



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN AND DEVELOPMENT OF WOODEN MOLD BASE
FOR EDUCATIONAL KITS**

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) (Hons.)

by

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This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (Manufacturing) (Hons.). The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Projek ini membentangkan kajian mengenai fabrikasi acuan asas untuk tujuan pembelajaran yang menggunakan kayu jenis Jelutong sebagai bahan utama. Jenis acuan yang dipilih adalah acuan 2 plat yang mempunyai rekabentuk mudah. Di dalam pembelajaran rekabentuk acuan, kaedah pembelajaran yang digunakan kurang efisien dengan menggunakan bahan multimedia sebagai bahan mengajar. Tujuan projek ini dilaksanakan adalah untuk membina sebuah asas acuan kayu bagi tujuan pendidikan. Projek ini bermula dengan memahami konsep acuan terlebih dahulu untuk mengenal pasti bentuk struktur acuan asas. Satu konsep acuan asas dipilih berdasarkan pemilihan konsep iaitu “Pemasangan buka tutup lego”. Pembangunan acuan asas dimulakan dengan proses fabrikasi komponen-komponen acuan asas. Proses kemas dan pemasangan dilakukan untuk menjadikan sebuah model acuan berasaskan kayu. Acuan asas kayu ini menjadi sebagai satu alat bantu mengajar didalam pembelajaran rekabentuk acuan. Struktur komponen acuan asas dapat dilihat dengan lebih jelas oleh pelajar dengan acuan asas kayu ini.

ABSTRACT

This project presented a study on the fabrication of mold base for educational purpose using Jelutong wood as the main material for educational purpose. The selected mold base type is two plate mold with simple plate design. In the study of mold design courses, teaching methods are used less efficiently with the use of multimedia as the teaching material. The aim of the project is to build a wooden mold base for educational purposes. The project began with understanding the concept of mold for identifying the basic mold structure. The mold concept is determined by the selection of the concept of "Lego open close assembly". Development of mold base begins with the fabrication process of mold base components. Finishing and assembly process is carried out to make a mold of the wood-based model. This wooden mold base as a teaching aid tool in the study of mold design courses. The structure of the mold base components can be seen more clearly by students with the guidance of the wooden mold base.

DEDICATION

Especially for my beloved parent:

Kamal Arifin bin Ahmad

Habibah binti Hassan

To my siblings:

Nurul Ayreen binti Kamal Arifin

Muhammad Aqil bin Kamal Arifin

To my supervisor and co-supervisor:

En. Mohd Faizal bin Halim

En. Mohd Kamal bin Musa

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

| | | |
|-------|---|---|
| UTeM | - | University of Technical Malaysia Malacca |
| BETD | - | Bachelor Degree in Manufacturing Engineering Technology (Product Design) |
| JTKP | - | Manufacturing Engineering Technology Department |
| Al | - | Aluminium |
| Cu | - | Copper |
| P20 | - | Group P steel |
| SS | - | Stainless steel |
| CSM21 | - | Precipitation stainless steel |
| ProE | - | Pro/Engineer |
| SW | - | SolidWorks |
| CATIA | - | Computer Aided Three-dimensional Interactive Application |
| CAD | - | Computer Aided Design |
| 3D | - | Three dimensional |
| BOM | - | Bill of Material |
| EDM | - | Electrical discharge machine |
| VMC | - | Vertical machining centre |
| CNC | - | Computer numerical control |

| | | |
|------|---|-----------------------------------|
| HD | - | High dimension |
| STL | - | Stereo Lithography |
| SRP | - | Tool path software |
| ABS | - | Acrylonitrile Butadiene Styrene |
| IPTA | - | Public colleges and universities |
| IPTS | - | Private colleges and universities |

CHAPTER 1

INTRODUCTION

1.1 Background of Project

Engineering education is a knowledge about learning science and mathematics application to solve the problems around us. In Malaysia, engineering education is provided by the public, whether at education center or anywhere. There are many courses offered in engineering fields such as mechanical, electrical, civil and chemical engineering. Three important components in engineering education which are knowledge, skill and attitude (Rohana et. al., 2012). Knowledge is a fact and concept in engineering education. While the skill is used by the learner in applying their knowledge in problem solving. Attitude is a ways of people act on how they use their skills and knowledge to related fields.

