

DESIGN AND FABRICATION OF MULTIPURPOSE TABLE KID

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ABSTARCT

The study of manufacturing was very important in order to carry out this project to ensure that the student understand on what are needs to do. This report present about design and fabricate a multipurpose, long-life span and lower cost table kid. The table kid is one classes of table which enable children to writing, reading, drawing and store their stationaries. In this project, concept is generated through research on existing product in order to improve its limitation. The material of steel and wood were using to fabricate this table kid. Mild-steel and galvanized iron was used to accomplish the factor of long life span. In other hand, the design of two surface tables were joined is enable factor of multi-user and also save space. SolidWorks Simulation Xpress software is using to do the stress and displacement analysis in order to study the maximum load of the multipurpose table kid can support. In the other hand, SolidWork Mass Estimation also is used to know the weight of the multipurpose table kid. Methods and process involve in this project include joining using MIG welding, making hole with drilling method, bending using profile bending machine and bending machine and also cutting using shearing machine.

ABSTRAK

Kajian pembuatan adalah sangat penting untuk menjalankan projek ini untuk memastikan bahawa pelajar faham tentang apa yang perlu dilakukan. Laporan ini membentangkan tentang pelbagai reka bentuk dan guna, dan meja kanak-kanak kos yang lebih rendah. Kanak-kanak jadual adalah satu kelas meja yang membolehkan kanak-kanak untuk menulis, membaca, melukis dan menyimpan alat tulis mereka. Dalam projek ini, konsep yang dijana melalui penyelidikan ke atas produk sedia ada untuk meningkatkan had. Bahan besi dan kayu telah digunakan dalam memalsukan meja kanak-kanak ini. Besi ringan dan besi tergalvani telah digunakan untuk mencapai faktor jangka hayat yang panjang. Sebaliknya, dua meja permukaan telah digabungkan untuk membolehkan banyak pengguna boleh guna dan juga menjimatkan ruang. SolidWork SimulasiXpress telah digunakan untuk melakukan analisis tegasan dan anjakan untuk mengkaji beban maksimum meja kanak-kanak boleh menyokong. Di samping itu, SolidWork Anggaran Mass juga digunakan untuk mengetahui berat badan meja kanak-kanak. Kaedah dan proses yang terlibat dalam projek ini termasuk menggunakan kimpalan MIG, membuat lubang dengan kaedah penggerudian, lentur menggunakan mesin profil lentur dan mesin lentur dan juga memotong menggunakan mesin ricih.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The purpose of this chapter is to explain about the project background, problem statement, project objectives and the limitation of the study project scope.

This project is to design and fabrication of multipurpose table kid. This project is to improve and enhances the functions of current market table kid. The basketball structure is attached to the left side of table that can let the child to play basketball with adjustable height function. Furthermore, the table can be expanding to become 4 tables which allow multi-user. Overall, the project will meet the acquire skill of design, analysis and fabrication.

1.2 PROJECT BACKGROUND

Table is necessary furniture in human life. At nowadays market, there are various type of table kid that comes in different specifications and shape. The table kid is specially designed for children and used for writing, reading, drawing and storage their thing like toys, book and beg.

As we know that, the table kid normally can be used by one child. Hence, for a big family which have many children, this has force their parent to buy 2 or more table kid to let their children use. Moreover, the size of table also is fixed and large.

In order to solve this problem, the table kid that I design is considering all the current weakness. The table can allow maximum 4 children together use in order to fulfill the need of big family.

1.3 PROBLEM STATEMENT

Most of the current table kid in market is only just used for writing and equipped drawer to store the stationaries. Besides this, the size of table kid is fixed and results in space constraint. Moreover the existing table also can only be used by one child.

1.4 OBJECTIVE

Design and fabrication of Multipurpose Table Kid by enhance its function and minimize the manufacturing cost with basic technical skill.

1.5 SCOPE

- I. Table kid equip with more than 2 functions.
- II. Design for child in range of 4 years old to 12 years old.
- III. Table height is no more than 76.2cm
- IV. Table can hold at maximum load of 686N (70 kg).

1.6 THESIS ORGANIZATION

Chapter 1 will explain about the introduction, project background, problem statement, objective, scope and project Gantt chart. This particular chapter planned the direction of my final year project.

Chapter 2 will then go through the literature review of the table kid. Then it will explain about the advantages and disadvantages of market existing products and also the comparison between these products.

