

Extendable Dining Table Inspired by Air Hockey Table for Open Concept House

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Abstract: A dining table is a central element for houses where house members or family gather, especially for meals. A standard or traditional dining table has a fixed number of users, which might be sufficient to accommodate all family members staying together in one house. An issue arises when more people visit or come for a special occasion such as a birthday party, gatherings, dinner party, and many more. A fixed number of seats will cause difficulty to provide seating for all at once. People need to wait for their turn to enjoy their food or use furniture such as a foldable table or sit on the floor. This situation makes the house owner awkward as they need to serve their guests as best as possible. Therefore, this study aims to design an extendable dining table with a capacity range from 4 to 8 persons inspired by the air hockey table. In this study, the questionnaire was distributed online via Google Form. The design and manufacturing process is influenced by the data obtained from the questionnaire. Design criteria in designing an extendable dining table include a modern concept that suitable to accommodate 4 seats (normal setting) to 8 seats (extended), using wood as a material with a butterfly leaf extendable concept of the top table. The attractive modern extendable dining table inspired by the air hockey table fabricated in this study meets the consumers' requirements based on the input gained from the questionnaire. This will bring added value and potential commercial value for commercialization.

Keywords: Extendable, Open concept, Air hockey, Dining table

1. Introduction

Furniture is defined as a removable device that designed to make people's offices or homes more suitable and comfortable for living or working. Furniture can be used for storage, seating or sleeping, or other human activities. Most materials' basic design remains largely unchanged, although the materials and stability become stronger and longer in life, while modern life pays more attention to comfort and luxury. For example, the chair is designed not only as a place to sit but also to relax such things as recliners and swing functions. The bed is designed to make us feel comfortable when we

sleep, rather than just providing basic knowledge to prevent us from lying on the ground. The furniture design changes show that our society has evolved from pure survival to luxurious and privileged life.

A dining table is a central element in the family. Everyone gathers here, especially for family meals. It has various materials and styles, from classic wooden tables to more modern glass and metal tables (Gomez-Zerpa, 2017). The size of the dining table depends on the number of seats that can be accommodated. Usually, depending on the dining table's size and design, the dining table will be equipped with double, four, six, or more chairs (Ramli *et al.*, 2018). The best choice to pair the dining table furniture can achieve harmony between the restaurant's size and style. Considering the layout of restaurant furniture means calculating the size and evaluating the available space. But for today's market, people most like the dining table can be expanded to accommodate more seats (Gomez-Zerpa, 2017). Extensible can be defined as something that can be fully extended or elongated. To expand something is to extend its time, whether it is physically or temporally. However, many expandable dining tables on the market are designed for open concept rooms.

Open concept room, also known as open floor plan room. The phrase "open floor plan" refers to a house that combines two or more traditional-use spaces by eliminating certain partition walls that are usually used to separate rooms, thereby forming a larger space. Since 1990, this has been the dominant architectural trend in new residential construction and the goal of many large-scale renovation projects targeting older houses. The goal is to combine the kitchen and dining room, dining room, and living room or all three into some form of a common living room or "large room." Structurally, in open floor plan construction, heavy beams (rather than internal load-bearing walls) carry the floor's weight above. Aesthetically speaking, an open floor plan promotes a sense of openness and greater traffic flow (Wallender, 2002).

The air hockey table includes a large, smooth playing surface, a fence to prevent ice hockey and paddleboards from leaving the table tennis, and notches on the fence at both ends of the fence. There is usually an ice hockey return at the end of the table below and below the target. In addition, the table will usually have some mechanism that creates air cushions on the game surface through tiny holes to reduce friction and increase game speed. Some tables save manufacturing and maintenance costs, avoid using machinery, and choose a smooth table surface (usually plastic). Please note that these watches are not technically hockey watches because they do not involve air. Some ice hockey uses batteries and fans to create their air cushions, but they are usually only sold as toys because they are easily damaged. The air hockey table has very little friction.

Having a standard or traditional dining table with a fixed number of seats might be sufficient to accommodate all family members that stay together in one house. An issue arises when more people visit or come for special occasions such as birthday parties, gatherings, dinner party, and many more. A fixed number of seats will cause difficulty to provide seating for all at once. People need to wait their turn to enjoy their food or use furniture such as a foldable table or simply sit on the floor (United Constructors of Texas, 2019). This situation makes the house owner awkward as they need to serve their guests as best as possible. Thus, this study aims to provide a solution to this problem by designing an extendable dining table to accommodate more seating, especially during special events.