Teaching styles of most lecturer in engineering education are auditory, intuitive, deductive, passive and sequential (Richard, 2002). Engineering education does not match with the student learn styles which resulted in poor student performance. Learning styles of student are visual (picture), auditory (sound) and kinesthetic (touch, taste and smell). Kinesthetic learning is one of the best styles because combination of information perception and information processing (moving while learning).

Pedagogy is a strategy of the teacher use to teach. The appropriate pedagogical strategy approach will provide effective learning. Innovation pedagogy combines learning with the creation and application of new knowledge (Markku, 2011, p.100). Effective pedagogy act as a supportive intellectual engagement and classroom environment to improve students and teacher's confidence.

In mold design subject, the current technique is applied to understand mold structure is through multi-media equipment, illustration from the book and explains from teachers. Teachers explained the abstract principle and the basic structure of mold on the podium, students could only be imagined because of the lack of practical experience (Wang, 2011). Some students difficult to imagine the structure of the mold due to the invisible the internal mold structure. Heavy weight of real mold in plastic injection gives restriction to student to review the mold base component.

In this project, the prototype of wooden mold base will be developed as teaching aid apparatus. The purpose of this project is to help mold learning process of students for better understanding the operation and structure of mold. With the wooden mold base, the concept of real mold can be described clearly with light and easy handling prototypes.

1.2 Problem Statement

From mold of teaching experience, the problems of traditional mold design course teaching are outdated course contents, rigid teaching method and old examination methods (Wang, 2011). The teaching material was relatively old and teacher explains the basic structure of mold in class without show the real concept. Students difficult to imagine the real concept of mold that has the internal characteristic mold consists of complex component such as sprue, runner, gate and others. The existing mold is heavy and difficult to assemble and disassemble to carry anywhere. Teaching and learning technology need hands-on activity or practice. Nowadays, cost to start up in engineering education for new education center is definitely high. Engineering education needs enough facilities, high technology equipment and professional trainers to provide a perfect education center. Due to the high cost investment of new learning center, it is impossible to prepare a real mold for education purpose.

1.3 Objectives

The aim of this project is to design and develop wooden mold base for educational purpose. The objectives of this project are:-

- (a) To identify the mold structure and its components
- (b) To generate a conceptual mold base for education purpose
- (c) To fabricate the prototype of the wooden mold base

1.4 Scope

In order to achieve the objective of this study, the project scopes is development of wooden mold base for educational purpose. This mold base does not use in plastic injection molding machine. The prototype act as a teaching aid apparatus only. Other than that, design of mold base is two plate injection mold with simple design. There are several types of injection mold, such as cold runner mold, two plate mold and three plate mold. In this project, the type of mold that selected only two plate mold. Moreover, development of the mold base until the prototype fabrication only. This project does not include the evaluation of student understanding.

CHAPTER 2

LITERATURE REVIEW

2.1 Learning Styles

The figure 2.1 as shown below are the survey analysis of learning styles of 50 students where study at University of Technical Malaysia Malacca (UTeM) that take the course Bachelor Degree in Manufacturing Engineering Technology (Product Design) Cohort 2 Survey analysis was conducted for all the students taking mold design courses by answer 20 question on education planner website for student learning style self-assessment. Results for each student is shown after the students answered 20 questions whether, as auditory learner, visual learner or tactile learner. Finding survey result as shows figure 2.1, study pattern of BETD student more preferred on visual and kinesthetic learning style.

