



# Partisipatory Design To Develop Montessori Modular Furniture For Pre-Prosperous Community Learning Center

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## Abstract

Education plays an important role in human development. Through learning human are enabled to write, speak, and create. The pandemic has disrupted education, especially for those whom are depend on free educational program that counts on volunteers on day to day operational. Children of the golden age are the most affected. Online learning can never cover the social interaction provided by offline learning. This research was done in Rumah Langit which is a free community learning center for children located in Rusunawa Urip Sumoharjo, Surabaya. After months of getting to know the people involved, their surrounding environment, and participating in their daily activities, it can be clearly seen that Rumah Langit are lacking of learning media. Especially learning media for children of the golden age who are often very curious and are in the stage of developing their five senses. Using 6 steps of design thinking method (Understand, Observe, Define Point of View, Ideate, Prototype, and Test. OTTM (One, Two, Three, More?) is a modular furniture specifically designed as learning media at home for preschoolers. With it endless configuration, OTTM can be used as an open storage, table and chair set for preschooler, seating chair for adult, and learning media for kids. It is inspired by the montessori method of learning, where it allows children to be creative and to learn at their own pace. OTTM offers an easy and fun way of learning at home for children, especially for children of the golden age. By using OTTM children can learn about basic numbering, colors and how primary colors create secondary colors, and shapes, from geometric to organic shapes.

## Keywords

*Education, Children, Montessori, Modular Furniture, Rumah Langit*

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## 1. Main Text

### 1.1 Introduction

Rumah Langit is a free community learning center for children located in Rusunawa Urip Sumoharjo. This facility has succeeded in guiding 35 children ranging from age 4 to 15 years old. Apart from teaching basic education such as Mathematics, English, and Bahasa, they're also aware about the importance of exploring with their children's creativity. Sadly, after the occurring of Covid-19's the number of volunteers continues to

decline, and now leaving only 2 volunteers to teach 35 children. Through some observation and many casual interviews, writer begins to understand the actual struggle of having to teach 35 individuals who have different needs and wants. Apart from the reduced number of volunteers, Rumah Langit is also struggling economically to meet the learning and creative needs of their students. Little things from colored pencils to coloring books are a rarity for Rumah Langit. After obtaining those problems, the author got the idea to create a modular furniture with a participatory design that can not only meet the needs of space and users, but can also meet the educational and economic needs of Rumah Langit.

## 1.2 Methodology

This study starts in early February 2021 and ends in June 2021, the author uses the design thinking method, which is divided into 9 stages. Design thinking is an innovative problem-solving process rooted in a set of skills.[1]

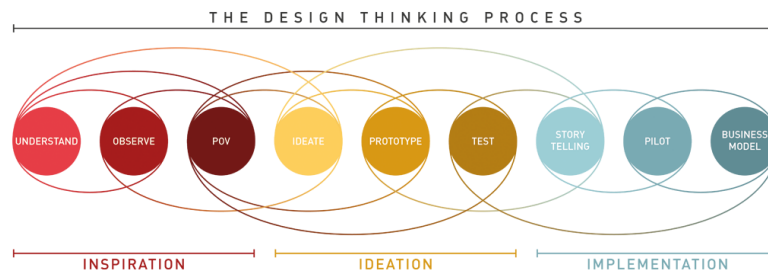


Figure 1. Design Thinking Process (Source : [blog.varonis.com](http://blog.varonis.com))

### Understanding

At this stage, literature data collection, typology and gaps of knowledge were created to act as a guide for this research:

#### Children

According to the general Indonesian dictionary, etymologically the definition of a child is a human who is still small or an immature human being, and according to the Indonesian Ministry of Health (2009), the categorization of children's age is divided into 3 periods, namely the age of 0-5 years which is called the toddler period, the age of 6 -11 which is referred to as childhood, and the age of 12-16 years which is called early adolescence.[2]

#### Participatory Design

Participatory design is a form of research that was first invented d in Scandinavia in the 1970s and 1980s.

“Unlike conventional research, which is directed primarily at producing results of interest to those beyond the immediate research site, an essential goal of action research is to achieve practical or political improvements in the participant’s lives (e.g., less routine work, greater autonomy, more effective tools). The researcher becomes directly involved in the ongoing work and feeds results back to the participants”. (1993, p- 133) [3]

#### Montessori

“The Montessori method is essentially the provision of education based on an extraordinary respect for children's ability to learn about the universe without interference. adult hand” (Thomas Armstrong ,2011:94) [4]

#### Modular Furniture

Furniture in general has a sense means, a place to store something in a fixed position or has a certain place in the room from certain materials that stand alone.

