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Potential utilization of virtual reality learning for vocational school teachers

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Abstract

This study aims to determine the potential of using virtual reality as a learning tool for teachers, especially at Vocational High Schools. This research is descriptive research with a quantitative approach. Descriptive analysis aims to reveal an objective picture of the conditions in the subject under study. Descriptive quantification seeks to describe an object using numerical data. In addition, verbal/qualitative descriptions of targets are also carried out through in-depth and detailed studies of organizations or certain phenomena through observation or analysis to generate data. The implementation of Virtual Reality-based learning has been systematic, following the design, development/production, utilization, and management and evaluation models. The stages that have not been implemented are developing a learning system integrated with virtual reality models, using virtual reality as a system, managing information systems, and evaluating the effectiveness of implementing virtual reality-based learning. In addition, there are several obstacles, including: 1) The limited quantity and quality of resources that include professionals, specialists, and technicians in the use of virtual reality-based learning; 2) Not all teachers are enthusiastic and motivated, especially older teachers, to apply virtual reality-based learning concerning improving the quality of learning; 3) Not all schools have the necessary infrastructure for optimal implementation of virtual reality (such as multimedia classrooms), there are no buildings or spaces to manage the development of virtual learning in vocational Schools; and 4) The high cost of official/original software is an obstacle for the development and production of virtual reality programs.

Keywords: Potential; Virtual Reality; Teacher Vocational High School; Study

1. Introduction

The progress of science and technology (IPTEK), especially information and communication technology (ICT), is very rapid. This progress will affect many areas of life, including education. With this comes the globalization of education, which emphasizes educational autonomy, competition and quality. Academic independence and successful globalization can only be achieved through information and communication technology in the educational process.

21st-century learning must be able to prepare the Indonesian generation to face advances in information and communication technology in social life. We are learning in the 21st-century results from how society develops over time. As is well known, humanity has evolved from a primitive society to an agricultural and industrial community and transitioned to an information society. One of the characteristics of the information society is the marked progress of digitization. Thus, the very rapid development of information and communication technology currently has a significant influence on the process of developing various kinds of multimedia learning based on the application of technology as

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one of the innovations in the world of education [1], this is expected to advance the quality of education in line with progress. The use of computer multimedia in the world of education continues to change and develop so that the emergence of a computer-based teaching device commonly known as CAI (Computer Assisted Instruction), which is related to Virtual Reality multimedia, where Virtual Reality technology is a technology that presents a visual display made in such a way. Appearance looks like the situation in the real world.

Virtual Reality (VR) has attracted attention in recent years. Along with this publicity came many conflicting terms, some unrealistic expectations, and many uninformed comments. Technology brings significant benefits to students and the learning process of new technologies. Virtual Reality is one of the places where virtual Reality brings learning with the help of sophisticated technology.

Virtual Reality is a learning medium to improve learning outcomes, motivation and attention of students in the learning process and can reduce the cost factor. The use of Virtual Reality technology in visualizing objects so that they can be represented in three dimensions [2]. The development of Virtual Reality begins with establishing a virtual environment that accommodates visual objects, where later users can interact directly with the virtual world and its graphical objects. The virtual environment is expected to stimulate the absorption of information provided to students.

Virtual reality technology allows users to interact with the natural world or just a virtual environment through multiple input devices such as a mouse or keyboard or multimodal devices such as wired gloves, Polhemus cantilever arms, and Omnidirectional tires. The atmosphere created may resemble the real world [3]. Smartphones and other digital devices can be used as potential sources to support learning. Mobile devices such as laptops and smartphones have great potential to support learning inside and outside the secondary school classroom [4]. This is not surprising, and if smartphone applications are implemented more beneficially in learning than in traditional learning, this indirectly increases student participation in learning [5]. A good learning process if it includes interactive aspects and teacher-student interactions that liven up the classroom atmosphere [6].

