Robotic Learning Media Development for D3 Students of Information Management Unesa

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Abstract: This study aims to design and create learning media of robotics, describing student responses to trainers developed and analyzing the feasibility of robotics trainers in digital electronics courses for D3 Informatics Management students at Surabaya State University. This research conducted with the development of learning media referring to the 4D design model from Thiagarajan (1974). The four stages are the stage of defining, designing, developing and disseminate. The defining stage includes front-end analysis, student analysis, concept analysis, task analysis and specification of learning objectives. The design phase consists of the preparation test, media selection, format selection, and initial design (initial design). At the development stage in this study carried out by socializing learning media.Result of research showed (1) an average score of validation module is 3.59 (good); (2) an average score of trainer validation is 4.46 (good); (3) students showed a positive response to learning that indicated as many as 90% of students feel happy and motivated by using a learning module that is equipped with learning aids (trainer) and as much as 90% of students find it easy to understand the material by using a learning media robotics. Based on these results it can be concluded that learning media developed are feasible to be used in digital electronics lectures. The application of learning media in digital electronics courses is the subject of digital circuit applications in everyday life suitable for learning activities.

1 INTRODUCTION

Mobile robots (robots in motion) are robots that need an activator to move (Budiharto, 2006: 6). This mobile robot has a driving mechanism in the form of wheels and/or legs to be able to move from one place to another.

Hartini (2011) stated that the car robot is Wahana Nir Awak (WaNA) which has become a tool used by the military and civilians to carry out surveillance, exploration and supervision to places that are dangerous to humans.

The development of robotics in the country has been very encouraging. As a barometer, the success of the Indonesian Robot Contest (KRI), Indonesian Fire Extinguisher Robot Contest (KRPAI), Indonesian Football Robot Contest (KRSBI), Indonesian Dance Art Robot Contest (KRSTI) and Indonesian Flying Robot Contest (KRTI). The contests more than 40 major universities in Indonesia took part. But the development of the robot is only limited to the contest and has not been developed as a learning media taught to all students of electrical engineering surabaya state university.

Theory and practice progress of the course Digital circuits along with their implementation (one of them microprocessors) provide an important role in the development of robotics technology. However, the process has not been widely applied evenly by Electrical Engineering students and is still limited to a number of students involved in (participating in) becoming members of the Unesa Robotic Team.

In an effort to introduce robotics technology to all university students especially in electrical engineering, this study aims to (1) design and create digital electronic learning devices as intelligent robot applications; (2) describe student responses during the application of digital electronic learning devices as intelligent robot applications. The benefits gained are providing knowledge and training skills to students in their understanding and

skills in the field of Robotics in the Department of Electrical Engineering at Unesa, in addition to teaching lecturers and instructors being able to dig deeper into each topic presented.

2 LITERATURE REVIEW

According to Gagne and Briggs (1979: 3). Instruction or learning is a system that aims to help students' learning process, which contains a series of events designed, arranged in such a way as to influence and support the occurrence of student learning processes that are internal.

According to Ratumanan (2004: 8) learning objectives essentially refer to the expected results after the learning process. It can conclude that in planning learning, the learning objectives are set first, all learning activities are directed towards achieving the goals to be achieved. Learning objectives classified into general goals and specific objectives.

Rahman (2007: 65) defines "media is a tool used to channel messages or information from the sender to the recipient of the message". From this understanding, media can interpreted as an introduction or intermediary that channel messages or information from the sender to the recipient of the message. In learning activities, media can interpreted as something that can bring information and knowledge in the interactions that take place between educators and students.

According to the Ministry of National Education (2008: 3), modules are printed teaching materials designed to study independently by learning participants. Module also called media for independent learning because they have instructions for self-study. It can interpreted that the reader can carry out learning activities without the presence of the teacher directly. This media called independent instructional material.

According to the Ministry of National Education (2008: 3), module writing has objectives including: clarifying and facilitating the presentation of messages, overcoming limitations (space, time, and sense power) for both students and teachers, enabling students to learn independently according to their abilities and interests, and allows students to be able to measure or evaluate their own learning outcomes.

