Influence Of the Simulation Program Methods to the Students Learning Outcomes on the Subject Of the Microcontroller System

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Abstract. This study aims to see the effect of program simulation methods on the learning outcomes of microcontroller systems. The microcontroller program simulation method is done in two ways, namely through hardware assembly and software assembly. Simulation through hardware devices using trainer kits, while simulating through software use Proteus application software. This type of research is a quasi-experimental. The research design uses nonequivalent control group design techniques. The sample group is not randomly selected but is chosen based on the class that is already in the lecture. Learning outcomes variable (Y) while program simulation method (X). The research data analysis was carried out with Variance Analysis (ANOVA) to see the effect of the program simulation method on the learning outcomes of the microcontroller system.

Keywords: Program Simulation Methods, Quasi Experimental and ANOVA

1. Introduction
The subject of the Microcontroller System at the Electronics Engineering Study Program at the Faculty of Engineering, Padang State University in the Diploma III level, is one of the learning programs in the technology and vocational education groups. Technology and vocational education is offered to be chosen only by people who need, want and feel to benefit from it. In contrast to general education which provides students with a number of knowledge and insights to continue their education to a higher level, vocational technology education prepares students with a number of competencies and a certain level to enter employment. Vocational education is education that aims to fulfill a skilled workforce and experts, who are able to develop identity with the concept of lifelong learning. Students participating in education are expected to be skilled professionals who are responsible, know and understand and respond quickly to what is happening in their environment. In the learning process students are introduced to various new problems and are trained to find solutions, besides being able to develop their own abilities, find alternatives, and solve them to make decisions quickly. If there is a problem in doing a job, students must be able to find various alternatives to overcome it.

Furthermore, vocational education must be able to provide certain life skills skills (specific life skills) so that later graduates can compete in the job market. Life skills are needed for people to overcome certain problems or to do work. Mentions specific life skills or specific life skills including: "(1) academic skills (academic skills); (2) vocational skills [1]. Academic aptitude leads to scientific activities such as identifying a variable, connecting various phenomena, designing research, and proving an idea. Vocational skills are like repairing a motorbike, making television show scripts,
repairing electronic devices. In fact, a job requires both of these skills, although in one field the skills work is more prominent than what is needed in other fields.

2. Literature Review

Studying microcontroller systems is part of vocational education states that a modern philosophy of vocational education concerns developing a view of man and a view of society. A view of man, a philosophical perspective, examines what man is, what is his greatest potential, and what he is capable of achieving. A sociological perspective relates to the conditions for developing it potential [2].

According to a philosophical view, modern vocational education can be seen from two perspectives, namely from a human point of view and from a community perspective. From the human point of view the modern philosophical view examines who the human is, and what the greatest potential he has and whether he is able to achieve it. From the point of view of the community that is related to human beings, that is how the condition of the community allows him to develop the potential he has. A person must be fully aware of who he is and the potential that exists in him and then strive to reach the existing potential. One effort that can be done to recognize the potential that exists in a person is the emergence of a great interest in an expertise in the field of vocational. To explore the vocational potential in a person, exercises and a supportive environment need to be carried out. If the condition of the surrounding community allows someone to develop their vocational potential, their vocational expertise can develop rapidly.

There are states that vocational education is for everyone, where everyone has the right to receive vocational education; the main purpose of vocational education is to apply the actual situation, as will be found by students later in the workforce; and the effectiveness of vocational education is assessed in employment. Vocational education is intended for all students with the aim of how students can effectively do work in accordance with the demands of the workforce [3].

1. Learning Simulation Methods

Various methods can be done to study expertise in the microcontroller system, one of which is to use a simulation method. Learning simulation methods is a learning process that uses media simulators as learning aids. The media simulator used can be software or hardware. Simulators that use software will display behavior phenomena simulated on a computer screen while simulators that use hardware will use the actual equipment but the target may be simplified, minimized or replaced with similar targets.

