



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF MACHINE ELEMENT OF  
TEACHING AID FOR SECONDARY SCHOOL**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Product Design) with Honours.

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## **APPROVAL**

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Product Design) with Honours. The member of the supervisory is as follow:

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## ABSTRAK

*Tiada bantuan mengajar khusus untuk topik elemen mesin. Walaupun terdapat banyak alat bantu mengajar di luar sana, mereka tidak benar-benar menekankan tetapi hanya secara umum. Matlamat projek ini adalah untuk membangun kit automatik unsur mesin yang melibatkan kelajuan dan revolusi per minit (RPM) sistem penderiaan dan untuk merekabentuk amalan berasaskan model yang membantu pelajar dalam pembelajaran mereka. Projek ini menggunakan gabungan Arduino UNO dan NANO yang membantu memaparkan nilai RPM dalam paparan LCD dengan menggunakan sensor IR. Motor stepper dapat berputar tetapi ada kelewatan antara rotasi. Walaupun putaran itu tidak bagus, tetapi RPM masih boleh dilihat pada LCD.*

## **ABSTRACT**

There is no specific teaching aids for the machine element topics. Even though there is a lot of teaching aids out there, they are not really emphasize but only in general way. The aim of this project is to develop an automated kit of machine element that involve speed and the revolution per minute (RPM) sensing system and to design a model based practice that helps student on their learning. This project use combination of Arduino UNO and NANO that helps to display the RPM value in the LCD display by using IR sensor. The stepper motor are able to rotate but there are delays between the rotations. Although the rotation is not good, but the RPM can still be seen on the LCD.

## **DEDICATION**

I would like to dedicate to my beloved parents that always support, been source of inspiration and strength of my life, Abdul Hamid Bin Haroon and Norhiza Binti Mohamed Noor. To my siblings that always there encourage to be a better person in future, Nurusyifa Binti Abdul Hamid, Ahmad Afiq Bin Abdul Hamid and Ahmad Azfar Bin Abdul Hamid. Also to my humble and kind hearted supervisor for her guidance and advice, Encik Mohd Azlan Bin Mohamed. And lastly to Allah S.W.T, thank you for His guidance, strength, protection and healthy life. With all of these, we offer to you.



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## LIST OF SYMBOLS

V - Voltage

## LIST OF ABBREVIATIONS

MBP	Model Based Practice
DBL	Design Based Learning
PWM	Pulse Width Modulation
USB	Universal Serial Bus
PBL	Problem Based Learning
GBL	Game Based Learning
PIR	Passive Infrared sensor
DC	Direct Current
AC	Alternating Current
FDM	Fused Deposition Modelling
PLA	Polylactic Acid
ABS	Acrylonitrile butadiene styrene
CAD	Computer Aided Design
PLC	Programmable Logic Controller
IR	Infrared Sensor
RBT	Reka Bentuk & Teknologi



## **CHAPTER 1**

### **INTRODUCTION**

#### **1.0 Introduction**

In this chapter, the focus is on how this project is selected. Starts with the background study, and followed by the problem statement that will look on problem surrounding of the product. A strongly objective needed to point out the aim of this project. Lastly followed by the scope of project, which help on planning on determining and documenting.

#### **1.1 Project background**

Education is an actions of learning, or acquirement of knowledge, techniques, values, and skills. A person one can have or create an own path with a good knowledge. Knowledge comes in different type of methods to be obtain. Two main side of knowledge that is the theory and practical application. This two type of knowledge are essential and improve yourself to be better. Theoretical knowledge helps for better understanding because its shows the whole content, context to be built in, and helps on strategy setting. Deeper understanding can be gain from theoretical education of visual concepts for greater context. Meanwhile practical education helps to obtain the particular method which become the mechanism which is much closer to your actual working day. There are some things that can be only learn through performing and experiencing. Theory is often

educate without having an interaction or connection with actions, while the practical is acquired in the reality life. Practical knowledge can usually go through a deeper understanding through the act of a concept by implementing and personal experience.