Chapter 3 which is the methodology and this chapter will explain about the concept design and also the finalize concept of the design. The tools and machine that were used for fabrication would be discussed as well.

Chapter 4 which is the results and discussion and it would study on the final product that has been fabricated. The product is then being tested to find out its effectiveness in solving the problem statement.

Chapter 5 is the conclusion of the project. This specific chapter would then summarize the result related to the real world problem and recommend some suggestion for final product.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter is to provide a review of children, table and material needed. It also will explain about the market existing product and concept of table kid. Many products at the market have different specification, shape, type and material when manufacture by different manufacturing company.

2.2 TARGET USER (CHILDREN)

Biologically, a child (plural: children) is generally a human between the stages of birth and puberty. In other words, the range of age for child is from new born old until 12 years old. In detail, newborn (ages 0–1 month); infant (ages 1 month – 1 year); toddler (ages 1–3 years); preschooler (ages 4–6years); school-aged child (ages 6–12 years).Some vernacular definitions of a child include the fetus, as being an unborn child. The legal definition of "child" generally refers to a minor, otherwise known as a person younger than the age of majority.

Table 2.1: Human Development Period

Birth	Childhood			Adolescence	Adulthood
Period	Infancy	Toddlerhood school age	Primary	Secondary school age	-
Month	1-10	11-12	-	-	-
Age	0	1-3	4-12	13-18	19 and above

2.3 TABLE KID

A table is a form of furniture featuring a flat and stationary horizontal upper surface used to support objects of interest, for storage or display. Tables come in a wide variety of materials, shapes, and heights that depends on their origin, style, and intended use. All tables are composed of a flat surface and a base with one or more supports, or legs.

The table kid is one classes of table that design for children. It is setting for reading and writing. The table kid can been made of wood, plastic, metal, cardboard and combination of metal and wood. However, wood is the most common material used for table kid. But, metal and plastic have also become popular due to their durability and availability in different colors. The table must equip with convenient or comfortable height when sitting, and therefore it often used in conjunction with chair. The height of table kid is different for each range of age of children.

