

# 3D SIMULATION LABORATORY MODEL OF WEB-BASED INTERACTIVE TO IMPROVE ACCESSIBILITY, DESIRE TO LEARN, AND COMPETENCE OF STUDENT VOCATIONAL SUBJECT

Hendra Jaya<sup>1</sup>, Sapto Haryoko<sup>2</sup>

<sup>1,2</sup>Electronics Engineering Department, Faculty of Engineering, Makassar State University (UNM)  
<sup>1</sup>[hendra070982@gmail.com](mailto:hendra070982@gmail.com), <sup>2</sup>[saptoharyoko@yahoo.com](mailto:saptoharyoko@yahoo.com)

## Abstract

The development of today's educational world is entering an era marked by incessant technological innovation, so it requires the adjustment of the education system in tune with the demands of the workplace. Some practical subjects other than the need to know the basic concepts and theories supporting, also must perform experiments / experiments in the laboratory to understand a certain concept or the basic theories that have been studied in order to have a broader understanding level . Urgency ( virtue ) of this study are: 1 ) The creation of a laboratory model of a web -based interactive 3D simulation, is expected to address issues such as limitations on conventional lab time and place to implement practical, resource constraints are capable of teaching control of productive subjects , lab equipment and materials is minimal and difficult to establish because of the high cost of equipment / materials and maintenance costs , improve the competence of vocational students especially for productive subjects and 2 ) increasing the critical thinking skills of vocational students through the use of web -based 3D simulation lab before entering the industry. From this research a product produced laboratory models simulating three - dimensional interactive web-based which can be used in productive in vocational subjects. Products such as display / web pages on the implementation of the practice on the subjects of Analog, Digital, and Industrial Electronics SMK designed in 3D interactive connected to the internet on-line. Evaluation results show that the validation of the product by the average expert judgment obtained excellent ratings and the students' response to the media very well.

**Keywords:** 3D simulation laboratory, web-based, interactive

## 1. Introduction

The development of today's educational world is entering an era marked by incessant technological innovation, so it requires the adjustment of the education system in tune with the demands of the workplace. Vocational School (SMK) is designed to prepare students or students who are ready to enter the world of work and be able to develop a professional attitude in the field of vocational, and must be able to provide the competencies or skills that can improve the quality of graduates to achieve success .

Success in SMK size can not be separated from the name of the learning process and the lab . Some practical subjects other than the need to know the basic concepts and theories supporting , also must perform experiments / experiments in the laboratory to understand a certain concept or the basic theories that have been studied in order to have a broader

understanding level . To carry out a lab activities will require several factors, including laboratory space in accordance with the practice subjects, facilities equipment, and a complete practice materials .

Fact the field after the observation is found that there are many vocational equipment and materials that have very minimal practice , there are even schools that do not have laboratory space, so that the lab is not running optimally . Hope students are gaining the knowledge and experience of learning outcomes , while the teacher's expectations are practical learning process toward the achievement of cognitive changes , psychomotor , affective , and improving the competence of students through on-line learning .

To overcome these problems , in this study developed a laboratory model simulations by using an online network / website as a means of animation and 3 -

dimensional simulations interactively. To develop a laboratory model of a web-based interactive 3D simulation of this, we need a research development.

The purpose of this research is : 1 ) know the process of developing a laboratory model of a web-based interactive 3D simulations that can improve vocational competence vocational students.; 2) obtaining results of laboratory model design web-based interactive 3D simulations that can improve vocational competence vocational students. The development of information and communication technology (ICT), especially the Internet provides an opportunity to access a variety of educational information, either in the form of text, image, simulation, and sound. Integration of information technology in education, especially packaging web-based learning environment in PBL (Problem Based Learning) brought a new revolution and enabling the achievement and higher learning outcomes [1].

Emphasized that the World Wide Web [2] is often called the web into a powerful environment to distribute information, and many educational institutions use it to transmit knowledge to the stakeholders. The opinion supports who considered the information and communication technology innovations change the rules in the creative and send academic learning resources.