In simulators that use equipment software and target simulation everything is in the form of animation on a computer screen. In the learning process, learning a basic concept of simulation in the form of animation on a computer screen feels less about the target, because students never come into direct contact with equipment and simulated phenomena. In addition, simulation with software is also less impressive because the challenges faced are low. Learners feel less need to work hard to anticipate errors because errors will not result in anything on the system. If an error occurs in the program being simulated it will cause the simulator to issue a warning if the program is wrong. By pressing a certain button the simulation is immediately restored. Besides that, errors are easily corrected by changing them and then trying again according to the principle of trial and error. Simulations that use software are suitable to be used to develop or increase understanding of a concept. This means that simulation with software will be effective if it is used for students who already understand the concept of a phenomenon.

Learning simulation methods is closer to constructivism learning models, because the knowledge gained by students is a construction of learning experiences gathered during the learning process through simulations carried out. In order for the simulation learning method to be carried out effectively and efficiently, learning must be arranged constructively. According to the constructivist paradigm, science is temporary because science is always developing and influenced by cultural
progress and social interaction. The learning process is a process of self-regulation to resolve thought conflicts that often arise through real experience, discourse and interpretation. Learning is an active activity of students to build their knowledge, so that they have responsibility for the learning process and learning outcomes. Students themselves are doing reasoning and organizing experiences and combining with the knowledge that has been previously owned.

There are five basic principles of constructivist learning, namely: 1) Determining the topic of discussion that is relevant to the needs of students; 2) Arrange learning material around key concepts; 3) Respect the views of students; 4) Learning material adapts to the needs of students; 5) Assess contextual learning. Constructive learning depends on the cognitive activities of students during learning including the selection of relevant information, organizing the information obtained and integrating that information with existing knowledge. Information that enters someone's mind will be a construction based on existing experience to form so as to produce new knowledge.

The role of the lecturer in simulation learning cannot be said to be lighter, because the lecturer has a large responsibility. The lecturer is not only required to just mention the scientific concepts and skills that are being studied, but the lecturer is also required to have provisions on the explanation of scientific concepts and skills, explain factors, resolve obstacles, lead discussions and others. There are four roles of teachers/lecturers in simulations, namely: explaining, refining, training, and discussing [3]. At the beginning of the simulation learning the teacher / lecturer must briefly explain the knowledge and skills that will be learned through simulation. A brief explanation at the beginning of learning is also called debriefing. Debriefing is not intended to provide full understanding to students, but provides an explanation that only triggers their motivation and creativity and awareness. The knowledge that students will get is expected to be a construction of the experiences they can get after they do the exercises with simulation.

The second role of the lecturer is refereeing. Initiating is the role of the lecturer who is very important in simulation learning. To carry out simulation learning the lecturer divides the learning group by paying attention to the characteristics of the students. A practical work group must consist of students who can motivate group members during practice and other students as ordinary members. Students who fall into the category of academically disadvantaged must be spread into various groups. It should be avoided in the formation of this practice group that students who are more academically capable form their own groups, so that on the other hand students who are weak are academically grouped themselves. This makes a gap both in terms of processes and in terms of learning outcomes. Besides that the role of the lecturer is also expected to be a controller during the learning process, whether students who practice simulation have done the correct rules and procedures. Lecturers are also required to be actively involved during the simulation practice. Lecturers should not just sit in their chairs or leave the simulation room. Things like this often occur in workshops or laboratories where practical learning is carried out, lecturers leave the practicum on the grounds that the lab is equipped with a jobsheet, and students are considered capable of practicing on their own.

The third lecturer role is to train. As a trainer, the lecturer must provide advice to students during practice simulation. Lecturer advice during the simulation learning process aims to maximize the simulation process. The trainer lecturer must be a facilitator rather than a lecturer who is an expert in certain disciplines, but the lecturer must be able to direct the students who are practicing to take certain steps so that they lead to an understanding that students will find themselves. The trainer may not make or do what the students have difficulties in practice, but must be able to make statements, questions or parables so that students who are practicing can use all of their abilities to try and construct their own knowledge.
The last part of the role of lecturers in simulation learning is to discuss the experiences gained by students after practicing simulation. First, the lecturer must lead a discussion that discusses the difficulties encountered during the practice of the simulation. The lecturer must be able to explain why the difficulties arise and how the solution. Next, the lecturer will direct the discussion to the experiences gained by the students and their relationship with the material being studied. By asking for opinions among the students, the coach will reinforce or even straighten out opinions that come from the opinions of students. A brief explanation from the instructor lecturer about the relationship of experience that students have gained with the material being studied will add to the confidence of students to construct their knowledge. In addition, it is also very important to discuss the experiences that have been gained and their relationship with real-world life. This will add to the confidence of students that the material being studied will be of great use in the lives of humans.

