DESIGN OF AN ARTIFICIAL INTELLIGENCE ROBOT AS TEACHING MEDIA BASED ON CONTEXTUAL TEACHING AND LEARNING

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ABSTRACT

This study was conducted by applying a research and development design with the aim of producing a learning tool in the form of Artificial Intelligence robot module and kit based on Contextual Teaching and Learning at the Department of Electrical Engineering to improve the students' skills. This was a development research adopting 4-D model, proposed by Thiagarajan and Semmel (1974) that consisted of four stages: Define, Design, Develop, and Disseminate. Data of the Indonesia Robot Contest during the period 2009-2015 reveals that the developed modules have reached the fourth stage of 4-D research model that is dissemination thus, the module is considered perfect, ready to be duplicated and distributed as a learning device for Artificial Intelligence robotics courses. While, the developed module was validated with the average assessment score of 3.34. The module is expected to be able to produce Artificial Intelligence Robot Tool for teaching based on Contextual Teaching and Learning to improve the students' skills to be applied in the field. In the results, students also showed positive responses on the robotics module and Contextual Teaching and Learning strategy.

Keywords: artificial intelligence robot, contextual teaching and learning, learning tool, robotics course

INTRODUCTION

The development of robotics in Indonesia has been very encouraging. The indicator is reflected on the success of the Indonesian Robot Contest. In the contest, more than 40 major universities in Indonesia took part in the event. The development of such robots, however, is limited to contests and has not been emerged to address more real issues, especially in the industrialized world.

The focus of this study is the design of a device for the course of Artificial Intelligence Robotics through the fire-fighter home robot which is rapidly growing and will be exhibited in the annual Indonesian Robot Contest and be implemented in the industries in order to advance Indonesian robotics world. The types of robots created by developed countries such as America, Japan, the United Kingdom are high-cost. The robots, nowadays, utilize high technology as they are fully controlled by a microprocessor as a substitute for human and some efforts. As the consequence, more research are conducted to develop the Low Cost Technology (Greinert, 1992). The focus of this study, in the first stage, is creating a teaching module of manufacturing, mechanical planning design, control system through microprocessor technology and maneuverability of the robot. The first stage of the study is expected to produce an Artificial Intelligence robot that is reliable both in terms of technology and of economy.

The main issue is how the curriculum and the learning modules are implemented in accordance with the approach of industrial needs (Brown, 1999). The complexities of current labor market have led fundamental transition in vocational education and training curricula, and it's become much significant, a competency-based point of view and simultaneous attention to technical and nontechnical competencies (Nourian and Ghoddousi, 2015). In order to support competency-based curriculum as needed by the industry, both manual and interactive modules have been compiled which are oriented to the competency achievement as well as are designed to accommodate the working life skills. Ayonmike et al. (2014) highlighted the benefits of competency based education and training as a training approach that is learner focused, thus allowing participants to acquire

competencies required in the performance of their jobs.

The problems emerge a question of what kind of learning module that is appropriate to meet the characteristics of the learning goals associated with the workspace as well as the competency achievement in the field of life skills by using the main teaching materials in the form of modules and learning media (Adviso & Bernardo, 1990).

In this study, the answer of these problems is manifested by a creation of a learning device of Artificial Intelligence robotic tool for teaching based on Contextual Teaching and Learning to meet the industrial needs. Here, Contextual Teaching and Learning strategy is used as it holds the concept of learning in which the teacher brings the real world into the classroom and encourages students to make connections between knowledge possessed by its application in everyday life. Contextual Teaching allows students to participate and play an active role in learning to improve students'achievements and to increase the students' motivation (Nugraha & Hertanto, 2014; Hariyanto, 2010). The following Figure 1 presents the picture of Artificial Intelligence Robot Kit (Trainer).

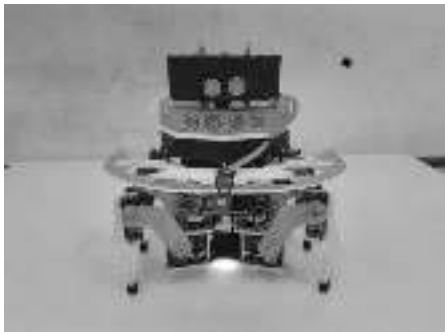

Figure 1. Artificial Intelligence Robot Kit (Trainer)

The result of this study is expected to be able to bridge the needs of industries in general, and for Electrical Engineering graduates of State University of Surabaya in particular to work as vocational teachers or to work in the industries.

METHOD

This study was conducted by applying the design of research and development with the aim of producing a learning tool in the form of Artificial Intelligence robot module and kit based on Contextual Teaching and Learning at the Department of Electrical Engineering to improve the students' skills (Norton, 1985).

The research procedures consisted of several stages as follows: (1) identifying various issues regarding to Artificial Intelligence robots used in robotic contests through literature study and data mining used as references for the formulation of theories, simulations and applications; (2) analysing and formulating the identified issues which were relevant to be developed in the Department of Electrical Engineering; (3) analysing and drawing up learning contents and scenarios as well as infrastructure designs required for the development of the equipments, teaching staffs, laboratory personnels, and for the establishment of appropriate materials evaluation system; (4) formulating the success indicators for teaching and learning process which were oriented to the achievement of the performance demands of the professional needs; (5) implementating the teaching module and learning device (kit) based on Contextual Teaching and Learning to integrate the theories, simulations and applications which met the learning needs and the issues concerning Artificial Intelligence robots for contest; (6) conducting field trials based on Contextual Teaching and Learning in the Department of Electrical Engineering focused on the mastery of the required competencies; (7) analyzing the results of field trials and making the improvements to validate the test procedures and the test results; and (8) conducting the final revision based on the results of field tests and validation (Norton, 1985).

