

Modern Corner Bookshelf Inspired By ASPAM Building

Lee Chia Zhen¹ & Juliana Abdul Halip^{1,*}

¹Department of Production and Operations Management, Faculty of Technology Management and Business, Universiti Tun Hussein Onn, Malaysia, Parit Raja, Batu Pahat, Johor, 86400 MALAYSIA

*Corresponding Author

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Abstract: Most of the people stayed in small houses always faced the problems less enough storage for books or magazines but normal bookshelf occupied more space. Therefore, the objectives of this study are to identify the design characteristics of corner bookshelf, to design and to develop a prototype of corner bookshelf inspired by ASPAM building for small houses. A total of 50 respondents who live in Batu Pahat were asked by the given questionnaire. Data obtained from the survey was applied for sketches, design survey, mock up, technical drawing and fabrication of the prototype. Findings revealed that people prefer a corner bookshelf with 3 tiers, open shelf, equipped with door, made from the plywood and has neutral colour. A total of 45 thumbnails, 8 ideations, and 4 idea developments were sketched and the final design was determined by the design survey. A prototype of corner bookshelf made from plywood and finished with Formica in the oak pattern was successfully fabricated. The modern corner bookshelf could benefit family those stay in small houses for storing books and magazines.

Keywords: Corner bookshelf, Modern, ASPAM

1. Introduction

1.1 Research Background

Wooden furniture is the biggest contribution in Malaysia's exports of major timber and timber products with the highest amount of RM 9,143.65 mil in year 2019 (MTIB, 2020). This industry endures to be a significant contributor to the Malaysian economy and ranked as the top ten largest exporter of furniture in the world since 2012. Nowadays, most of modern and contemporary furniture were selected by the customer due to their refined stylishness. Today's modern style derive from a design evolution that was established at the 20th century (Lee, 2019). Modern style furniture characteristics are simplicity, practicality and flat lines. In the most modern furniture, the features has less ornamentation, which is brings a sense of refinement and purity, and coloured with basic colors namely black, white,

*Corresponding author: julianaah@uthm.edu.my

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grey and other neutral colour (Sandeva & Despot, 2013). Additionally, the shape in the modern style is a clean profile and fresh lines (Kate, 2019). Materials used in the modern style furniture are wood, plastic, metal, steel, glass, fabrics and textiles include leather, vinyl, and microfiber.

Nowadays, there are lots of modern furniture includes bookshelf. The bookshelf is a shelf or set of shelves for holding books. There are many types of bookshelf which can be placed in the small space or even in the small house such as corner bookshelf, barrister bookshelf, glass bookshelf, industrial bookshelf and bookworm bookshelf (Winston, 2019). In current market, bookshelf appear in various styles including Scandinavian and Minimalist (Hughes, 2019; Tanuwijaya & Edison, 2018). Since the revolution of industrial, bookshelf has become basic and have to exist in each family.

1.2 Problem Statements

Bookshelf occupied space especially for those who live in small houses. As reported by Roberts (2017), most of the people who are living in the small houses faced less working space and less storage. Small houses are the house with dimensions of 40 square meters or in 430.56 square feet (Johnson, 2008). Based on a current survey by the Australian Bureau of Statistics (ABS), authorized by Commonwealth Securities, the general area of the floor of a new separated house built in Australia in 2015 and 2016 was 231 square metres, which down since a record 247.7 square metres in 2008 and 2009 (Grennan, 2017). Most of the small houses in Malaysia ranging from 827 to 1008 square feet (Chew, 2019). According to the data that provided by United Nations Commission on Human Settlements (UNCHS) and the World Bank (UNCHS & World Bank, 1996), the floor area per person in Malaysia is about 293.9 square feet which are smaller than the other Asian countries.

