

Transformable eco-friendly one-touch DIY children's furniture for children's growth and development

JEON Jin-Soo

Director, Stereotype, Kaiserin Design Group

KIM Hyun-Joo+

Full-time lecturer, Dept. of Fashion Merchandise Design, College of Arts, Dankook University

Han Sul-A

Director, R&D Center, Harriette Kim, Kaiserin Design Group

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+Corresponding author : Kim, Hyun Joo | seraphim772@naver.com

Summary

Under the paradigm of 'Eco', the core of sustainability management, this study aims to establish both domestic and international markets and secure competitiveness in the global markets through the development of children's furniture composed of recycled and unharmed materials.

Currently, in Europe and in the Western regions, the concepts of 'eco-friendly', 'children', and 'DIY' are well-placed in the daily lives of the people. On the other hand, compared to the domestic demand for eco-friendly children's furniture, the essential approach and the qualitative improvements about the subject are being slowly progressed. Particularly, the process of applying eco-friendly materials and finishing materials to the children's furnitures are mostly in a non-existent state.

Thus, in this study, simple application of basic eco-friendly

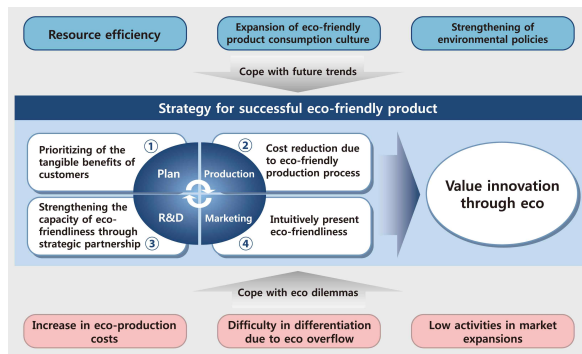
materials such as natural woods or imitation of overseas furniture designs were avoided to create transformable eco-friendly one-touch DIY children's furniture for children's growth and development through the application of eco-friendly processes of technology, design, and other stages of the development process.

In other words, under the big category of eco-friendly children's furniture, the furniture was developed through an environmentally-friendly process of universal design that is suitable for children of all ages, and thus, ultimately maximizing the economical effective value and reducing consumption of resources and environmental pollutions.



[Image 1] Overall instruction

[Diagram 1] Strategy for successful eco-friendly product



(Source: Strategy for successful eco-friendly product, Samsung Economic Research Institute, CEO Information, Issue No.863, 2012.9.29.)

1. Design backgrounds

Furniture design is gradually emerging as a single 'LIFE STYLE' rather than a manufacturing business, and consumer culture of 'eco' is gradually being spread. Globally, consumers who consider the eco-friendliness of products when making purchases are gradually increasing, and governments of each country are starting to exclude products that have negative effects on the environment and starting to strengthen the country's environmental policies. In addition, in a situation where the prices of resources are rising, eco-friendly products are alternatives of achieving economic growth and resource conservation at the same time.

Therefore, the concept of eco-friendly furniture must include the social and the user experiences caused by the demands in culture and lifestyle through the changes in modern society from the furniture of its original form, instead of simply referring to the concept of reusability and sustainability. In other words, rather than concentrating on external developments such as materials, conceptual approaches considering the thoughts of the era must be attempted.

Also, through concerns of children's low birthrate and nuclearization of families worldwide, children's furniture are also forming large markets worldwide according to widely accepted form of culture and high growth of angel businesses(business targeting children), affecting the overall industrial markets. Eventually, children-related products will most likely be the key figures in the future society, whereas the design is expected to play an important role of creating the added value of the products in the international community. Therefore, countries around the world(especially Europe) are currently having a profound interest in child-related product designs, and thus, our country is urgently in need of further research and studies on children's furniture, especially on eco-friendly kids furniture.

In order to develop, commercialize, and export

eco-friendly children's furniture design, design elements such as creativity, color presentation, and manufacturing stages should be processed efficiently, and not only the materials should be applied to the furnishings, but a design process in a level of a superordinate concept through the identification of the true meaning of 'eco-friendly' and 'children' and a recreation process through a systematic and objective analysis is essential. Thus, modern reinterpretations of using only simple materials to combining values and the perspectives of the modern era is necessary in developing eco-friendly children's furniture.

2. Design development plans

A typical eco-friendly raw material such as the birch wood has high labor cost and is unsuitable for mass production and export markets due to its distorted shape and its characteristic of being manufactured by hand.

Although the main materials used in our country's children's furniture are known to be eco-friendly, chemical-free materials, the finishes such as glue and paint, that are also eco-friendly, are rarely used. Particularly, addition of chemical oils(paint) and artificial, toxic substances such as plastic and synthetic materials are raising environmental problems, and thus, the development of an entire eco-friendly production process, from the material to the finishing stage, is desperately needed.

