The new teaching method using virtual reality technology in building technology subject

Wiyantara Wizaka¹, Gatot Suharjanto¹, Welly Wangidjaja¹

¹Architecture Department, Faculty of Engineering, Bina Nusantara University, Jakarta, Indonesia 11480

Corresponding author: wwizaka@binus.ac.id

Abstract. One of the challenges for educators in the future is that educators are faced with students with high technological mastery abilities. Advances in the business and entertainment sectors drive the evolution of computer equipment with increasingly sophisticated technology that can make things easier. The development of equipment that supports virtual reality technology is also increasingly modern and realistic, so that the use and the utilization of virtual reality technology can also be widened in various disciplines. Researchers and educators also start competing to explore their potential, develop pedagogical strategies, create teaching materials, and build technology-based and educational infrastructure to find learning systems that are more likely by students and can present high-quality, easy and fun education. In this study, it will be reviewed how the role of Virtual reality technology can help students in understanding the science of building construction. Through combination the use of tools such as VR Gear, 360 cameras and digital computer design, it is expected that various methods that are appropriate, convenient and easy for students.

Keywords: architecture, building technology, virtual reality.

1. Introduction
One of the challenges for educators in the future is that educators are faced with students with high technological mastery abilities and accompanied by a flood of information on each object being studied. This, on the one hand, will make every material easy to learn but on the other hand it will make students lazy and tend to underestimate every problem because the information will be very easy to obtain. Advances in the business and entertainment sectors drive the evolution of computer equipment with increasingly sophisticated technology that can make things easier. So, this is where researchers and educators also start competing to explore their potential, develop pedagogical strategies, create teaching materials, and build technology-based and educational infrastructure to find learning systems that are more in demand by students and can present high-quality, easy and fun education. Educators are also demanded that some of the entertainment equipment not only be used as a tool for fun but also be able to present the potential in the field of education as an interesting and fun learning tool [1, 2, 3, 4, 5, 6, 7].

Studying a building construction thoroughly is by studying the theory first, then observing it directly in the field. But unfortunately learning directly the construction of a building in the field is not
as easy as studying objects with smaller sizes. The object of building construction can be a building foundation that is embedded in the ground so it will be difficult to observe and analyze it except during the construction process. Besides studying the construction of the roof is also quite difficult because of its location on the roof of the building so that in addition to the observation angle is quite difficult because it is covered by other cover material, also has the risk of injury during the observation. So that the presence of virtual reality technology becomes an option for educators and students to learn directly through virtual objects that have shapes, sizes and structures that are almost 90% close to their real conditions.

Besides, the development of equipment that supports virtual reality technology is also increasingly modern and realistic, so that the use and utilization of virtual reality technology can also be widened in various disciplines. In the field of construction, the use of virtual reality can be used close to the way it is used in games or games so that its use will feel more fun and spark the enthusiasm of student learning. Mastery of construction can affect the quality of an architect's design. So that mastery of construction should be owned by every Architect to produce quality designs in design and construction. But on the other hand, mastery of this construction.

2. Research Method

Stage 1: Conceptual Planning
The purpose of the first stage is to formulate the objectives to be achieved by analyzing the teaching material and then rearranging it in a suitable format or accordance with virtual reality teaching methods. Initial exploration of the objects and materials that have been prepared are carried out at the same time as the analysis and feedback received from students. The use of VR Headset equipment and its supporting variants is also evaluated to find the most suitable format in studying building construction. Extensive literature reviews are always used to support the evaluation of exploration results in the field that conducts by students.

Stage 2: Application and Testing
At this second stage, further testing is carried out to get better results. Objects are made in the form of modern buildings and traditional buildings for testing construction understanding. At this stage 2, a "Cyberspace" for each student begins. Namely a virtual room where students can see and read the material taught but in a virtual space. Students can also store books in softcopy format in this cyber room and also watch video recordings of lectures from lecturers as the main or additional material. Also, it will analyse the possibilities of relationships with other sources of this cyberspace.
**Stage 3: Implementation and Validation**

To be able to apply the teaching methods of building construction virtually, it is necessary to make testing and assessment instruments that are packaged together with the material taught/explored by students and to accommodate the feedback needed. This instrument is packaged as one package per learning topic. For example, the column and beam topic. The exploration process can be carried out following the Bimx file, the testing process is carried out after the exploration process in the form of a web-based application/questionnaire, while the assessment instrumentation is used on drawings made by students after the exploration process in manual/analogue or digital format.