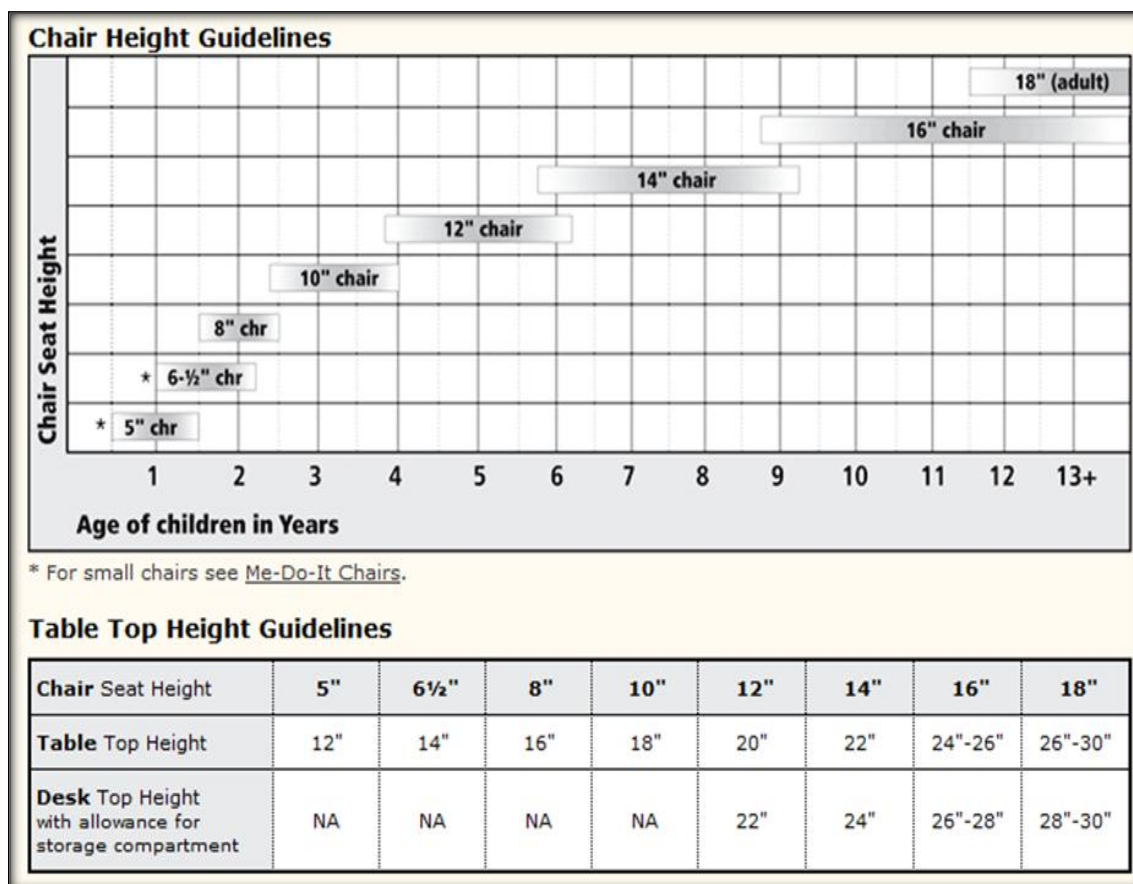


Figure 2.1: Kid's table top height guidelines

Source: <http://www.communityplaythings.com>

2.3.1 Basic Part of Table Kid

The basic parts of table are dividing into 3 parts:

- i. Surface table: Usually this made from wood. For new technology, surface table using sheet metal that joined with nut and bolt and welding with steel frame and leg steel.
- ii. Arm: Arm is function to lock leg table and make table become stable. Usually arm like a small rectangular bar. It is joined with surface table and leg table.

iii. Leg table: This using steel is because it has good strength to support heavy loaded that place on the surface table. It is joining with frame surface table or directly with surface table.

2.4 CHILDREN BASKETBALL RING

Children basketball ring is belong to one type of toy which specially designs for children to play basketball. The standard diameter of children basketball ring is 25mm. This basketball ring is not attached with basketball pole.



Figure 2.2: Children Basketball ring

Source: <http://www.kidsbabydesign.com>

2.5 PRODUCT REVIEW

This topic shows the 5 different type and design of existing products in the market and comparison about their advantages and disadvantages. Product review about the table kid is to get data and make new concept of table kid.

2.5.1 Product A



Figure 2.3: Table kid

Source: <http://www.elfa-mesh-kid-color-table.com>

Table 2.2: Product A overview

Cost	\$259.89
Materials	Rod hollow stainless steel, rectangular hollow stainless steel (low carbon steel)
Size:	32"W x 24"L x 18-1/2" H

The design of product A is for writing, drawing and reading purpose use. It also equipped drawer which can store the stationaries of child. This design is most easy found at the current market. The advantages of this product are equipped 6 drawers in different size which enable to store the different size of stationaries. The surface table features rounded corners for safety. Moreover, the durability of product is very high due to using metal material. The disadvantages of the product are quite expensive. Secondly the size of table is large and occupies space. The product can only be used by one child.

2.5.2 Product B



Figure 2.4: Drawing type table kid

Source: <http://www.kaboodle.com>

Table 2.3: Product B overview

Cost	\$154.95
Materials	Wood and plastic
Size	35 1/2"W x 20"L x 40"H

The design of product B is for drawing purpose use. This is because its surface table design is ease children to drawing. The advantages of the product are it will comfort when using this product for drawing purpose. Secondly, its appearance is more attractive and colorful due to using the plastic material. The disadvantage of the product is just only can be used by one child. Secondly, the table sized also is fixed and occupy space. Third, this design also is not suitable for reading purpose.

2.5.3 Product C



Figure 2.5: Multi-user type table kid

Source: <http://www.kaboodle.com>

Table 2.4: Product C overview

Cost	\$129.95
Materials	Wood
Size	30"W x 47"L x 21"H

The design of product C is multi-user. This is because its surface table is large enough. Hence, more than one children can together use on this design of product for writing and reading purpose. The advantages of the product are low cost. The product also can be used by more than one child. The disadvantage is the size of product is very large, so it is no suitable for small house family.

