Design of Smart Educational Robot as a Tool For Teaching Media Based on Contextual Teaching and Learning to Improve the Skill of Electrical Engineering Student

M S Zuhrie*, I Basuki, I G P Asto B, L Anifah

1,2 Department of Electrical Engineering, Faculty of Engineering, Universitas Negeri Surabaya, Indonesia.
3,4 Department of Computer Engineering, Faculty of Engineering, Universitas Negeri Surabaya, Indonesia.

*zuhrie@unesa.ac.id

Abstract. The development of robotics in Indonesia has been very encouraging. The barometer is the success of the Indonesian Robot Contest. The focus of research is a teaching module manufacturing, planning mechanical design, control system through microprocessor technology and maneuverability of the robot. Contextual Teaching and Learning (CTL) strategy is the concept of learning where the teacher brings the real world into the classroom and encourage students to make connections between knowledge possessed by its application in everyday life. This research the development model used is the 4-D model. This Model consists of four stages: Define Stage, Design Stage, Develop Stage, and Disseminate Stage. This research was conducted by applying the research design development with the aim to produce a tool of learning in the form of smart educational robot modules and kit based on Contextual Teaching and Learning at the Department of Electrical Engineering to improve the skills of the Electrical Engineering student. Socialization questionnaires showed that levels of the student majoring in electrical engineering competencies image currently only limited to conventional machines. The average assessment is 3.34 validator included in either category. Modules developed can give hope to the future are able to produce Intelligent Robot Tool for Teaching.

1. Introduction

The development of robotics in Indonesia has been very encouraging. The barometer is the success of the Indonesian Robot Contest. In the contest no less than 40 major universities in Indonesia took part. But the development of such robots is limited to the contest and has not been developed to address the issues more real, especially in the industrial world.

The focus of this research is the design of the device in the course of the smart educational robot through the firefighter home robot that is booming and will be implemented in annual of the Indonesia Robot Contest and the industrial in order to advance the world of robotics Indonesia. Robots of this type developed by developed countries such as America, Japan, the United Kingdom the cost is very
Currently, the robot actually uses high tech, because the control is fully controlled by a microprocessor as a substitute for human and we strive to develop the Low-Cost Technology.[1]

The focus of this research is a teaching module manufacturing, planning mechanical design, control system through microprocessor technology and maneuverability of the robot. The first phase of the study is expected to produce a smart educational robot that is reliable both in terms of technology and in terms of economy.

The principal issue is how the curriculum and the learning modules are implemented in accordance with the approach of industrial needs [2]. In order to support competency-based curriculum needs of the industry, has also been compiled modules both manual and interactive, oriented to the achievement of competence as well as accommodate the working life skills. With regard to the problems that will arise is what kind of learning modules appropriate to the characteristics of the attainment of the goal of learning the world of work as well as the achievement of competence in the field of life skills by using the main teaching materials in the form of modules and learning media.[3]

To answer these problems in this study will be compiled in the form of learning devices in the course of the smart educational robot as a tool for teaching based on Contextual Teaching and Learning to the needs of industry. Expected results of this study will be able to bridge the needs of energy, particularly of graduates majoring in Electrical Engineering Universitas Negeri Surabaya which will work as a vocational teacher or plunge into the world of industry.

2. Theoretical Framework
2.1. Educational Robot
The educational robot is a broad term that refers to a collection of activities, instructional programs, physical platforms, educational resources and pedagogical philosophy. The primary of objective of the educational robot is to provide a set of experience to facilitate the student's development of knowledge, skills, and attitudes for the design, analysis, application and operation of robots. The term robot here is used quite broadly and may include articulated robots, mobile robots or autonomous vehicles of any scale.

2.2. Contextual Teaching and Learning Strategy
Contextual Teaching and Learning is a learning concept that helps teachers connect the contents of the subject matter with real-world situations and motivate students to make connections between their knowledge application in about his life as a member of the family and community.[6]

Meanwhile, contextual teaching and learning is the concept of learning where the teacher brings the real world into the classroom and encourage students to make connections between knowledge possessed by its application in everyday life.[7]

US Department of Education and the National School-to-Work Office is a concept that helps teachers to connect teaching materials with situations in the real world and motivates students to make connections between knowledge and practice into their lives as family members, citizens, and labor.[8]

2.3. Development Learning Tool 4-D Model
The steps of 4D model are (1) define stage, the purpose of this stage is to determine and define the conditions of learning. This phase has five basic steps include: front-end analysis, learner analysis, concept analysis, task analysis, and formulation of learning objectives, (2) design stage, the design of prototype learning device is produced. The result of this phase is usually a preliminary design of the learning device depending on requirements. Device components used are very diverse, such as student book, modules, teacher guide, student activity sheets, lesson plans, tests of student learning outcomes, and learning media, (3) develop stage, this stage aims to produce learning tools that have been revised based on the input of experts. The next step is a trial with an appropriate number of students in a class of real (not unlimited). This activity was conducted to determine how effective learning tools developed when applied to the learning process. The effectiveness of the learning device can be seen through the observation, for example, the activities of teachers and students, the ability to manage learning and student achievement test, (4) disseminate stage, this stage is the stage of deployment and
uses learning devices. Learning tools that have been tested and revised earlier, duplicated and distributed for use on learning on a larger scale.[1]