Noting the above goals, the module as teaching material will be as effective in face-to-face learning. Writing a good module as if it were teaching students about a topic through writing.

Robot is one form of technological advancement that has many varieties and functions. Almost no one knows no robot. However, everyone has a different understanding of the meaning of robots. In general, intelligent robots are mechanical or biomechanical equipment that can produce movements, both using human supervision and control/using predetermined programs (artificial intelligence). The term robot comes from the Czech language "robota" which can be interpreted as a tireless worker. The tasks carried out by robots are usually repetitive, dirty, heavy, and dangerous jobs.

Most robots used in industrial fields, such as car assembly. Along with the development of the times, robots have entered into various fields, such as education, entertainment, banking, and so on. Robot technology itself has been developed long before the word robot introduced by the North Korean Tired. In the past, robot lovers knew it as automata (automaton). Etymologically, "automata" comes from Greek, automatos, which means moving on its own accord. This word often used to describe non-electronic moving machines, especially those designed to resemble human or animal movements (Pram, 2013: 2).

Robots applied to life actually designed in a form that suits their needs. For example, a robot to move goods on a conveyor is designed as an arm and sensors, and is not equipped with wheels or legs because it does not require mobility, but a freight robot that moves on a flat field will be equipped with wheels, and robots moving on irregular terrain will be equipped with feet. In short, in order to obtain a robot with an economical design, the robots only designed according to their needs. In this case, a human-shaped robot (android) often used for demo purposes or as a receptionist (Nalwan, 2012: 1).

3 RESEARCH METHOD

This type of research is development research aims to produce learning media of robotics for students of D3 MI Unesa. This research conducted at Surabaya State University and the time of implementation in the odd semester of 2013/2014. As a subject in this study were D3 Informatics Management students at the Electronics Engineering Department at Surabaya State University consisting of 20 students.

This module development research design uses qualitative and quantitative methods as a support with a development model called 4-D (Four D Models) which consists of 4 stages, namely: (l)

Definition (Define), (2) Design (3)) Development (Develop), (4) Dissemination (Disseminate).

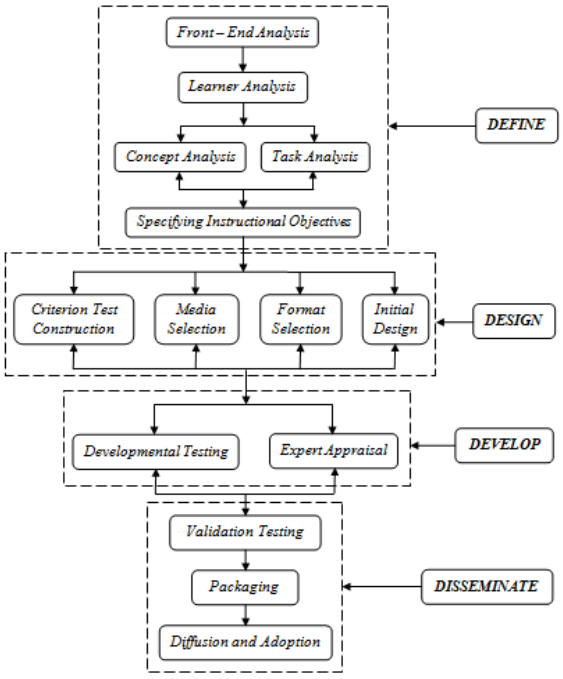

Figure 1. 4-D Model.

The instruments in this study included module validation sheets, validation sheets for trainers and student response questionnaires. The data collection technique done by submitting a module and trainer along with a validation sheet to the Validator. Then the results of the validation sheet used to revise the learning module and trainer. After the module and trainer revised, followed by a trial of a small group of learning modules and trainers in a number of student samples. In this case, the sample conducted on 20 students to find out the student's response to the modules and trainers used.