“Modular is a product design concept aimed at different systems for different functions. The idea of modular is to develop a series of components to assemble into a product.” (Ardi Priyono, 2018)

Observe

At this stage, field observations and casual interviews with Rumah Langit were conducted regularly for the first two months. From this step, the author not only can picture about Rumah Langit’s goals and needs, but can also feel the location’s atmosphere by actually participating in their daily activities.

Rumah Langit is located on the third floor of Rusunawa Urip Sumoharjo. This 24m<sup>2</sup> room contains ten folding tables, one table to put the TV, and two closed storages to store books and children’s creative equipment.

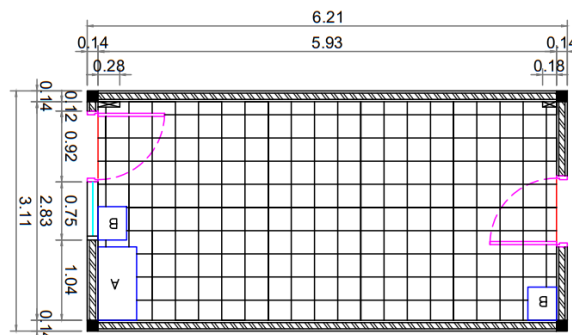


Figure 2. Rumah Langit Layout (Dimension: Meter)

After some observation and casual interview, some of the main problems can be concluded. The first problem being the two closed storage which isn’t enough to store all the books and children’s creative tools. The room are also lacking of decoration and colors, remembering that children are a visual-beings, it is very important to play with shapes and colors to help stimulate their brain into thinking in a more creative way [5]. And the last problem is the lack of ergonomic chair for the teacher of Rumah Langit, especially for volunteers who have entered older age.



Figure 3. (a) Rumah Langit Front Look ; (b) Rumah Langit Back Look

Point Of View

Through the data and information that has been collected, an affinity diagram is made to find out what needs and problems exist in Rumah Langit. Placing oneself in the position

of the sky house becomes easy for the writer after several gatherings and participating in activities at the location

### Ideate

At the beginning of this design process a FGD (Focus Group Discussion) that included the authors and the tutors of Rumah Langit was held in the Rumah Langit's study room. Here the two tutors talked about their hopes from this research. Considering how narrow the space is and the number of it's daily users, the number of scattered items makes the space seem narrower than it actually is, so the presence of a storage will be very helpful.

After that, we thought about what form of storage would be suitable for Rumah Langit, and here one of the tutor stated her desire to have an open storage that would give the impression of a mini library in the room. In addition, during this FGD, one of the tutor adviced that we should not use MDF for our furniture materials, considering that the room has a lot of insects, so the use of MDF will not have a long life-span. After that the two tutors talked about the lack of playing media in the room, especially for golden age children who should often be trained both in the sensory and visual fields. With that in mind, the author came up with the idea to combine aspects of open-ended toys on the furniture that would be removable, so that it could be easily removed and stored afterwards. At the end of our discussion of furniture design ideas, we realized another problem, which is the absence of chairs with ergonomic heights for the tutors, especially for one of the tutor who has entered the age of 60. Activities that require her to sit on the floor for a long time will be very dangerous for her joint's health, so an idea to create a modular furniture who can act as an open storage, playing media, and a chair begins.



*Figure 4. FGD Documentation at Rumah Langit*

With the information that has been collected through our FGD (Focus Group Discussion), a concept that can solve the problems that exist in the location is chosen, namely the Montessori concept. Montessori is a learning method for children who believe that children initially have intelligence without any help from adults. Using the Montessori Concept, a modular furniture design is created. This modular furniture is intended not only to meet the needs of space and users, but is also expected to meet the educational needs of children, especially children at the age of golden age. Some educational elements such as primary and secondary colors, organic and geometric shapes, and basic numbering will be applied in this design.

### Prototype

With the concept in mind, the design of OTTM modular furniture is made in the form of 3D Sketch-Up. This furniture is also especially designed in a modular form to suit the conditions of Rumah Langit's study room, which is quite narrow. By using this modular form of furniture, it can also be changed easily to suit the needs of the child and the tutor. Throughout the whole design process, author also receive many inputs from Rumah

Langit, starting from the selection of furniture materials, colors, to adding English and numbering learning aspect in the furniture.