2. Literature Review

Ancient furniture was made of stone, wood, and metal to meet human beings' basic needs, including sitting, sleeping, and eating. With the rise of the community and the diversification of materials, furniture has been developed on time. The appearance of furniture is not independent of place. Furniture and places are derived from natural forms and local materials. These forms are shaped according to modern requirements, so they can be placed first and provide furniture (Lee and

Halip, 2020). The geographical and cultural aspects of different parts of the world have had a major impact on furniture and places. In Egypt, Mesopotamia, Greek, and Roman civilization, furniture began to take modern forms (Ozcelik & Karpol, 2016). Since the beginning of history, furniture design has been part of the human experience. Evidence of furniture can be traced back to the Neolithic period, including paintings, frescoes found in Pompeii, sculptures, and other frescoes. Some examples have also been found in Egypt's pyramids and the graves of Giraud (modern Turkey). These instructions will track the main advances in furniture design, development, style, and materials, highlight each period's identifying characteristics, the materials used, and display some images of the most important furniture ever designed (Design, 2016). The timeline history of furniture is shown in Figure 1.

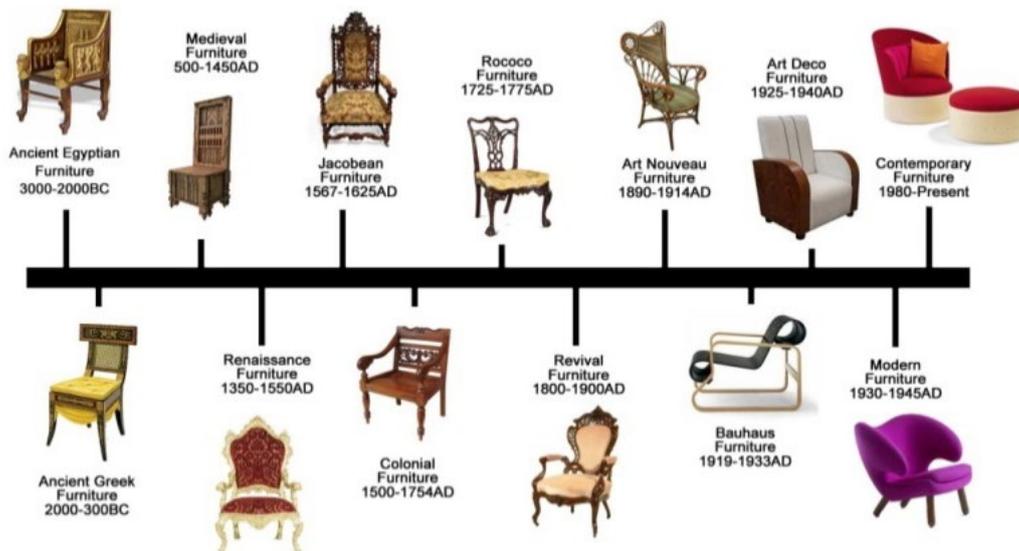


Figure 1: The timeline history of furniture

A dining table is a table placed in the dining room or restaurant. It has the most common shape, usually rectangular, with two end chairs with armrests on the long side and an even number of side chairs without armrests. It is mainly used for family meals. This activity includes setting tables, serving food, eating, cleaning after meals, storing tableware and crockery. Figure 2 shows the picture of the set of a dining table.



Figure 2: Set of the dining table

An extendable table is a table that increases its size so that more people can sit around them. They are usually more expensive than regular tables, but the extra cost is worth it. It aims to solve the problem of insufficient dining space. There are three types of design concepts for extendable dining tables. For example, traditional concepts, butterfly-leaf concepts, and drop-leaf concepts. Figure 3 shows a picture of the extendable dining table.



Figure 3: Extendable dining table

3. Research Methodology

This study applies the same method as the previous researcher reported (Husuno and Selimin, 2020; Selimin *et al.*, 2019). In this study, a total of 50 questionnaires was distributed via Google Form targeting respondents living in an open concept house located at Persiaran Pakatan Jaya, Taman Pakatan Jaya, Ipoh, Perak. This questionnaire consists of three sections which are section A (general information), section B (design selection), and section C (extendable dining table). The data obtained from the questionnaire will be analyzed and used as design criteria in designing an extendable dining table.

Next, visual research was done to identify the existing dining table's characteristics based on its top table shape, table legs design, and design concept. A total of 6 visual research was done in this study. By using the data obtained from the questionnaire, the thumbnail and ideation were generated. More than 30 thumbnails were made on 5 pieces of A3 papers based on the extendable dining table criteria in this research. Next, selected thumbnails were further refined during the ideation process (12 ideations). Then, few ideations were selected for the next process, known as the idea development process. In this process, all questionnaire criteria were inserted and refined into the idea development sketches. A total of 5 idea development sketches were used as final design candidates. The final design selection was conducted via Google Form.

