Learning management system based on virtual reality technology in elementary school

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Abstract

The main problem faced by teachers both during the pandemic and post-pandemic is the interest and learning performance of elementary school students who are still not in line with expectations. This study aims to develop a learning management system based on virtual reality technology to increase the effectiveness of learning in elementary schools. This research is a design and development study. The subjects of this study were teachers and elementary school students. Data collection in this study was carried out through focus group discussions, interviews, observations and questionnaires. The data analysis technique used is the descriptive quantitative analysis and qualitative analysis through interactive analysis. The research findings indicate that the product developed can have a positive impact on both students and teachers. Students feel more motivated to participate in learning activities and learning feels more interesting. Students find it easier to understand the subject matter so it has an impact on mastery of the material and better learning outcomes. In addition, through this product, teachers can present learning efficiently, confidence in teaching will be better and the effectiveness of teaching activities will be better.

Keywords: Learning management system, virtual reality, elementary school.

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1. Introduction

The presence of the COVID-19 pandemic provided a very valuable experience for educational practice, especially in Indonesia. This situation is accompanied by an appeal to maintain distance by changing teaching and learning practices from conventional/classical to distance learning or online learning (Herwin et al., 2022b). However, on average, institutions and teaching staff in Indonesia are not as prepared as those in more developed countries. This results in online learning, but it has been less effective (Herwin et al., 2020; Widiyono, 2020). Students feel bored and frustrated (Ambarsari, 2021; Putria et al., 2020) and lose interest in learning (Budiman, 2021).

Online learning during the distance learning period is less effective. The situation of remote learning system forces educational institutions to place high hopes on the integration of technology in the management of learning (Pujiastuti et al., 2021; Herwin et al., 2021). However, it turned out that this did not go smoothly in the field. Students tend to be bored and frustrated and lose interest in learning because of the ineffectiveness of the learning media used.

Elementary school is one of the education levels most negatively affected by online learning policies. Although teachers and educators in schools have tried their best to achieve the learning objectives outlined in the curriculum, this still raises many weaknesses that need to be addressed. Online learning is dominated by the use of the Zoom application for face-to-face and WhatsApp for materials and assignments (Herwin et al., 2020; Nurmaya et al., 2021). Although it is effective for theory learning, it is not for practical learning. This is a big note that needs to be addressed.

Initial findings in the field indicate that teachers still experience learning problems both during the pandemic and post-pandemic. It is shown that during the pandemic, the main problem for students is the boredom of studying from home and feeling that the learning experience is boring. The same thing was also found after the pandemic: that student learning and performance were also not satisfactory. Teachers still have difficulty presenting learning variations that can encourage student learning activities. This shows that there is a need for innovation in learning activities to raise the spirit of learning and the effectiveness of learning in elementary schools.

The application of virtual reality technology in online learning is the right solution in today's learning (Cortiz & Silva, 2017; McFaul & FitzGerald, 2020; Valdez et al., 2013). Virtual reality is suitable for both online and offline learning (Brazley, 2019; Chang et al., 2016; Martín-Gutiérrez et al., 2017). In addition, several findings support that virtual reality technology has been shown to increase student involvement in learning and enhance learning experiences (Cai, 2017; Carbonell-Carrera & Saorín, 2017; Häkkilä et al., 2018; Hu Au & Lee, 2017; Kamińska et al., 2019; Martín-Gutiérrez et al., 2017; Megat Zakaria, 2020; Stojšić et al., 2019; Vesisenaho et al., 2019; Vogel et al., 2004). Virtual reality helps optimise students' understanding (Lee & Wong, 2008), but with better learning through books and videos (Allcoat & von Mühlenen, 2018), especially in practical learning (Kustandi et al., 2020), because virtual reality is easily able to explain concepts that are difficult to explain using the lecture method (Nur, 2020).

Although very promising, the level of introduction of virtual reality technology in Indonesia, especially in various regions, is still very low (Shabir, 2021). In fact, the Ministry of Education of the Republic of Indonesia strongly recommends the application of virtual reality in online learning. Meanwhile, with the arrival of the metaverse version of MetaFacebook, virtual reality technology will become commonplace in the next 2–3 years. Therefore, it is important that virtual reality-based learning applications be presented, in addition to increasing the effectiveness of learning, as well as preparing elementary school students to face the metaverse era.

Preliminary studies that have been conducted have pointed to the very appropriate use of virtual reality to increase the effectiveness of online learning (Shabir, 2021). The elementary school level was chosen because it is the level of education most affected by online learning policies (Alifia et al., 2021). The targets of this study were teachers and elementary school students. The urgency of the research is to increase the interest and learning performance of elementary school students in undergoing distance learning programmes both now and in the future, if similar possibilities exist. Virtual reality learning applications can also be used offline, particularly in practicums, virtual visits to cultural sites and nature reserves, and theoretical visualization.