Each subject has a different character from other subjects. Thus, each subject also requires different learning tools. In organizing learning, teachers need facilities that can support their performance so that learning can interestingly occur. With the support of adequate learning facilities, the teacher not only conveys the material orally but also in writing and demonstrates the infrastructure that the teacher has prepared. Teachers need learning facilities to support learning activities. In addition to the ability of teachers to organize learning activities, support from learning facilities is very important in helping teachers. The more complete and adequate learning facilities owned by a school will make it easier for teachers to carry out their duties as educational staff. Likewise, with the atmosphere during learning activities. Learning facilities must be developed to support the teaching and learning process. Therefore, teachers must be able to act as facilitators and motivators to find and use learning resources through digital progress. This also inspires students to study harder and find sources of information through the development of virtual learning technology. One is that teachers must be creative and innovative in implementing virtual reality-based learning facilities. For this reason, this study examines how the potential for using virtual reality as a learning tool for teachers, especially Vocational High School teachers, is studied.

2. Literature review

2.1. 21st Century Learning

Vocational schools are expected to be able to answer the challenges of the industrial revolution 4.0 and have an excellent opportunity to produce the graduates needed in this era if they succeed in participating in the revitalization program. The success of the implementation of the revitalization of Vocational High Schools cannot be separated from educational programs that are based on nine principles of 21st-century skills [7], namely:

- Making relevant learning;
- Teaching with discipline;
- Developing low and higher thinking skills to encourage understanding in different contexts;
- Encouraging the transfer of learning;
- Improve meta-cognition;
- Correcting misunderstandings directly;
- Promote teamwork;
- Utilize technology to encourage learning;
- Improve students' creativity.

Thus, nine teaching principles in the 21st century need to be applied to succeed in increasing the ability to face the industrial revolution 4.0.

Education in Era 4.0 aims to develop creative talents to meet current needs as the world faces a digital-based industrial revolution [8]. Education 4.0 fosters a new revolution in education, not limited to the general rituals of learning in the classroom. Education 4.0 is limited to classrooms and becomes an educational challenge in the digital era. Digital-based education in Indonesia is developed in the form of startups or applications that contain the same content as the needs of school students. Various startups such as Quipper Video, Zenius, and Ruang Guru have emerged as digital education developers in Indonesia [9]. These three startups have in common the unlimited transfer of student learning space and time. Today's issue is the effectiveness of digital learning. There are many problems with virtual-based learning. One of the challenges that must be overcome is the soft skill factor of students. Studying at home requires high student awareness because teachers cannot monitor student learning activities directly [10]. Aspects of collaboration, digital literacy, communication, creativity, independent learning, cognitive development, and critical thinking skills are needed by students, especially in this 21st-century digital era. This aspect of soft skills is believed to significantly impact the success of 21st-century students [11].

2.2. Virtual Learning

Virtual learning refers to the learning process in virtual classrooms in cyberspace via the internet [12]. The use of virtual learning aims to overcome the problem of physical and temporal separation between students and teachers through computer media. Students can receive designed course materials in study packages available on the website. Virtual learning allows students to study learning materials independently [13][14], optionally through computer-based learning (CAL), computer-based interactions such as interactive web pages, and synchronous learning supported by a teacher or tutor. Assistance can be obtained in the form of concurrent). Moreover, other learning resources, such as email, are asynchronously (at different times) or supported by students or other professionals. Assessment is done remotely and openly via computer. By implementing an open grading system, students can take assessments whenever they are ready. From this statement, it can be seen that the characteristics of learning that apply the concept of virtual learning are:

- There is a disconnect between educators and students;
- Open learning system (open access and freedom to choose different learning resources and the course of the learning process);
- Network-based.

The concept of virtual learning was not developed to replace face-to-face learning. Combining the concept of face-to-face and virtual learning can improve the quality of learning and increase the effectiveness and efficiency of learning [15]. Virtual learning was developed to support face-to-face learning [16]. Virtual learning can be used as the sole learning process for distance learning or combined with face-to-face learning. In implementing virtual learning, the components of students, teachers, and learning resources are facilitated by ICT to achieve learning objectives. The main principle of virtual learning is empowerment and collaboration. Authority is the sense that students are responsible for determining the material, access to learning resources, the time allotted to them, the media used, and the location and procedures of learning to achieve learning objectives. Collaborative in the sense that students must interact with other students, teachers or tutors, and other available learning resources in order to complete these tasks.

2.3. Virtual Reality

Virtual Reality is a technology that uses a computer or other electronic technology to produce an output in the form of a realistic 3 dimensional atmosphere so that users can feel through hearing, sight, and touch, which will later form a virtual world. Virtual Reality is an interface technology between machines and humans that can simulate people as if they were in a natural environment, complete with hearing, sight, movement, and other actions. With Virtual Reality, users can not only see the virtual environment clearly but also allow users to observe the virtual environment and feel like being in that place [17].