Subsequently, a mock-up with a 1:10 ratio was developed based on the final design. This mock-up was used to evaluate the visual, physical, and function of the final design. The materials used to produce the mock-up include mounting board, Formica, tape, and hot glue. Any observation for improvement will be taken into account to extend the values of the product. Afterwards, the technical drawing was made accordingly as a reference and overview of the final product, including 2D, 3D, and rendering drawings. At last, the prototype of this project was fabricated. Various processes, such as material preparation, jointing, finishing, and packing, were done based on a suitable method that matched the material used in this study.

4. Results and Discussion

In this study, 60 respondents living in Persiaran Pakatan Jaya, Taman Pakatan Jaya, Ipoh, Perak was selected to answer the questionnaire. After collecting data, the researcher analyzed the data by using google form. This questionnaire consists of three sections which are section A (demographic information), section B (design selection) and section C (extendable dining table). Table 1 shows a summary of the questionnaire result. This study found that modern furniture is the preferred design concept than contemporary, classic and minimalist. As most of the respondents understand and understand the term “extendable dining table”, almost all of them agreed that this kind of dining table

could provide more seating, especially during special occasions. Also, the butterfly-leaf extendable concept is the preferable method of extending the table.

Table 1: Summary of the questionnaire result

Element	Percentage (%)	Description
Demographic	71.7	Female respondent
	83.3	30 years old above
	70.0	Chinese respondent
	58.3	Married
	55.0	Living in a household with 2-4 person
	78.3	Living in terrace
	51.7	Dining room with open concept design
	41.7	Income between RM4001 to RM8000
	Design Selection	48.3
36.7		More emphasize on the capacity of users
41.7		Prefer ceramic material for the top table
61.7		Prefer wood material for the leg table
Extendable Dining Table	91.7	Know extendable dining table
	93.3	Agree with the use of extendable dining table
	91.7	Agree with an extendable dining table can provide more seating
	53.3	Prefer an extendable dining table extend by the butterfly-leaf concept

Next is visual research. In this study, the visual research was made based on the shape, design and material of extendable dining table (from top to legs) of the existing product in the market. 6 pieces of visual research were produced to enable the researcher to identify the most suitable design direction, as shown in Figure 4. This visual research output will provide an important glance at the direction of the design process.