The website has several functions, namely: communication function, the function of information, entertainment functions, and functions of the transaction. Various functions held by a website cause its development flexibility for various purposes, especially for improving the quality of teaching and learning (PBM) in the school. PBM activities in the main high school in SMK more stress to the lab. Processes more practical in SMK 70 % compared with 30 % theory [3]. Practicum is one of the important factors in the success of students in participating in the process of teaching and learning activities. To achieve this there needs to be a complete laboratory facilities, combined with the utilization of information technology such as the internet that can be done anywhere and at any time based on-line [4]. Moreover, the characteristics of the developed laboratory -

based 3-D simulation is applicative, communicative, interactive, and able to develop critical thinking skills than just the ability observation alone.

## **2. Laboratory**

The emergence of more complex interactive multimedia supported by the development of computer technology which gave birth to the more complex types of media as well as the combination of audio media, video and communications, known as multimedia computers that can be used as an alternative medium of supplements lab at the school referred to as laboratory simulation.

Laboratory is a scientific research, experiments, measurements or scientific training done. Laboratories are usually made to allow such activities in a controlled manner. Scientific laboratories are usually distinguished by the discipline, such as physics lab, chemistry lab, biochemistry labs, computer labs, and language labs.

## **3. Simulation Model**

Simulation is the imitation of the operation, according to the time, a real-world process or system. According to Law and Kelton (1991) simulation is a technique mimics the operations or processes that occur in a system with a computer and guided by certain assumptions so that the system can be studied scientifically. Simulation can be interpreted as imitating a real system that is full of complex probabilistic nature without having to experience the real situation [5].

Furthermore, the simulation model is basically a learning strategy that provides a more concrete learning experience through the creation of a clone-clone form experience approaching the real atmosphere. From the definition of the experts above, it can be concluded that the simulation is a form of presentation by manipulating an object and make copies for the purpose of reducing misperceptions of the material-the material is complex or abstract. Variety of learning media will be able to turn the learning environment, encourage and facilitate the learning motivation understand abstract concepts or complex [6].

The simulation model consists of two types , namely the analog simulation and symbolic simulation. According Sunarno (2008) analog simulation using the physical representation to describe the characteristics of a problem, while the simulation of mathematical models that emulate symbolic solution using computers , called computer simulations . Simulation is generally used to solve a variety of problems: difficult to be solved by analytical means such as the complex electrical circuits; has a data size and high complexity; very difficult to implement directly since it requires very expensive, when the relationship between variables is not linear, and when the model has a random variable .

In the simulation approach , to solve complicated problems will be easier to do when starting to build an experimental model of a system. Learning model simulation aims to: (1) specific skills training is both professional as well as for everyday life, (2) gain an understanding of a concept or principle , (3) trained to solve problems, (4) increase the activity of learning, (5) motivate students to learn , and (6) foster students' creative power . [7] .

Model simulation approach [8] are presented in Figure 2 . Boxes in the figure is a key stage in the research consists of : 1) real world (problem ) , is an implementation of the solution and/or understanding gained ; 2) conceptual models, a description of the model will be developed; 3) computer models, a simulation model is applied to the computer.; and 4) solutions/understanding, is the result of a process of experimentation.

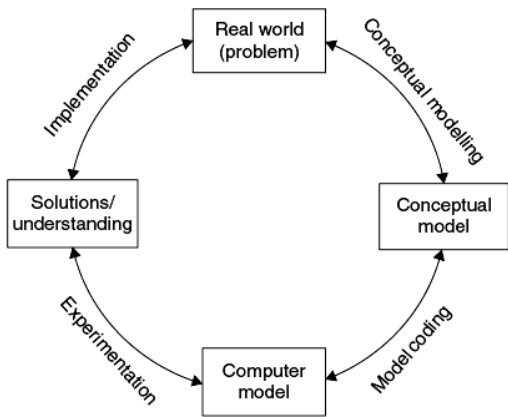


Fig 1.  
Key Stages and Process of Simulation [8]