Virtual Reality (VR) technology is a way of making learning images appear in the form of three-dimensional media or what is usually better known as 3D [18]. This process is made with the help of computer components so that the results will look more natural and, of course, support many other essential tools. This condition will make users (students) feel like they will see directly and physically in a predetermined environment. With this technology, it is hoped that the concept of interacting in the learning process will become easier to use along with the development of smartphone technology which has an essential factor in the implementation of the learning media. Even now, based on research

conducted by several researchers, it is explained that only a smartphone and the help of Google Cardboard can display the world of Virtual Reality (VR) [19].

3. Research Methods

This research is descriptive research with a quantitative approach. Descriptive research aims to reveal an objective picture of the conditions of the subject under study. Descriptive quantification aims to describe an object using numerical data. In addition, verbal/qualitative descriptions of targets are also carried out through in-depth and detailed studies of organizations or certain phenomena through observation or analysis to generate qualitative descriptions, namely data in the form of text or words. People's speech observed symptoms or behavior. Data sources for this study included school administrators, teachers, education personnel, and students who responded to the research. Data was collected by asking a list of questions and conducting interviews with respondents—the tools used in the form of two questionnaires and interview guidelines. Interviews and observations were conducted to collect data about the model or stages of implementing virtual reality training and the potential for applying virtual reality technology to improve the quality of learning.

4. Results and discussion

School facilities and infrastructure, mainly Vocational High Schools (SMK), need more attention as one of the factors supporting the success of educational programs in the learning process and producing competent graduates. Facilities and Infrastructure Vocational high schools must, of course, be equipped with theory and school practices standards in the industry as a level of education that aims to produce quality graduates who can compete in the industrial market. The lack of practice facilities, or none in SMK, creates a gap in understanding between theory and practice and ultimately reduces the quality of graduates.

The budget for the procurement of learning infrastructure is still insufficient, so more and more new vocational schools are unable to meet the needs of facilities that meet the requirements of the World of Work curriculum. Another obstacle is that not all students meet the minimum proficiency standards set by the industry.

Based on the following observations, the distribution of learning infrastructure in vocational education is shown in the figure 1.

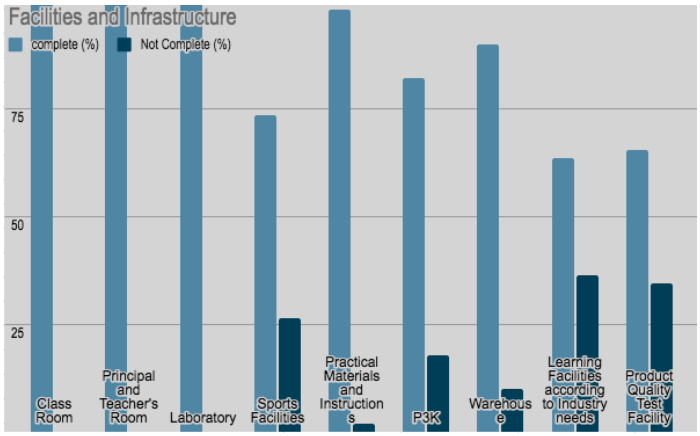

Figure 1 Availability of Facilities and Infrastructure, including learning facilities in Vocational Education Schools in Makassar

Figure 1 shows that Learning Facilities that follow the needs of the business world and the industrial world show that 63.7% meet the needs and 36.3% do not meet the needs, while for the Product Quality Testing Facilities, data obtained are 65.6% meet the adequacy and 34.4 % does not meet adequacy.

The availability of learning infrastructure in vocational education schools is the essential supporting factor that can affect the effectiveness of the learning model and the quality of graduates. Figure 1 shows that vocational schools' learning infrastructure includes classrooms, principals' rooms, teachers' rooms, practice rooms, practical materials, and learning. In addition to the available space, various supporting facilities are still not in line with the growing scientific and technical needs of the business and industrial world—security Facilities, Storage Facilities, Learning, and Training

Facilities. The availability of complete infrastructure is expected to support and increase the effectiveness of the learning model and produce high-quality graduates whom the business world and industry can accept.