The main problems that always occur in the small houses are lack of storage place (Hofseth, 2012). In their study, people stayed in small houses always faced problems with not enough storage place for books, magazines, and others. The design criteria and criteria of the space are limited to meet the needs of routine home and also for storing the things such as books, clothes, and others in the small houses (Mahmud et al., 2012). There is an insufficient space design because the furniture has occupied some space and limited the people to carry out activities (Ishak et al., 2018). Apart of that, insufficient space design includes storage space for storing items that need to be stored. Thus, this study proposed a modern corner bookshelf suitable for small houses in Malaysia. Modern corner bookshelf was proposed to maximize the corner area of houses. As stated by Winston (2019), corner bookshelf will maximize and consume less space in the small house. The corner bookshelf is one of the simplest and most appropriate designs in bookshelf. The modern corner bookshelf was influenced by Aomori Prefecture Sightseeing Products Mansion building (ASPAM) which represent as is a triangle-shaped building that located in Japan.

1.3 Research Questions

The research questions of this study are:

- (i) What are the design characteristics of modern corner bookshelf inspired by ASPAM building for small houses?
- (ii) How to design a modern corner bookshelf inspired by ASPAM building for small houses?
- (iii) How to develop a prototype of modern corner bookshelf inspired by ASPAM building for small houses?

1.4 Research Objectives

The objectives of this study are:

- (i) To identify the design characteristics of modern corner bookshelf inspired by ASPAM building for small houses
- (ii) To design a modern corner bookshelf inspired by ASPAM building for small houses
- (iii) To develop a prototype of modern corner bookshelf inspired by ASPAM building for small houses.

1.5 Significance of the Study

The significance of this study was focus to small houses residential. The modern corner bookshelf could minimize the space and ease the storage of books and magazines.

1.6 Scope of the Study

The target user is aimed to be used by the student, family and the parents who have children in primary, secondary, college and university in the small houses. The research area is at Batu Pahat. The main material use for the manufacturing of modern corner bookshelf was determined based on the questionnaire. The market of the modern corner bookshelf can be for local and export for foreign country.

2. Literature Review

2.1 Modern design

Modern design symbolizes to be the contrast of the past fashion of design which used engrave, large surface and the style of wood in all places of the house. Thus, many modern design's elements contains smooth, clear lines with less characteristics (Sandeva & Despot, 2013). Some of the modern design has steel element without a stain and chromium, and most of the houses coloured in black, white and neutral colours (Asaff, 2019). Apart of that, a shift in the modern designs use synthetic materials, namely Formica, and the introduction of new design elements to reflected the cultural (Gürel, 2009).

2.2 Corner bookshelf

Corner bookshelf is one type of bookshelf that could be placed in the corner of the room thus the space could be utilized. With this L-shaped shelf board at the back of the shelf, the space can be used more effectively. Modern corner bookshelf should made from wooden material. The corner industrial bookshelf increase the feeling of the past and nature to some area because it is a big exchange of the part revolve massive piping made from the iron into a stylish city view (David, 2019). According to Winston (2019), the body of the industrial bookshelf is made from the heavy mechanical metal carrier or edges.

2.3 Dimension of the bookshelf

The standard height for a two-rack bookshelf is 81.28 cm, for the width is 78.74 cm and the depth are in the range from 30.48 to 33.02 cm (Munson, 2019). The two-rack bookshelf is suitable for the small accumulation of book. The standard height for the three-rack bookshelf may differ from 101.14 to 121.92 cm. While for the standard widths for three-rack bookshelf are in the range from 76.2 to 91.44 inches. Meanwhile, the depth of a three-rack bookshelf could be between 30.48 to 33.02 inches. While for the standard height for a four-rack bookshelf is 137.16 cm, the width of a four-rack bookshelf will between 60.96 cm and for the deepness of a four-rack bookshelf may have the scope from 30.48 to 36.83 cm. Besides that, for the standard height for a five-rack bookshelf is in the height from 182.88 to

195.58 cm, the width will from 78.74 to 93.98 cm and the deepness will be from 30.48 to 33.02 cm (Munson, 2019).

2.4 ASPAM building

ASPAM stands for Aomori Prefecture Sightseeing Products Mansion. ASPAM is a triangle-shaped building and it is 76 meter with 15 floors (Figure 1). This building is one of the best alluring districts in the country and it is situated in the north of Japan was fixed in 1986 (Velgus, 2012).



