Microprocessor Practicum Module Development Using ASSURE Model

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Abstract. The design of this microprocessor practicum module uses the ATmega2560 microcontroller and several input output modules. The development procedure adapts the ASSURE model. The stages of developing the ASSURE model include Analyze learner, State Objectives, Select Methods Media or Material, Utilize Media and Materials, Require learner's participation, and Evaluate and Review. The design of the practicum module consists of Block Input, Block Process and Block Output. Block Input consists of a Thermocouple module, Camera, Voltage Sensor, Temperature Sensor, Keypad, Potentiometer, LDR, Current Sensor, Infrared Counter, Touchscreen and Rotary Encoder. The Process Block consists of Atmega2560 Microcontroller and RTC + EEPROM as memory. Block Output consists of DC Motor, Stepper Motor, Relay, Traffic Light, Servo Motor, LED, LED Dot Matrix, Seven Segment and LCD modules. This study aims to develop a device in the form of a microprocessor practicum module and its guidelines.

Keywords: Microprocessor, Practicum Module, ASSURE Model

1 Introduction

Education is a process carried out by humans to seek knowledge and experience. Education in the process involves many elements, both in terms of education personnel and facilities and infrastructure that support the continuity of education. In improving the quality of education and learning, educational institutions are an important means of making it happen[1]. Improvements in the quality of learning which are based on reflection activities on the implementation of a subject substantively are carried out through process improvement programs, including the application of applied strategies so that students have both knowledge and experience after studying a learning material[2]. Improving the quality of education can be done by improving the quality of learning[3].

There are two elements that affect the teaching and learning process, namely teaching methods and learning media[4]. These two aspects are interrelated, the selection of certain teaching methods will affect the media used[5]. Learning media is a means that can support the achievement of learning objectives. The use of instructional media in the teaching and learning process can generate motivation and stimulation of learning activities, and even have a psychological influence on students[6]. The use of instructional media in the teaching and learning process can generate new desires and interests, generate motivation and stimulation of learning activities, and bring psychological influences to students. The use of learning media in educational institutions varies, including learning media in the form of power points, demonstration tools and trainers[7].

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The development of the practicum module is made based on the needs of students, as well as from the problems faced by students based on observations. So that the modules are developed according to the needs of students in order to achieve learning objectives and in accordance with the curriculum used. The development of media in the form of practicum modules is expected to increase the enthusiasm of students to learn independently and improve their thinking skills[8].

To obtain maximum learning outcomes, a synergy is needed between lecturers, the material presented and the learning media. Learning devices used in practicum also give greatly support for student understanding. For example, in the microprocessor practicum courses. This course requires a complete microprocessor practicum module in order to increase student competence. However, at the Microprocessor Laboratory of the Department of Electrical Engineering Education, UNIMED, the facilities and infrastructure have not met the competency needs of graduates yet[9].

Based on the results of observations and interviews conducted, problems were found, among others, the modules and components used tended to be old and partly damaged. In addition, the use of the previous practicum module was not equipped with a user manual, so the practicum was not carried out as expected. This happens because the practicum material is not aligned with the availability of equipment that will be used by students[10].

Based on the description of the problem above, it is necessary to design a practicum module to support microprocessor practicum activities that are complete and in accordance with the curriculum material. The development of learning media requires a development procedure. A development procedure is a procedural step that a developer must take to arrive at a specific product. The media development procedure includes several stages, namely the preparation of design, production and evaluation of media[11].

The design of this practicum module uses a microcontroller and several separate modular input outputs. The microcontroller was chosen because it has almost the same architecture as the microprocessor, so that the material contained in the practicum module can be adjusted. The development of this practicum module is expected to increase the enthusiasm of students to learn independently and improve their thinking skills[8].

Microcontrollers are now widely known and used in the industrial world. Lots of research or student projects that use various versions of microcontrollers that can be purchased at relatively low prices. This is due to the mass production carried out by chip manufacturers such as Atmel, Maxim, and Microchip. The microcontroller itself is known as a sub-system of the computer system which is a combination of semiconductors packaged in one IC or often referred to as a chip, so it is known as a Single Chip Microcomputer[9].

