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Robotic Tournament (ROBOTO): Evolution from Formal Learning to the Battle Court

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Abstract

Embedded Robotic courses are measured through 4 types of assessment, namely quizzes, theory tests, practical works and mini projects. The evaluation of mini projects is seen to be more effective if it is competed where students can pour ideas into improving their respective robots. Thus, the main objective of ROBOTO is designed as a competition platform to measure the achievement of Course Learning Outcome (CLO4) for mini project in Embedded Robotic Course. There are 3 phases of ROBOTO implementation, namely the initial phase, the screening phase and the competition phase. Each student will be divided into groups of 3 and will need to prepare robots according to the assigned tasks. Only groups that are successful in the screening phase will compete in the ROBOTO program. The implementation of ROBOTO is seen to contribute to the improvement of CLO4, PLO11 achievement in the December 2019 Session. In conclusion, ROBOTO is an alternative in diversifying teaching and learning activities that can encourage students to think creatively and innovatively in a real competition environment. Improvements that can be implemented in increasing the quality of ROBOTO organization is by improving the specifications and rules of the Sumo robot competition. The size and quality of the sumo court used in the December 2019 Session will also be improved according to the Federation of International Robot-soccer Association (FIRA) competition standards. This improvement will definitely have a positive impact on students and institutions as the ROBOTO platform also involves industry panels, alumni and the local community.

Key-word: - Embedded Robotic, ROBOT

1. Introduction

The Embedded Robotic Course (DEC50122) is an elective course that must be taken by all semester 4 students of diploma program at the Department of Electrical Engineering, Politeknik Ibrahim Sultan. The measurement of student comprehension for this course is measured through 4 types of assessment, namely quizzes, theoretical tests, practical training and also mini-projects that include 4 Course Learning Outcome (CLO) namely CLO1, CLO2, CLO3 and CLO4.

Table 1 shows the tasks involving CLO and PLO measurements. It can be observed that the evaluation of a mini project involves the measurement of all CLOs where the generic skills of the students are measured through CLO4. Figure 1 shows the measurement of generic skills assessed in the DEC50122 course, namely time management, decision making, organization of ideas, delegation of work and motivation. Through this measurement, teamwork and leadership skills among students can be assessed (PLO11).

Table 1: Relationship between CLO, PLO and Assesments

Course Learning Outcome (CLO)	***Programme Learning Outcome (PLO)***	***Assessment***
CLO1: *Investigate the concept and fundamentals of mobile robotic, embedded controller, sensor and actuators based on land mobile robot design*	**PLO4(*Cognitive*):** *Design Knowledge*	*Quiz, Test, Mini Project*
CLO2: *Design the concept of robot positioning, identification and communication in mobile robot control*	**PLO3(*Cognitive*):** *Analysis &*	*Test, Mini Project*

according to a standard robot organization regulation	*Investigation Knowledge*	
CLO3: *Manipulate the application od sensor and actuator, robot identification and communication during practical work based on land mobile robot design*	**PLO5(*Psychomotor*):** *Practical Skills*	*Practical Work, Mini Project*
CLO4: *Demonstrate good ability in managing a well-defined engineering-based project in a cost effective manner. (Generic skills: Project Management & Finance)*	**PLO11(*Affective*):** *Teamwork & Leadership skill*	*Mini Project*

GENERIC SKILLS

a. Project Management & Finance

Attribute 1: Managerial
Sub-attribute:

i. Time Management
ii. Decision Making
iii. Organization of Ideas
iv. Delegation of Work
v. Motivation

Reference: iCGPA Rubric Learning Outcomes Assessment Guide 2016.

The generic skill(s) need to be assessed at least **TWO (2)** times.

Figure 1 : Generic Skill Measurement

A platform in the form of a robot competition or better known as ROBOTO is designed as a teaching aid (ABBM) tool to measure CLO achievement as well as generic skills for mini-projects. In line with the 21st-century learning methods (Siong, 2018), ROBOTO can also introduce ABBM which is more attractive to students where the teaching and learning process can be fully practiced. This platform provides opportunities and space for students in transforming their understanding in the form of competition and also cost and material savings can be achieved due to the optimal and repeated use of materials. ROBOTO Program has been organized twice, during the June 2019 Session and the December 2019 Session. This method is seen to increase the enjoyment among students of learning and mastery of the syllabus. ROBOTO's organization is seen as improving the skills of students in Arduino programming and correctly installing components on the robot controller board (robot controller). The achievement of Student PLO11 (Teamwork & Leadership skills) in the December 2019 Session was also increased compared to the June 2019 Session.

