

Creativity and Innovation in Hexa-Piece Furniture Design for Effective Room-Space Management

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The current global economic challenges necessitated creativity and innovation in hexa-piece furniture design, as opposed to traditional actions, for effective room-space management. Achi (*Brachystegia nigerica*), a tropical hardwood readily available in the market as "Achi", was used to construct the hexa-piece wooden furniture which comprised units A and B linked by means of a pivot to enhance convertibility into tripartite positions, with dual functions in each position. Unit A is a stand with four tapered legs fixed to the minor seat while Unit B is a wide board rounded at one end with elliptical curve at the other end. The design of the hexa-piece furniture entailed measurement, marking, setting out, sawing, planing, assembling, sanding, filling and spraying the wooden piece to the desired shade. The design makes for

maximum utilization of wood and the attendant cost savings. By performing six functions in one, the hexa-piece furniture helps to solve the problem of over-crowding a room facility with much furniture. The hexa-piece furniture can function as a convertible chair, storage box, self-standing ladder, lamp stand, ironing board and writing table. The hexa-piece furniture is recommended for bachelors, spinsters and as an instructional material for teaching life skills in woodwork, for job creation and for foreign exchange earnings.

Keywords: Creativity, innovation, design, hexa-piece furniture, room-space management

INTRODUCTION

Nigeria is in the midst of global economic recession. It is imperative to evolve new ideas, concepts and alternatives to the traditional actions and mode of living. This necessitated creative and innovative designs for sustainable economic development in the country through Technical Vocational Education and Training (TVET). TVET is the type of education which involves in addition to general education, the study of technologies and related sciences as well as the acquisition of practical skills and knowledge relating to various occupations (Ben, 2010). Furniture making is one of the technical components of TVET (Usoro, 2018b). Furniture making requires the intelligent and imaginative thinking to evolve suitable designs for the intended purpose (James, 2015).

Design is the intentional planning, drafting and making of objects for a particular use (Akpan, 2006). According to Utuk and Usoro, (2018), furniture design is the intentional creation of moveable and immovable objects to support human activities such as eating (e.g. dining table and

chairs), sitting (e.g. chairs, stools and sofas), sleeping (e.g. bed and sofas), storage (e.g. chest of drawers, wardrobes and cabinets) as well as for comfort. Well-designed furniture, according to Feirer (2001), is one that adheres to certain style, has beautiful wood and finish, fine construction and attractive cabinet hardware. Furniture construction entails interpreting the design, choice of materials, fabrication and assembling of the component parts to build the desired object (Usoro, 2018a). Creativity in furniture design, therefore, is the ability to make furniture piece in such a way that exhibits intelligence and the imaginative power of the designer to evolve original concepts to solve human problems. It does not merely show the use of mechanical skills but also exhibits ingenuity, in making new concepts. Innovation entails making changes in the design to evolve new things as against the traditional actions.

The Hexa-piece furniture is free-standing furniture that is designed in cognizance with the science of ergonomics to perform six functions at tripartite

positions. These include: convertible chair for sitting, trinket box for storage; ironing board, writing table, self-standing ladder and lamp stand. The hexa-piece furniture is a technical innovation in wood technology in the efficient utilization of wood, cost savings and to solve the problem of over-crowding, thereby promoting effective room-space management. Room-space management is the process of planning, directing, controlling and organizing pieces of furniture in a room so as to create space and achieve maximum comfort for occupiers of the room (Gate, 2000).

The cost of the hexa-piece is far less than the cost of six different furniture pieces summed together. The amount of wood used for its construction is far less than that required for six different furniture. This will enhance conservation of our forest reserves, in the long run. The hexa-piece furniture could be used as an instructional material for teaching life skills to teeming youths for job creation and economic development. More so, the product could be exported for foreign exchange earnings to boost the economy.

Purpose of the study

The major purpose of the study was to design and develop hexa-piece furniture design for effective room-space management. Specifically, the study sought to:

- (a) Design hexa-piece furniture for effective room-space management.
- (b) Determine the cutting list for hexa-piece furniture design.
- (c) Develop hexa-piece furniture design for effective room-space management.
- (d) Develop appropriate wooden joints for the hexa-piece furniture.