In connection with simulation learning that simulation can stimulate learning about: 1) competition; 2) cooperation; 3) empathy; 4) social system; 5) concepts; 6) skills; 7) efficacy; 8) serving a sentence; 9) the role of opportunity / opportunity; 10) ability to think critically [4]. Simulation learning can improve healthy competition among students who practice. Students who are left behind in practice material will try to catch up, so that the practice process can be more passionate and vibrant. During the simulation students are trained to do positive cooperation to work on an activity by working on sub-activities whose results can be synergized. Besides that, if there are friends who are late or even deadlocked during a simulation, they can be helped by encouraging or other ways. Friends who have not finished working on simulated practice assignments must wait until it is finished because the results of the practice must be collected in groups. It will train to create a sense of empathy for students who are learning. In terms of synergy, simulation learning can also train students to interact socially.

Learning with simulation methods can also stimulate students to construct scientific concepts. By doing simulation exercises students can gather their experiences to construct the concept of a science. The more often students do simulations, the more learning experience he can get, the better the concept construction he can get. Likewise simulation learning can train the skills and skills (skills) that will be possessed by students who are learning. Repeated simulation exercises cause habituation to students to deal with the difficulties that occur in microcontroller programming. The difficulty can be a program error caused by syntax errors or other writing errors. If students are familiar with the difficulties faced and always try to find solutions, it will result in their skills getting better. With simulation learning students also find good tricks to solve a problem. By finding many good ways to solve a problem, students can determine effective ways to use when dealing with similar problems later.

In learning simulation methods, students who are learning will also be able to meet a reward for the simulated program results. The reward can be a warning that the program you wrote cannot be compiled because synt errors or other warnings in the form of files does not exist. If the compilation process is successful, the reward is news success and no errors found. As soon as the program is simulated on the trainer kit, it can be rewarded if the load installed with the programmed load is not the same, the appearance will deviate or will produce unexpected movements. Simulation learning can provide a huge opportunity for students who are learning to be creative in trying out various possibilities and analyzing the results. Trying out various possibilities for microcontroller programs with simulations can improve the microcontroller programming capabilities they are studying.

3. Microcontroller Trainer Kit Simulator
In this simulation learning trainer kit serves as a learning medium. Learning media is a component of the teaching delivery system that can be used to support the learning process. The development of learning media is based on the perception that learning will take place well, effectively, and pleasantly.
if it is supported by learning media that can attract students' interest and attention. At present the learning media is already multimedia, because of the combined use of several media and involving computers. Multimedia refers to computer-based systems that use various types of content, such as text, audio, video, graphics, animation, and interactivity [7]. The point is that multimedia refers to a computer-based system that can convey information in an interactive manner that includes text, audio, video, images and animation. Multimedia as an interactive computer-based communication system capable of creating, storing, presenting, and re-accessing text, graphics, sound, and video or animation information. In this case the microcontroller simulator trainer kit is included in the multimedia group. Simulator trainer kits are used to simulate microcontroller programs that can display data in the form of bits and bytes as well as text, graphics, sounds in various forms of animation.

Interactive multimedia (IMM) has the potential to accommodate people with different learning styles [5]. The meaning is that interactive multimedia can accommodate different ways of learning. Interactive multimedia has the potential to create a multisensory environment that supports certain learning methods. Multimedia in the teaching and learning process can be used in three functions. First, multimedia can function as a learning aid. Second, multimedia can function as an interactive tutorial, for example in simulations. Third, multimedia can function as a source of learning instructions, for example, multimedia is used to provide guidance for understanding a subject matter.