Analysis of the Module Validation Sheet for the assessment score (SP) of each component was carried out descriptively then averaged. The results of the average score described in the following categories (Ratumanan & Laurens, 2006):

1,0 ≤ SP ≤ 1,5 = Not Good: Not yet usable
1,6 ≤ SP ≤ 2,5 = Pretty good: Can be used with major revisions
2,6 ≤ SP ≤ 3,5 = Good: Can be used with small revisions
3,6 ≤ SP ≤ 4,0 = Very Good: Can be used without revision.

Analysis of the Trainer Validation Sheet for the assessment score (SP) of each component was carried out descriptively then averaged. The results of the average score described in the following categories (Ratumanan& Laurens, 2006):

1.0 ≤ SP ≤ 1.5 = Not Good: Not yet usable
1.6 ≤ SP ≤ 2.5 = Poor: Can be used with major revisions.
2.6 ≤ SP ≤ 3.5 = Pretty good: Can be used with moderate revisions.
3.6 ≤ SP ≤ 4.5 = Good: Can be used with a slight revision.
4.6 ≤ SP ≤ 5.0 = Very good: Can be used without revision.

Analysis of Student Response Results are based on the results of student response questionnaires distributed after the learning activities, student response questionnaires are used to obtain data about student opinions or comments about the tools developed by the researcher. To calculate the percentage of answers from students are done by calculating the proportion of existing answers divided by the number of students who receive questionnaires multiplied by 100%.

$$P = \frac{F}{N} x100\% \text{ (Arikunto:2006)} \quad (1)$$

Information:
P = Percentage of respondents' answers
F = Number of respondents' answers
N = Number of respondents

4 RESULTS AND DISCUSSION

Literature study in reviewing the Digital Electronics curriculum in Unesa'sDepartment of Electronics Engineering in the form of SAP and Syllabus for Digital Electronics courses.

4.1 Learner Analysis

Students in this study were Surabaya State University students, Electrical Engineering Department, Information Management D3 Study Program, 2013/2014 who were on average 20 to 21 years old. According to Jean Piaget in Trianto (2008: 43). The stage of cognitive development is included in the formal operation stage (11 years to adulthood). At this stage students have characteristics that can think abstractly and purely, are able to form concepts that are not dependent on physical reality, and can solve problems through the use of systematic experimentation.

4.2 Concept Analysis

Analysis of this concept by identifying the main concepts to taught. The main concept of the material taught in the robotics module is the subject of digital electronics.

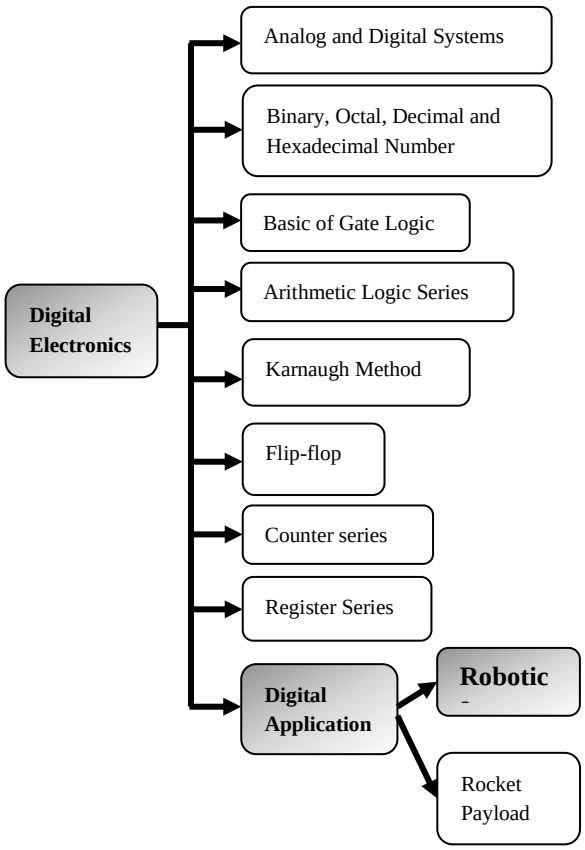

Figure 2. Robotics module concept map as digital electronics applications.

The activity carried out is to determine the tasks of students as learning experiences that are in accordance with the subject matter of digital electronics as an intelligent robot application, so that indicators of learning outcomes can achieved.