2.5.4 Product D



Figure 2.6: Moveable type table kid

Source: <http://www.kaboodle.com>

Table 2.5: Product D overview

Cost	\$209.95
Materials	Wood and Plastic
Size	26"W x 24"L x 25"H

The design of product D is moveable. This is because the leg table is attached with 4 rollers. Hence, it is very easy to move from space to another. The advantages of the product are moveable and making its easy to store and save space. Beside this, the side of product is attaching with chalkboards which allow drawing and writing. The appearance of table also is attractive due to equipped colorful drawer. The disadvantages are the cost of product is quite high. The product will feel not comfortable when conjunction with chair for writing or reading use.

2.5.5 Comparison Between Existing Products

Table 2.3 shows the comparison of all the existing products in the market in aspect of multipurpose, cost, moveable, durability, multi-user and size. From the table, we know that only product D can considered as multipurpose. For cost and durability is depending on the material used. The product A is most expensive due to using metal material while its durability is very high. On other hands, the durability of product C and D is low due to using plastic material. Moreover, only the product C is multi-user but its size is larger. Lastly, only the product D is moveable due to table leg is equipped with rollers.

Table 2.6: Comparison between existing products

Aspect	Product A	Product B	Product C	Product D
Multipurpose	No	No	No	Yes
Cost	High	Low	Low	Medium
Moveable	No	No	No	Yes
Durability	High	Medium	Low	Low
Multi-user	No	Yes	No	No
Size	Large	Medium	Large	Small

2.6 TYPE OF MATERIALS

2.6.1 Galvanized Iron

Galvanized steel is a special type of steel that is zinc plated. Galvanization is primarily carried out on the surface of a steel to make it more resistance to corrosion. All galvanized steel has a distinguishing metallic-gray appearance. The surface is also a hundred times smoother than uncoated steel. Because of its high durability, galvanized steel has a wide range of application.

2.6.2 Wood

Wood is an organic material, a natural composite of cellulose fibers (which are strong in tension) embedded in a matrix of lignin which resists compression. Wood is produced as secondary xylem in the stems of trees (and other woody plants). In a living tree it performs a support function, enabling woody plants to grow large or to stand up for them. Wood may also refer to other plant materials with comparable properties, and to material engineered from wood, or wood chips or fiber.

Wood has always been used extensively for furniture, such as chairs and beds. Also for tool handles and cutlery, such as chopsticks, toothpicks, and other utensils, like the wooden spoon. However, people have used wood for millennia for many purposes, primarily as a fuel or as a construction material for making houses, tools, weapons, furniture, packaging, artworks, and paper.



Figure 2.7: Table kid made from wood

Sources: <http://www.kidsbabydesign.com>

2.6.3 Mild-Steel

Mild steel is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Mild steel is a type of steel alloy that contains a high amount of carbon as a major constituent. A high amount of carbon makes mild steel different from other types of steel. Carbon makes mild steel stronger and stiffer than other type of steel. Carbon atoms get affixed in the interstitial sites of the iron lattice and make it stronger. Mildest grade of carbon steel or 'mild steel' is typically carbon steel, with a comparatively mild amount of carbon (0.16% to 0.19%). The calculated average industry grade mild steel density is 7.85 gm/cm³. Its Young's modulus, which is a measure of its stiffness, is around 210 GPa.

2.7 TYPE OF MANUFACTURING PROCESS

There have 4 main type of manufacturing process have been chosen in order to complete this project. There manufacturing process include welding, drilling, bending and grinding.

2.7.1 MIG Welding

Metal Inert Gas (MIG) welding is a semi-auto arc welding process which consumes wire electrode and a shielding gas. These two things are fed through a welding gun. Constant voltage and direct current power source is normally use in MIG welding.

MIG welding is applied to steels. It allowed for short welding time compare to other type of welding process. The gases MIG welding process normally is carbon dioxide gas. MIG welding is different with metal arc welding. The carbon dioxide gas is use to prevent other gases or particle to go inside the welding part.