2. Problem Statement

Based on observations, the measurement of generic skills in the Embedded Robotic Course (DEC50122) is difficult to evaluate effectively through traditional teaching and learning methods (Yusmahaida,Nor Faizah & Nor Hidayu, 2020). Furthermore, it involves a large number of classes and students. Evaluation inconsistencies will occur if the evaluation methods are implemented separately according to the respective classes. In addition, traditional teaching methods limit student's ability to highlight leadership talents in managing projects and finances more effectively. As a result, students will work individually and the measurements of CLO4 and PLO11 are difficult to assess. In addition, traditional assessment methods limit lecturers to track potential students for promotion as participants of the Federation of International Robot-soccer Association (FIRA).

3. Objective

The objectives of this innovation are to:

i. Facilitates the measurement of CLO and generic skills of students in the mini project of the Embedded Robotic Course through 3 developed phases.
ii. Provide space for students to highlight leadership abilities in managing projects towards the ROBOTO program.
iii. Facilitate the selection of potential students to be featured as a successor to the Federation of International Robot-soccer Association (FIRA) participants.

4. Methodology

There are three phases of ROBOTO implementation namely Initial Phase, Screening Phase and Competition Phase.

a. Initial phase

Students are divided into several groups (3 people per group) and supplied with basic kits as shown in Figure 2. In the December 2019 Session, 8 classes were consisting of 319 students taking the Embedded Robotic Course. Based on modules taught in laboratories and lectures, students are exposed to the construction of robots (Figure 3) as well as the use of sensors. They need to prepare robots according to mini project task questions. Each group of students will be given a task in the 5th week of the lecture by using a voting method. The mini-project questions contain 5 tasks, namely Task 1 (Robot Dance), Task 2 (Robot Sumo), Task 3 (Robot Line Follower / Photobotic), Task 4 (Robot Racer), and Task 5 (Robot Voice Control).

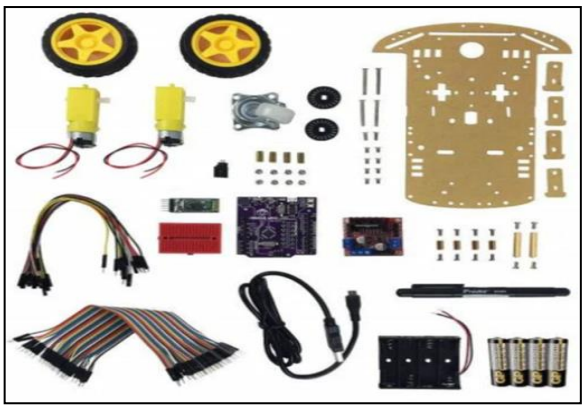

Figure 2: Basic kit

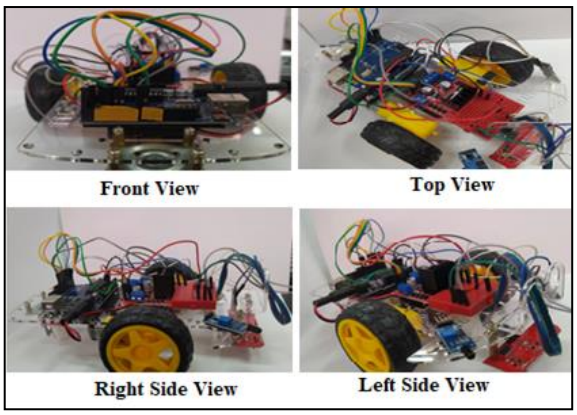

Figure 3: Installed Basic Robot Kit

b. Screening phase

As shown in Figure 4, students are given the opportunity to create and beautify their robots based on mini-project questions. To produce the strongest, stable and effective robots, each group will compete with each other and it is supervised by course lecturers. The course lecturer will give the scoring of mini-projects with reference to the DEC50122 Mini Project Rubric. To facilitate the selection process in the December 2019 Session, each class must send a representative of each category of robots as follows:

- sumo robot (2 groups)
- dance robot (2 group)
- line followers' robot (1 group)
- racer robot (1 group)
- voice control robot (1 group)

Each class should represent each category. Lecturers are responsible for selecting a qualified group to participate in ROBOTO program.

Figure 4: Some of robots that have been decorated

c. Competition phase

The successful group to the next level is given a week to improve their respective robots. Experts from the industry, as well as expert lecturers from nearby polytechnics, will supervise the competition level. The winner is decided by the results with the highest score. Each competition category has its own competition and scoring rules, which were explained in depth to the students in the initial phase.

Figure 5: ROBOTO competition in June 2019 session

Figure 6: ROBOTO competition in December 2019 session

5. Result

Analysis of the findings of the Course Outline Review Report (CORR) was carried out during the organization of the ROBOTO Program where the achievement of PLO11 students for all Diploma in Electrical & Electronic Engineering (DEE), Diploma in Electronic Engineering (Communication) -DEP and Diploma in Electronic Engineering (Control) -DJK found to increase as Figure 7.