Figure 1: ASPAM building (Chris, 2017)

3. Research Methodology

3.1 Development of questionnaire

The questionnaire in this study has 3 parts which are Part A for the demographics of the respondents, Part B for the design criteria of the modern corner bookshelf and Part C for the view of the modern corner bookshelf. In this study, the questionnaire was distributed to the 50 respondents who are live in Batu Pahat through the google form. The target respondents are student, family and the parents who have children in primary, secondary, college, and university in the small houses. The questions that been asked in the questionnaire were used to develop ideation, idea development and produce a prototype. The data collection was calculated after the survey and start for the sketches based on the obtained design criteria.

3.2 Sketches

In this study, the sketches was divided into thumbnail, ideation, idea development and final design. Thumbnail is a description of a small image for a large image and it can help to make simple and quick to look at or conduct a group of the larger images. There have 45 thumbnails were sketched. The ideation was based on the design criteria that have been answered by the respondents through the questionnaire. There have 8 ideations and the selected ideation was then used in the idea development. Idea development was related to ideation. Four ideations were selected and become the idea development. The final design was chosen from the idea development and only one piece of the final design was selected after a design survey through the google form and it would be processed to become a prototype.

3.3 Design survey

In this study, the design survey was carried out through the selection of the final design by the respondents. Three designs were proceeded for design surveys to determine the final design and would be used to develop a prototype.

3.4 Mockup

In this study, mockup was done by using the cardboard. The mock up was done on a scale of 1:5.

3.5 Technical drawing

In technical drawing, 2D and 3D drawings were done through the AutoCad and SolidWorks. The 2D and 3D drawings were done to perform more clearly product design.

3.6 Prototype

The material that are used in the manufacturing process of prototype including the plywood, ruler, pencil, eraser, cutting machine, knife cutter, scissors, measuring tape, laminated plastic adhesive, formica, finish nails, electric drill, soft close door hinges, sanding paper, and thinner. The final design would be processed in the manufacturing process to become a prototype. The manufacturing process was started from the measuring, cutting, sanding, gluing, assembly to the finishing process. In the measuring process, a measuring tape was used to measure the dimension of each tier according to the dimensions shown in Figure 5. In this process, each dimension must accurate to ensure that each tier of the corner bookshelf is within the specified dimension. While in the cutting process, the shape of each tier was cut out by using a cutting machine.

Next, in the sanding process, a sanding paper was used to smooth the surface of the plywood that have been cut. In this process, each part of the plywood needs to sand until getting a smooth surface and free of impurities. In the gluing process, a piece of tiers was applied a layer of the laminated plastics adhesive before sticking the Formica with the oak pattern on the surface of the plywood. Then, in the assembly process, the tiers was screwed using the electric drill. Finally, during the finishing process, the surfaces of the tiers and frame were wiped using thinner to clean the dust and impurities.

4. Results and Discussion

4.1 Demographic of the respondents

Table 1 shows the demographic data and design criteria of modern corner bookshelf. All respondents live in Batu Pahat. As shown in Table 1, majority of the respondents are female at a value of 66%. The respondents at age of 21-30 years old is 70%, followed by 20 years old and below (18%), 31-40 years old (6%), 41-50 years old (2%), 51-60 years old (2%) and above 60 years old (2%). Most of the respondents are Chinese at a value of 64%, followed by Malay (32%) and Indian (4%). Majority of Batu Pahat residents are dominant by Chinese people. In this study, 42% of the respondents live in terrace house in Batu Pahat area. The percentage of the respondent who lives in the flat, apartment and condominium are 28%, 18% and 6%, respectively. This low average values might be due to the less flat, apartment and condominium buildings in Batu Pahat. Apart of that, there are only 1 people with a value of 2% live in the semi-detached house, low-cost house, and the detached house.