Microcontrollers and microprocessors have the same working system, namely as controllers. Microcontrollers can be called small controllers because complex electronic components such as transistors, TTL ICs and CMOS can be minimized, centralized and controlled using a microcontroller. By using a microcontroller, the electronic circuit becomes simpler because the system can be more easily changed according to user needs or modification. It can be said that a microcontroller is a chip or micro-small size of a computer because there are parts that are directly used, including analog to digital conversion (ADC), analog to digital conversion (ADC), serial and parallel ports, comparators, and so on, only components use an uncomplicated minimum system[12].

2 Research Method

This research is included in the types of research and development methods (Research and Development). Meanwhile, to test the effectiveness of the resulting product, it is necessary to develop the product so that it can be used by the wider community[13]. The development of this practicum module is a product produced for the world of education. The validity and reliability of these products must be tested for their effectiveness in order to achieve learning objectives and competence of graduates according to the curriculum.

The development model adapted in this study is the ASSURE model. The ASSURE model is a class-oriented development model. The ASSURE model was developed by Sharon Smaldino, Robert Heinich, Michael Molenda, James Russel by publishing the book Instructional Technology and Media for Learning. The book emphasizes the implementation of technology and media to facilitate effective learning. The ASSURE model has a constructivist philosophical approach, behaviorism and cognitivism so it is relatively easy to implement and can be easily developed by every educator[14].

This research and development is a procedural model, which is a model that is descriptive and outlines the steps of development. Research & Development research design is a study that produces or develops the design of a product which is then validated by experts or experts and tested on students after the product is revised to get the final product. There are several development procedures proposed by several experts. One of them is the development research procedure proposed by Sugiyono[13].

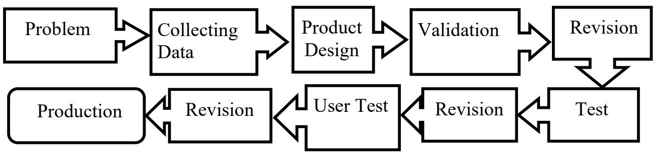

Fig 1. Development Research Procedures[13]

In this research, the product to be produced is a microprocessor practicum module. After the product is produced, further development is carried out to see the effectiveness and benefits of the product when used. The development procedure that was adapted in this study is the ASSURE model. The advantages of the ASSURE Model include 1) it is simpler and easier to implement by each educator; 2) this model can be planned and implemented in a relatively short time; 3) components that are complete enough to design the implementation of learning; 4) students are actively involved in learning; 5) media selection has a special place in the ASSURE model[14]. The stages of developing the ASSURE model include Analyze learner, State Objectives, Select Methods Media or Material, Utilize Media and Materials, Require learning participation, and Evaluate and Review[15].

In this study, the design of the practicum module consists of three major parts, namely Block Input, Block Process and Block Output. In the Block Input section, there are several components that function as input to the system, including the Thermocouple module, Camera, Voltage Sensor, Temperature Sensor, Keypad, Potentiometer, LDR, Current Sensor, Infrared Counter, Touchscreen and Rotary Encoder. The Process Block consists of Atmega2560 Microcontroller and RTC EEPROM as memory. The Output Block consists of a DC Motor, Stepper Motor, Relay, Traffic Light, Servo Motor, LED, LED Dot Matrix, Seven Segment and LCD module.

In this study, the instruments used were the media feasibility assessment sheet for the validator which included material experts and media experts, as well as a media use test sheet by lecturers and students. There are three types of instruments that will be used in this study, namely the Material Expert Assessment Instrument, the Media Expert Assessment Instrument and the User Assessment Instrument. The data analysis technique used in this research is a simple qualitative descriptive analysis technique, which describes the results of product development in the form of an electrical engine module.