Animation of bit data display can be simulated with a microcontroller kit trainer in the form of a bit position on an LED in accordance with its weight. The arrangement of 0 and 1 bits in the data is called the Binary number system. For example data 0110 0010 shows the bits on the LED in the form of. When the LED display lights up () means that the data bit is 0 and if the LED is not lit () means that the data bit is 1 (negative logic principle). In learning the bit position microcontroller system determines the meaning of the data. The bit position in the data shows the bit weight. The bit weights are determined based on the rightmost bit which is the lowest weight (least significant bit) which is given a value of 20 or 1. The second bit weight from the right and so on is weighted 21 to 2 in accordance with the number of sequences calculated from right to left (n = sequence number of bits in the data). If the data above shows the value is (0) 27+ (1) 26+ (1) 25+ (0) 24+ (0) 23+ (0) 22+ (1) 21+ (0) 20 = 0 + 64 + 32 + 0 + 0 + 0 + 2 + 0 = 98 (ninety eight in decimal places). The simulation of the number display can be reversed, for example how the shape of the number 98 displays on the LED. Students who are learning the meaning of data in the system can enter various decimal numbers and record the display of binary numbers on the LED. Because the data displayed on the LED is equivalent to the binary value of the simulated data.

Simulation of data from various number systems can be demonstrated by this microcontroller trainer, but usually there are only four system numbers that are practiced, namely: binary, octal, decimal and hexadecimal. This is in accordance with the need to assemble a microcontroller program involving only the four number systems. The binary number system is needed in microcontroller programming because only this number system can be recognized by microcontroller systems. The decimal number system is a number system that is used by humans everyday. Whereas the octal and hexadecimal number systems are translator number systems of binary numbers, so that the meaning of data can be understood by humans.

The advanced simulation that can be done by the microcontroller kit trainer is the operation of numbers and conversions between number systems. Broadly speaking the number operations that can be done are divided into two, namely arithmetic operations and logic operations. Arithmetic operations in the form of add, less, times and divide. While logic operations are: and, or, not, and, nor, exor, exor and buffer. Conversions between number systems can be done such as: binary conversion of the other three number systems, conversion of the third octal of other number systems, decimal conversion of the other three number systems and conversion of the third hexadecimal number to another number.
Students who use the microcontroller trainer kit can simulate various ways to carry out operations and conversions between the number systems. Simulation can be done to the extent that the curiosity of students who are learning wants to understand it.

Still using the LED as a simulation output can be displayed next advanced data operations, such as: left shift, shift right, left rotate and various forms of the mixture. The left shift operation will cause the data value to be multiplied by the number two from the data value before shifting to the left. While the shift right operation will cause the data value to be divided into two data before being shifted to the right. For example, the initial data is 4, if the data is carried out with a left-left operation then the value of the current data becomes 8 that comes from 2x4. Likewise with the initial data, if the shift right operation is carried out, the current data value becomes 2 which is derived from 4 divided by 2. So the two operations can be carried out continuously and the results can be observed on the LED display. Besides that these two operations can also be carried out together and in succession. Students who are learning who use this simulator trainer kit can simulate the extent to which they want to deepen it.

The rotate left operation is actually a development of the left shift operation, where data that is shifted past the leftmost bit position will enter the rightmost bit position and so on so that the data bits will rotate to the left. Likewise, the shift right operation that shifts data over the right bit position will enter the leftmost bit position, so that the data rotates to the right. These two operations can be simulated individually or a combination of the two. As what forms of data animation in these two operations can be planned and carried out by students who are learning microcontroller programs in accordance with the level of creativity and awareness of thinking. Some program simulations on the rotate left and rotate right operations with LED display can be done such as: the display of lights running to the left, the display of lights running to the right, the display of wiper lights (alternating), the display of hungry turtle lights, the display of turtle lights hungry, the appearance of the lamp Miss Open the window and other variations on the display animation.