METHODOLOGY

Theory of design and production by Koskela, Laurin (2000)

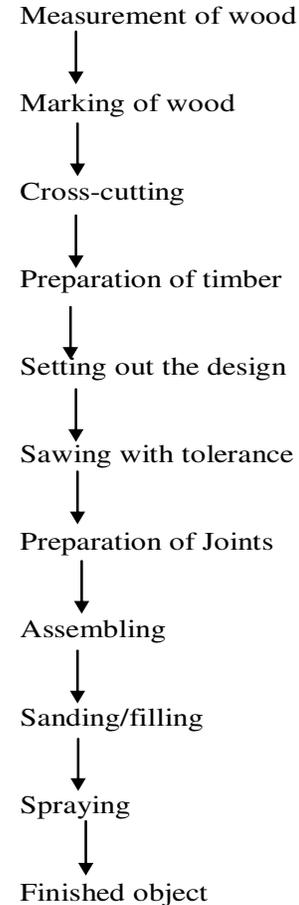
The theory viewed production in three conceptualizations:

- (i) Production is the transformation of input to output.
- (ii) Production is the flow of processes.
- (iii) Production is the means for the fulfillment of the customers' need.

The theory relates to this study in that the wood has to be transformed efficiently into the marketable hexa-piece furniture in a well-defined production flow processes to meet the needs of the customers.

Development of the Hexa-piece furniture

The success of any design project starts with the choice



Flow chart of the production process of Hexa-piece. Source: Utuk and Usoro, (2018).

of constructional materials. In this case, the researchers decided to make use of Achi (*Brachystegia nigerica*) for the construction of the hexa-piece furniture. Achi is a hardwood, readily available in the timber market in Akwa Ibom State. According to Etukudo (2011), Achi is brown in colour, very dense, moderately strong, fairly durable and used for plywood cores and faces, wood flooring, window and door frames, stairways, tool handles, furniture and cabinet works, roofing trusses, carcassing and shuttering. Achi has good figure of wood with straight grain orientation, it is durable, easy to handle and has a high strength property. Other materials used for the construction of the hexa-piece furniture include: glue and ironmongeries such as piano hinges, butt hinges, mechanical stoppers, lever stands, mortice lock, zig-zag nails and ordinary wire nails. The timber was first air dried for three weeks under a shade. The seasoned timber was measured, and marked using pencil and try square into lengths of 1200 mm. The board was then cross-cut into short pieces.

Preparation of cutting list

Cutting list was prepared based on the working drawing. Table 1 shows the cutting list required for the production of hexa-piece furniture. It consists of wood with various sizes ranging from (12.5 x 250 x 265) mm to (25 x 30 x 1100) mm. The sizes of timber described on (Table 1). The costing on (Table 2) shows the total sum of eleven thousand Naira (11,000.00) only. This implies that the cost of production will be determined by the size of the Hexa-piece to be produced.

Ironmongery used in the construction of the hexa-piece furniture

1.	Piano hinges	1 No
2.	Butt hinges	2 No
3.	Mechanical stopper	2 No
4.	Lever Stand	2 No
5.	Mortice lock	1 No
6.	Zig-zag nails	4 No
7.	Ordinary wire nails	1 kg

Preparation of timber

This is a set of operations carried out on every piece of timber to be used in the construction of furniture. According to Walton, (2007), these operations are in six consecutive steps which could be represented by the acronym (F.E.W.T.E.L), where F = Face side; E = Face Edge; W = Width; T = Thickness; E = End; L = Length of the board.

- (i) Select the face side and plane it perfectly flat. Use straight edge to test its flatness. Mark the face side appropriately.
- (ii) Plane the face edge. Use straight edge and try square to test for straightness and squareness respectively. Mark the face edge as well
- (iii) Gauge both sides to the required width using marking gauge. Plane off wastes. Test for straightness and squareness.
- (iv) Gauge the piece to the required thickness from the face side. Plane off the wastes and test for flatness.
- (v) Square, cut and shoot one end. Test for squareness.
- (vi) Measure the required length from the prepared end. Square, cut and shoot off waste.

Setting out

Set out the various dimensions on the different pieces of the prepared timber. This involves measuring and marking according to specifications in the cutting list.

Sawing

There were two operations that were carried out namely ripping and cross-cutting. Ripping – sawing along the grain of wood using rip saw and Cross-cutting – sawing across the grain of wood, using cross-cut saw.