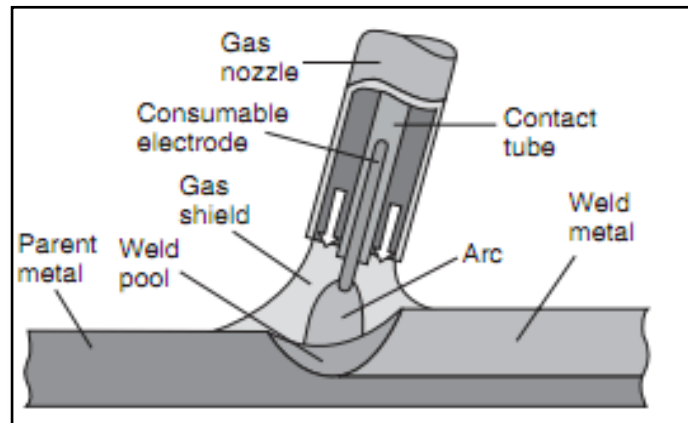


Figure 2.8: Schematic diagram of MIG welding

Source: <http://www.weldingengineer.com>

2.7.2 Drilling

Drilling is a cutting process that uses a drill bit to cut or enlarge a hole in solid materials. The drill bit is a multipoint, end cutting tool. It cuts by applying pressure and rotation to the work piece, which forms chips at the cutting edge. Consequently, chip disposal and the effectiveness of cutting fluids can present significant difficulties in drilling. Generally, the hole diameters produced by drilling are slightly larger than the drill diameter (oversize). Therefore, a drill can be easily removed from the hole it has just produce.

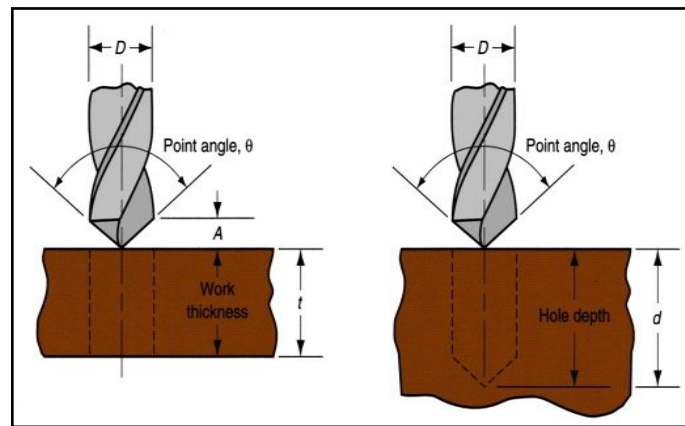


Figure 2.9: Schematic illustration of drilling process

Source: <http://www.custompartnet.com>

2.7.3 Bending

Bending is a process by which metal can be deformed by plastically deforming the material and changing its shape. The material is stressed beyond the yield strength but below the ultimate tensile strength. The surface area of the material does not change much. Bending usually refers to deformation about one axis. The material is placed on the die, and positioned in place with stops and/or gages. It is held in place with hold-downs. The upper part of the press, the ram with the appropriately shaped punch descends and forms the v-shaped bend.

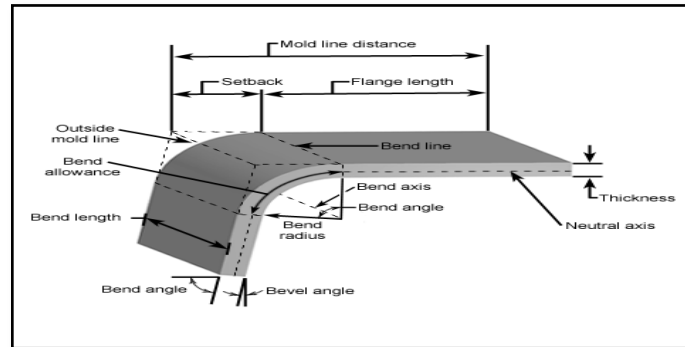


Figure 2.10: Schematic illustration of the bending process

Source: <http://www.custompartnet.com>

2.7.4 Grinding

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. The abrasive material is typically on the surface of a wheel or belt and abrades material in a way similar to sanding.

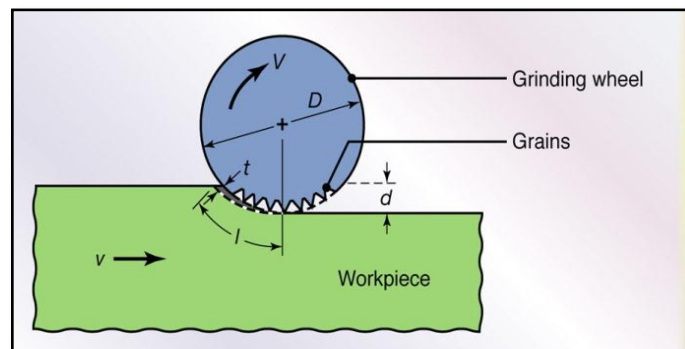


Figure 2.11: Schematic illustration of the surface-grinding process

Source: <http://www.machsources.com>

CHAPTER 3

METHODOLOGY

3.1 INTRODCUTION

This chapter will explain about the concept design that has been made in order to solve the problems in problem statement. This chapter also will explain about how all the concept design being evaluate in order to get the finalize concept. Material selection and fabrication process of project will also being discussed.