Table 1: Demographic and design criteria of modern corner bookshelf

Details		Percentage (%)
Demographic		
Gender	Male	34
	Female	66
Age	<20 years	18
	21-30 years	70
	31-40 years	6
	41-50 years	2
	51-60 years	2
	>60 years	2
Race	Chinese	64
	Malay	32
	Indian	4
Types of residential	Terrace	42
	Flat	28
	Apartment	18
	Condominium	6
	Others	6
Design criteria		
Do you have the bookshelf in your houses?	Yes	94
	No	6
Do you want to have a modern corner bookshelf in houses?	Yes	76
	No	24
Number of tiers	Three	64
	Four	34
	Five	2
Types of shelf	Open	68
	Close	22
	Mix	10
Bookshelf with door	Yes	90
	No	10
Preferred colour	Neutral	56
	Natural	44
Preferred material	Plywood	74
	Metal	2
	Glass	28

4.2 Design criteria of corner bookshelf

In this study, the questionnaires were answered by 50 respondents. As shown in Table 1, the respondents that have the bookshelf obtained the highest percentage which are 94% compared to the respondents that did not have the bookshelf which only have 6%. This show that bookshelf are among the most used furniture in most houses. There are 76% of the respondents want to have a modern corner bookshelf in the houses while the other 12 respondents with a value of 24% did not want to have a modern corner bookshelf in the houses. As stated by Winston (2019), corner bookshelf could benefit for the small houses as it is placed in the room's corner can help to maximize the corner area of houses.

As tabulated in Table 1, majority (64%) of the respondent prefer to have 3 tiers, followed by 4 tiers (34%) and 5 tiers (2%). There are 34 people are most preferred to have the open shelf with a value of

68%. While there are 11 respondents preferred to have the close shelf with a value of 22% followed by the fewer people are preferred to have the mix modern corner bookshelf which is 5 respondents with a value of 10%. According to Deen (2015), the open shelf is the most available type in the market and more practical. There are 45 people with a value of 90% are preferred the modern corner bookshelf with door followed by 5 people with a value of 10% are did not prefer the modern corner bookshelf with door. The percentage of the respondents who are preferred the neutral colour is 56 % followed by 44% of the respondents are preferred the natural colour of the wood.

Meanwhile, the respondents can choose more than one answer for the material of the modern corner bookshelf. Finding shows that there are 74% of the respondents are choose the plywood as the material, followed by 28% of the respondents are choose the glass as the material for the modern corner bookshelf. While there is only 2% of the respondents choose the metal/steel as the material for the modern corner bookshelf. This indicates that people are more preferred to use wood-based materials for the furniture. Wooden materials are synonym with the modern furniture as they look more attractive and natural. The most material use for bookshelf in the market is hardwood such as walnut as it is heavy and durable (Holman, 2015).

Besides, 54% of the respondents are strongly agree with the statement of corner bookshelf maximizing the corner area of houses and by 22% of the respondents are agree with the statement. Table 2 shows the summary of the design characteristics of the modern corner bookshelf inspired by ASPAM building for small houses. The characteristics of the modern corner bookshelf including 3 tiers, has an open shelf, equipped with the door, has neutral colour and made by plywood. As reported by Booth and Plunkett (2014), plywood keeps the veins and the natural wood colours and it is in a place in a series for capability and character of the laminate's apparent.

Table 2: Summary on the design characteristics of modern corner bookshelf

Characteristic	Response
Number of tiers	Three
Types of corner	Open shelf
Door	With the door
Colour	Neutral colour
Material	Plywood

4.2 Ideation

Figure 2 shows the ideation of the corner bookshelf. The ideation was based on the design criteria that have been answered by the 50 respondents. Among these ideation, there have a different pattern, and types of design. There was have 4 pieces of ideation was selected to the idea development.

Figure 3 exhibits four idea development of the corner bookshelf with the different dimensions and patterns of the design. In idea development, the dimension of each design was listed and each design was coloured. The design in Idea development 1 have 3 tiers shelf, with 2 doors and the door is assembly by using the magnetic and open from the left and right-hand side and the height of the modern corner bookshelf is 140 cm. While the design in Idea development 2 have 3 tiers shelf and the shape of each tiers are in the L-shaped to place in a corner place, have 2 doors and the door is assembly by using the soft close door hinges, the height of the bookshelf is 150 cm. For the design in Idea development 3, there have 3 tiers shelf, the front board is decorative with lines and with 150 cm and have 2 doors. Lastly, for the design in Idea development 4, there have 3 tiers shelf and the third tier have one piece of plywood to separate it and becomes 2 places to put the books, with 2 doors, and the height of the modern corner bookshelf is 140 cm.