Regarding access places for Virtual learning activities, four places were identified: at home, schools, classrooms, and other places such as internet cafes or other places. From Table 4, it can be seen that the majority of respondents access virtual learning at home as many as 15 people (17.65 %), in other places 5 people (5.88%), at school 23 people (27.06 %), and finally in classroom 42 (49.41 %) with a total of 85 teacher respondents. The number of teachers who access virtual learning in the classroom is due to when teaching productive subjects that require a virtual display to vocational students.

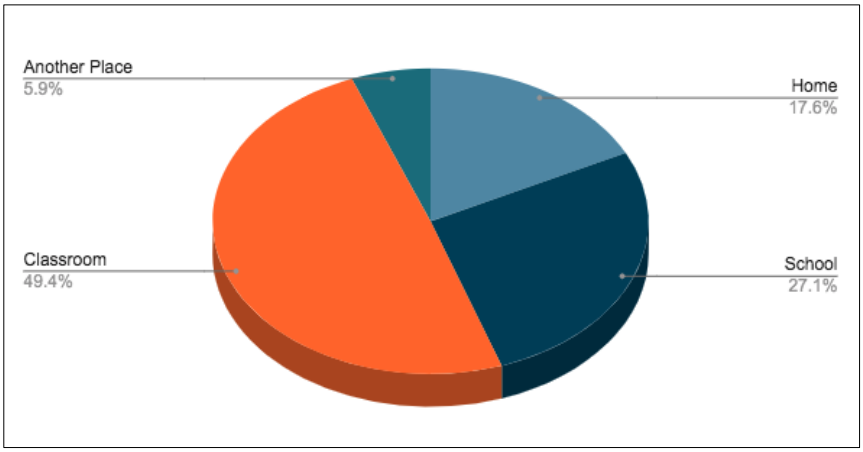

Figure 2 Vocational School Teacher Virtual Learning Access

The existence of a learning infrastructure ready to be used at any time is one indication of the high utilization of virtual reality. The lack of internet access in other places and at home is understandable because the infrastructure and facilities are not yet ready to be used by teachers who access them. After all, it is used as reading material before entering teaching and as a trial process.

4.1. Virtual Reality Implementation

Virtual reality implementation has generally been carried out systematically according to the model or procedure, starting from design, development/production, utilization, management, and evaluation. In particular, the virtual reality implementation model applied by SMK teachers in Makassar City can be described as follows.

Figure 3 Teachers Implement Virtual Reality

4.1.1. Design

Design activities in implementing virtual reality learning include identifying the initial abilities of teachers, developing instructional systems and strategies, and applying design principles from the results of interviews, data that identifies teachers' initial abilities. Identifying teachers' initial abilities in the Information Technology field are generally good. Teachers are accustomed to using Information Technology, especially in attending IT classes. Identification of the initial ability of the teacher is made by distributing questionnaires and observing the teacher at the time of teaching. Many teachers bring/have their laptops when teaching. The implementation of three design points is unclear, namely the

development of instructional systems, instructional strategies, and the application of message design principles in designing the implementation of virtual reality learning for learning.

4.1.2. Development

The development of virtual reality learning includes the development of audiovisual, computer-based media and the development of integrated media between the virtual and real worlds. The results of interviews revealed that most of the media developed are computer-based. In addition, multimedia development has not been integrated with the learning system. For example, there are no multimedia products for all subjects packaged in VCD form or uploaded on the website.

4.1.3. Utilization

Virtual Reality is Some form of multimedia for learning. Virtual reality is used as teaching material, multimedia for a complement, and virtual reality for enrichment. From the results of the interviews obtained, it can be drawn as a form of school approach to the use of virtual reality in the use of multimedia as a teaching aid, compliment, and enrichment. Multimedia is not used as an integrated system in the development of the education system. Leverage activities are carried out through training, making learning media, producing audio-video, and web, to improve human resources and familiarize themselves with virtual reality. Many teachers use IT in their learning. Students are also trained to use virtual reality to learn. Based on the results of the training, students can: They understood the teacher's material, assigned assignments, finding materials, and learning forums. To increase the use of information technology in learning, the school offers basic computer training, web training, and ICT. Train teachers, students, administrative staff, and IT managers. Schools are limited to promoting, encouraging, and motivating the use of virtual reality.