3.2 PROJECT FLOW

This section will explain about the flow or step involve in designing out the finalize concept. Basically, the project flow is as below:

- I. Identify the problem statement and find the solution
- II. Concept design and evaluation
- III. Finalize concept
- IV. Material selection
- V. Fabrication process and finishing

3.2.1 Project Flow Chart

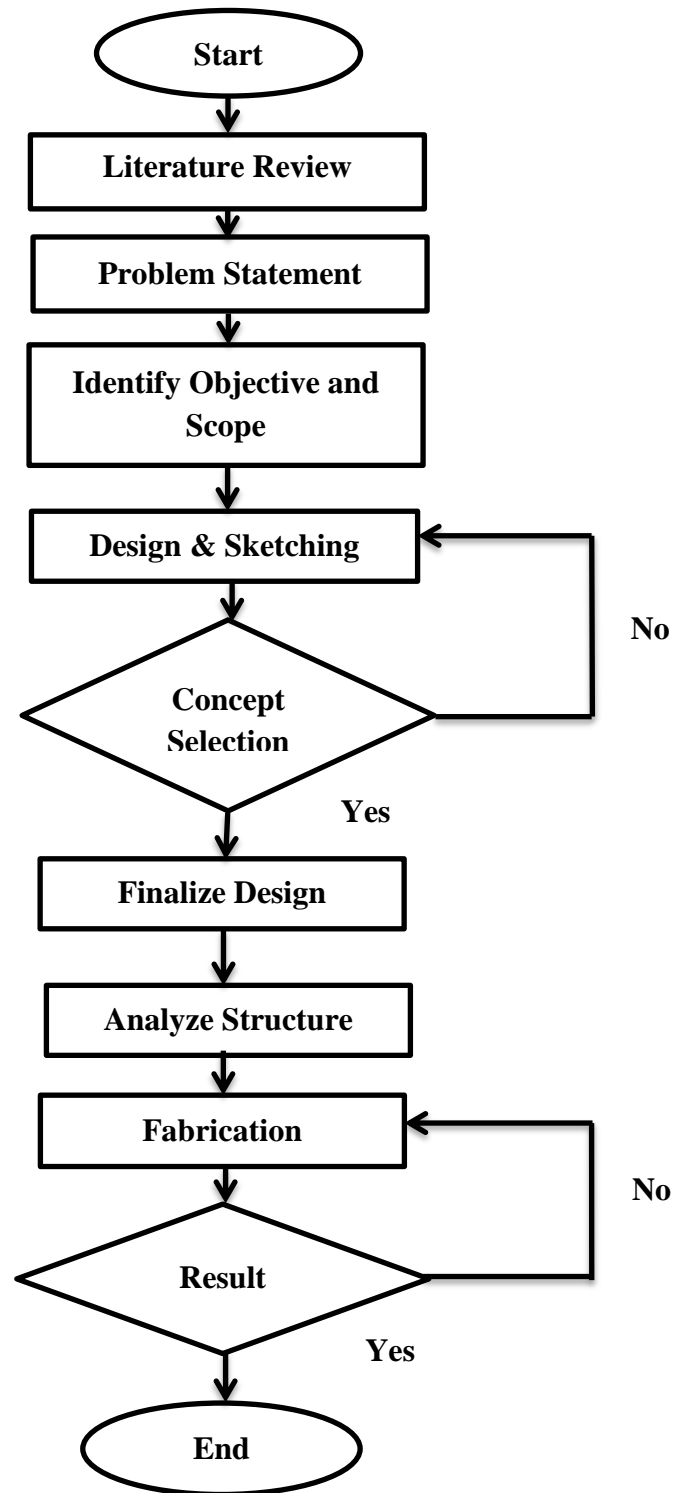


Figure 3.1: Project Flow Chart

From the flow chart above, this project starts off with literature review about the project title. After finish the literature review, it is proceed to process of identifying the problem that is being faced by the customers. In order to know what are the problems that being faced by the customers, market surveys about the existing product is carry out. Before come out with concepts, objective and scope of the project was determined so that the process of concepts generation will be easier and more effective. After that, five concept designs have been sketch out and then the evaluation is carrying out on these concept designs. Method of concept screening is using to design out the finalize concept. After final concept was chosen, it will be draw by using solid work and dimension will be given