Basic competencies (KD) and indicators of the modules developed are as follows:

Basic Competency 1 is without opening a book, 80% of students can understand the microcontroller, Code Vision AVR and Proteus 7.10 Professional software properly and correctly. Indicators are (1) independently, 80% of students can explain the usefulness of each port on the ATMega32 microcontroller properly and correctly; (2) Without opening the book, 80% of students can explain the tools in Code Vision AVR at least four tools; (3) independently, 80% of students can make digital electronic circuit schemes usingproteus 7.10 Professional software properly and correctly.

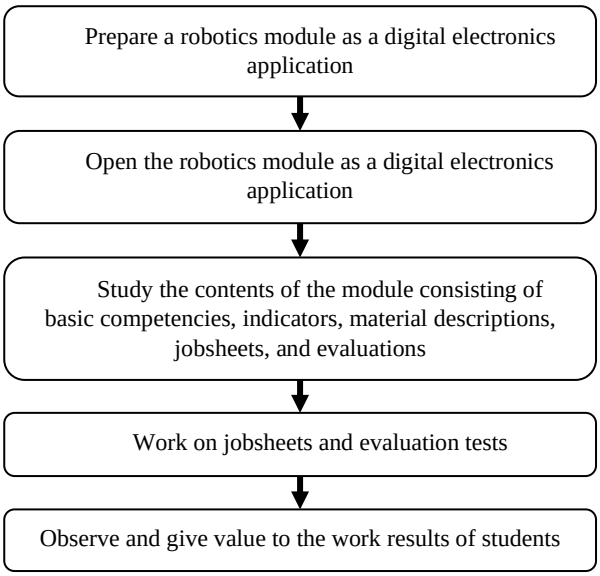

Figure 3. Procedure for using the robotics module as a digital electronics application.

Basic Competence 2 is independently, 80% of students can make microcontroller programs using Code Vision AVR and do simulations on Proteus 7.10 Professional properly and correctly. The indicators are (1) independently, 80% of students can make the Input and Output (I/O) program properly and correctly; (2) independently, 80% of students can make the LCD Display display program properly and correctly; (3) without looking at the book, students can simulate I / O and LCD Display programs on the Proteus 7.10 Professional software properly and correctly.

Basic Competence 3 is without looking at books, students can understand the application of proximity sensors, proximity sensors and fire sensors with a microcontroller properly and correctly. The indicators are (1) without looking at books, 80% of students can make a program to display proximity sensor data according to the answer key; (2) independently, 80% of students can make a program to display proximity sensor data properly and correctly; (3) without looking at books, students can create programs to display fire sensor data properly and correctly.

Basic Competency 4 is that without opening a book, students can understand the application of a fan/extinguisher, a servo motor and a vexta motorbike properly and correctly. The indicators are

(1) independently, 80% of students can make a program to activate fan/extinghuiser according to the answer key; (2) independently, 80% of students can make programs with servo motor properly and correctly; (3) without looking at books, students can make programs with vexta motorcycles properly and correctly.

The robotics module as an application of digital electronics learns four things, namely: (1) Introduction of microcontrollers, software Code Vision AVR and software Proteus 7.10 Professional, (2) programming microcontrollers using Code Vision AVR and Simulation on Proteus 7.10 Professional, (3) application of proximity sensors proximity sensors, and fire sensors with microcontrollers, (4) fan/extinghuiser applications, servo and vexta motors with microcontrollers.

Next is Figure 4 will show the cover of robotics module asa digital electronic application.