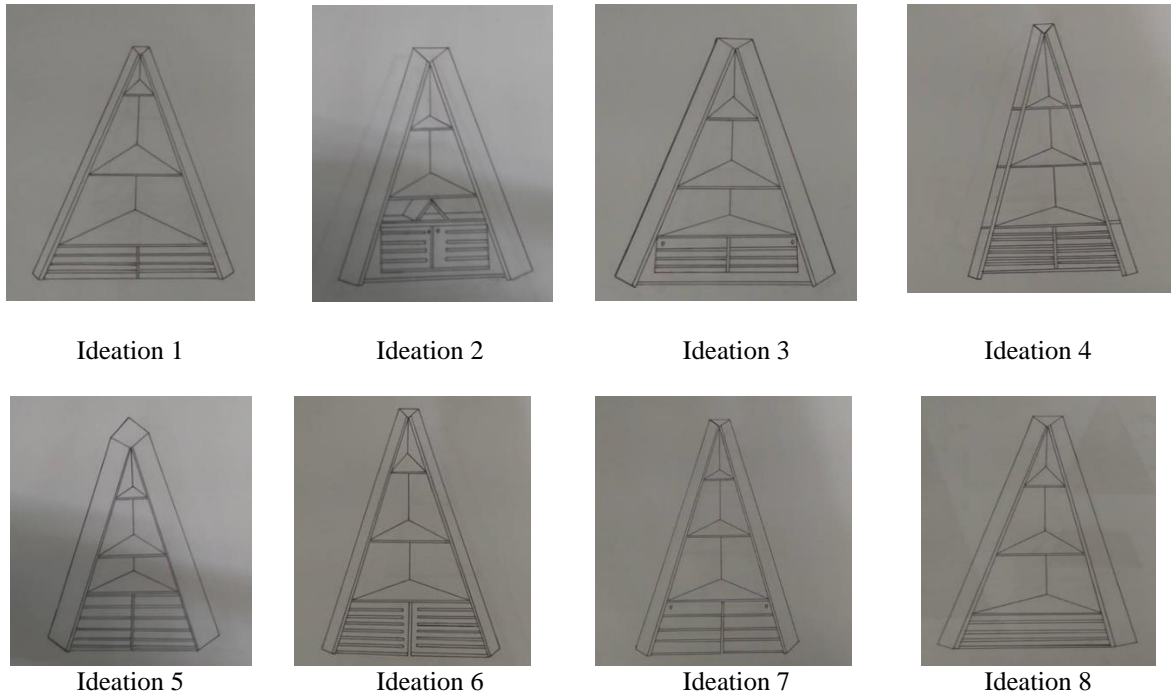


Figure 2: Ideation of modern corner bookshelf

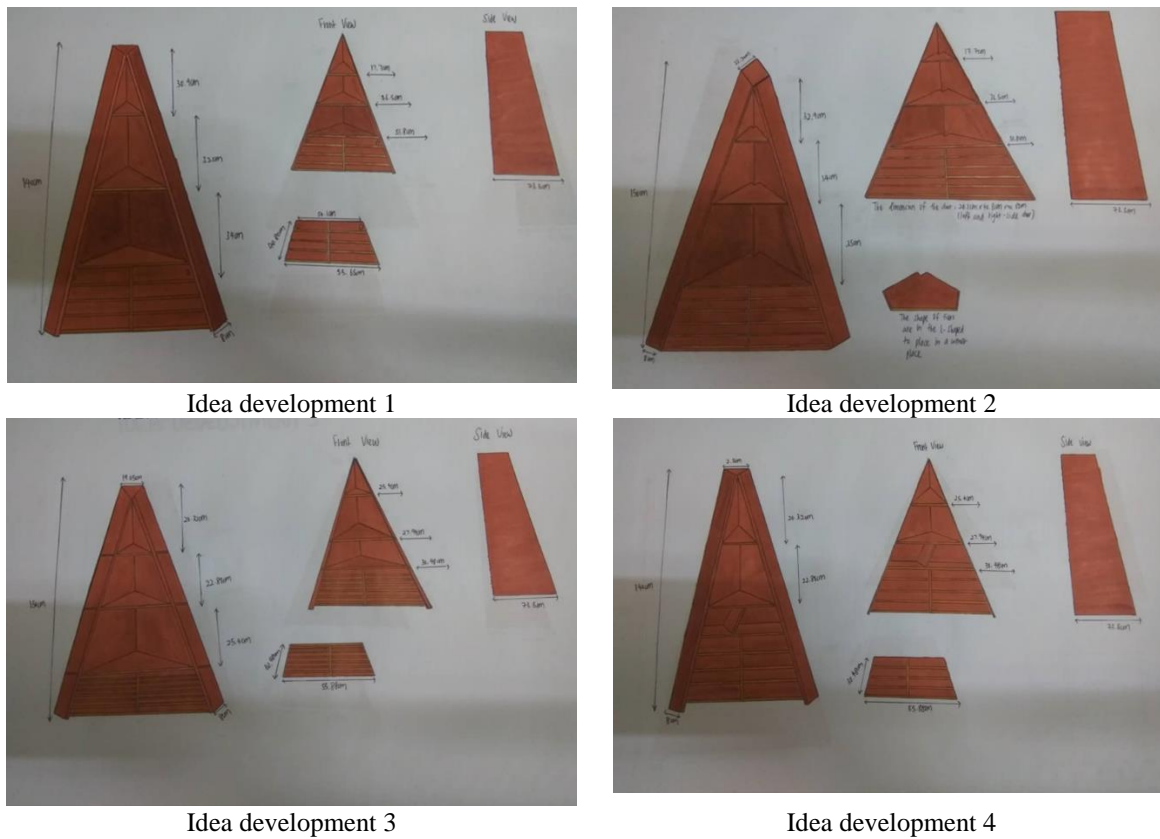


Figure 3: Idea development of modern corner bookshelf.

4.3 Final design

Design survey was conducted through the google form and answered by the 50 respondents. With this, the final design was determined by the design survey. Figure 4 shows the design survey on the modern corner bookshelf. The respondents that choose Design 3 obtained the highest percentage which is 54%. This shows that Design 3 is among the most preferred by the respondents. While there are only 15 respondents with a value of 30% are choose Design 2 and only 8 respondents choose Design 1. Therefore, Design 3 was proceed for the prototype manufacturing. Prior to the technical drawing and prototype, the mockup was done by using the cardboard to determine the functionality of the prototype.