Therefore, by developing this educational kit, it is considerably good for children than the normal toys. The benefits is, educational kits not only use imaginations, but learn an actual things and understanding how the world actually operate which will help in both institute and the real world in future time. Instead of just accepting things, the curiosity will appear and begin to ask questions, and realize that there is reason and logic to world around us. Educational experiment kits is the best way to learn as studies unveil that learning concepts and skills more quickly, longer memory preserve, and more fun while learning with practical experiments rather than plainly reading books. Educational kits are designed particularly for these experiments that makes a dull subject fresh and full of excitement. The aim of this project is to develop a teaching aid of machine element for secondary school.

## **1.2 Problem statement**

Reka Bentuk dan Teknologi (RBT) is a new subject which replace Kemahiran Hidup. RBT is an elective subject that emphasizes design in the production of technology-based products. RBT aims to produce students who can work together to produce products that are simple and meaningful.



Figure 1.1 : Interview session with Mr. Nathan

The field of design and technology is something that needs to be emphasized in the national education system that enables students to apply knowledge, skills and values through design activities and produce functional products. Referred to Mr. Nathan A/L Balakrishnan, teacher who teach RBT subject in SMK Bukit Baru, Melaka said that RBT has only been 3 years in syllabus. There is no specific teaching aids for the machine element topics. Even though there is a lot of teaching aids out there, they are not really emphasize but only in general way.

### **1.3 Objective**

1. To design an automated kit of machining element with speed and revolution per minute (RPM) sensing system.
2. To develop a model based practice that helps student on their learning.

#### **1.4 Scopes of work**

- Designing and developing an automated educational kit for Form 1 to Form 3 students that take Reka Bentuk & Teknologi as their elective subject.
- Designing elements from the machine such as belting, chain, and spur gear. Addition of motor and also Arduino with USB cable to helps for the movement of the gear.
- Building the circuit and turning a motor on and off through a transistor with code the Arduino, and finally PWM for speed control through the Arduino.

#### **1.5 Project significance**

The finding of this study will enable the teachers use teaching aids to help the student to learn and studies concepts and skills more quickly. This is because, with the educational kits, students are able to see, touch, and applied the suitable application. This because, studies reveal that learning concepts and skills rapidly and longer memory preserve when learning with practical experiments rather than simply reading books.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

This chapter is to discuss and overview of project based learning and the past research which related to teaching aids. In this study, the pro and cons of the previous research are also showed and compared. Other than that, research on the hardware components that have been used in other researched is also studied. By analysing the previous projects, the possibilities that affect the quality in their project can be analysed and reviewed. Lastly, some recommendations have been made to overcome the problem exist in the previous study.

#### **2.1 Overview**

##### **2.1.1 Project/Problem Based Learning**

The traditional teacher-centred lecturing approach referred to Olzan Goldstein (2016) helps on delivering details to bigger classes which is more effective in the higher education. Sadly, this passive learning produce bad outcomes which make student less courage to study and it doesn't give an impact, and student tend to forget easily what they learn after examination. Project based learning (PBL) is a method that highlight on inquiring learning which contain through interaction in a group.