As explained above, these are simulations that can be done with an LED display. There are still many LED display animations that can be done using the trainer kit. Apart from the LED viewer on the microcontroller kit trainer, there are output loads and other input loads that can also display various kinds of program simulation results. Output loads such as: seven segment viewer, dot matrix, LCD, DC motor, stepper motor, speaker, relay and others. While the input load is like: switch, button, keypad and various sensors. Various forms of display on the load will be planned and made to achieve competencies in the microcontroller system courses. Each display form will be made in the form of microcontroller program packages that can be simulated to the appropriate loads. Each simulation program package is given a certain level (level), for example a LED display package level 1, LED display level 2 and so on up to a certain level package. Likewise for other load display packages both the input load and the output load will also be made packages to a certain extent, according to the characteristics of these loads.

4. Research Method
The research method is quasi experimental where the research subject consists of experiment class and control class. The experimental class used Microcontroller Trainer Kit in its practice lesson, while the control class did not use it. After the learning took place eight times the meeting conducted measurement of learning outcomes, then analyzed. Student competency competency variable (Y) based on the assessment of the level of ability obtained by students after following the learning using Microcontroller Trainer Kit (X). The learning competence variable is organized into indicators such as: (1) cognitive ability; (2) psychomotor abilities; and (3) affective ability. The research hypothesis is that leaning using Microcontroller Trainer Kit is better than that do not use it.

Data of research result as seen in Table 2. Learning outcomes from the experimental group and control group. To test this hypothesis is used univariate analysis, by the help of SPSS.
Table 1. Learning Outcomes

| EXPERIMENT GROUP | CONTROL GROUP |
|------------------|---------------|
| Res p. | Using Trainer (0/1) | Competence Resp | Not use Trainer (0/1) | Competence |
| 1 | 1 | 4.027 | 1 | 3.272 |
| 2 | 1 | 2.862 | 2 | 3.406 |
| 3 | 1 | 3.731 | 3 | 3.528 |
| 4 | 1 | 3.346 | 4 | 3.384 |
| 5 | 1 | 2.025 | 5 | 3.906 |
| 6 | 1 | 4.027 | 6 | 3.328 |
| 7 | 1 | 4.415 | 7 | 3.15 |
| 8 | 1 | 3.923 | 8 | 3.506 |
| 9 | 1 | 3.927 | 9 | 3.984 |
| 10 | 1 | 3.919 | 10 | 3.784 |
| 11 | 1 | 2.862 | 11 | 2.972 |
| 12 | 1 | 3.350 | 12 | 3.272 |
| 13 | 1 | 3.246 | 13 | 2.828 |
| 14 | 1 | 3.442 | 14 | 2.972 |
| 15 | 1 | 3.35 | 15 | 2.828 |

Analysis is done through the following consecutive menus: Analyze → General Linear Model → Univariate → Univariate Dialog Box → Enter the Y Value Variable into the Dependent Variable box → Enter Group Variables and Variables _Y to the Fix Factor (s) box → Options → Check Descriptive Statistics → Contribute → OK. So that displays the results of the analysis in the form of descriptive data Table 3. Descriptive Statistics The mean figures for each of the variables tested in the control group and the experiments in the descriptive data table were compared. A higher mean number of a variable indicates a better group for the variable being tested. The experimental group had an average learning outcome of 3.708 higher than the average learning outcome of control group only 3.446. Thus it can be concluded that learning using Microcontroller Trainer Kit is better than those not using it. A higher mean number of a variable indicates a better group for the variable being tested. The experimental group had an average learning outcome of 3.708 higher than the average learning outcome of control group only 3.446. Thus it can be concluded that learning using Microcontroller Trainer Kit is better than those not using it.

Table 2. Descriptive Statistics

| GROUP | VARIABEL_X | Mean | Std. Deviation | N |
|-------|------------|------|----------------|---|
| CONROL GROUP | Total | 3.445923 | .5027442 | 30 |
| EXPERIMENT GROUP | Total | 3.708778 | .4473527 | 30 |
| Total | Total | 3.581590 | .4892865 | 60 |

5. Conclusion
The learning outcomes of microcontroller using Microcontroller Trainer Kit is better than those not using it.

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