Motivation in performing a simulation is the recognition of some of the problems that occur in the real world that would cause concern for it is necessary to run for a simulation . to propose a model that is suitable to handle it . Thus , conceptual modeling consists of the following sub - processes :

1. Develop an understanding of the problem situation
2. Determine the purpose of modeling
3. Designing conceptual models : input, output and content models
4. Collecting and analyzing the data needed to develop a model

In the model coding conceptual model is converted into a computer model. Here, coding is defined in the most general sense and does not have to mean computer programming. In contrast refers to the development of computer models. The model can be encoded using a spreadsheet , a special simulation software or programming language. The assumption here is that the simulation was built and performed on the computer. it should be noted that other forms of physical simulation is the simulation. Once developed, experiments performed with simulation models to gain a better understanding of the real world and/or to find solutions to real-world problems .

One of the models developed in the study are presented by Figure 1. Consists of material, discussion forums, progress reports, examinations, assignments, exercises, and additional files search. All of which will be presented in the form of a website through a virtual learning activities.

#### 4 . Characteristics Simulation

The desire to do interactivity , active involvement and support of navigation in the simulation are important characteristics that contribute to the educational outcomes of these tools. In addition, an important characteristic of simulation is its validity. Various types of validity can be distinguished. Content validity revealed the degree of simulation environments in accordance with the relevant aspects, activities and operational parameters of the real environment to simulate, construct validity reveal the level at which the construction, the knowledge and skills

students should have evolved in a simulated environment resembling that we use in the real world .

As according [9], simulations are used to demonstrate something ( skills ) so that students feel like being in a real situation . Simulation is widely used in the learning material harm, difficult, or costly, for example, to train pilots or fighter aircraft .

Riyana and Asra ( 2011) simulation model has several characteristics, namely: a) the operation of the process is something the tools, the creation of a particular product; b) consists of a procedure in the form of a particular system; c) learn how to use the tools, procedures and specific measures; d) aims to prove something through a process of experimentation; e) modeling and simulation showed sequentially; f) in the form of analysis , synthesis and application; g) require careful observation process; h) focuses on achievement of affective and psychomotor aspects; i) requires the evaluation of practice and observation .

The points above are general provisions which are required the use of

computer -based learning media simulation model to help teachers convey the message of learning to students. In the simulation model, students menggunakan computer and obtain learning materials are packaged in the form of animations that can strengthen the responsiveness of students to instructional material that is packaged in the form of animations that can strengthen the responsiveness of students to the learning material .

Basically different simulation programs with drill and practice programs, the simulation program, the students did not respond to questions but rather on creating an atmosphere closer to the actual situation, which is probably the real situation that is too expensive or too dangerous to be done by the student, but with the use of simulation it can be overcome, because the strength of the simulation is the fact that response by the computer based on the choices made by the students themselves .

Some of the objectives of the simulation activities are as follows: 1) to improve student learning by engaging students in learning situations

