practical learning that educators will teach students [7].

Building materials practice learning in the Building Engineering Education study program has been doing direct practice in the laboratory. Still, during the pandemic a few years ago, the building materials practice course was constrained due to social restrictions. At that time, I had to do practical activities for some time due to face-to-face conditions. In addition, inadequate equipment in the laboratory significantly affects the teaching and learning process of students. Building material practice is a simulated course equipped with Jobsheet or printed teaching materials used as a reference for doing practicum in the laboratory. Building materials practice courses require learning media that can simulate practical activities so that learning is natural and easy for students to understand.

[3] Human resource development is of particular concern in this article to face the transition of the 4.0 era to 5.0.

[4] An article displayed on the Ministry of Education and Culture website to increase readers' insights about digital learning.

[5] The discussion in this book is about virtual reality as a fundamental technology that answers the needs of today's educational world.

[6] Articles talk about virtual reality as a business system and technical information system.

[7] Examining virtual reality technology's impact on building students' diagnostic skills in mathematics learning.

Therefore, our perspective on the needs of the world of education today needs to be oriented. In facing the progress of the times, especially the era of society 5.0 as academics who struggle in the world of education, they should have prepared teaching materials that can answer human needs in the metaverse world [8]The Industrial Revolution used technology or networks as a space for information search and then analyzing and solving problems. Still, the era of society 5.0 combines network components technology, and the results of dictionary analysis are poured into the virtual world in natural form, namely by realizing it through Virtual Reality [9]. For this reason, practical learning can continue in a virtual form where vocational education oriented to practical knowledge can visualize practical understanding in the virtual format so that students can see characteristics and processes more accurately than in other places [10]. Thus, the teaching and learning process, both face-to-face and virtual, can be adequately realized [11]. Virtual reality applications that develop in the world of education are the Millea Lab application. This application on two devices, namely Millea Lab, an application used by users on a PC or laptop, and the results of virtual media design can use a viewer tool in the form of an Oculus headset accompanied by a stick that can interact directly to touch the endpoint to explored so that users, namely students, can learn to use virtual reality media [12]. Millea Lab is a virtual reality-based teaching media application with various educational features according to the needs and content of the chosen course. Able to complement the media in video and sound so that the press compilation feels more real [13]. Millea Lab is a precise and accurate virtual reality platform equipped with complete learning content to be seen in reality.

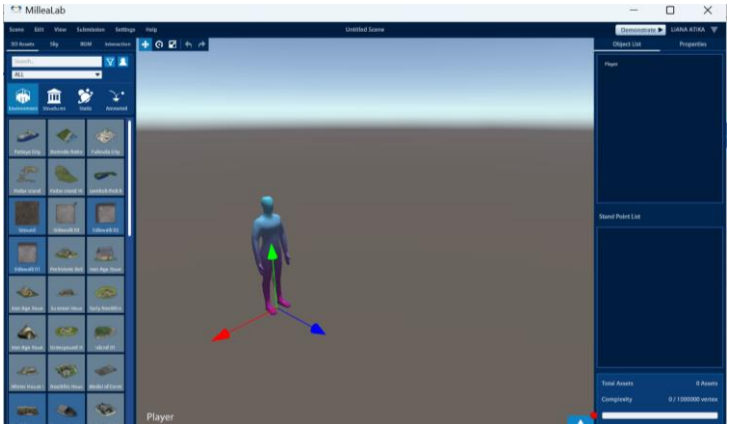

Figure. 1. Display of Millea Lab Application

[8] An article that writes about community service to apply virtual reality media as an introduction to digital literacy in the world of the metaverse.
[9] Virtual reality as a medium for students in learning
[10] Journal of technological and vocational Education on occupational health and safety abominations in practical learning
[11] Articles that discuss virtual reality as digital learning connected to the classroom are used as an educational medium.
[12] CIRP proceedings on computation manufacturing engineering published in February 2019.
[13] Mentoring learning media through virtual reality for Lebak Regency teachers

