


# Peer Activity Approach for Engineering Students to Understand Robotics Course

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## ABSTRACT

This article provides the overview and conceptual explanation of a robotic course using a peer learning activity. In this approach, the demo-based peer teaching education activity was performed to improve the engineering education system. Strategies that relate to student experiences and engage their interests can be difficult to glean and execute in a short duration. The introduction of a demo-based learning method reduces complexity and time frame to complete for students. Initially, the prototype was developed using a 3D printer and it is used to explain the mobile robot concepts through peer teaching techniques to undergraduate students. The activity results were used to study the peer teaching impact among the student's group through weighted average and correlation coefficient method. Through demo assignments and assessment the results justify the improvement of students self-confidence, interest towards the course, perspective thinking, student to student interaction and teamwork.

## KEYWORDS

3D printer, Correlation coefficient, Mobile robot, Peer learning, Plickers

## 1. INTRODUCTION

The robotic courses are taught nowadays by adopting innovative teaching methods like Active learning techniques, project-based techniques to engage students actively learn the course and not to be a passive recipient for their own learning (Cocota et al., 2015). In many research works stated that the classroom lecturing atmosphere created passive learning students. Now-a-days the students are learning not only by reading, writing, listening and watching instead learnt by interacting among themselves or participating in activities (Eason, Noble, & Sneddon, 1955). The capstone course triggered the student to involve interdisciplinary among department to create a mini-projects and share knowledge among themselves through interdisciplinary laboratories. Also, engineers from mechanical discipline might experience ample hands-on during these activities based special course offered (Shiller, 2013). The project-oriented approaches for Electrical and Electronics Engineering (EEE) curriculum was offered at coast guard named United State Coast Guard Academy (USCGA) that is used to teach courses like electromagnetic, antenna and radio frequency (Crilly, 2014). Peer Learning Assistants (PLAs) were used for the under graduate computer science courses to understand foreign concepts to other department students. This activity required more time to do activities in class than the actual hours prescribed in curriculum. (Pivkina, 2016). In student technology-based

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learning named open student modeling (OSM) that engage students by doing activities in both online and offline to increase student's engagement, motivation and developing skill (Brusilovsky et al., 2016). In courses like C programming and python languages, faculty might facilitate students to design low cost robots and control that robot using the codes developed in these languages may improve students coding knowledge (Ortiz et al., 2017). The special courses like robotics, students may expose their design ideas and fabricate their own robot by basic trainer kits like LEGO would encourage students to understand concepts clearly (Fiorini, 2005). To fulfill the criteria laid out by Accreditation Board for Engineering and Technology (ABET) (Karampinis, 2018) and National Board of Accreditation (NBA) (<https://cft.vanderbilt.edu/guides-sub-pages/clickers/>), many engineering laboratory courses introduce student to fabricate their own prototype as experiments. The design and fabrication of robots as experiment in Mechanical and Mechatronics robotics laboratories will encourage students to understand current real-time application. In this development and application surly inculcate the interdisciplinary knowledge and skills among the students (Garduño-Aparicio, 2017). Certain research explains the improvement in education among students by introducing co-teaching at least every subtopic (Martin & Polly, 2017). The learning system with educational robots and its animations with multimedia objects provide student betterment towards application knowledge in the course (Hsu, 2009).

The development of Autonomous mobile robot using ARM technology demo for student laboratory experiment. These innovative ideas made current generation student to show more interest to learn core courses (Chin et al., 2014). The rubrics-based assessment criteria made students to develop prototypes or mini projects as assignment (Nayak et al., 2016). The demo-based teaching practice in engineering students made significant result than conventional learning strategy through ANOVA approach (Giridharan & Raju, n.d.). From the study many researchers explain faculties are recommended to follow Innovative teaching method like blended learning strategy methods, peer teaching methods that made faculty teaching method as simple as possible.

In this paper the development of peer teaching method and formative assessment strategy was explained in detail. Initially, the 3D model of robot wheels and accessories are designed using CAD software. By using 3D printer, the model is converted into prototype and submitted as an assignment by post-graduate students. Once the prototype is developed, the post-graduate students involved in teaching the under-graduate students through peer teaching activity (demo-based teaching method). Here the design procedure consists of robot model which is developed using 3D printer. The designed file is converted into 3D printer file format (.stl to G code) using Cura software. The 3D printer is interfaced with Pronterface software to develop the prototype model. The organization of this paper is as follows, Chapter 1 gives the introduction and literature survey. Chapter 2 demonstrates the prototype design done by PG students and submitted as assignment for Course-1 (Autonomous Vehicles). Chapter 3 gives the case study scenario of peer teaching activity for Course-2 UG students. Chapter 4 compares the quiz results, survey results of Course-2 students, model designed and comparison with correlation results and graphs. Chapter 5 gives the conclusion and future work to engage the students in another innovative activity-based teaching.

## **2. PROTOTYPE DESIGN**

The Extracurricular constructive based learning method develop school students learn major robotics concept without any complex way of teaching practices. Introduction of practical based learning made students to learn robotic concept in simple manner and easy to understand (Karampinis, 2018). Nowadays the student to student interaction during learning process are reduced by the domination of online courses and internet sources. In order to encourage effective learning, process a demonstration-based learning method is implemented to reinforce underlying theoretical concepts for students. The Prototype model design of two wheeled robot for Path planning operation was done by our PG students and the design procedures are shown below.

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