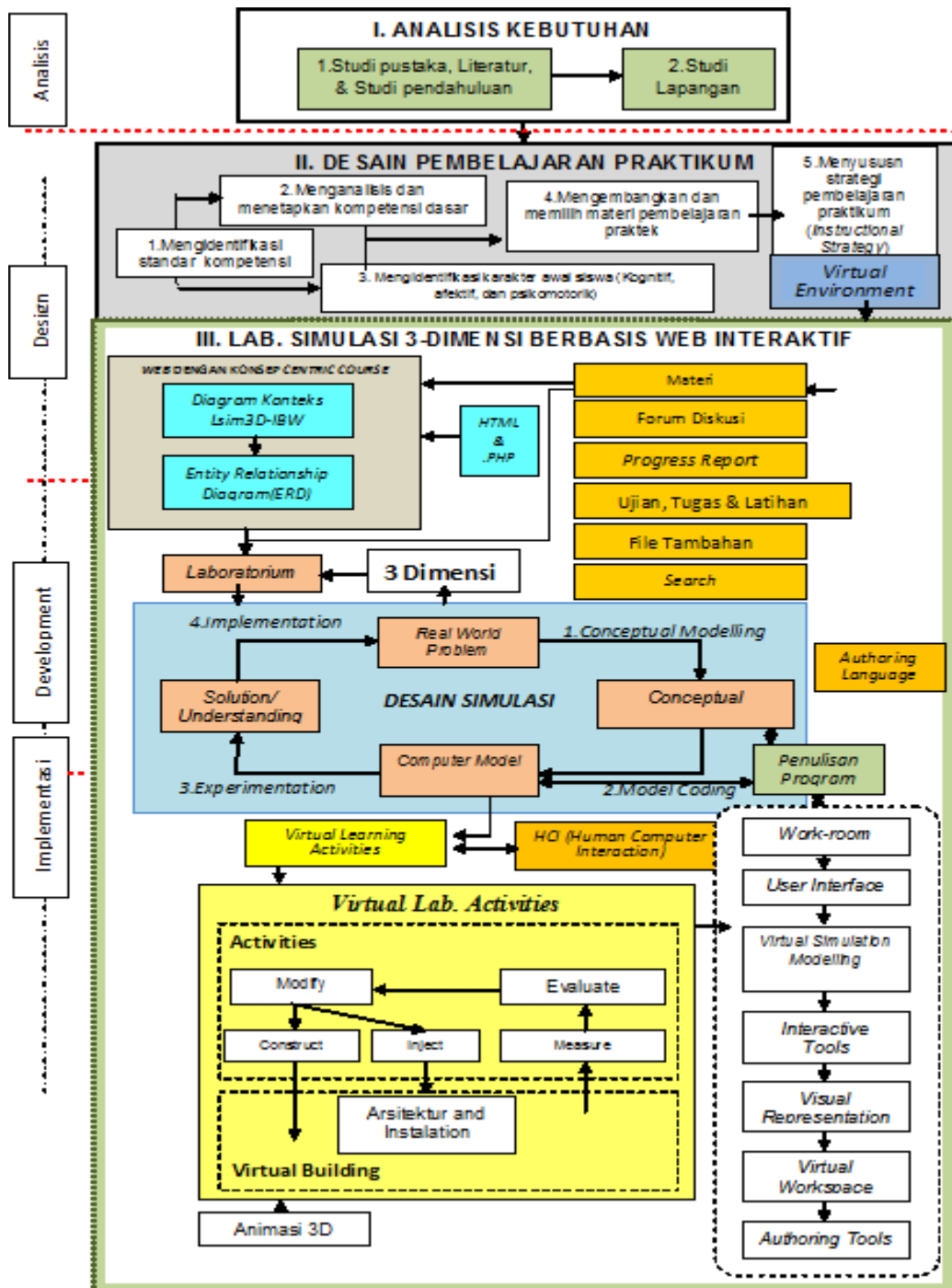


Figure 1. Model of Web-based Simulation Model

almost similar to the actual occurrence ; 2) to train students on specific skills , both professional and is essential for everyday life ; 3) To train solve the problem; 4) To provide stimulation or excitement of student learning (Ahmad and Prasetya, 1997: 83).

The simulation model is divided into four categories, namely: physical, situations, procedures, and processes where each

category is used in accordance with specific interests. This is in accordance with that proposed by Alessi and Trollip (2001): simulations play divide into four categories: physical, procedural, situational, and process . A physical simulation models some aspect of physical reality, such as an aeroplane cockpit , with the which the learner must interact. Procedural simulation present a series of actions that constitute a

particular procedure to be learned, such as diagnosing faults in automotive electronic circuits. Situational simulations represent human interactions with the environment or other people. Process simulation allows the learner to experiment with "what if" situations in a safe environment.