**3. Result and Discussion**

The purpose of this research for 1 year is to formulate the objectives to be achieved by analyzing teaching materials and rearranging them in a suitable format or by the method of teaching virtual reality. Initial exploration of the objects and materials that have been prepared are carried out at the same time as the analysis and feedback received from students. The use of VR Headset equipment and its supporting variants is also evaluated to find the most suitable format in studying building construction. Extensive literature reviews are always used to support the evaluation of exploration results in the field to produce a virtual teaching method concept that is quite complete and applicable.

To test the VR experience and gather the necessary feedback, the steps taken are:

1. Before exploration, 30 students were divided into 6 groups consisting of 5 groups. Exploration systems and how the VR Model works are explained and demonstrated. After that, virtual explorations were conducted in 2-3 times and then discussions were held to gather their opinions;
2. Based on the results of step 1, the VR model is arranged based on certain topics and then students are asked to sketch objects that are studied/explored. After that, a short questionnaire survey was used to get their opinions.
3. All responses are analyzed. Pros and cons regarding the material as a whole, specific topics, the use of VR Gear equipment are identified.

Here are some results from research in the field (see figure 1).
Figure 1. Diagram of students' assignment points before and after they use Virtual Reality as study’s tool.

From the above table it can be concluded that by comparing the perceptions of students learning before using the VR method and after the VR method, it can be concluded that easier learning can be achieved through the learning system with the VR method. The score of ease and understanding was obtained after the student studied with the VR method where previously learning was considered quite difficult and confusing.
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Figure 2. Diagram of students’ perceptions about learning using VR material.

The diagram above shows the level of student perception of teaching methods with Virtual Reality. This needs to be tested to find out in advance whether the use of this method is quite well received and is considered a convenient tool or even vice versa.

In the diagram above it can also be concluded that almost 99% of students stated that learning with the VR method was quite enjoyable and very desirable by students, although there were approximately 1% who stated that they were less attractive because they experienced few symptoms of dizziness and lack of focus when using VR tools Gear.

This is caused by VR technology and the equipment used still uses equipment with standard qualifications where the technology that was created has not been able to present VR visualization that is comfortable enough to be enjoyed in a long time or above 15 minutes. Besides, the use of Virtual reality requires habituation or exercises to be able to explore comfortably and following its objectives.

To give more information about how fun and existing the student to learn with Virtual reality method, below are some picture:

Figure 3. The use of VR technology in the Classroom.

Figure 4. Exploration of student’s assignment through VR gear.
Virtual material exploration is carried out individually by all students but divided into 3 groups to facilitate control and discussion. Exploration can be done as often as possible in accordance with the needs of students in capturing and understanding construction objects that are presented virtually.

**Figure 5.** Student’s assignment made in Bimx format.

Display objects in Bimx format that can be explored from students’ cell phones directly using their hands or fingers without VR Gear. The object displays in the Virtual Reality format that was witnessed by students using the VR Gear tool.

**Figure 6.** Building that should be explored by students as building construction case.

**Figure 7.** The title of the research can be seen by students through VR Gear.

The title and description of the research are presented in a Virtual file as a marker or identity of virtual research activities. Also, photographs of the research team are presented on one side of the building as information on this research activity. Besides, it makes it easier for students if several...
students participating in Building Technology 1 courses are presented as well as users of VR material, so that the exploration atmosphere becomes more comfortable and cheerful so that the exploration process of is more comfortable and enjoyable.

Virtual reality material is presented in the form of a 2-story building that is made in full and given a mark or certain codes to guide students in conducting exploration activities.

Buildings present in full the topics that are generally taught in a face to face method. So that each topic taught in class can be rechecked on VR material and discussed both with the lecturer and with fellow students.

4. Conclusion

The use of VR is an impact of technological advances that cannot be avoid in the world of Architecture and should be able to be utilize to the maximum extent possible in every field of science. The use of mobile phones that have become personal tools such as clothes attached to the body should also be used as a source of knowledge not only as an entertainment tool.

This study proof that the role of mobile phones as one of the learning tools inherent in every student becomes a source of fun knowledge so that learning becomes easier, more frequent and easier to understand.

More varied presentations along with links and connectivity with other applications will make VR look more attractive and more attractive to students as well as the potential for further development of these VR presentation techniques. Video 360 from a real project can be combined with VR and equipped with other file formats such as PDF and Video such as Mpeg and AVI.

At each Building Technology course, at least 2 topics will be inserted in the Virtual Reality format to help students facilitate the learning process.

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