The research aims to create a learning management system by integrating virtual reality-based learning applications that are suitable for online and offline learning purposes at the elementary school level. This is important to increase student interest and learning performance. State-of-the-art research is an application developed to optimise online learning in elementary schools by accommodating a cross-subject thematic curriculum where learning content is integrated with YouTube VR so that it is easily and freely accessible from smartphone devices and only requires low-cost HMD devices made from relatively inexpensive materials that can even be made independently by students.

2. Methods

2.1. Types of research

This research is a design and development study. In this study, the design of learning products was carried out, which was intended to overcome the problems of distance learning, low interest in learning and learning effectiveness. The product developed is a learning management system based on virtual reality technology. Research developed a learning management system for use in smartphone applications. Furthermore, the material content is specifically designed for presenting in virtual reality.

2.2. Research subjects

The subjects of this study were teachers and elementary school students. Teachers and students have a role as the main users of the developed product. In addition, teachers and students are among the product assessors to obtain product quality feedback. The selection of subjects was based on the determination of the schools that the research team had collaborated with on this research project. Therefore, at this stage of design and development, the research subject is focused on partner schools. Although the main focus of the research subject is teachers and students, this research also incorporates the views of parents, the community and related experts. They are also used as additional informants to complement the information provided by teachers and students regarding the quality of the virtual technology-based learning management system developed.

2.3. Data collection technique

Data collection in this study was carried out through focus group discussions, interviews, observations and questionnaires. Focus group discussions were conducted with a team of experts such as: learning media experts, basic education experts, software engineering experts, user interface experts and teachers. Furthermore, the involvement of several experts is intended to gain confidence regarding the validity and reliability of the product. Interviews were conducted with teachers, students and parents to obtain information related to the product being developed. To obtain user responses during learning, observations were made when using the developed product. In addition, students and teachers were also given a questionnaire to determine the responses of students and teachers to using a management learning system based on virtual reality technology.

2.4. Data analysis technique

Basically, the data obtained from this research consists of quantitative data and qualitative data. Quantitative data were analysed using descriptive data analysis techniques. The data analysed by quantitative analysis comes from a survey conducted using a questionnaire for both teachers and students. Furthermore, the data obtained in qualitative form were analysed using interactive analysis techniques. The data analysed by qualitative analysis came from the results of observations, interviews and focus group discussions. Confirmation between the two forms of data and analysis techniques is the basis for the verification and conclusion in this study.

3. Findings and Discussion

The results of this study focused on the design and development of virtual technology-based learning management systems in elementary schools. At the design stage, this research product is designed to consist of various components. In the system management learning component, various supports have been developed, such as opening page, sign in page, sign up page, main page, subject page, material page, quiz page, discussion forum, chat facility and settings page. All of these pages support the learning management system to be carried out in learning activities with teachers and students. Figure 1 shows an example of a page on the product being developed.
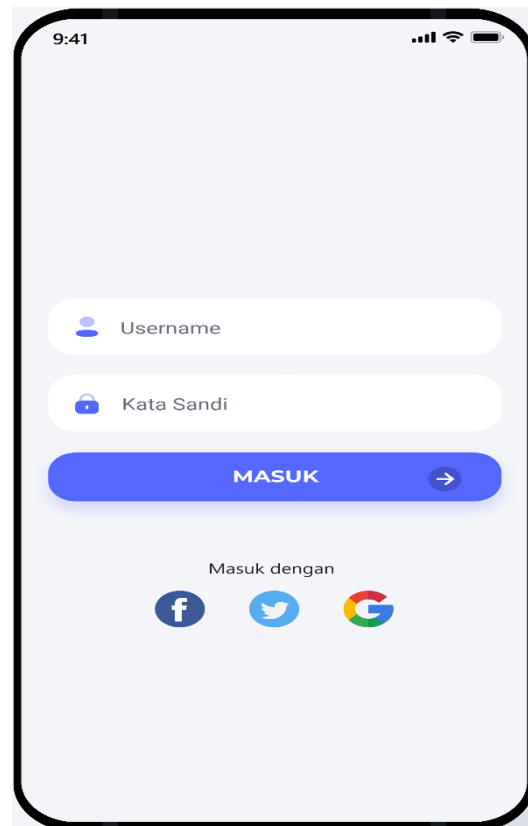

Figure 1
Login Page of the Learning Management System

Figure 1 shows the opening page to enter the Learning Management System application that has been developed. Permanent users register an account using email, Facebook, or another method to gain access to this page. In practice, there are two types of accounts. The first account is a teacher account, which is only for teachers. This account is used by the teacher to manage all his needs in

presenting material to students. The second account is the student account. This account is specifically for students to use in following lessons, doing assignments, quizzes and more.