2 Research Methods

Research that uses development through the stages of analysis, design, development, implementation and evaluation is called the ADDIE model which is run through five stages of media development [14]. This research aims to develop a product that has been analyzed for its needs and answer the needs needed, especially in the world of education. The initial stage is to analyze the situation where the research is carried out, what conditions students need by coordinating with course lecturers, and what things students need to improve their competence. Then, after identifying the need, start designing something that can answer the problem. After creation, the media is then developed according to the advice of several experts and taking valid data from each expert. Then, after revising according to the suggestions, implementation was carried out for students who taught building materials practice courses and took pretest and post-test data. The last is to evaluate the performance of virtual reality-based learning media [15]. Processing research data for the development of virtual reality teaching materials uses a mixed approach that combines several methods, namely quantitative techniques and qualitative approaches. This approach connects data related to the results of analysis that have been collaborated to understand research problems well so that the research results have constructive conclusions and suggestions that can be used as new findings that are useful for readers.

The activities carried out in the ADDIE development model are through the following stages of development: (1) The analysis in this study is to analyze student problems that occur in the field; researchers observe the beginning of things that cause the source of the problem [16]. Data can be taken from student observation, analysis of field conditions and field situations, whether they have sufficient equipment and learning media or not and analysis of the potential in field conditions. (2) The design at this research stage is to prepare teaching materials according to student needs and design teaching media following the potential that can developed from the observations [17]. (3) Development at this stage and producing media using virtual reality applications. The application used in this study is the Millea lab application, where this application is a virtual reality application in the field of education that has a lot of educational content in it. Then, after the media is finished, virtual reality media is validated by several experts and the expertise of each expert. Then, the validation results are taken on average scores so that it can be seen whether the media is suitable or not for student use [18]. Stage (4) Implementation is to conduct trials for students with several tests, namely taking data one to one, where this stage takes practices for three students, then works small group exams for 11 students and finally trials for one class of research samples totalling 28 students. Finally, the evaluation is to evaluate to students whether virtual reality media for building material practice courses is suitable for student use or not.

[14] Articles containing effects and factors that affect learning using virtual reality[15] The application of the
[15] The application of the ADDIE model is shown in this article; the steps and stages are reviewed in the article
[16] Media development using technology is studied using the ADDIE development model, and the test methods are well described using average score scores.
[17] Reviewing the model of learning media development model using technology
[18] The development of teaching media developed uses five stages, namely Analysis, Design, Development, Implementation, and Evaluation.

This development research is commonly used to develop educational projects, such as the development of textbook media, multimedia learning media, virtual reality learning applications, reality augment, learning videos and others that strongly support learning in the world of education [19]. Academic research and development includes several stages where a product is developed, tested, and revised according to the results of field tests. The procedure for conducting this research is explained in the following diagram:

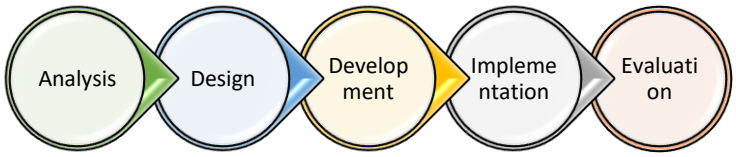

Figure. 2. ADDIE Model development image

Conducted this research in the building engineering education study program and building materials practice course at the Faculty of Engineering, Medan State University. The object of research is students of the Building Engineering Education Class of 2022 in even semesters. The research time is 6 (six) months from May to October 2023. This research requires the involvement of several parties, namely the author as researchers, media experts, and validation teams, along with students tested using virtual media using the Millea Lab application.

The processing of this research data uses effectiveness analysis. Ineffectiveness analysis uses learning outcomes tests. Student learning outcomes are assessed based on scoring. It is starting from the validity of the question items and the distinguishing power of the question items. Then, the effectiveness of learning outcomes is assessed by assessing the increase in pretest and post-test students to determine whether. This research will improve students' ability to understand building material practice courses in the program Unimed Building Engineering Education Studies.

3 Research Results and Discussion

3.1 Analysis Phase

This research, according to the development stage, begins at the analysis stage, namely observing learning activities in the program and building materials practice courses. The results of preliminary research observations were found: (1) Learning objectives and competencies are not what students need in learning outcomes, (2) the assessment of the learning process does not use evaluation sheets, (3) Students have difficulty understanding the course due to the absence of appropriate teaching materials, (4) Learning activities do not go through introduction, core activities, and closing, (5) There is no initial ability test for students. Therefore, it is necessary to develop teaching materials for virtual reality-based building materials practice courses.