As a result, the design development, depending on the material, techniques, and the design, were planned according to the following criteria.

First, to raise awareness of eco-friendliness by applying eco-friendly materials for every component parts.

Second, focusing on the technical efficiency of assembling and transforming the furniture. Through the simplicity of the assembly process, the furniture was designed to transform in accordance to children's growth and development.

Third, if the process of assembling and disassembling was inconvenient in the previous DIY furniture, this product is created with one-touch joint system that allows anyone to assemble and disassemble the parts easily and quickly.

Fourth, each part can be added or purchased separately according to the preferred design.

Lastly, light, non-distorted materials were used in order to optimize into the global markets and exports, and the design were developed so that no other assembling or after-processing stage is needed.

3. Design development process

[Table 1] Eco-friendly children's furniture design development process

Research on furniture DB, foreign and domestic markets	Design, material selection according to the modern taste	Mass production	Domestic consumption, exports
Selection of applicable DB, establish added value, material and design development			Market activation (establishment of exporting webpage, participation in domestic and overseas exhibitions, and other sale strategies)
Research & application stage	Modern interpretation	Globalization	Economic, social, and cultural impact

**1 Market research, advisory from related authorities
Eco-friendly children's furniture DB, item planning**

- Business cooperation and consulting demands from industries/institutes related to Eco design, Green design
- Analysis of DB on color, structure, material, etc.
- Case study of each country's eco-friendly children's furniture products
- Global and domestic furniture trend and market research
- Color Palette based on market research and trend analysis
- Analysis on the body size and proportion according to the children's growth and development (based on the research from Korea Institute of Industrial Technology)

**2 Material selection and graphic development
(Universal design)**

- Visualization of images suitable to the target, composition of modernized color and pattern DB
- Material development with application of pattern DB
- Application and development of eco-friendly materials such as ABS and biodegradable corn

3 Design development (360° Design)

- Eco-friendly children's furniture design
- Sample development (prototype, mock-up)
- Main production (Domestic production, private production and outsourcing 1:1)

4 Certification of eco-friendliness, marketing and exporting activities

- Rise of reassurance through the use of eco-friendly materials (procedures for certification of eco-friendliness)

4. Design result

The following product offers the meaning of eco-friendly children's furniture through its technology, function, material, and design. The target of the work is limited to children from ages four to thirteen years old.

4.1. The design

① **Material:** Each pieces of the furniture were created with PLA and non-toxic ABS in order for the consumers to be able to choose the materials depending on each circumstances.

First, PLA(Polylactic acid) is a 100% organic polyester with outstanding antibacterial effect developed from biodegradable corn material(from corn starch to glucose by fermentation, lactic acid is produced by condensing of biodegradable resources).

The PLA resin is approved by Korean Food and Drugs Administration, the FDA of the United States, Europe, Canada, Japan, Germany, and other related governmental agencies as substances harmless to the environment and the human body, which also do not produce toxic substances such as dioxins that cause cancer. In addition, the PLA material is 100% organic-based plastic that is both safe and hygienic. General chemical products produce endocrine-disrupting and carcinogenic compounds when exposed to heat; however, the PLA does not produce such harmful substances.

Secondly, reduction of eye fatigue and insecurity were induced through the use of ABS that does not release harmful substances such as formaldehyde and volatile compounds, which is also safe from sick house syndromes, atopic dermatitis, and stimulation of the nervous tissues. In addition, due to the nature of the material resistant to water, a wide variety of products could be stored as a shoe cabinet, or as a kitchen or a bathroom storage.

② **Color:** 4 colors—White, Green, Pink, Black

③ **Size:** Each panel is 400, 300, 200mm in size, and they can be each connected to transform into different sizes and shapes through the use of 'connecting bridges'.

[Table 2] Product summarization chart

Image of targeted technologies-products and keyword for development	
Technology	 <p>Connecting bridge One-touch joint</p>
Design	 <p>Furniture that is transformable according to children's growth and development</p>
Material	 <p>Non-toxic ABS (Light Weight, Durability, Expedition Strength, Formaldehyde, zero)</p> <p>Polyester from biodegradable corn starch ('Nature Works PLA')</p>
Strengths	<ul style="list-style-type: none"> ■ Eco-friendly material, eco-friendly design ■ Transformable design according to the growth and development of children ■ Efficiency of assembly through one-touch joint <ul style="list-style-type: none"> ■ Self-assembly type furniture ■ No additional components or finishes necessary → <p style="text-align: center;">Efficiency of mass production</p> <p>→ Advancement into the global markets and exports</p>

4.2. Technology

① The technology that allows the users to easily assemble and disassemble the parts through the system of cross-matching the panels.