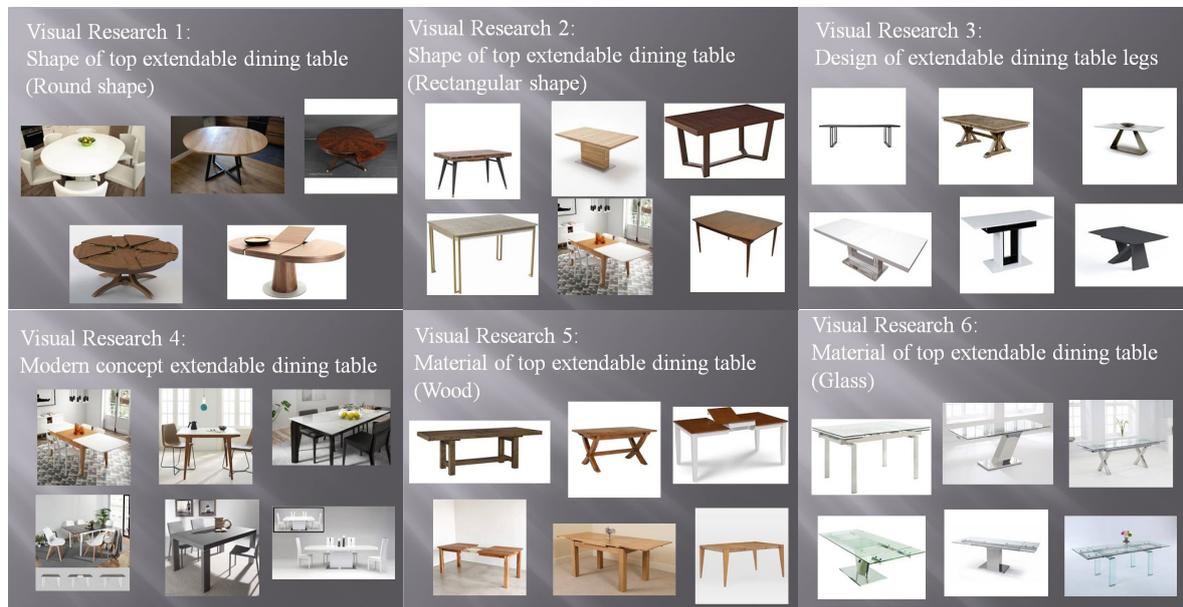


Figure 4: Visual research

Moving on to the thumbnail, the researcher had sketched more than 30 thumbnails on 5 pieces of A3 paper. The sketching is done by using the black pen and freehand without using any other stationary aid. The thumbnail design criteria are based on the result from questionnaire, which are modern styles, extension with butterfly leaf concept, and can fit for 4-8 persons. Figure 5 and Appendix A show the thumbnail of the extendable dining table for this study. Some thumbnails are

chosen for the next process, which is ideation. The selection was made based on the attractiveness, design of dining table shape, and the most important element meeting the design criteria. Thumbnails marked using a red dash line box were selected as the basic sketching for the ideation process.

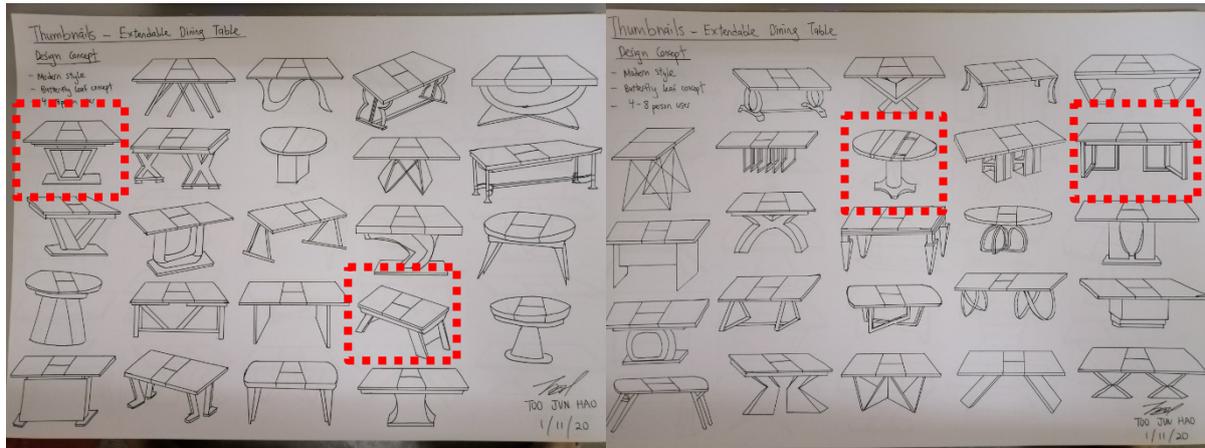


Figure 5: Thumbnail 1 and 2

As for the ideation, the researcher sketched 12 ideations on 4 pieces of A3 paper. The ideation focuses more on the dining table extension style, the shape of the top table, and the table legs. Figure 6 and Appendix B show the ideation of this study.

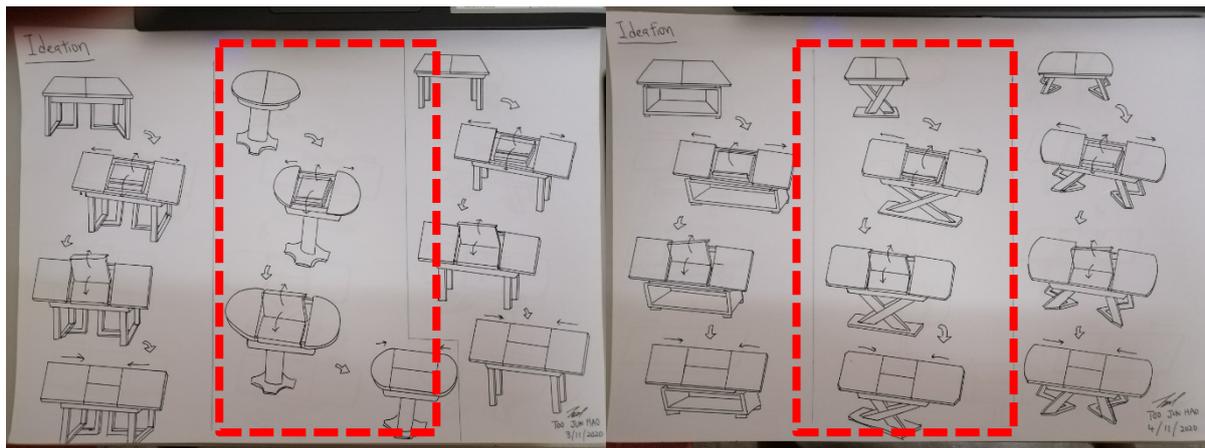


Figure 6: Ideation 2 and 3

Afterwards, the researcher chooses 2 ideations as the basic design for further detailing through the idea development process (marked with red dash line box). The selection was made because those ideations fit the design criteria and modern concept, especially the table legs design.