3.2 Design and Development Phase

At this stage, the development of virtual reality-based teaching materials for building materials practice courses is carried out by experts in virtual reality media using virtual reality

[21] Measuring the effectiveness of online learning to deal with epidemics published in educational science journals

applications, namely the Millea Lab application. Millea Lab is a virtual reality media developer application in the world of education; this application is connected to the user's Google email and can be used if you wear VR glasses or use a mobile phone that has Milea Lab installed Viewer by using a passcode to enter the course that has been designed [20]. The design of the development of virtual reality teaching materials in the building materials practice course in design has 16-course content whose contents can be in the form of learning and evaluation videos. The entire range of the content can be explored by students freely. In addition, virtual media reality is equipped with a spatial layout like the actual state; we can touch the existing parts through the endpoint or use a VR stick.

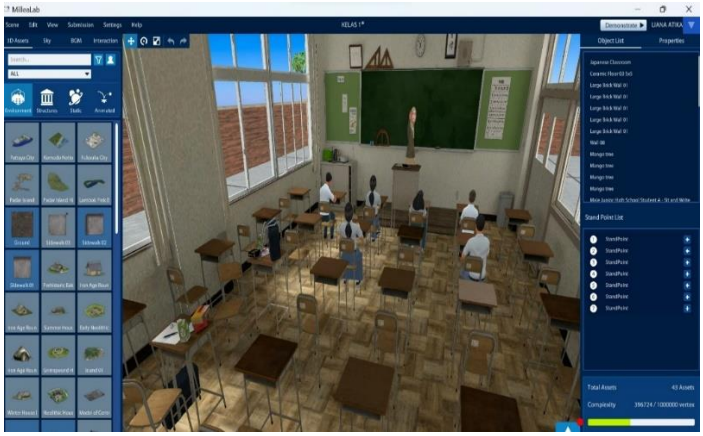

Figure. 3. VR media development Building materials practice courses

At the stage of developing virtual Reality teaching media, teaching materials were validated by a learning design expert with an average percentage score of 77.00 in the excellent category, a material expert with an average percentage score of 75.44 in the superb category and a learning media expert with an average percentage score of 77.20 with a good variety.

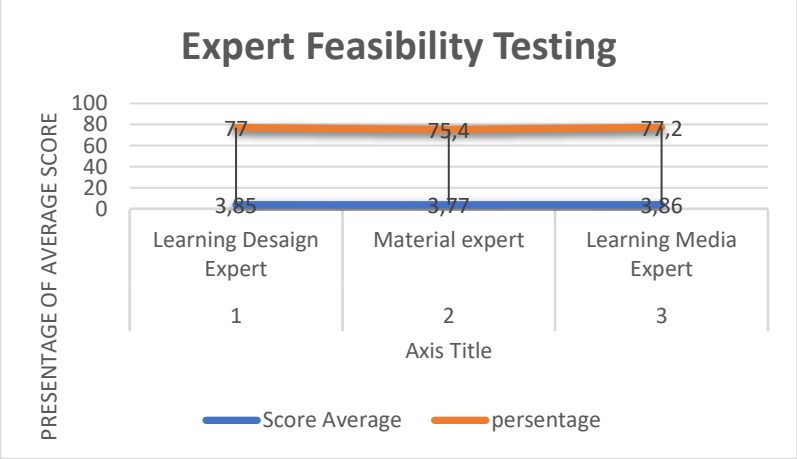

Figure. 4. Member qualification test graphic

[22] Evaluate the application of technology in early childhood education with the CIPP evaluation method by testing the effectiveness of a learning program using technology.

3.3 Implementation

The implementation of virtual reality teaching materials was carried out in the program, where the performance of the research took data for three tests, namely one-to-one tests that tested three students to fill out questionnaires on the effectiveness of the use of teaching materials, small group tests to 11 students who tried virtual reality media, then for an enormous scope tested to 1 class of 28 students to get pretest data and post-test of the research instrument. Effectiveness is measured based on how many learning objectives are achieved, interpreted as the accuracy of managing learning conditions [21]. For this reason, learning effectiveness can be interpreted as a learning process that is beneficial and aims for students by developing a suitable learning design model.