3. Research Methods
This research was conducted by applying the research design development with the aim to produce a tool of learning in the form of the smart educational robot as a tool for teaching based on Contextual Teaching and Learning at the Department of Electrical Engineering to improve the skills of Electrical Engineering student.[4]

Procedure development in research carried out through several stages as follows:

- Identifying the various issues surrounding the smart educational robot used in the robot contests through the study of literature and data mining to be used as reference for the formulation of theory, simulation and applications approach;
- Analyze and formulate the identification of various issues surrounding the smart educational robot relevant to developed in the Department of Electrical Engineering Analyze and formulate the identification of various issues surrounding the smart educational robot relevant to developed in the Department of Electrical Engineering;
- Make analysis and draw up scenarios content and design of learning and infrastructure needed for the development of equipment, teaching staff, laboratory personnel, and the establishment of appropriate evaluation system material needs robotics;
- Formulate indicators of success for teaching and learning process oriented to the achievement of the performance demands of the professional needs;
- Implementation of the manufacture of smart educational robot as a tool for teaching based on Contextual Teaching and Learning as a means to integrate the theory, simulations and applications suitable with various issues surrounding the learning needs and smart educational robot for contest;
- Conduct field trials on smart educational robot course tools of learning based on Contextual Teaching and Learning in the Department of Electrical Engineering oriented to the mastery of the competency needs;
- Analyzing the results of field trials and make improvements to validate test procedures and test results;
- Doing the final revision of the smart educational robot as a tool for teaching based on Contextual Teaching and Learning, the results of field test and validation.[4]

4. Data Collection and Analysis Techniques Data
Information on the results of field surveys and discussions in order to implement the standards needs of the Indonesia Robot Contest and the learning device is analyzed with descriptive techniques. Likewise, data from focus group discussions in order to identify and formulate the essential topics as teaching materials for integrated robotic courses in the form of theory, simulation, and applications by using qualitative descriptive analysis techniques. Qualitative descriptive analysis techniques emphasis on making the evaluation and synthesis of the conclusions resulting from the activities. Synthesis and conclusions on the outcome of this study were formulated through forums workshops and focus group discussions.[5]

5. Results And Discussion
5.1. Data from the Indonesia Robot Contest 2009-2015
From the data of the Indonesia Robot Contest during the period 2009-2015 can be seen that the modules that have been developed have reached the fourth stage of the research methods of development that disseminate methods. So that, the module is perfect, ready to be duplicated and distributed as learning devices subject to intelligent robot courses. In Indonesia Robot Contest, material-based teaching module compiled specifically for the contest is not only electrical or
electronic engineering majors alone, but multi-disciplines, and the object of research being developed not to be the latest technology and appropriate technology alone, but include the development of learning tools.

5.2. Data Socialization Result in Student Learning Tool

Based on the data about the socialization of the learning is done on students majoring in electrical engineering at the above resulted in the following data. For questions 1, 2, and 3 all respondents consisting of 10 students from representatives of various courses in the department of electrical engineering (100%) answered no understanding of the application of smart educational robot in the industry, or about smart educational robot equipment. Respondents also argued robotics competence that is not taught in the department of electrical engineering. This shows that the image of the competence of the department of electrical engineering is currently only limited to the classic electronic circuit, which ranges on flip-flop, NAND gate, AND gate only, not offensive competence in the industrial smart educational robot. Yet today the development of machinery industry has many uses industrial intelligent robot.

To question no. 4 of smart educational robot teaching module of respondents who answered draw was as much as 9 students (90%) of the 10 student-vocational and vocational representatives argue unattractive as much as one student (10%). As for the question no. 5 and no. 6 on the use of computer tools and modules of respondents who think "interesting" as many as 10 students (100%) and argue "unattractive" as none (0%). This shows the positive response of the device in the form of learning modules and devices are developed lesson.

To question no. 7 all respondents as many as 10 people (100%) found the module that was developed to facilitate the understanding of the matter. All respondents (100%) believed that they feel happy and motivated by learning to use teaching modules and tool of learning. This indicates that the module can be motivating Electrical Engineering student and assist Electrical Engineering student in understanding the material.

5.3. Data from the validation of learning by teaching staff (lecturers)

A module that has been created and then validated on 5 validators consisting of faculty learning experts, education experts, engineering experts, and grammarians. And the average assessment is 3.34 validator included in either category. So that the module can be used in trial 2 that experiments performed in the course of the smart educational robot.

6. Conclusions

Based on the results of data analysis and discussion, the researchers can draw conclusions as follows:

This is a module developed research results and monitoring research officer with the team for 6 years continues to develop research-based robotics contest, with the hope of the future be able to a tool of learning in the form of intelligent robot modules and kit based on Prj Contextual Teaching and Learning.

The results of student responses during learning tools developed socialization shows that the image of competence for the department of electrical engineering is currently still limited to classic electronic circuit, which ranges on flip flop, NAND gate, AND gate only, only, not offend industrial robots. Yet today the development of industrial automation has many uses industrial robots. Therefore we need a learning device that can support learning robotics competence in the department of electrical engineering. From the results of student responses also showed a positive response to the module of intelligent robot based on Contextual Teaching and Learning developed.

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