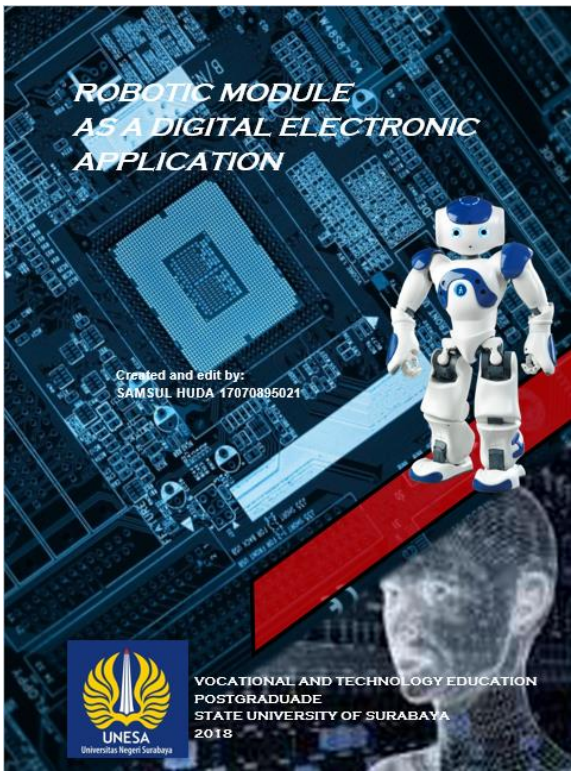

Figure 4. Cover the Robotics Module as a Digital Electronics Application.

ERC Trainer Version 1.0 is a trainer that will used to learn several competencies taught in the robotics module as a digital electronics application. Following is Figure 5 will explain the parts of ERC Trainer V1.0.

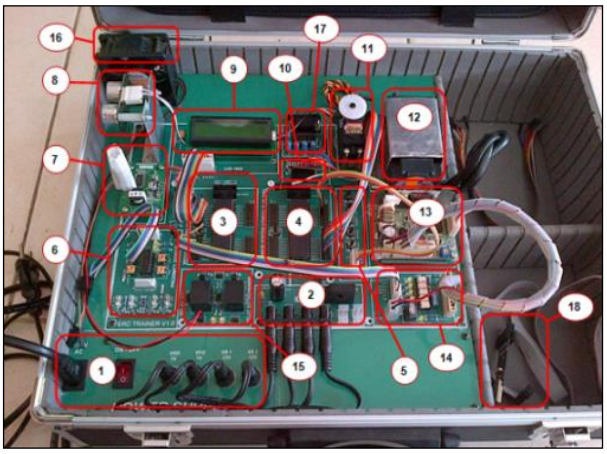

Figure 5. ERC Trainer V1.0.

Description of ERC Trainer V1.0 are (1) power supply is used to supply power of circuit; (2) power management is used to connect power supply with circuits; (3) minimum system ATMega32 (master) is a minimum system series that has been accompanied by output from all PORTs contained in ATMega32; (4) minimum system ATMega32 (Slave) is a minimum system series that has been accompanied by output from all PORTs found in ATMega32.(5) Buttons module are series of push button functions; (6) proximity sensors are electronic circuits to distinguish the color of black and white lines; (7) hamamatsuUVTron fire sensor is a circuit module that serves to detect the intensity of Ultra violet Light or Fire; (8) distance sensor SRF04 is a circuit module that serves to detect distances by using ultrasonic; (9) LCD display 16x2 is a circuit module used to display characters; (10) bargraph LEDs are LED circuit modules.(11) Servo motor is a dc motor that can be driven based on an angle that is equipped with a gearbox and driver circuit in it; (12) vexta motor is a brushless DC motor that has a large power that is equipped with a module driver to move it; (13) vexta motor driver is a circuit module used to drive a vexta motor; (14) optocoupler circuit is a circuit used to reduce the bias voltage caused by a rotating vexta motor by separating the ground of the microcontroller circuit with the ground of vexta motor.(15) Relay module is a relay circuit to activate Fan or Extinguisher; (16) fan is a tool used to extinguish fire in intelligent robot applications; (17) serial circuit is a series used for communication needs of microcontrollers with computers or laptops; (18) USBasp is a circuit module used to insert AVR programs into the AVR microcontroller chip.

4.3 Validation

4.3.1 Module Validation by Expert Lecturers

The feasibility of the module used as learning media is determined from the results of validation by 3 expert lecturers. The feasibility of the robotics module as a digital electronics application assessed from six components, namely characteristics, content, language, illustration, format, and display. The following is a list of module validator names.