In the idea development, 5 idea developments were created. In this process, the air hockey table's shape (design subject matter) was implemented into the dining table design by adding the rounded-end corner shape. The table legs improved on a modern appearance by transforming the table leg from four to one leg only. Meanwhile, the top table's butterfly-leaf of extension concept was applied to the design to make it much easier to pull-out the extending panels with one single move only. Figure 7 and Appendix C show the idea development sketches.

Before the prototype's actual fabrication took place, the mock-up was developed to evaluate the stability, appearances, and any possible rooms for design improvement. The mock-up was made using a mounting board, butt hinge, tape, hot glue, and Formica. In the process, the mounting board was cut with a 1:10 ratio in dimension with the dining table's actual size. For the extended part, the tape was

used to stick two boards together to make the extension part (panels) movable. Figure 9 shows the mock-up of the modern extendable dining table before and after the extension.

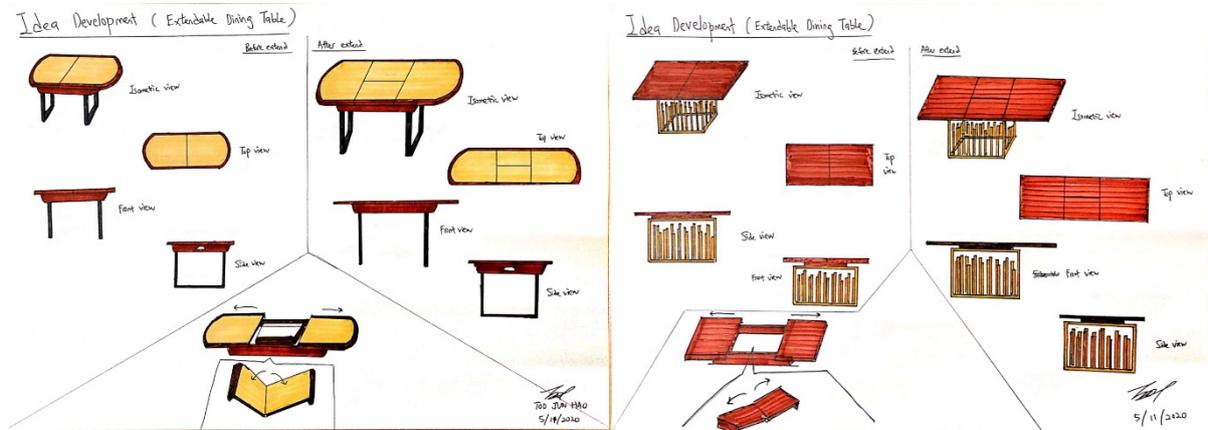


Figure 7: Idea development 2 and 5

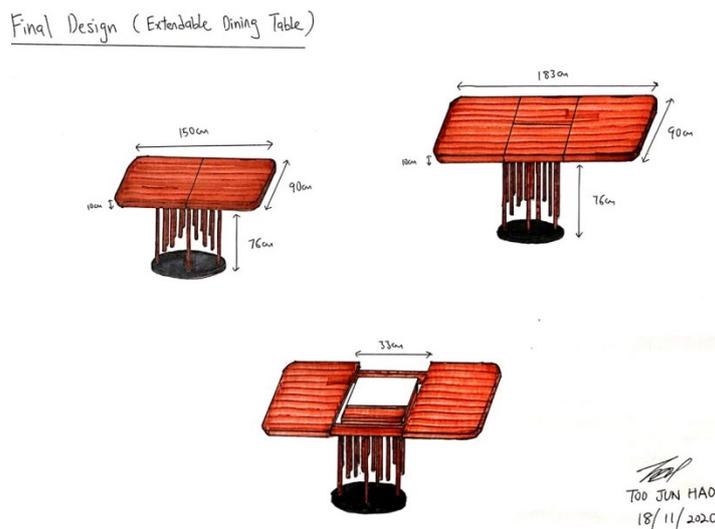


Figure 8: Final design of modern extendable dining table

An AutoCAD 2016 software was used to create and develop all the technical drawings in this study. The orthographic view of the modern extendable dining table before the extension is presented in Figure 10. Based on Figure 10, the dimension of the top view is 147cm (length) x 87cm (width), with all edges were fillet (8 cm in radius). Also, Besides that, the radius of the wood pillars with 4cm and 2cm. The rendering technical drawing is presented in Figure 11.