Simulation has a good transfer of learning, as studied in simulations usually good transfer to the real situation. 3) efficient. The definition of efficient is far more worthy of examination, as follows: a) The other way to increase the efficient learning is to equip students with an environment that is more conducive to study one of the real activities; b) simulation offers other advantages as well. Simulation is safe, comfortable, and can be controlled; c) simulation is also more convenient in the real world activity. Usually a little, always available, can be repeated and time-consuming bit. Simulations can also be controlled and can be compared in a simulated life situations but not just an imitation of reality but also to make a simple simulation. This is necessary because in reality it is impossible to replicate every detail becomes simple is an advantage for learning; d) the simulation can be used as a test.

Many studies suggest that computer simulations can help students eliminate misconception. In this simulation, students can manipulate the data, collecting data, analyzing data, and drawing conclusions. If the simulation students get different data with predictions, will have conflicts. With this conflict, students are motivated to ask, why. The use of simulation is very beneficial because students can repeat themselves outside the classroom and students can change misconceptions quickly becoming a true and complete concept.

The reason the authors chose the simulation model, because it has the characteristics: 1) simulation model according to [10], is basically one of the learning strategies aimed at providing a more concrete learning experience through the creation of imitations that experience shape approaching the actual atmosphere and takes place in an atmosphere without risk; 2) simulation models of computer-based learning is relevant to learning digital electronics that have the characteristics of

concrete in which there are laws, formulas, theories, and concepts are very complicated. Digital electronics lesson as the writer explained in chapter I are subjects that are considered by students as subjects abstract and difficult to understand. Something that is expected by the authors of this simulation model is to evoke the spirit of the students in the study of digital electronics, as well as to improve student learning outcomes.

## 5. Advantages and Disadvantages of Computer-Based Simulation

Application of a model is very dependent on the condition of the media and the learning environment. There is no perfect model or good in any model of applied learning in the classroom. Each model has definite advantages and disadvantages of each.

### 5.1 Benefits Simulation Model

The advantages of the simulation model is as follows (Ferro, 2005: 25:1) creating excitement learners to learn; 2) foster the creativity of learners; 3) foster courage and steadiness appearance learners; 4) channel that gets pent up feelings of satisfaction, freshness and mental health; 5) as a provision in community life; 6) reducing the things that are abstract and displays real activity; 7) can be found new talents in acting or acting.

In addition to the advantages described earlier, another advantage of the simulation method are: a) the fun of students; b) encourage teachers to develop students' creativity; c) foster critical thinking; d) allow experimentation lasts without requiring the actual environment; e) does not require complicated alignment and depth; f) Potential positive response from students who slow / less capable [11]; g) reducing the things that are abstract and displays real activity [12].

Furthermore, according to [13] that there are many benefits to be gained by using the simulation model are: a) compressed time (saving time), meaning that if an activity performed requires significantly longer periods of time, if the use of simulation, then quite a few minutes; b) control sources of variation (to oversee the sources vary), the point in the simulation, data collection and processing

on a computer can be obtained from various sources that vary quickly and concisely ; c) in mensurment error correction (correcting errors in calculation and measurement) digital electronics means in practice , at the time of measurement of a component of a more valid and do not need to doubt that the components measured yng damaged , otherwise the simulation , the computer rarely found error - error in the calculation process , especially when the numbers taken from the computer regularly and freely ; d) stop and restart the simulation (can be stopped and started again) , that computer simulation can be terminated for such purposes without having a negative impact on the simulation program , and then quickly run back ; e ) easy to replicate ( easy to be repeated ) , the intention is with the computer simulation experiments can be done at any time and can be repeated . Learning activities can be carried out repeatedly in accordance with the time and opportunity that student .

Furthermore, [14] states that there are some advantages and disadvantages of using a simulation model of learning . Excess simulation model is as follows : a) the simulation can be used as stock for the students to face the real situation in the future, both in the lives of families , communities, and face the world of work . Simulation can develop the creativity of students, because through simulation the students are given the opportunity to play a role appropriate to the topic being simulated; b) simulation can cultivate courage and confidence of students; c) enrich the knowledge, attitudes, and skills necessary in the face of problematic social situations; d) the simulation can enhance arousal permbelajaran students in the process .