Preparation of joints

Two types of joints were used in the construction of the hexa-piece furniture. These are: Tenon and mortise joint and butt joint as shown in (Figure 5).

Tenon and mortise joint

The following steps were used:

- (a) Prepare the timber according to the required width, thickness and length.
- (b) Set out component parts according to working drawing/cutting list. Mark positions of mortise on the stile (leg). Square lines across the face side and edges. Set out length of tenon on end of rails. Set mortise gauge to the width of chisel blade.
- (c) Chisel out mortise half-way through.
- (d) Cut tenon on rails. Saw on waste sides of lines. Pare slopping grooves and saw off shoulders to obtain tenon.

Butt joint

Ensure that mating end and side are perfectly straight and squared.

Assembling

- (a) Clean up mortise and tenon.
- (b) Try to fit the tenon and mortise without applying glue (trial assembling).
- (c) Apply glue on mortise and tenon and fix them together.
- (d) Cramp glued tenon and mortise and nail in position.
- (e) Ensure that side and end pieces for butt joint had been prepared and tested for straightness and squareness.
- (f) Apply glue on side and end pieces.
- (g) Nail glued side and end in position.

Unit A comprising the V-shaped legs, minor seat, trinket box and 1st step is assembled first. Followed by assembling.

Unit B comprising the board/table top, lamp stand/3rd step and major seat/2nd step. Join Units A and B using piano hinge and screws.

Table 1. Cutting list of the Hexa-piece furniture.

Qty	Description	Remarks
1 No.	25 mm × 300 mm × 1100 mm wooden board	Used for ironing board/table top
1 No.	25mm × 300 mm × 225 mm wooden board	Used for major seat
1 No.	25mm × 300 mm × 130 mm wooden piece	Used for minor seat
4 No.	25mm × 65 mm × 600 mm wooden legs	To be tapered
2 No	25mm × 50 mm × 260 mm wooden pieces	Used for side rails
2 No	25mm × 50 mm × 300 mm wooden pieces	Used for front and rear rails
1 No	25mm × 270 mm × 360 mm wooden piece	Used for 1 st ladder rung
1 No	25mm × 220 mm × 300 mm wooden piece	Used for 2 nd ladder rung
1 No	25mm × 110 mm × 265 mm wooden piece	Used for 3 rd ladder rung/ lamp stand
2 No	25mm × 65 mm × 450 mm wooden pieces	Curved according to template and used for board support
1 No	25mm × 265 mm × 270 mm wooden piece	Used for box door
2No	12.5 mm×250 mm × 270 mm Triangular shaped plywood	Used for side cover
1 No	12.5mm × 250 mm×265 mm plywood	Used for box cover

Table 2. Costing of the product/project.

Description	Qty	Unit Price	Amount
25 mm × 310 mm × 5460 mm wooden plank	1No	3800	3,800
Piano hinge, 910 mm long	1No	150	150
Butt hinges	2 pairs	100	200
Fastener/nails	-	200	200
Glue (Top Bond)	-	300	300
Finishing	-	-	1,000
Mechanical fittings (lever stands and stoppers)	2 pairs each	750	1,500
Labour	-	-	2,600
Mark up	-	-	1,250
Total (Eleven thousand Naira) only	-	-	11,000

Sanding/filling

Use 1½ glass paper on a wooden block and sand along the grain. Use wet cloth on the piece to raise the grain. Allow to dry and sand again using glass paper. Punch nail holes and apply wood fillers to provide level background for spraying.

Spraying

Mix a solution of stain, nitro-cellulose lacquer and thinner to the required consistency. Spray the assembled hexa-piece furniture to the desired shade.

RESULTS AND DISCUSSION

Design of the hexa-piece furniture

The design of the hexa-piece furniture is shown in (Figures 1-3). Figure 1 shows the hexa-piece in ironing board/writing table position. The overall height of the board/table was 820 mm from the ground level. The figure shows unit A being pivoted to unit B by means of a piano hinge. Unit A is a stand, made of four tapered wooden legs being fixed to the minor seat by means of

glue and nails, the wooden stiles (legs) are fixed to the rails using mortise and tenon joints. The legs are joined in pairs using zig-zag wire nails in a butt joint. Unit B is made of a wider board measuring (300 x 1100) mm with an elliptical round edge at one end. Units A and B are kept in position by means of a pair of mechanical levers and stoppers.