The prototype was fabricated at TP Carpentry located at Taman Rekreasi Tambun, Bandar Sunway, Ipoh, Perak. The prototype fabrication process can be divided into three parts, which is material, manufacturing, and finishing. For the manufacturing process, the main material use is plywood. Three pieces of plywood with dimension 243cm x 122cm x 1.5cm were used. This plywood was used to fabricate the top and the bottom part (table leg base) of the dining table. Besides that, the wood pillars were used as the decoration part of the dining table, which attached to the table's legs. As for the finishing part, the Formica is used to cover the plywood to provided better finishing work for

the dining table. Lastly, the extending mechanism of the mechanical part, which is the extension ball bearing drawer slide, is used as the extension part.



Figure 9: Mock-up of modern extendable dining table

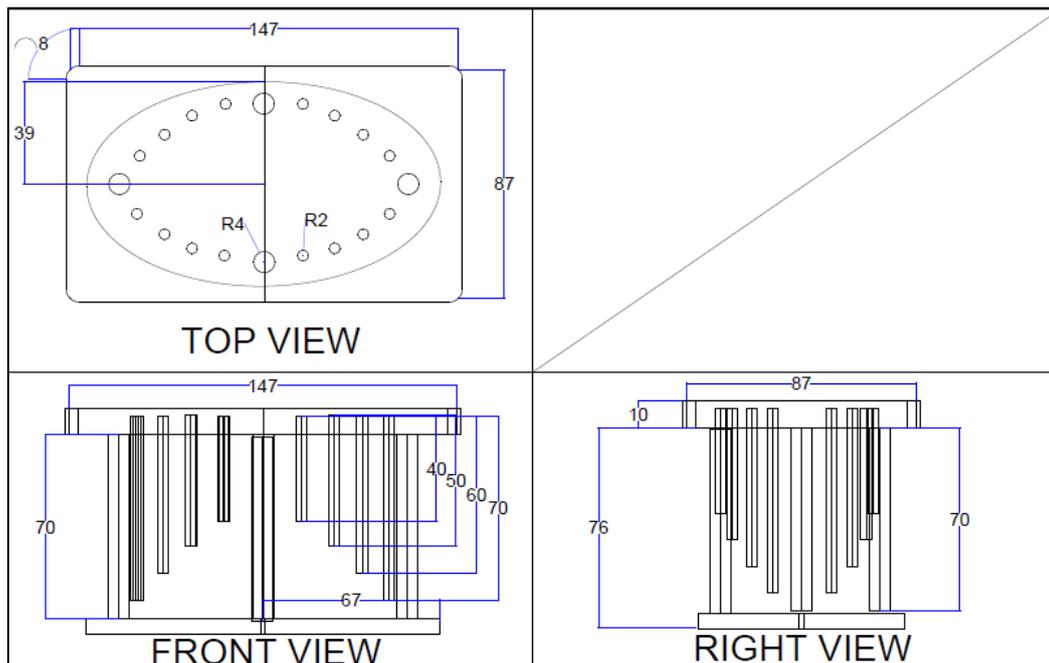


Figure 10: Orthographic view of modern extendable dining table before extension

As for the manufacturing process, the table leg base's oval shape was cut off from the plywood using the jigsaw machine. Subsequently, the sandpaper is used to remove the sawdust and to refine the plywood surfaces. The Formica was laminated on top of the plywood's oval shape leg base using contact adhesive as a finishing process for this table part. Next, the plywood was cut again for the top table fabrication process. The plywood was cut into the desired dimension (as stated in Figure 10 and Figure 11) with a fillet corner edge. The same finishing processes as the table leg were applied to the top table part of the dining table after cut into the dimension. The same processes were applied to the wood pillars. The round or circle (final design) changes to oval shape (fabricated prototype) were made to give better stability to the table.



Figure 11: 3D rendering of modern extendable dining table (before and during extension)

The wood frame-making process for the extension parts was done by shaping the wood frame based on the technical drawing. After that, the extension ball bearing mechanism was installed on the frame to enable the top table to be opened and closed during the extending process. The complete assembled prototype of the extendable dining table inspired by the air hockey table is presented in Figure 12.