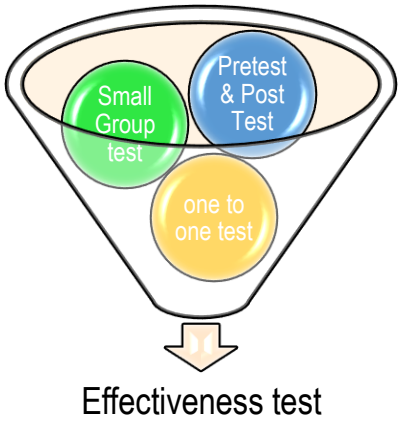

Figure. 5. Member qualification test graphic

The purpose of this field trial is to identify the shortcomings of building material practice manuals and virtual reality teaching materials when used in the learning process of building materials practice courses that are by actual circumstances. Field trials were conducted at the Department of Engineering Education at Unimed building, and the number of students present was 28 people. Effectiveness Test Scores can the following table:

Table 1. Table of effectiveness of virtual reality teaching materials

No.	Test	Skor average	(%)	Category
1.	One to One test	4.49	89.73	Excelent
2.	Small Group test	3.93	78.65	Good Enaught
3.	Pretest and Posttest	33.68	87.77	Excelent

[22] Evaluate the application of technology in early childhood education with the CIPP evaluation method by testing the effectiveness of a learning program using technology.

3.4 Evaluation

The evaluation stage is assessing a product development implementation process [22]. The results of the development of virtual reality teaching media were on 28 students who taught building materials practical courses by taking the initial pretest data; students got an average pretest score of 41.12 and took the final average post-test data of 74.78. From the intermediate results of the pretest and post-test scores, researchers concluded that virtual reality media experienced a significant increase, looking at the table below:

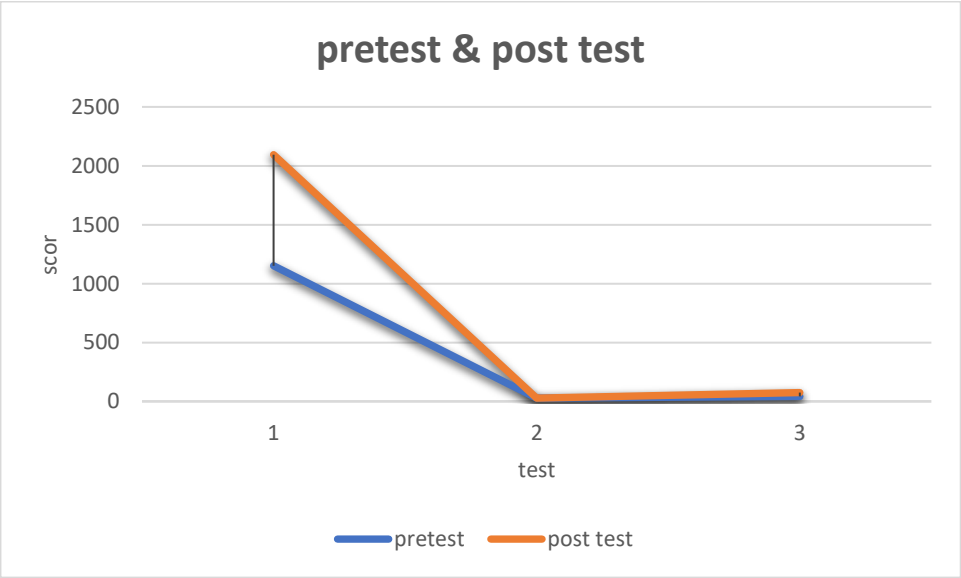

Figure. 6. Student pretest and post-test test charts

Conclusion

From preliminary research, it is necessary to develop teaching materials for virtual reality-based building materials practice courses, considering the unavailability of multimedia for these courses. The physical form of the development results in the form of teaching materials for virtual reality-based building materials practice courses. Development of teaching materials for virtual reality-based building materials practice courses in the Department of Building Engineering Education Unimed provides output in the form of teaching materials for virtual reality-based building materials practice courses in the form of softcopies that can through mobile applications (android) and other VR media. The teaching materials for virtual reality-based building materials practice courses in the Department of Building Engineering Education at Unimed are suitable for use by students.

[22] Evaluate the application of technology in early childhood education with the CIPP evaluation method by testing the effectiveness of a learning program using technology.

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