This design is a self-assembly furniture that is able to transform into new forms of furniture by connecting plates of panels to other panels.

The component parts consist of the panels, the connecting bridges, the main blocks, the panel inserts, and the rear plates. Panels along the edges are separated by multiple numbers of accommodated inserts, and the connecting bridges are placed along the main blocks that are developed in the form of a brick. The bridges are also placed along the front, the rear, the upper, or the lower part of the main block, where the connecting plates are fixed, and on the sides of the connecting plates that are formed to insert each of the connecting plates. In addition, the upper and the lower parts contain pin-supporting blocks that suspend elastics through springs.

- The main block above is formed in the shape of a square.
- The side of the main block above is formed in the shape of an arc, and the connecting polyphases of the plates above are formed at right angles.
- A screw hole is formed for the connection of the main block and the connecting plates above.
- The connection holes for connection pins on the upper and the lower part of the panels are developed more.
- An insert of a rear panel exists along the edges of a line that is formed by the rear panel that is placed at the back side of the furniture.
- At the front of the furniture consists a door installed at the axis of rotation.
- The door contains no.1 magnet as well as magnet no.2

② One-touch assembly technology

Like the cross-matching one-touch system above, one slight press of the button, and the furniture is assembled without the need of separate tools.

When disassembling the parts, the usage of the buttoner allows the easy disassembly of the furniture without the fear of breakage.

As shown in the following [Table 3], the brackets are connected to the joint body to transform into different shapes of +,I,T,R,L joints. Solid structural design is safe for heavy loads, and the button-assembly system allows anyone to assemble the furniture quickly and easily.

[Table 3] Component parts and weight

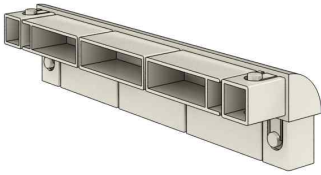
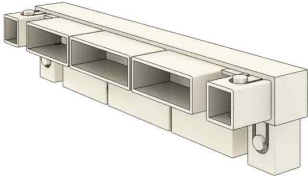


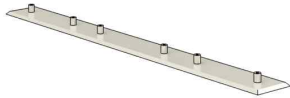


Components	Image	Material	Weight(g)
P202		ABS / PLA	326
P316		ABS / PLA	510
JOINT		PC	60
S-JOINT		ABS / PLA	42
S-CAP		ABS / PLA	16
R-JOINT		ABS / PLA	28
R-CAP		ABS / PLA	26

[Table 4] Connection brackets

Image

[Table 5] Instructions for joints and parts

Joint and individual parts	
Detailed description for each joint parts	<p>+ 조인트(WHITE)</p> <p>CREATIVEFURNITURE</p> <p><small>A finished cabinet from matched multi-colors ranging from blue and red color with harmony. Table colors, not primary colors from white to log the color. Based on a common white and color scheme, so please without combining with each other with each other in the same color group parenthesis.</small></p> <p>+ 조인트(WHITE) 상세도</p> <p><small>조인트 바닥에 브라켓을 연결하여 + T/R L 조인트 등의 다양한 형태로 변형합니다. 튼튼한 구조 설계로 무거운 하중에도 안정하고 사용할 수 있습니다. 배편을 눌러 조립하는 형태로 누구나 쉽고 빠르게 조립할수 있는 크레아 만의 독창적인 기술!</small></p> <p>CREA</p>
	<p>+ Joint</p>
<p>I-Joint</p>	
<p>T-Joint</p>	

R-Joint	
L-Joint	
Component 1 (Joint) Diagram	
Component 2 (Joint) Diagram	
Component 3 (Cap) Diagram	
Component 4 (Panel 2)	
Structure	

[Table 6] Assembly order

	Image
Assembly 1	
Assembly 2	
Assembly 3	
Assembly 4	
Assembly 5	
Assembly 6	
Assembly 7	
Assembly 8	

[Table 7] Final result

Upper part	 <p>Description) Through the cross-matching of the parts of the panels, the users are able to create or self-assemble the furniture suitable to their needs.</p>
Transforms	
Round	 <p>Description) When developing the corner of the furniture, round corners can prevent the children from injury.</p>

5. Conclusion

In this study, all sides of design, technology, and material were actively applied in developing eco-friendly children's furniture. Thus, under the big category of eco-friendly children's furniture, the purpose of the study was to develop an environmentally-friendly furniture with a universal design approach at children's eye level, and thus, ultimately maximize economic benefits by reducing consumption of resources and pollution of the environment. As a result, develop an eco-friendly furniture that is suitable to the foreign markets as well as the exporting markets, acting as a role model for the currently-withering domestic markets. Through this, one wishes the further development boom of the eco-friendly children's furniture, and hopes this study can be one of the best cases for the future directions of eco-friendly children's furniture.

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