Figure 12: Prototype of the extendable dining table inspired by the air hockey table

The final design features include a rounded-corner edge shape with one leg (frame) with wooden pillars underneath the top table as decoration to give better appearance value. The researchers have to change the table leg design from a round shape to an oval shape. This decision was done mainly to bring a more aesthetic appearance and better stability. The table height is 76cm with a length is 150cm (before the extension) and 183cm (when extended). The butterfly-leaf extension concept is used to extend the table from 4 to 8 seating by simply pulling out the part of the extension panels placed inside the center of the dining table.

5. Conclusion

This research successfully achieved its objectives. This research produced a modern extendable dining table inspired by an air hockey table. The design criteria were obtained by distributing the questionnaires to respondents living at Pakatan Jaya, Ipoh, Perak. The results of the questionnaire were used as a reference in the design process. Two sketches of ideation (Ideation 2 and 3) were selected for further development in the idea development stage which 5 idea developments were made.

Meanwhile, idea development 5 was chosen as the final design for this study due to the appearance and attractive design. During prototype fabrication, the final design was slightly amended to improve the quality, appearance, and stability of the modern extendable dining table. The prototype of the extendable dining table is made using plywood, wood pillar, and Formica. An attractive modern extendable dining table inspired by an air hockey table fabricated in this study can meet the

consumers' requirements based on the questionnaire's output, such as the modern style concept, butterfly-leaf concept extension, wood-based material and fit for 4 to 8 persons. This also brings added value and potential commercial value for commercialization. This design could ease users who faced a problem with limited seats on the dining table, especially during special occasions.