After the final concept and material selection has been identified, cosmos software is using to do analyse structure on final concept. After finish the analyse structure, the fabrication is proceed to fabricate the final concept. Cutting, welding, drilling, filling, rolling and finishing process is carrying out in fabrication process. After fabricate the final concept, we will do testing process on the product. Lastly is to finish the report according to the due date and perform final presentation.

3.3 CONCEPT GENERATION

After gather all the necessary data, 5 concepts were generated and sketch out by hoping that it will solve the problems in problem statement. These 5 concepts named as concept A, concept B, concept C, concept D and concept E.

3.3.1 Concept A

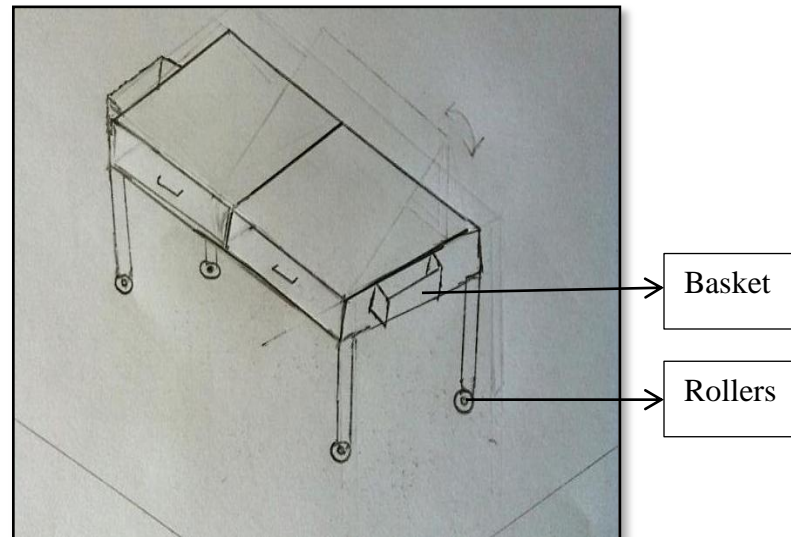


Figure 3.2: Concept A

Figure 3.2 shows the first concept. This concept is combination of 2 top surface of table to enable more than 1 child to using this table. The concept also design for moveable as 4 legs of table is attach with rollers. The table sides also attach 2 small baskets which can store stationery things. For the disadvantage of this concept is big and will result space constraints.

3.3.2 Concept B

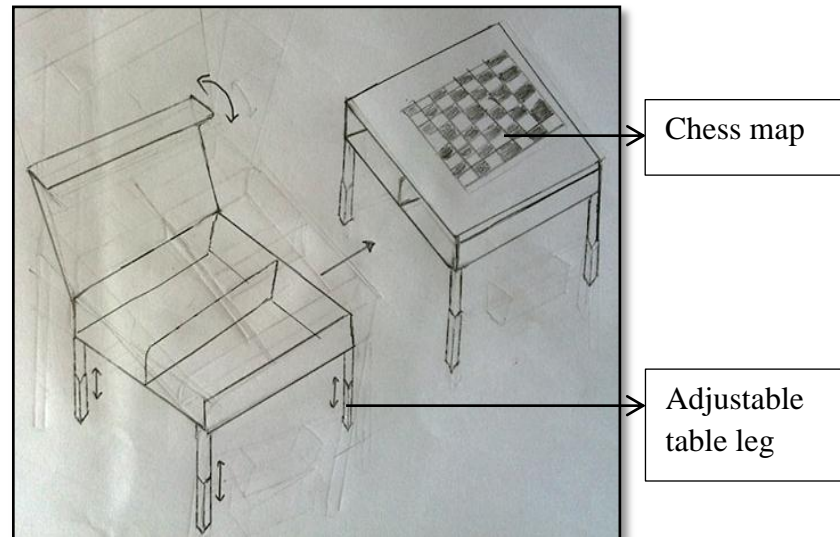


Figure 3.3: Concept B

Figure 3.3 shows the second concept. This concept is able to adjust the table height in order to meet the satisfy height of children for writing and reading. The top surface of table can be open to ease of children to take their thing that store in drawer. Moreover, the surface of top table has equipped with a chess map which can let the children to play the chess. For the disadvantages is can only be used by one child for purpose of writing and reading. This concept also no ease for children to use as it need adjust 4 table legs when adjust the table height. The top surface is hard to take care.