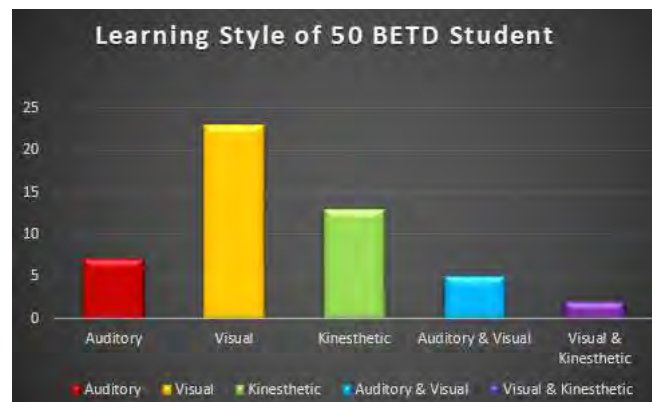


Figure 2.1: Learning Styles of BETD students (Survey method from website <http://www.educationplanner.org/index.html>)

Table 2.1: Result description for each type of learning style

| Learning Styles | Results Description |
|-------------------------|---|
| Auditory | If you are an auditory learner, you learn by hearing and listening. You understand and remember things you have heard. You store information by the way it sounds, and you have an easier time understanding spoken instructions than written ones. You often learn by reading out loud because you have to hear it or speak it in order to know it. As an auditory learner, you probably hum or talk to yourself or others if you become bored. People may think you are not paying attention, even though you may be hearing and understanding everything being said. |
| Visual | If you are a visual learner, you learn by reading or seeing pictures. You understand and remember things by sight. You can picture what you are learning in your head, and you learn best by using methods that are primarily visual. You like to see what you are learning. As a visual learner, you are usually neat and clean. You often close your eyes to visualize or remember something, and you will find something to watch if you become bored. You may have difficulty with spoken directions and may be easily distracted by sounds. You are attracted to color and to spoke language (like stories) that is rich in imagery. |
| Kinesthetic/ tactile | If you are a tactile learner, you learn by touching and doing. You understand and remember things through physical movement. You are a "hands-on" learner who prefers to touch, move, build, or draw what you learn, and you tend to learn better when some type of physical activity is involved. You need to be active and take frequent breaks, you often speak with your hands and with gestures, and you may have difficulty sitting still. As a tactile learner, you like to take things apart and put things together, and you tend to find reasons to tinker or move around when you become bored. You may be very well coordinated and have good athletic ability. You can easily remember things that were done but may have difficulty remembering what you saw or heard in the process. You often communicate by touching, and you appreciate physically expressed forms of encouragement, such as a pat on the back. |

2.2 Mold Teaching and Learning Method

Mold is a restrictive pattern to form an object with a particular shape from the molten liquid material. Learning is an exposure of knowledge or skill through experience or study. Mold learning means the education of the mold toward the design, structure and its function. There are several methods of learning about mold, such as visual, animation and kinesthetic. Optimization of teaching method should be done to allow students to meet the needs of mold industry sustainable development (Wang, 2011)

2.2.1 Visual

This method illustrates the image that represents internal parts of the mold. Advantages of this method are students are able to learn the internal structure which consists of sprue, runner, gate and others. Explanation from lecturer along with the aid of diagrams, students will be able to understand how the mechanism works. While the disadvantage is a student cannot sense the reality of the mold base. Learning will become less attractive in a classroom with only seeing and listening to lecturer explanation.

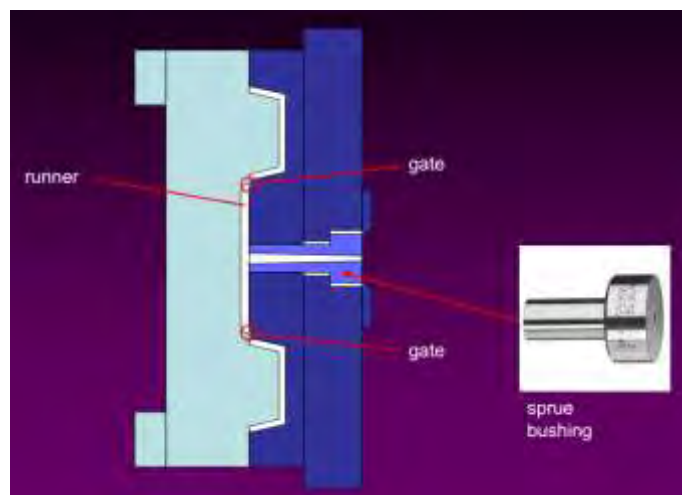


Figure 2.2: Structure image of the mold