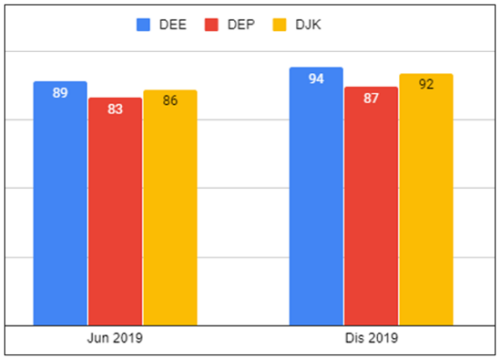

Figure 7: PLO 11 training graph for each program

In addition, a questionnaire was also given to the participants of the ROBOTO Program December 2019 Session where the findings showed good feedback from the participants of the competition as shown in Figure 8. The results of student feedback on the implementation of the ROBOTO program that has been conducted found that 97.2% agreed that ROBOTO can adapt learning outcomes to work skills, while 94.4% showed that students can work in groups and train themselves to communicate better. A total of 97.2% of students admitted that ROBOTO can increase their creativity

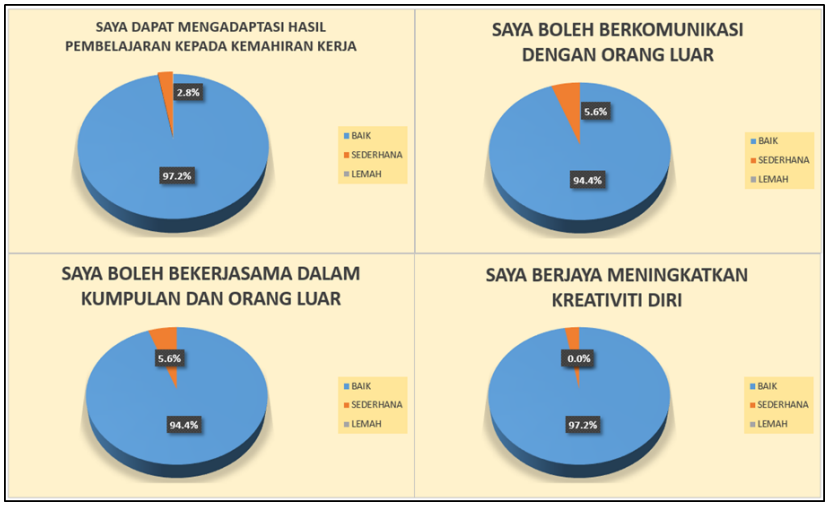

Figure 8: ROBOTO Feedback participant program

Overall, the ROBOTO program not only has an impact on student achievement in the Embedded Robotic Course but also contributes to the institution and the community. The following is the impact of the ROBOTO Program on students:

i. Provide direct exposure to students about the actual competition process.
ii. Develop fresh creative ideas among students in styling their respective robots in terms of the variety of functions and functions of robots.
iii. Foster team spirit and cooperation between students in preparing their robots.
iv. Introducing ABBM that is more attractive to students where the teaching and learning process can be fully practiced through ROBOTO.

The impact on the institution is:

1. The development of the ROBOTO platform contributes to the organization of the Arduino Lifetime Course (PSH) at the Department of Electrical Engineering, PIS.
2. Promote Ibrahim Sultan Polytechnic brand, especially to the local community, especially schools around Pasir Gudang by inviting them to participate in ROBOTO in side events
3. Involve Alumni in programs with students
4. Collaborate with the industry as well as contribute to the polytechnic KPIs.

6. Suggested improvements

Overall, there are some improvements that can be implemented in the ROBOTO program to be the best platform to strengthen students' skills in robotics. Based on the findings and comments from the panel and contestants, some of the game concepts will be improved such as sumo robot matches. Robot competition categories will be added, namely the robot weight category below 500 g and the robot weight category between 500 g - 1 kg. Meanwhile, the size and quality of the sumo court used in the December 2019 Session will also be improved according to FIRA competition standards.

7. Conclusion

ROBOTO is an alternative teaching and learning activity that can encourage students to think creatively and critically in applying learning outcomes in a real competitive environment. Students can also pour ideas into designing and programming robots according to their creativity. The organization of ROBOTO can not only increase the motivation of students to produce good robots according to the categories competed but also can provide an opportunity for the institution to find new talent that can be featured as a complement to FIRA Polytechnic Ibrahim Sultan participants. The ROBOTO program is also one of the events that can promote polytechnics, especially among school students in the area around Pasir Gudang.

References

McRoberts, M. (2011). *Beginning Arduino*. Apress.
Siong, W. W., & Osman, K. (2018). Pembelajaran Berasaskan Permainan dalam Pendidikan STEM dan Penguasaan Kemahiran Abad Ke-21. *Politeknik & Kolej Komuniti Journal of Social Sciences and Humanities*, *3*(1), 121-135.
Yusmahaida. Y, Nor Faizah.Z & Nor Hidayu.S (2020). “Roboto Tournament(ROBOTO)”, Best Practice in Teaching & Learning, Politeknik Ibrahim Sultan.