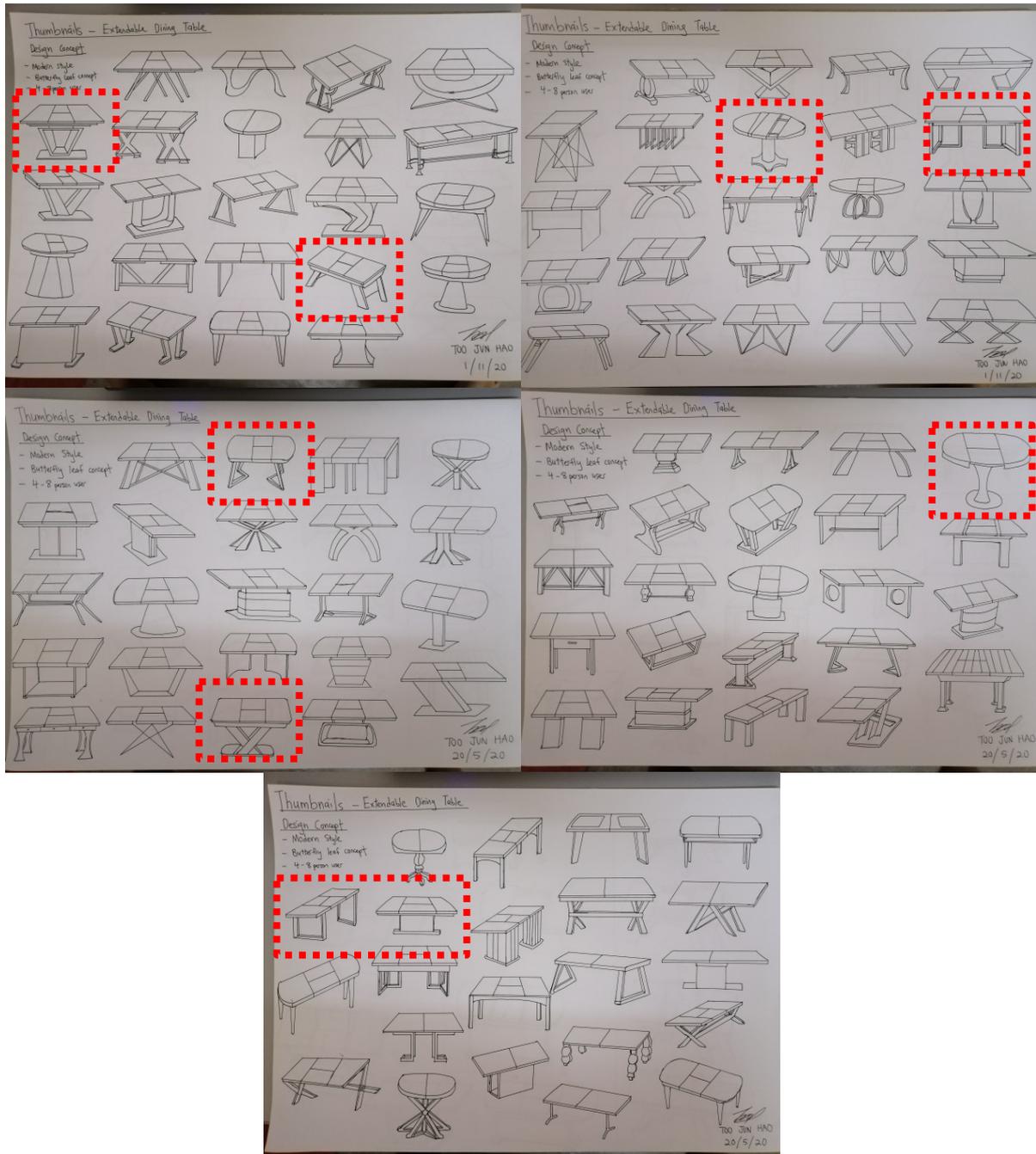
Acknowledgement

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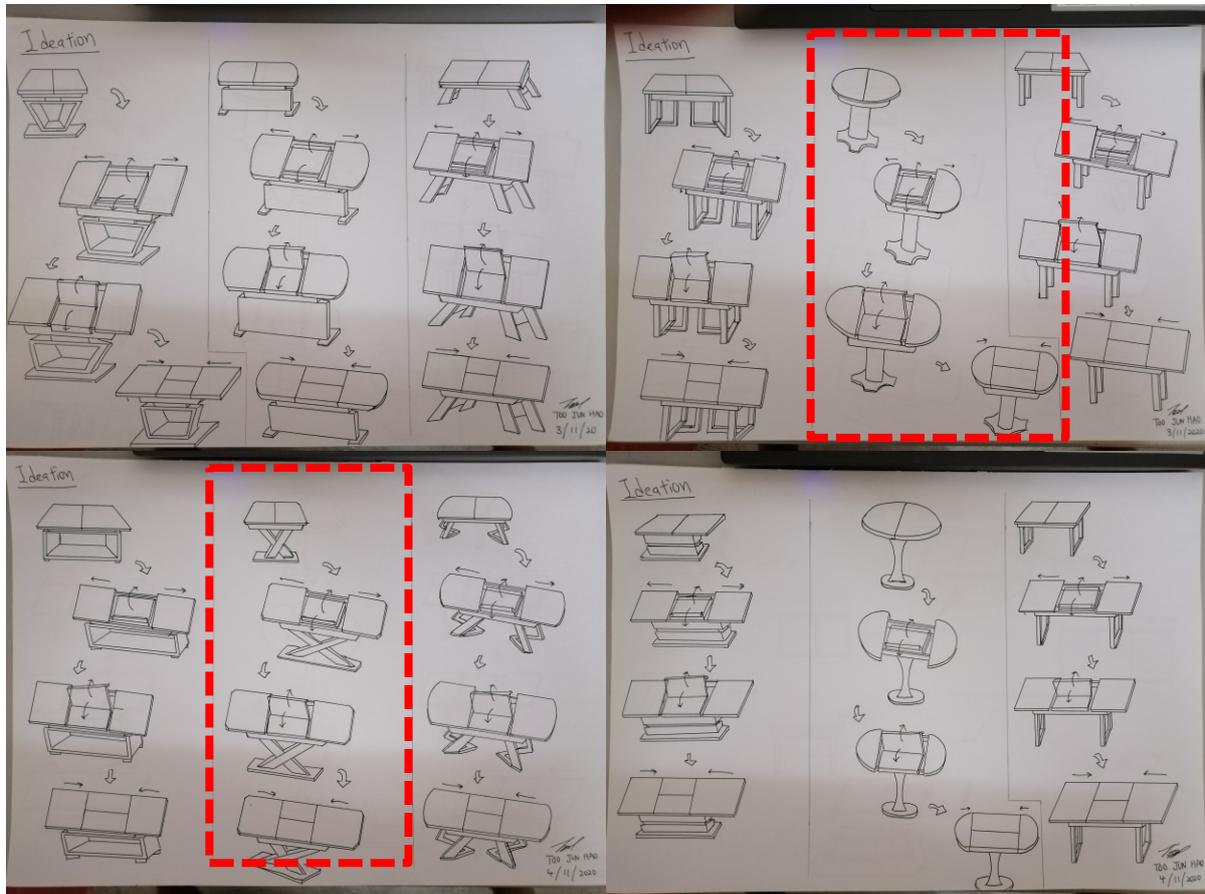
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Appendix A - Thumbnail



Appendix B - Ideation



Appendix C – Idea development