Furthermore, Ministry of Education (Pramod, 2008) mentions some of the benefits of media simulations , which are as follows: 1) provide a knockoff when performed on real equipment is too expensive or dangerous ( eg, simulation of the form of electrical voltage with an oscilloscope or simulations to practice flying the aircraft with simulated ) ; 2) shows an abstract process where the user wants to see the effect of changing a variable to the process (eg, changes in the frequency of the

alternating electric voltage through a capacitor or inductor ) .

Some of the advantages of simulation in the teaching media are : 1) simulate a real situation when viewed too dangerous (eg, simulation of nuclear reactors); 2) simulate a real situation when viewed too expensive (ie aircraft simulation); 3) mimicked a difficult situation to be repeated significantly (eg, volcanic eruptions or earthquakes); 4) if the situation mimicked in practice requires a long time (eg. plant growth teak) ; 5) mimicked the extreme natural conditions (eg, conditions at the poles) and so on .

There are several advantages of using the simulation as a teaching method , according to the Supreme (2009 ) include : 1 ) the simulation can be used as stock for the students to face the real situation in the world of work ; 2) simulation to develop students' creativity ; 3) simulation can cultivate courage and confidence of students ; 4) enriching the knowledge , attitudes , and skills necessary in dealing with various situations DU/AT; 5) simulation to increase the excitement of students in the learning process .

Excess simulation method according Munadi (2008:166) are: a) the students can acquire knowledge about the concept of covering the rules of principle, of its constituent parts, process, outcomes and impact in a fun way; b) provide an opportunity for students to think, to imagine, to show new ideas and original seamlessly and provide an opportunity to master the motor skills; c) students can participate actively and actually be creative .

## 5.2 Weakness Simulation Model

The simulation model can be our weakness rincikan as follows (Ferro , 2005: 26):1) requires a flexible grouping of students; 2) simulation experience is not always appropriate to the reality on the ground; 3) simulation as a learning tool into a tool of entertainment sometimes overlooked; 4) a sense of shame, doubt, and not confident will result in stunted simulation; 5) requires high imagination

The weakness of the simulation method can be detailed as follows: a) effectiveness in advancing student learning can not be reported by the research; b) the

cost is too expensive ; c) give rise to the relationship between teacher and student information which exceeds the limit (Roestiyah, 2001:23); d) the simulation experience is not always appropriate to the reality on the ground; e) simulation as a learning tool into a tool of entertainment sometimes overlooked; f) requires high imagination [12]

In addition to having the advantages, simulation also has drawbacks, according to the Supreme (2009 ) include: 1) the experience gained through the simulation is not always appropriate and in accordance with the reality on the ground; 2) poor management , simulation is often used as a means of entertainment, so that the learning objectives to be neglected; 3) psychological factors such as fear and shame often affect students in performing simulation; 4) simulation requires the imagination of students and teachers are adequate .

The advantages and disadvantages of this simulation method is a provision in the consideration of the use of simulation methods . Shortages owned by simulation methods not mean this method can not be used . Simulation methods in certain things will greatly help create a pleasant situation in the teaching-learning interactions in the classroom . Perform basic competencies of electrical wiring and lighting improvements by teachers deemed suitable to be applied using the method of simulation , partly because the material is abstract .

## CONCLUSION

Simulation has a good transfer of learning , as studied in simulations usually good transfer to the real situation. a) The other way to increase the efficient learning is to equip students with an environment that is more conducive to study one of the real activity; b) simulation offers other advantages as well. Simulation is safe , comfortable , and can be controlled; c) simulation is also more convenient in the real world activity. d) the simulation can be used as a test.can further improve the accessibility of web-based, desire to learn anytime and anywhere.

## ACKNOWLEDGMENT

Gratitude to the Directorate of Research and community services (DP2M\_DIKTI) which has provided the opportunity to carry out research activities.

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