Table1:List of names of module validators and trainers

No.	Validator	Expert Field	Keterangan
1.	Lusia Rakhmawati, S.T., M.T.	Learning	Lecturer
2.	Joko Catur Condro Cahyono, S.Si., MT.	Programming	Lecturer
3.	Nur Kholis, S.T., M.T.	Electronics	Lecturer

Module Validation by Expert Lecturers. Full results of the validation module by expert lecturers in Table 2 below.

Tabel 2. Results of modul validation

No.	Rated aspect	Average	Category
1	Characteristics	3.53	Good
2	Contents	3.42	Good
3	Language	3.56	Good
4	Illustration	3.58	Good
5	Format	3.67	Very good
6	Cover	3.78	Very good
	Total average	**3.59**	**Good**

Validation of Trainers by Expert Lecturers. Full results of the validation trainer by expert lecturers seen in Table 3 below.

Table 3. Results of trainer validation

No.	Rated aspect	Average	Category
1	Changable and layout	4.56	Good
2	Trainer description	4.33	Good
3	Fill in the Trainer's Series	4.50	Good
	Rata-rata Total	**4.46**	**Good**

Student response data obtained using questionnaire responses sheet instruments. This instrument used to find out the opinions of students on learning media developed in lectures on digital electronics, the subject of digital electronics applications in everyday life. The student response questionnaire sheet was filled by 20 students from the Department of Electrical Engineering, Engineering Faculty,Unesa. The results of the student response analysis shown in Figure 6 below.

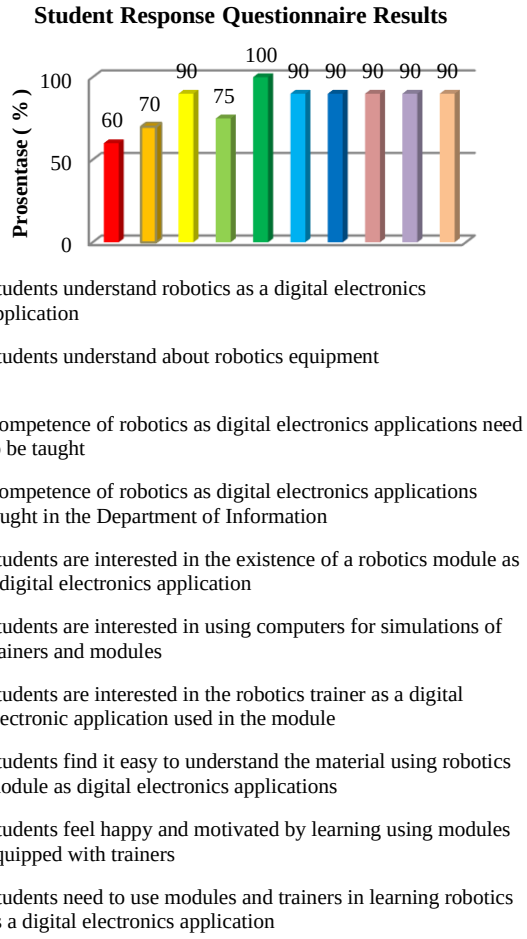

Figure 6. Results of Student Response Analysis Diagram

5 CONCLUSIONS

Based on the analysis and discussion conclusions are obtained (1) Based on the results of the assessment of 3 expert lecturers, it shows that the average score of all module components is 3.59 and the average value of the trainer validation results is 4.46 which is included in the good category with little revision.

This shows that the learning media is feasible to be used in digital electronics lectures on the subject of digital circuit applications in everyday life; (2) Students show a positive response, this is indicated by 90% of students feeling happy and motivated by

learning using modules equipped with learning aids (trainers) and 90% of students think that digital electronics lectures using instructional media developed can facilitate understanding lecture material.

Based on the results of data analysis and findings described earlier, the authors suggest that (1) learning activities using learning media can be used as an alternative in an effort to improve student learning outcomes; (2) development of learning media can be used as an example for instructors / lecturers who want to develop learning media to be used on other subjects or other appropriate subjects.

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