3.3.3 Concept C

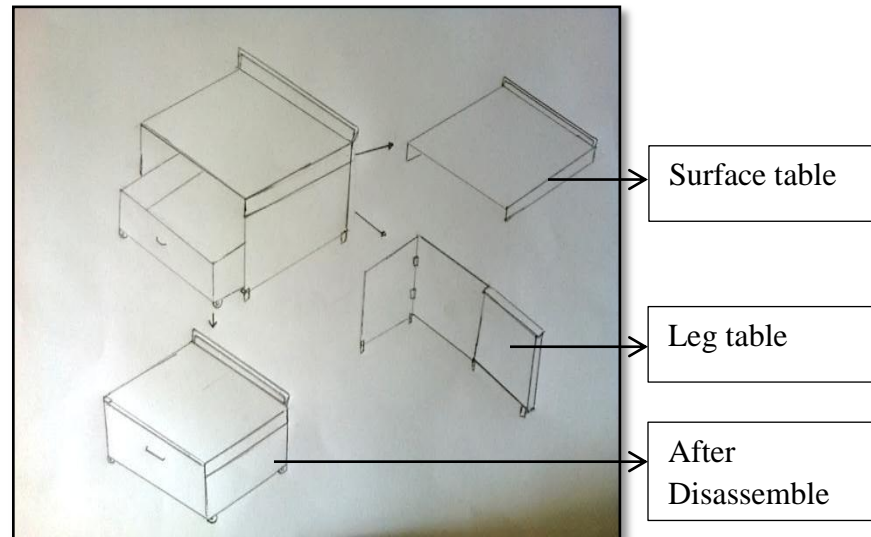


Figure 3.4: Concept C

Figure 3.4 shows the third concept. This concept is portable and store in anywhere as the table can be disassemble and store in its large drawer and become like a big luggage. The big drawer is attaching with rollers which enable it to bring to anywhere. The disadvantages of this concept is same as concept B which only be used by one child. This concept may cause danger to children when disassemble the table.

3.3.4 Concept D

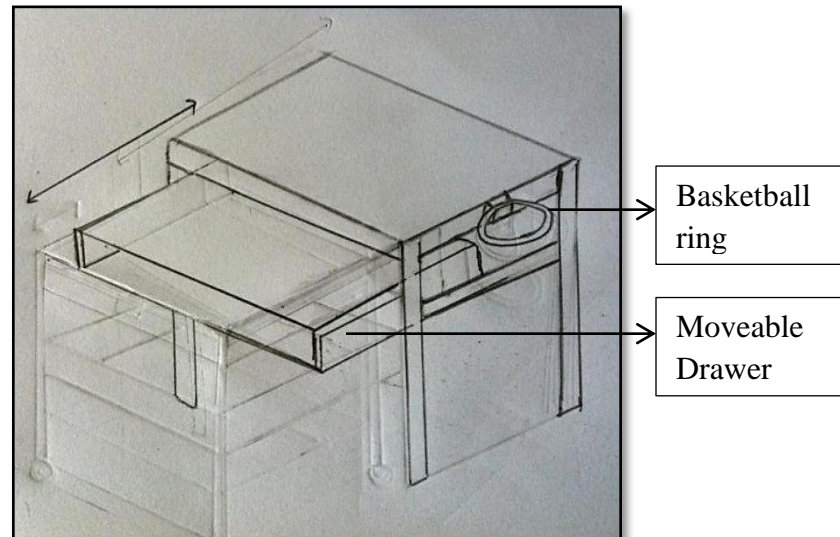


Figure 3.5: Concept D

Figure 3.5 shows the fourth concept. This concept has attached a basketball ring which enables children to play basketball. The drawer can be slide out and use as a table. Hence, 2 children can together using on this table. Beside this, this function also helps to save pace as the drawer can slide back when no use. The disadvantage of this concept is just only equipped one drawer which limited children to store their stationery.