Figure 2 shows a self-standing ladder having three rungs (step I, II, III). The ladder rung rises 290 mm, 305 mm and 360 mm respectively. The third rung of the ladder serves as the 3rd step as well as a lamp stand. Before constructing the furniture, a cutting list must be prepared according to the design. Figure 3 shows a convertible chair with a height of 570 mm from the ground level. It has two seats joined together by means of a piano hinge. The major seat measured (230 x 320) mm while the minor seat measured (130 x 320) mm. The unit has a trinket box with a mortise lock used for storage. Figure 4 shows the 1st angle orthographic projection of the hexa-piece furniture. The figure shows the front, plan and end elevations of the hexa-piece furniture. The hexa-piece furniture had been uniquely developed in cognizance with the science of ergonomics for the comfort of users. The choice of Achi, an indigenous tropical hardwood had ensured the stability and strength

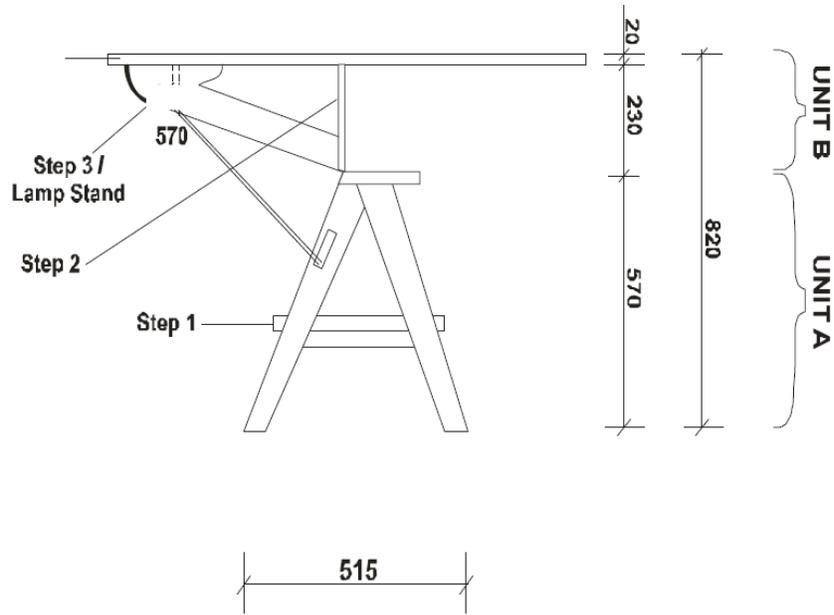


Figure 1. Ironing Board/Writing table position.

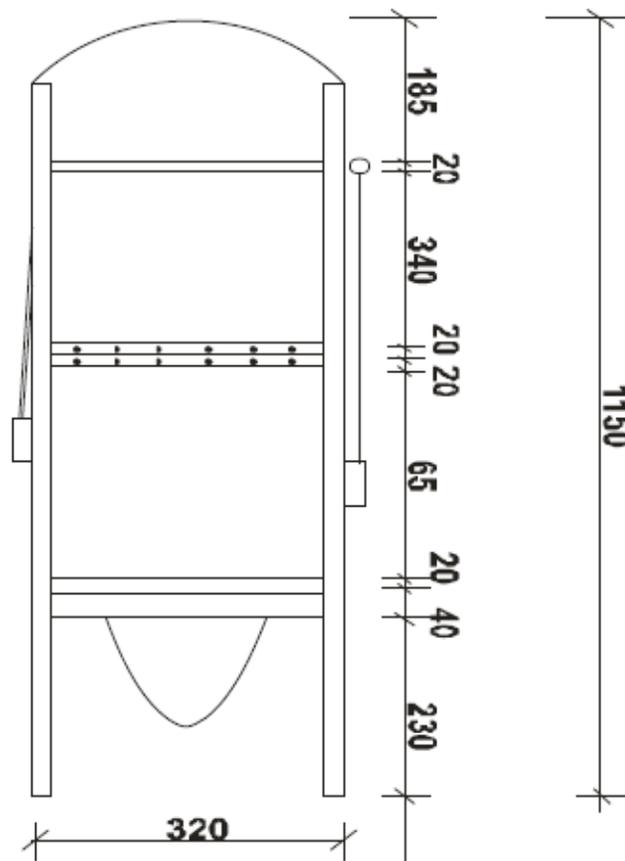


Figure 2. Self-standing ladder/lamp stand position.