After users register, they can log in with their respective accounts. If the user account is successfully logged in, one will be able to find various menus in the learning management system. The menu can be seen on the main page of the application. This page contains a summary of the menus/applications, such as subjects, discussion forums, student attendance lists and quizzes, to the most popular subjects. Through this page, students can set their own way to start the material based on their needs. In addition, it is also expected to meet the different learning styles of each student.

The integration of technology in learning management is very important to keep up with the times (Ilyas et al., 2022). All components of education should adapt to technological developments, including parents in accompanying their children to study at home (Herwin & Dahalan, 2022a). This is very important because the current trend of learning is in dire need of technological support to achieve the maximum.

Furthermore, one of the important menus that is recommended to be opened is the material page. On this page, teachers and students can choose which materials will be taught by teachers and which materials will be studied by students. This page is specially designed to make it easier for both teachers and students to participate in learning activities and is presented in accordance with the learning outcomes to be achieved in each subject matter. Therefore, teachers can more easily adjust lesson plans. Figure 2 shows an example of the main page and material pages on the learning management system that has been developed.
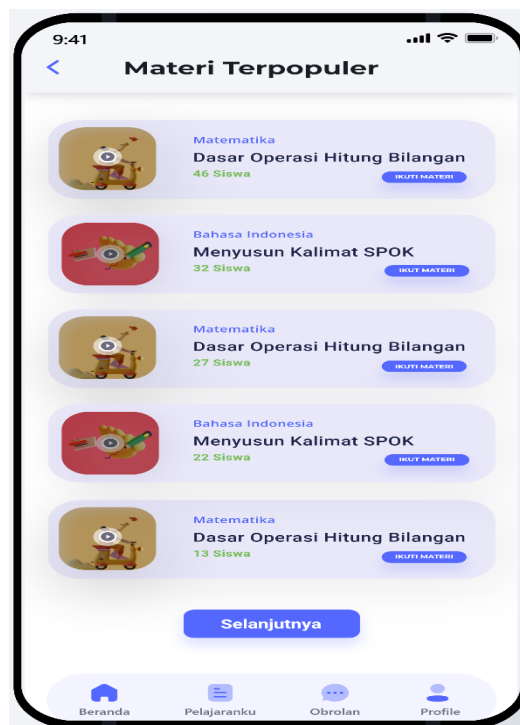

Figure 2

Course Material Page

Figure 2 shows an example of a course material page. The learning management system developed in this study is packaged in an application that can run on smartphones, especially those with the android domain. All content and learning needs have been packaged in the same learning management package. The developed application can be downloaded easily because it does not require a large capacity.

Another thing that can be explained based on the results of this study is the results of expert assessments. This study involved several related experts such as learning media experts, basic education experts, software engineering experts, user interface experts and teachers. The results of the expert assessment on the learning content management system programme have been declared suitable for use in elementary schools.

The need for learning management systems has become quite important in line with the development of information and communication technology, as well as the current trend of learning implementation. In addition to content about learning materials, the product developed also includes learning evaluation activities through the quiz menu. After studying the material, students can evaluate it independently through the quiz menu that has been prepared in the learning management system. This is very useful to increase students' independence in learning.

The results of this study are supported by relevant findings which explain that the use of learning management systems in the learning process has a fairly good impact, especially on students such as increased involvement in learning, and enthusiasm can be obtained easily because it is very open to including new things for students. In addition, with a learning management system, teachers can increase their knowledge of technology, especially for those who have less understanding of technology, and learning activities can be carried out by saving space and time (Snoussi, 2019).

Learning management systems are very helpful for teachers and students in strengthening the learning process (Bradley, 2020). Especially in online and distance classes, learning management systems help teachers and students in achieving learning goals. The proper use of this technology can support an inclusive learning environment for improving student learning outcomes with the components in it such as materials, discussions, quizzes and so on (Dias & Diniz, 2014; Jung & Huh, 2019).

The use of this technology provides consistent information about student performance in learning. Learning management systems are very good for increasing students' independence (Blau & Hameirie, 2010; Nasser et al., 2011; Strayhorn, 2010; Wood et al., 2011). Teacher involvement can be minimum, such as a facilitator (Al-Fraihat et al., 2020; Selwyn et al., 2011). This strongly supports the student-centred learning paradigm.

However, in its implementation, it is necessary to get initial assistance from both teachers and students, because the application of technology that is not usually used in the classroom has the potential to create confusion for users. Therefore, clear guidance and mentoring are very important in the initial implementation phase for both teachers and students (Al-Samarraie & Saeed, 2018).

