

# Utilization of virtual reality content for laboratory practicum learning

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**Abstract.** At present, the learning model with practicum learning methods in the laboratory is considered as an effective learning model. However, from these advantages, there are weaknesses. One of the weaknesses of practicum learning methods is the high cost of learning because it requires much equipment. Digital Learning is an educational concept that utilizes information technology in the teaching and learning process. The concept of learning in digital multimedia is by utilizing virtual reality technology. The concept of virtual reality that simulates the real world into the digital world can be used as a solution to overcome the weakness of the existing learning method. This study provides the development of virtual reality for practicum learning in the laboratory. The knowledge base applied came from scientific experts and used as a rule in learning. The purpose of developing this application is as a prototyping framework of virtual learning that can be applied to laboratory practicum learning.

## 1. Introduction

During this time, learning with practicum methods in the laboratory is considered as an effective learning pattern [1,2]. This is based on the direct involvement of students in cases or practicum equipment. The aim of practicum type learning is to provide students with cognitive, affective and psychomotor skills [3]. The material provided can be understood by practicing directly. From the practicum process, students get experience, and real case examples from the material presented [4]. However, from the advantages of learning methods practicum methods, it turns out there are some weaknesses. One disadvantage of this method is that it requires a large number of practical tools. This condition also makes practicum methods expensive [5]. As an example of chemical practicum, the campus must provide chemical equipment, test tubes, and other expensive equipment to support the teaching and learning process.





**Figure 1.** Practicum equipment.

Digital learning is an educational concept that utilizes information technology in teaching and learning [6]. This concept of learning has been done a lot because it makes it easier for users because it involves the support of a computer system [7]. Technology and media are useful tools if used appropriately. A good learning process is learning that gives birth to a pleasant atmosphere. The pictures and sounds that appear will make students not get bored quickly so that it can stimulate students to interest in learning [8]. In learning that involves the media in the process must consider the fundamental theoretical aspects of the material to be taught because not all theories can be made digital concepts. To make a theory which is conceptualized in the form of digital multimedia requires knowledge base from scientific experts who are the object of reference.

The concept of learning in the digital and multimedia world is one of them by utilizing virtual reality technology. Virtual Reality (VR) is a computer system that is produced from a three-dimensional environment that seems very real [9]. Virtual reality technology users use tools such as glasses to view three-dimensional stereoscopes. The user can look around by moving his head and walking around using hand control or motion sensors. The development of virtual reality is now believed to be developed to be able to assist the learning process or learning [10]. Learning in the world of virtual reality can provide a 3D artificial environment that helps users as if they were in a learning environment. The advantage of this technology is, virtual concepts can be adjusted to the needs so that the expected information will be conveyed.

The concept of virtual reality that simulates the real world into the digital world can be used as one solution to overcome the shortcomings of existing methods. The concept of virtual reality is more precisely applied to practicum learning patterns in the laboratory. Students will feel as if in a laboratory to do the learning process practicum. The applied knowledge base originated from scientific experts will be used as a rule in learning. So that using one application can be utilized for in many virtual laboratories. Finally, the need for expensive costs to build a laboratory for the learning process can be minimized. In this research, initial research will be carried out that produces a learning concept by utilizing VR technology. The development of VR applications can have a positive impact on learning practicum methods.

## **2. Learning in the laboratory learning**

Strategies apply a general sketch of the activities of teachers and students in realizing teaching and learning activities. Learning strategies through practicum methods are learning concepts that can help teachers connect material taught with real-world realities. The practicum method also encourages students to interact with the knowledge they have.

The practicum method is a teaching method that invites students to carry out experimental activities to prove or to test theories that have been learned indeed have truth [11]. Practicum activities are an inseparable part of learning Natural Sciences, so it is called experimental science. Teaching and learning processes with practicum mean students are given the opportunity to experience themselves, follow the

process, observe an object, analyze, prove, and draw their conclusions about an object, state, or process of something.

From some of the opinions of experts that have been described, the writer can conclude that the practicum method is a way in which students conduct experiments by experiencing to prove themselves questions or hypotheses being studied. Practical methods can foster and develop scientific attitudes in students. The activity can also provide a clearer picture and understanding than just a verbal explanation.

### **3. Learning activities**

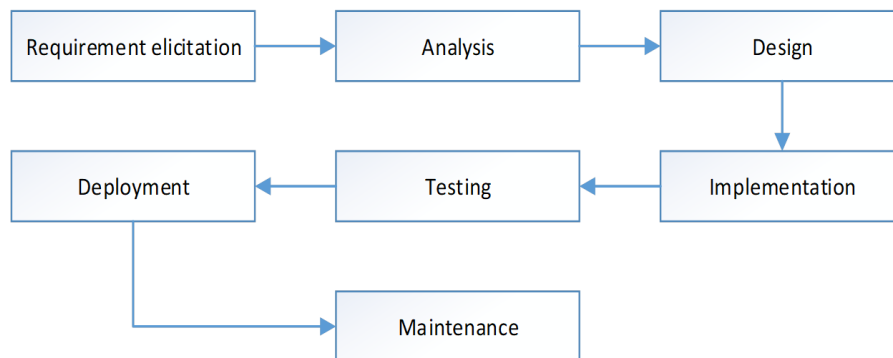
Without learning activities, learning is not possible well. Teaching and learning activities are a series of activities that include the activities of students in following lessons, asking questions that are not yet clear, taking notes, listening, thinking, reading, and all activities are undertaken that can support learning achievement [12]. Learning while doing more activities brings results for students because the impression obtained by students is more durable stored in the minds of students. Student activities include the following:

- Visual Activities, which include: giving advice, paying attention to pictures, demonstrations, practicum, experiments, and other people's work.
- Oral Activities; formulating, asking, giving opinions, giving opinions, conducting interviews, discussing.
- Listening Activities; listening to descriptions, discussion conversations, speeches.
- Writing Activities; such as writing stories, essays, reports, questionnaires, copying.
- Drawing Activities; like drawing, making graphs, maps, diagrams.
- Mental Activities; such as responding, remembering, solving problems, analysing, seeing, making decisions.
- Motor Activities; such as conducting experiments, making model construction, repairing, playing, gardening, and raising livestock.
- Emotional Activities; such as being interested, feeling bored, excited, excited, passionate, brave, calm, nervous.

Based on the above definition, learning activities can be concluded that a series of activities that include student activity in attending lessons or services. Learning while doing activities can cause impressions, messages, concepts obtained will last longer stored in the minds of students.

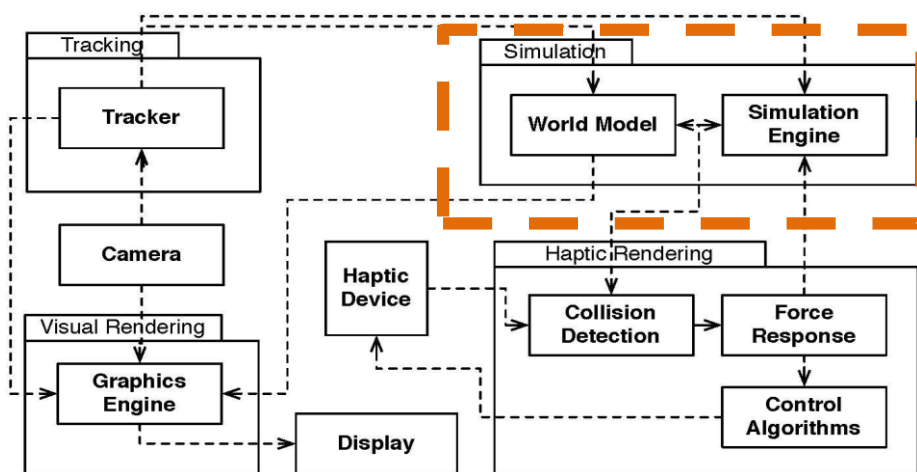
### **4. Research methods**

This research includes research and development. In this research, a virtual laboratory application will be developed for learning chemistry. The stages of the study were carried out following the research method. Currently, the research is in a preliminary study and analysis phase. At this stage a descriptive approach is used to explain the process of developing a virtual laboratory application. For the data collection process, the researcher will be in contact with the Lecturer from the Politeknik Negeri Malang, Chemical Engineering Department. As for the system testing process, respondents will be taken from Politeknik Negeri Malang, Chemical Engineering Department students who are or have taken chemistry courses.



**Figure 2.** Research methods.

VR for learning concept consists of four parts, namely Simulation, Haptic rendering, visual rendering, and tracking. The part that is done in this research is the simulation process.



**Figure 3.** VR concepts for learning.

## 5. Outcomes and discussion

This stage is carried out with a descriptive approach. The process of gathering information is done by conducting observations and interviews with instructors majoring in chemical engineering at the poor state of Malang. The results obtained are some information relating to laboratory facilities in the chemical engineering department and laboratory practicum materials.

Interviews were conducted with lecturers in the chemical engineering department in Malang State Polytechnic. The interview process was carried out to find out material in the chemical engineering department that could be included in the virtual laboratory content. Interviews were also conducted to obtain feedback about the creation of a virtual laboratory that will be conducted in this study. Based on the results of interviews with teachers, it was found that suitable material used as content in a virtual laboratory is a basic chemistry course. Then the main subject material is about endotherm and exotherm. In addition to the material in the virtual laboratory, this study also obtained feedback related to the use of the application.

## 6. Conclusions

A virtual laboratory is a supporting application of the practicum learning process. Virtual laboratories do not replace laboratory courses. The use of virtual laboratories is used before students enter the laboratory to do practical work or when explaining the theory. In general, virtual laboratory applications

do not significantly reduce the cost of practicum, and this is because the conventional practicum process still needs to be done. The virtual laboratory is used as a tool for the practicum process to reduce errors that may occur when practicum implementation in the laboratory.

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