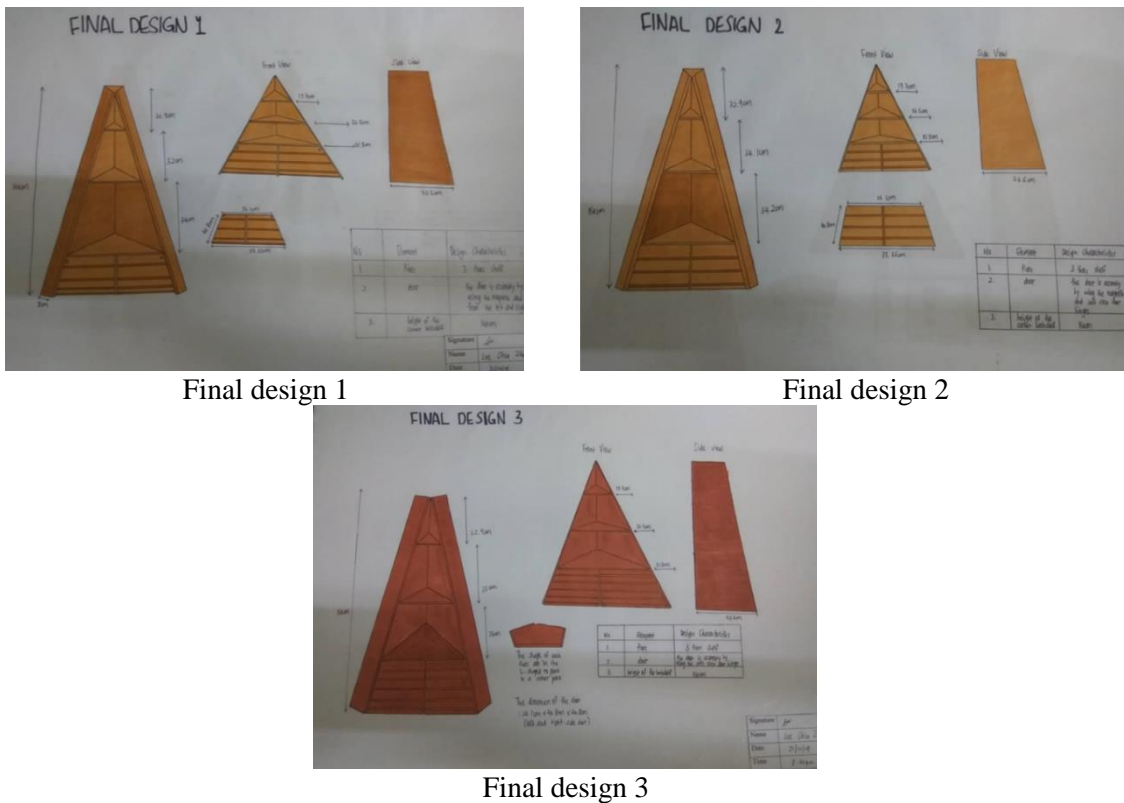


Figure 4: Three pre-final designs of modern corner bookshelf

4.4 Technical drawing

In technical drawing, 2D drawing are show in the Figure 5. In Figure 5 (a) shows the top view of the modern corner bookshelf. While the front and side views of the modern corner bookshelf are show in Figure 5 (b) and Figure 5 (c), respectively.

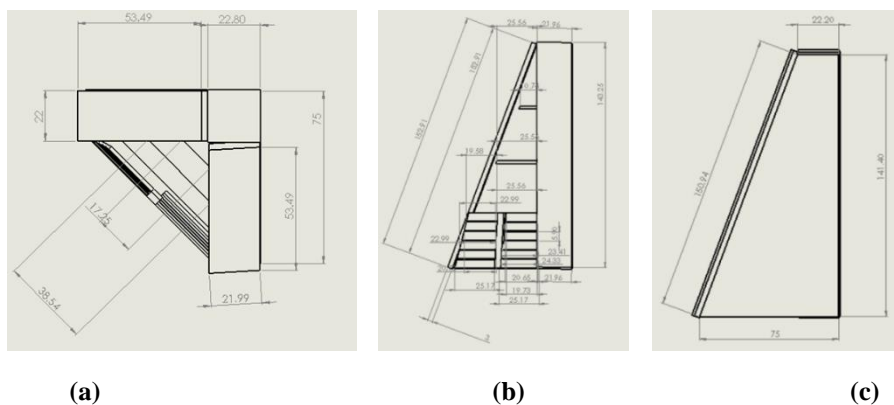


Figure 5: (a) Top, (b) Front, and (c) Side views of the modern corner bookshelf

4.5 Prototype

Figure 6 shows the completed prototype which is made from the plywood and sticks with the Formica with an oak pattern to enhance the aesthetic of the prototype. The prototype have 3 tiers shelf, have 2 doors and the door is assembly by using the soft close door hinges, and the height of the prototype is 150 cm.



Figure 6: The prototype of modern corner bookshelf

5. Conclusions

In conclusion, the design criteria for modern corner bookshelf are a triangle in shape, has 3 tiers, has open shelf, has door, made from plywood and in a neutral colour. Along the study, eight and four ideations and idea development were sketched, respectively. The final design was determined by the design survey, whereas Idea development 2 has been chosen as a final design and developed into a prototype. At the end of the study, the prototype of the modern corner bookshelf was successfully developed using the plywood and finished with Formica in the oak pattern.

After carrying out this study, there are some recommendations have been suggested to improve this study. Future study should consider a feasible shape of corner bookshelf. From observation, the triangle shape has less space for the storage. Rectangle shape could occupied more storage. Apart of that, additional hook could be added at the outer part of the bookshelf to maximize the space. Modern corner bookshelf can be added with a bulb at the top of the first tiers to look brighter and the commercial value of the modern corner bookshelf could be increased if luxury material such as glass or metal were includes.

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