3 Result and Discussion

Based on the needs analysis of the achievements results, the graduates and the learning outcomes of the courses as well as the availability of supporting tools for practicum in the laboratory, a microprocessor practicum module was developed to support the competence of graduates of the Electrical Engineering study program. The design of the microprocessor practicum module is carried out using the ASSURE model. There are 6 steps that must be done in developing the microprocessor practicum module.

Phase 1 is to analyze students. When the research team made observations, they saw the implementation of practicum in the laboratory that students were less enthusiastic about participating in learning and did not focus on the practical instructions that were delivered. Stage 2 is formulating learning objectives or competencies to be achieved. At this stage, the research team selects material according to the characteristics of the Electrical Engineering study program graduate and competency demands.

The third stage is to choose the strategy, method, material or subject matter needed for the manufacture of products such as: the main material and supporting aspects (text, images, animation, audio, and video). The researcher developed the supporting media for the practicum in the form of a microprocessor trainer using the ATMega 2560 microcontroller. In developing the microprocessor practicum module, the researcher designed a practical implementation guide in the form of a job sheet.

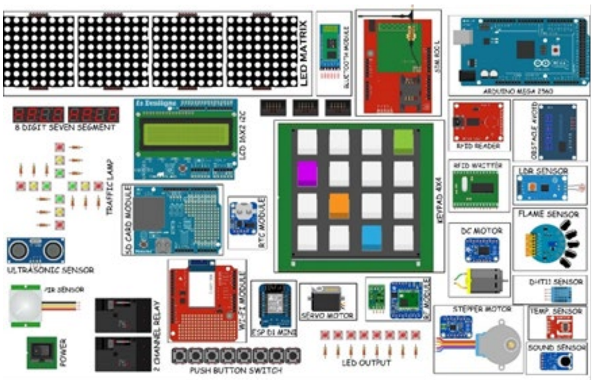

Fig 2. Microprocessor trainer design

Stage 4 is the phase of implementing Technology, Media and Materials. The implementation of the developed media is aimed at lecturers and students as practitioners. Before the module is used in practicum implementation, the product developed must be validated by material experts and media experts. The media validation developed contains an assessment from the experts from the point of view of the learning media and the material prepared. Product validation was carried out by 3 media experts and 3 material experts.

Then 10 (ten) students were also asked to provide responses related to media developed through questionnaires and interviews. Stage 5 is developing the role of students, namely students as practitioners. The main purpose of learning is so that students can play an active role in the teaching and learning process, especially during practicum implementation. The participation of students in the class, active student involvement shows whether the media used is effective or not. Learning should be designed to create activities that allow students to apply knowledge and receive feedback on the appropriateness of their efforts before and after learning. This stage has not been carried out because the microprocessor practicum module is still under development.

According to the evaluation data of media experts, the average is 89,4. Then use this value as a reference to determine the feasibility of the module. From the calculation and value conversion results, it can be said that the developed practical modules belong to a very feasible category. These results show that the internship module can be used as a medium for practicum learning. The assessment of materials experts includes four aspects, with an average value of 90,3. Perform feasibility testing to determine the feasibility level of the materials included in the practicum module. According to the calculation and value conversion, the results show that the materials in the developed module belong to a very feasible category. These results indicate that the materials developed in the practical modules fit the curriculum and the competencies to be achieved.

User trials were also conducted to obtain feedback. The experiment was conducted with ten students participating in digital engineering practice activities. Each student will receive a questionnaire to evaluate the feasibility of developing modules from the user side. After calculating the average value, the user trial average value is 89. Then perform calculations and conversions to determine the feasibility of the module in practice. The calculation results show that the developed module is in good condition.

4 Conclusion

The results show that the developed practice module is very suitable for digital engineering practice activities. In addition, it is necessary to develop other practical support facilities, such as trainers. Practical support tools in the form of logic gates with 3 inputs and 4 inputs are not yet available. Due to limited support tools, some experiments have not yet been completed.

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