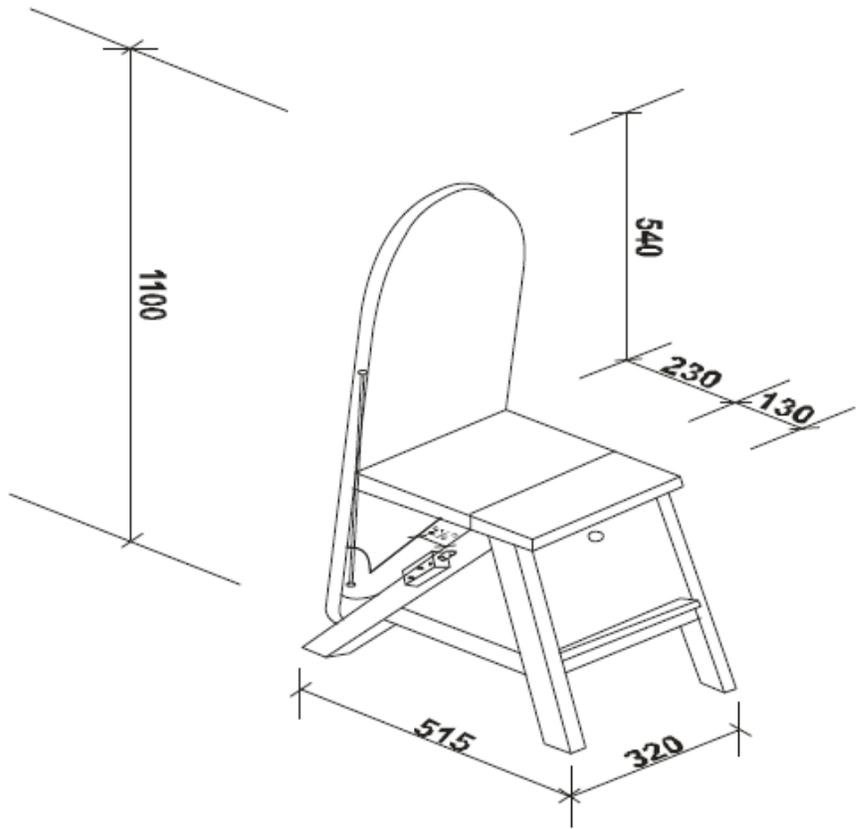


Figure 3. Convertible Chair/Trinket Box Position.

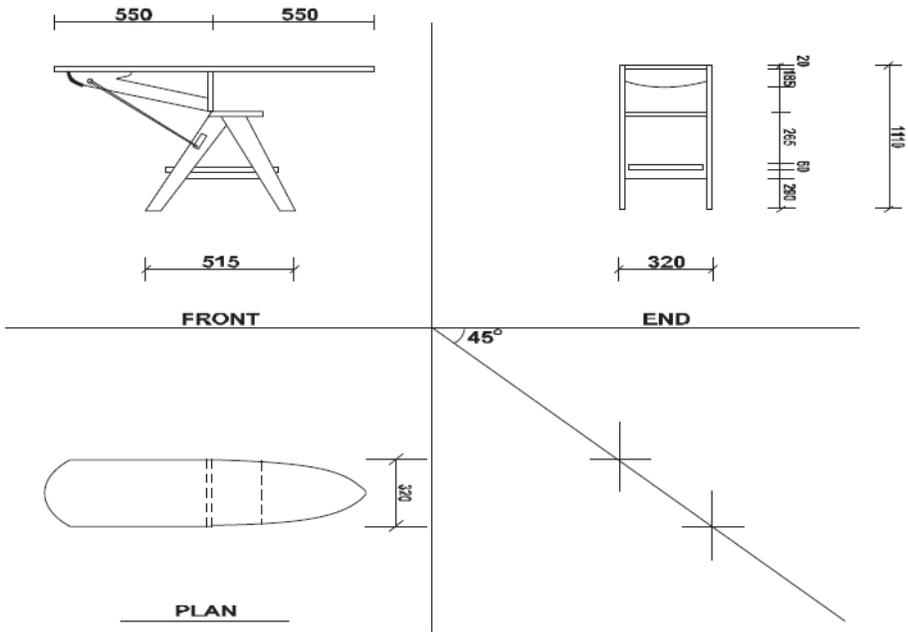


Figure 4. Working drawing of the Hexa-piece furniture.