Test

After many alternatives and revision, the final design was then sent to a handyman, later entering the material cutting stage using CNC cutting, followed by a furniture construction test, then ending it with the finishing process using water-based finishing.

Story Telling

A story telling canvas was later made to explained the purpose and the ultimate expectations of this design.

Pilot

The ready-to-use modular furniture was then tested at Rumah Langit along with the macrame training. At this stage we can finally see the success rate of this design, whether it has serves it initial purpose or not.

Business Model

Lastly, a business model canvas about the future plan for Rumah Langit is created. This canvas was made as a guide Rumah Langit if in the future the macrame skills that have been taught to the children want to be developed into a business idea.

1.3 Result

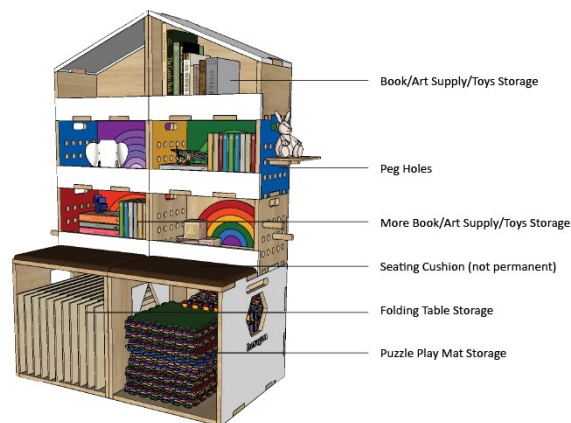


Figure 5. OTTM (One, Two, Three, More?)

The use of colors teaches children to recognize how when primary colors are meeting another primary colors, it will produce a secondary color. In addition, the coloring in the rainbow area is also to teach children about color gradations. Rainbow arches are disassembly, and can be used as a medium for playing and children's media to be creative with formations organic like the example picture beside

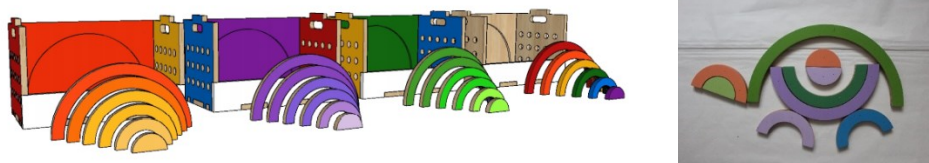


Figure 6. (a) Color Functions of OTTM ; (b) Example of rainbow stacks use



The merging of Part A and Part B into one like the picture below produces a new learning media to introduce children to geometric shapes. There are 6 pieces of shapes on each side which is equipped with the name of the shapes in English. OTTM can also be used as a medium for learning numbers and the sequence for early childhood. OTTM is equipped with 30 wooden dowels with a diameter of 25mm and a length of 5cm which reads the numbers from the numbers 1 - 30, where by using the side of part C, D, E, or F, children can be taught to sort the numbers.

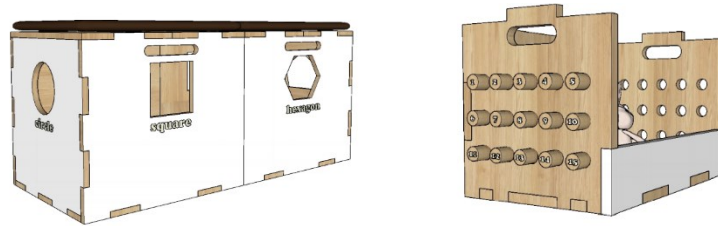


Figure 7. (a) Shape Functions of OTTM ; (b) Numbering Functions of OTTM

This modular furniture is called OTTM or stands for One, Two, Three, More?, where as the name implies, this furniture can be changed into many new configurations, according to the needs of the space and its users. OTTM has a length of 100cm, a width of 60cm, and a height of 150cm.

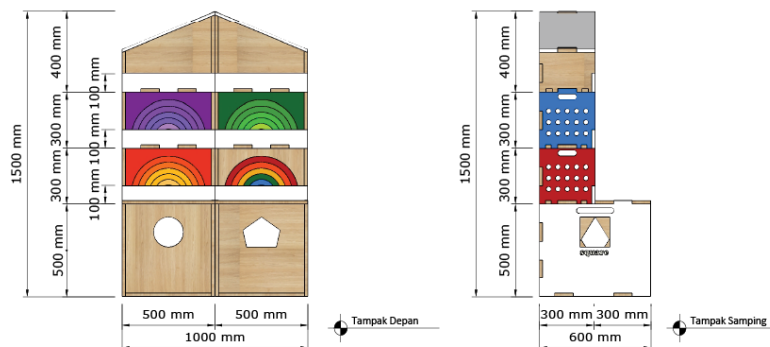


Figure 8. (a) OTTM Front Look ; (b) OTTM Side Look

OTTM is divided into eight main parts, namely, parts a, b, c, d, e, f, g, and h which are removable so that they can be easily configured into new shapes.