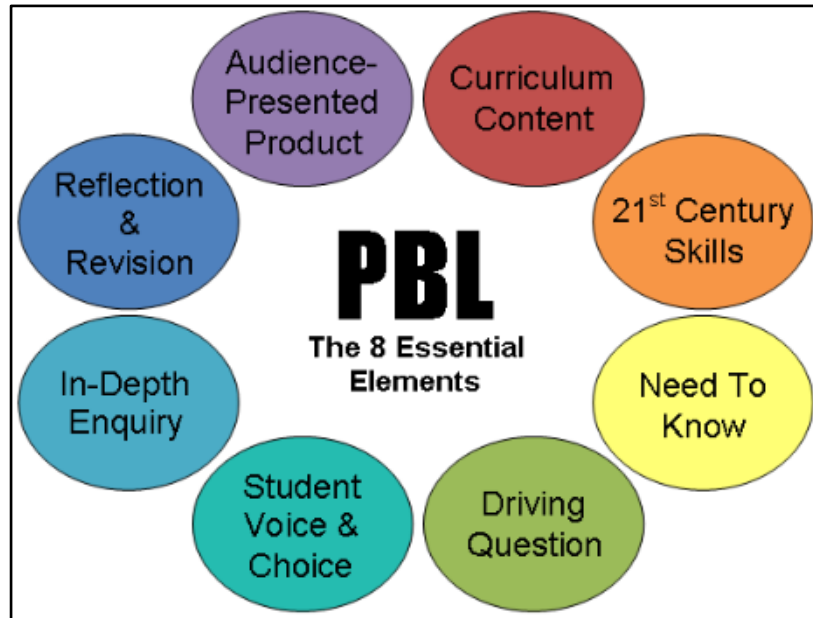


Figure 2. 1 : The 8 Essentials Element

In project-based courses referred to PEI Pounds (2015), inspired student to have more creativity in their learning, to achieve the outcomes of the project. When a goal is set, problem is assumed to be solved in the context of engineering education. Therefore, the objective will produce an outcomes based on the specify course and students activity on running the project. Designing a structure of work and setting up the objective helps student to gain a self-direct study on following direction. A PBL shall have good criteria that is which it is determination, adaptable, and problem solver.

Nowadays, teaching is not the only mediation of knowledge delivered from the educator to the students, but more on providing students to develop knowledge and skills with their own selections of activities. This PBL give students the ability on designing a project, solving problems, making decision, and investigative activities which help students by giving the chances to work independently over period of time. Five criteria referred to

RK Chowdhury (2015) are centrality, driving question, constructive investigations, autonomy, and also realistic. This five criteria are important to be evaluate for a project in PBL.

### 2.1.2 Game Based Learning

Jan L. Plass et al (2015) defined a game based learning usually focus more on the type of game to be play with a good learning outcomes. It is assume as a digital game but that is not the point. The point is the results gain from the game itself of balance need on covering the course or subject using the game play. Elements of the game encourage players to connect with the task given in game type is what gamification do or else it wouldn't be attractive. Current argument between the scholars are arguing about the real meaning or translation of game. GBL involve redesigning the schoolwork activities, using traditional problems and game guideline to make the game more interesting and connects with the player.

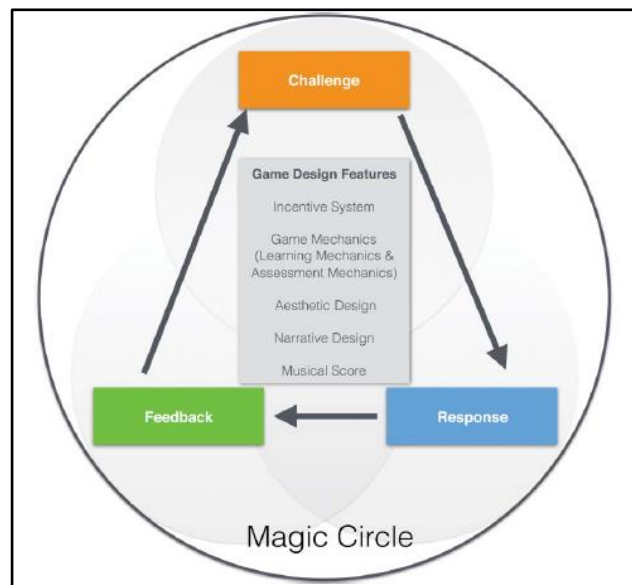


Figure 2. 2 : Game based learning model.

Although the argument about the definition of a game can't be concluded gaming is an element develop by human as a crucial experiment. This type of based learning has been an outstanding one over the past 10 years because it gave a solid guide of learning to K-12 students that consist of kindergarten (K) and the 1st through the 12th grade (1-12). Several studies has been done to analyse the result of gaming towards subject like, language, science, geography, mathematics and science in computer, obtain a satisfactory results which help motivate student to learn effectively. The positives result effect on the brain performance to kept memory longer and connect powerful understanding compared to traditional one. Games has their own objective to be achieve which help motivate to give a try and error until students able to solve the problem and rebuild their thinking in a critical way. This environment of creating awareness on learning helps student to upgrade their way on making decisions, applying skills, solving problems and work in a group

### **2.1.3 Design Based Learning**

The next based learning is DBL which is an acronym for Design Based Learning is an academic method that is used mostly in secondary education referred to Savery (2015). DBL helps student to obtain skills such as solving problems and logic thinking while performing a design task. It is known as a method on generating skills that merge with theoretical learning to solve undefined problem occur. PBL learners has perspective where allow students on performing research, combine together practical and theoretical and implement their learning and skills to obtain best solution to solve the problems.