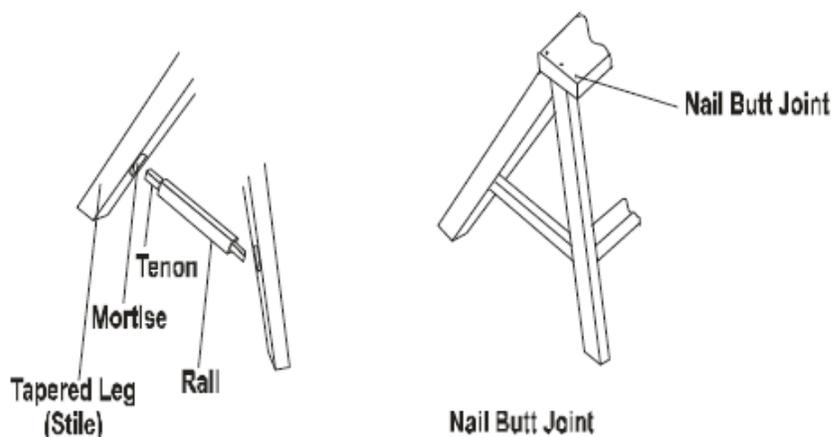


Figure 5. Woodwork joints.

of the product in line with the findings of Etukudo, (2011). The cutting list for the hexa-piece furniture had been prepared according to the working drawings. Tenon and mortise joint and butt joint adopted for assembling component parts were in line with the findings of Walton (2007), who stated appropriate joints for different wooden products. At each of the three positions in which the hexa-piece could be fixed, the product serves a dual purpose of ironing board and writing table; ladder and lampstand; or convertible chair and storage box. Its use in a room will make for economy of space, suitable for single room occupiers.

Conclusion

The hexa-piece furniture had been creatively designed and constructed to specifications to exhibit innovation in woodwork. The science of ergonometics had been incorporated in the design to ensure safety and comfort in the use of the article. The furniture performs six functions at tripartite positions. This is ingenuity in woodwork craftsmanship to ensure maximum wood utilization and the attendant cost savings. The use of the hexa-piece furniture is recommended for effective room-space management and for foreign exchange earnings.

Recommendations

- (i) The hexa-piece furniture is recommended as an instructional material for teaching life skills in Woodwork and Basic Technology.
- (ii) Production of hexa-piece furniture is recommended for inclusion in technical college curriculum for students and

artisans job creation in the country.

(iii) The hexa-piece furniture makes for maximum utilization of scarce hardwood and the attendant cost savings hence it is recommended to enable States and the Nation conserve their forest resources, at the long run.

(iv) The hexa-piece furniture could be exported by industrialists/government to other countries for foreign exchange earnings.

(v) The hexa-piece furniture is recommended for single room occupiers such as spinsters and bachelors as it is capable to solve the problem of over-crowding a room facility with many furniture.

REFERENCES

- Akpan S (2006). Woodworking with machines (a three dimensional approach). Uyo: Samuf Educational Ltd.
- Ben CB (2010). Vocational Technical Education. Ibadan: summer educational books.
- Etukudo I (2011). Ethnobotany conventional and traditional uses of plants. Uyo: the Verdict Press.
- Feirer JL (2001). Woodworking for Industry. Technology and Practice. Illinois: Chas A. Bennett Co. Inc.
- Gate D (2000). Essential Guides to Upholstery. Memphis: Merehurst Press Ltd.
- James W (2015). Upholstery Making. USA: Grand Rapids, Michigan, P. B.
- Koskela L (2000). An Exploration towards a Production Theory and its Application to Construction. Osasta: VIT Publications, 408.
- Usoro AD (2018a). Concise Handbook on Educational Research. Uyo: Penmark Publishers.
- Usoro AD (2018b). Timber and Metal Technology, Monograph, Vocational Education, University of Uyo, Uyo.
- Utuk IA, Usoro AD (2018). Basics of Woodwork design. Uyo: Penmark Publishers.
- Walton JA (2007). Woodwork in Theory and Practice. Sydney: New Century Press.