The sophistication of the functionality offered by virtual reality technology does not always get a positive response, and some people are against using virtual reality. Some of the people who oppose the use of virtual reality generally stem from a lack of understanding of the possibilities of technology and virtual reality. Virtual reality technology developed rapidly in 1965, and the provision of information about places and places is usually limited to verbal, video, or other two-dimensional formats such as maps and brochures. This type of information distribution has its advantages and disadvantages. The two-dimensional format, the delivery method commonly used in the teaching and learning process, does have drawbacks because the information conveyed is limited and not interactive. The video can depict locations interactively compared to 2D shapes, but it is not interactive because there is no feedback or input. The use of virtual reality media requires educators to be actively involved in technological developments, especially virtual reality. The development of virtual reality technology involves interdisciplinary computer science such as graphics, pattern recognition, multimedia, and image processing (Paulus, Suryani, Farabi, Yulita & Pradana, 2016). A suitable learning medium can inspire students and set the mood in the classroom [20](Falahuddin, 2014).

4.1.4. Management

Virtual reality learning management includes task management and learning resource management. At SMK in Makassar, virtual learning management is realized in the form of a Multimedia Center, Multimedia Room, and IT Coordinator under the direction of the head of the study program. The results of interviews with respondents indicate that virtual reality learning is used to provide learning systems and implement virtual reality learning organized by other agencies or bodies.

4.1.5. Evaluation

Assessment in virtual reality-based learning includes assessment of reference standards, formative assessment, and summative assessment. The evaluation reference standard is intended to measure whether the objectives have been achieved. Formative assessments are carried out throughout the process to identify existing barriers and suggest improvements. Summative evaluation to measure the success of virtual reality learning.

The school also conducts a needs analysis to determine the virtual reality-based learning needs. Research shows that learning requires multimedia technology. Virtual reality-based learning is so important that schools should always try to support teachers and students. Using virtual reality in learning makes students more active and less teacher-centered. The tools needed for virtual reality-based learning applications that are currently urgent are the Internet, educational television, and learning media. The results of the assessment on the use of virtual reality-based learning include: making it easier to systematically SWOT analysis has not been carried out (Table 1), but an analysis, in general, has been carried out to find out strengths, weaknesses, challenges, and opportunities for virtual reality development. Evaluation activities do not include regular formative and summative evaluations. The formative evaluation aims to determine the implementation of virtual reality-based learning according to the plan. The results of the formative evaluation are used

for improvement. The summative assessment aims to determine the effectiveness of ICT in improving the quality of learning.

Table 1 SWOT analysis on the use of virtual reality in teaching

Strength	**Weakness**
• Possibility to simulate real situations before they occur • Make teaching more interesting – student interest • Possibility of conducting online training • Possibility of distance learning and simulation • allow repetition • The cost of training can be reduced	• The need for VR experts • Investment needs to create and maintain technical facilities and standards • Time-consuming scenario creation. • Limited theory on the use of VR/AR in education. • Difficult conditions of spatial and technical infrastructure • HR teachers who use must be qualified in the field of ICT and high technology • Teachers in vocational school are old and not very motivated to use VR
Opportunity	**Threats**
• Diversity and diversity of learning characteristics that can be used as VR models • Improvement of students' employability in Industry • Effective collaboration with small student groups. • Opportunity to do a project.	• Able to lead impaired vision health • Teacher reluctance to work with new technologies. • Many VR learning topics are overwhelming and need material management.

5. Conclusion

The implementation of Virtual Reality-based learning has been systematic, following the design, development/production, utilization, and management and evaluation models. The stages that have not been implemented are developing a learning system integrated with virtual reality models, using virtual reality as a system, managing information systems, and evaluating the effectiveness of implementing virtual reality-based learning. In addition, there are several obstacles, including; 1)The limited quantity and quality of resources that include professionals, specialists, and technicians in the use of virtual reality-based learning; 2) Not all teachers are enthusiastic and motivated, especially older teachers, to apply virtual reality-based learning concerning improving the quality of learning; 3) Not all schools have the necessary infrastructure for optimal implementation of virtual reality (such as multimedia classrooms), there are no buildings or spaces to manage the development of virtual learning in vocational schools; 4) The high cost of official/original software is an obstacle for the development and production of virtual reality programs.

Compliance with ethical standards

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Disclosure of conflict of interest

We the authors of this paper hereby declare that there are no conflict of interest.

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