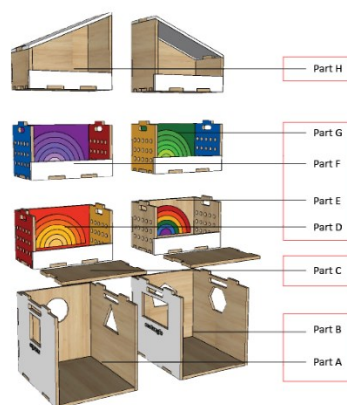


Figure 9. Division Part of OTTM

OTTM has 8 configurations with different functions, here are the eight configurations, the first one is called The Ginger Bread House and is inspired by the name Rumah Langit. This configuration can be used as open storage and seating for two in the front, measuring 30x50cm per seat (cushions are removable), and the second one is called The Red Queen. It has the same function as configuration one, but in this configuration, the seating is only for one with the size of 50x60cm in the middle.

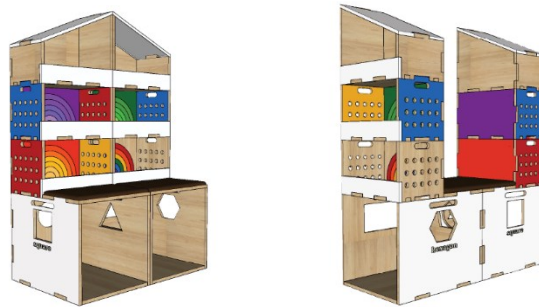


Figure 10. (a) OTTM's First Configuration ; (b) OTTM's Second Configuration

The third configuration is named The Jack and The Giant, and this configuration shows the flexibility of OTTM that can be separated into 2 separate pieces of furniture, which is one open storage, and one seating area measuring 50x60cm. The fourth configuration is called The Three Little Pig, and it is a development of configuration three, and here it can be seen how OTTM can be separated into 3 separate pieces of furniture, one open storage and 2 seating sizing 50x60cm per seat.

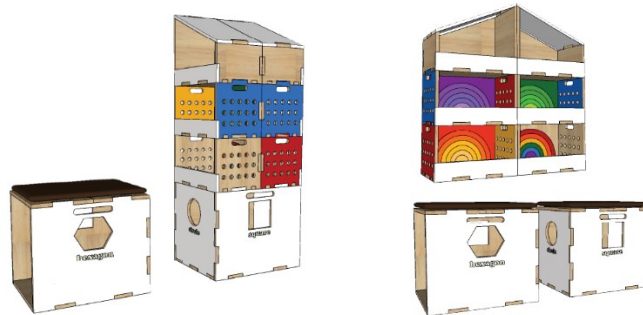


Figure 11. (a) OTTM's Third Configuration ; (b) OTTM's Fourth Configuration

The fifth configuration called The Grim's Brother, and in this configuration, OTTM can be function as a set of two children's chair and table, where the seat and table measurements are adjusted to the ergonomics of children aged 4-8 years. The sixth configuration named The Tea Party is a form of development of configuration five, where the function of the OTTM is as a set of one table and two chairs for children, and an open storage.

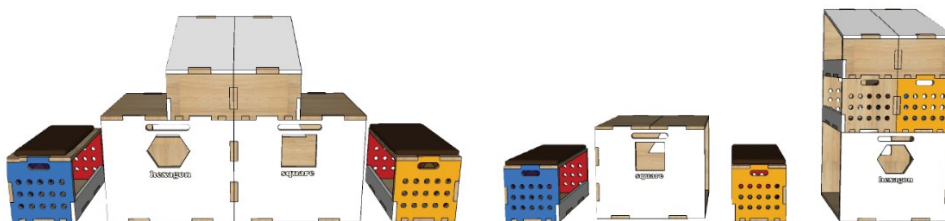


Figure 12. (a) OTTM's Fifth Configuration ; (b) OTTM's Sixth Configuration

The Seventh configuration is named The Cheshire Cat, and this is where the OTTM function as creativity development for Rumah Langit's children can be seen. In this configuration, the OTTM can be used as a supporting pillar for making macrame. By utilizing peg holes and 150cm long dowels, a hanging poles that can help macrame making process can be made. Lastly, the eighth configuration of OTTM is called The Far Far Away Castle and similar to configuration seven, this configuration serves as a tool for making macrame, but the difference is, configuration seven is intended for making macrame in a sitting position, whilst in this configuration, macrame making is done in a standing position.