The results of field surveys and discussions to implement the standard needs of the Indonesian Robot Contests and the learning devices were analyzed with descriptive

technique. Similarly, data from focus group discussions were used to identify and formulate the essential topics as teaching materials for integrated robotic courses in the form of theories, simulations, and applications by using qualitative-descriptive analysis technique. This technique emphasized on making the evaluation and syntheses of the results from the activities. The syntheses and conclusions on the outcome of this study were formulated through workshops and focus group discussions (Kulik in Baker, 1994).

RESULTS AND DISCUSSION

Data of the Indonesian Robot Contest during the period of 2009 to 2015 reveals that the developed module has reached the fourth stage of 4-D model, that is dissemination. This means, the module was perfect and ready to be duplicated and distributed as learning devices for Artificial Intelligence for robotics courses. In Indonesian Robot Contest, material-based teaching modules compiled, specifically, for the contest were not only for Electrical or Electronic Engineering majors itself but also for multi-disciplines. Besides, the research object did not stand as the latest and most appropriate technology but it included the development of learning tools. The socialization was conducted for the students majoring in Electrical Engineering and the results were presented in Table 1.

Table 1. Data From Student Socialization of Learning Tool

No.	Questions	Yes	No
1.	Do you understand about industrial-related robotics?	0%	100%
2.	Do you understand about robotics equipment such as Microcontroller, sensor, IC, etc.?	0%	100%
3.	Is robotics competencies taught in your major?	0%	100%
		Interesting	Uninteresting
4.	What do you think about the contextual learning-based Robotics Module with as a whole?	90 %	10 %
5.	What do you think about the use of computer as a simulation medium in this module?	100%	0%
6.	What do you think about the use of supporting tools / kits in the form of Robotics trainers used in this module?	100%	0%
		Yes	No
7.	In your opinion, is using a contextual learning-based Robotics module able to facilitate you to understand the materials?	100%	0%
8.	Are you happy and motivated by the learning using modules equipped with learning aids?	100%	0%
9.	Is it necessary to learn Robotics done using modules and props in the Department of Electrical Engineering - Faculty of Engineering - State University of Surabaya?	100%	0%

For questions number 1, 2, and 3, all respondents consisting of 10 students from representatives of various courses in the Department of Electrical Engineering (100%) answered that they did not understand the application of Artificial Intelligence robot in the industry or Artificial Intelligence robot equipment. Respondents also argued that robotics competencies were not taught in the their department. This proved that the competencies of the Department of Electrical Engineering were currently only limited to classic electronic circuits, involving flip flop, NAND gate, AND gate only, and did not cover offensive competences in the industrial Artificial Intelligence robots. In facts, today machinery industries employ industrial Artificial Intelligence robots.

For question no.4, the Artificial Intelligence robot teaching module with Contextual Teaching and Learning was considered “interesting” responded by 9

students (90%) of 10 vocational students and representatives, and argued as unattractive by the rest, one student (10%). As for the question no. 5 and no. 6 regarding to the use of robotic tools and modules respondents who thought them as interesting were 10 students (100%) and argued as unattractive were none (0%). This showed the positive responses toward the device in the case of learning modules and the developed learning devices.

For question no.7 all respondents as many as 10 people (100%) found the module able to facilitate the understanding of the learning materials. All respondents (100%) believed that they felt happy and motivated by learning with using teaching modules and learning tools. This indicated that the module enabled to motivate students and to assist them in understanding the materials.

The developed module then was validated by 5 validators consisting of learning experts, educational experts, engineering experts and grammarians with the average assessment score of 3.34. Therefore, the module could be used in the second trial, performed in the course of AI-robots.

Table 2. Data of the Learning Tool Validation by Teaching Staffs

	Aspect	Mean Score	Category
1.	Characteristics	3.27	Good
2.	Content	3.20	Good
3.	Language	3.25	Good
4.	Illustration	3.24	Good
5.	Format	3.40	Good
6.	Cover	3.67	Very Good
Average Total Score		3.34	Good

CONCLUSION

The module was developed through 6 stages of research procedures and monitored by research team to continuously develop robotics contests-based research to produce a learning tool in the form of Artificial Intelligence robot modules and kit based on Contextual Teaching and Learning in the future. The results of students' responses during the developing learning tool socialization showed that the competencies taught at the Department of Electrical Engineering were currently still limited to classic electronic circuits, such as flip flop, NAND gate, AND gate only, and did not cover the industrial robots. Today the development of industrial automation utilizes industrial robots. Therefore, a learning tool that can support robotics competencies in the Department of Electrical Engineering is urgently required. The students also showed positive responses to the developed module of Artificial Intelligence robots based on Contextual Teaching and Learning. The module was validated by 5 validators from different fiels such as learning experts, education experts, engineering experts and grammarians and it gained the average score of 3.34 which was categorized as good. The method of contextual teaching and learning lectures should be done for any existing courses in addition to courses in AI robots because the use of robotic devices as learning tools can help improving the students' motivation to attend lectures and to facilitate them to understand the robotic materials. The robotics competencies are necessary to be taught in Electrical Engineering Department, both for high school or university students since AI-robot competencies are necessary for the graduates majoring in engineering as they work in the industries, especially in industrial machineries that operate automatically.

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