In addition to focusing on learning management systems, this research is also oriented towards producing virtual reality-based learning application products by utilising the YouTube channel as a virtual reality content storage medium. All material content linked in the learning management system is integrated with virtual reality technology. This is aimed at optimising the online learning of elementary school students. In fact, this product can also be used for conventional face-to-face learning as usual. Smart learning environments that harness the power of technology are empirically proven to have

benefits in learning environments to shape students' learning experiences in a positive way. More modern interactive tools will help students achieve educational goals effectively (Omirzak et al., 2022). The application of this product to face-to-face learning in the classroom is also applied in this study, meaning that this product is used for online and offline classes. Figure 3 shows an example of its application in the classroom.

Figure 3

Application of Virtual Reality Technology in Learning Activities

Figure 3 shows the situation when applying virtual reality technology in learning activities. In this activity, it appears that students are observing something with the help of the virtual cardboard. In the picture, there is also a smartphone on the cardboard that is used. Basically, the smartphone used in the cardboard has been installed with a learning management system application that has been developed in this study. In addition, the learning management system application has included learning materials that have been set up based on virtual reality technology so that the combination of learning management systems and virtual reality-based materials is used by teachers to generate student interest in learning. Table 1 presents the results of the condensation of student data.

Table 1

Students' Responses to the Learning System Management Based on Virtual Reality Technology

No	Sub-themes	Correlation between sub-themes
1	The subject matter is very interesting. The material displayed looks like the original and seen directly in the field. Learning becomes more fun.	Students have a strong drive in participating in learning activities. Learning becomes more interesting for students. The subject matter becomes easier to understand. Learning outcomes can be improved, where students find it easier to complete the given quiz.
2	The subject matter is easier to understand. Very detailed explanations and more concrete learning resources. Quiz questions are easier to complete because the material is very clear.	

3	Learning to be like playing in the real world, even though this is only a video. The learning environment is challenging. Enjoy playing while learning.

At the trial stage, the learning activities were very exciting for both teachers and students. Learning system management products and virtual reality technology were very positively welcomed by both students and teachers. This product can make students more motivated to participate in learning activities. In addition, boredom in learning can be overcome. Another more advantageous thing is that it is easier for students to understand each material presented, and this has an impact on mastering the material and increasing student learning outcomes.

Currently, the integration of the Internet and technology is very effective in providing education in various fields, one of which is in elementary schools (Elmira et al., 2022; Herwin et al., 2022c, 2022d; Rahayu et al., 2022). There have been many recommended technology devices used in learning activities (Jun et al., 2018; Jung & Huh, 2019; Senen et al., 2021; Sugandini et al., 2018). One of them is mobile technology (Park, 2011; Park et al., 2012). This is also relevant to the current situation where smartphones have become common goods for everyone. Almost all families already have smartphones, so it can be ascertained that children can participate in learning without any complaints about the availability of smartphones.

Positive responses were also obtained from the teacher's side. From the teacher's point of view, the presence of this product makes it easier for them to present the material. With the integration of technology, the teacher's confidence and the effectiveness of their teaching activities will increase. This is relevant to various findings which show that the integration of technology in learning activities is very good and supports teacher performance in teaching (Garganté et al., 2014; Meneses et al., 2012; Sartono et al., 2022a, 2022b). This is very good for the development of teacher competencies, especially in the pedagogic section. Thus, finally, the integration of virtual reality-based learning management systems has a positive impact on both teachers and students. This product can be a good alternative in learning activities in elementary schools.

4. Conclusion

This study concludes that the learning management system developed in this study is supported by several main menus, such as the login page, material menu page, discussion forum, quizzes and settings page. The device is integrated with three-dimensional video material presented in a virtual reality device. The results of the expert assessment show that the content on this product has been declared suitable for use by elementary school students. Through this product, students feel more motivated to participate in learning activities, learning is more interesting. Students find it easier to understand the subject matter and it has an impact on mastery of the material and better learning outcomes. The positive response was also felt by the teacher. Through a learning management system based on virtual reality technology, teachers can present learning efficiently, confidence in teaching will be better and the effectiveness of teaching activities will be better.

The findings of this study recommend a learning management system based on virtual reality technology that can be an alternative for student learning activities. Teachers are expected to consider the application of this product because it is very good for supporting teacher pedagogic competence. In addition, through this product, learning can follow the trend of technological developments in the 21st century. This product can be applied to conventional face-to-face learning and online distance learning. Therefore, it is very possible to be applied continuously in learning activities. This study reports limitations on the content aspect of the new material offered on this one theme due to the fact that

this project is multi-year and this is the first year. However, content for more themes will be on the agenda in the second and third year.

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