*Figure 13. (a) OTTM's Seventh Configuration ; (b) OTTM's Eighth Configuration*

The design realization process begins with consultation with a carpenter, where at this stage the furniture gets a construction change, where previously there was no joint, now a dove-tail joint is added. This joint will act as a construction reinforcement, along with the help of screws. Furniture will be made from 18mm plywood and using a CNC Cutting tool to get a precise cutting. After that, the furniture enters the finishing stage, where the furniture will use water-based biovarnish paint that's safe for children.



*Figure 14. (a) OTTM after CNC Cutting Process; (b) OTTM after Finishing Process*

The furniture test was carried out at Rumah Langit at the same time as the macrame training, where through this training, we also wanted to see whether the OTTM function as a tool for making macrame was successful or not. Through this training process, it can be seen that the function of OTTM as a macrame helping tool has been proven successful, but there are several macrame knots which according to the children of Rumah Langit are

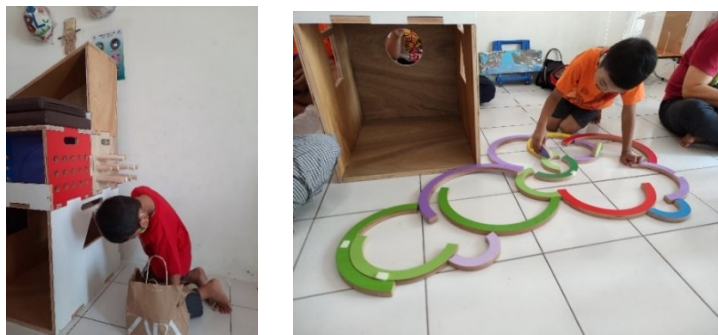


more comfortable to do on the floor than using OTTM hanging poles, one of which is the double hitch knot.



*Figure 15. Macrame Training at Rumah Langit with OTTM Seventh Configuration*

In addition to doing macrame training, the OTTM's educational function was also tested, where through the pictures below, it can be seen that Child A, one of the Rumah Langit children playing with the dowel and rainbow stack functions on the OTTM. This he does without any guidance or direction from an adult, and is entirely out of curiosity. These two photos prove that the Montessori concept used in the furniture has been successfully applied.



*Figure 16. (a) Child A with OTTM's Peg Holes; (b) Child A with OTTM's Rainbow Stack*

#### 1.4 Conclusion

The design of the modular furniture at Rumah Langit Rusunawa Urip Sumoharjo resulted in a modular furniture design called OTTM (One, Two, Three, More?) which is a Montessori-based piece of furniture with the aim of not only meeting the user's physical and spatial needs, but also meeting the educational and creative needs of children. This furniture is also designed to accommodate the needs of children in the development of macrame with the function of an assistant hanging pole. A few weeks after the placement of OTTM at Rumah Langit, the Rumah Langit's party shares about the developments and changes that have occurred since the presence of OTTM. Starting from visual changes, where the space becomes more organized with the help of the storage function in OTTM, to the impact of OTTM educationally on children. The form of open storage to store books in OTTM encourage children to take more initiative to read, and the rainbow stack and numbering dowel functions in OTTM still continues to attract children's attention, especially children of the golden age to continue to play and be creative with them. Through this discussion, it can be stated that OTTM as a modular furniture does not only act as a supporter of user activities, but also as a source of activity At the end of the research,



OTTM can be declared to have succeeded in meeting the needs users according to the author's initial expectations.

### 1.5 Discussion

Through this research, OTTM (One, Two, Three, More?) was created, with various functions available, we assure that this furniture can change the learning process at home for children to be much more easier and enjoyable, but we also realize that this furniture is still far from perfect, and there are still few aspects that need to be reconsidered. One of them is the main purpose of this furniture, which is the modular function. Although it serves many purposes, the process of changing one configuration to another will not be possible for a child to do on their own. Here children will need help from adults to change the configuration, and this in itself contradict the main concept of this design, Montessori, which wants children to be free to do activities without adult intervention.

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