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Implementing Human-Centric Design in Developing a Multifunctional Chair and Storage Solution for Children

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ABSTRACT

This research applies Human-Centric Design (HCD) principles to develop a multifunctional storage solution integrated with a chair, specifically designed for children. By considering the needs and preferences of both parents and young users, we combine ergonomic design elements with practical storage functionality. The resulting product not only organizes children's belongings for parents but also provides an enjoyable experience for kids. Our study contributes to a deeper understanding of how HCD can effectively create functional and appealing products for parents and child users.
Keyword: Human Centric Design, Multifunctional Children Product, Product Design

ABSTRAK

Penelitian ini menerapkan prinsip-prinsip *Human-Centric Design* (HCD) untuk mengembangkan solusi penyimpanan multifungsi yang terintegrasi dengan kursi, yang dirancang khusus untuk anak-anak. Dengan mempertimbangkan kebutuhan dan preferensi baik orang tua maupun pengguna muda, kami menggabungkan elemen desain ergonomis dengan fungsi penyimpanan yang praktis. Produk yang dihasilkan tidak hanya mengatur barang-barang anak untuk orang tua tetapi juga memberikan pengalaman yang menyenangkan bagi anak-anak. Studi kami berkontribusi pada pemahaman yang lebih mendalam tentang bagaimana HCD dapat secara efektif menciptakan produk yang fungsional dan menarik bagi orang tua dan pengguna anak-anak.
Kata Kunci: *Human Centric Design, Multifunctional Children Product, Product Design*

1. Introduction

Parents play a crucial role in the design process. Their insights and observations about their children's habits, play patterns, and storage needs are invaluable. By involving parents, designers can create a product that aligns with family dynamics. In today's world, the escalating number of children's toys has given rise to concerns among parents regarding clutter and disarray. Safety and Durability child-friendly furniture must meet stringent safety standards. Rounded edges, non-toxic materials, and stability are paramount. Parents seek items that can withstand the exuberance of playtime while ensuring their child's well-being. HCD ensures that the product is ergonomic, meaning it is easy to use and comfortable for both children and parents. Safety considerations are paramount, especially when designing for children. Rounded edges, non-toxic materials, and secure closures are essential. HCD prioritizes understanding the needs, behaviors, and desires of the end users. In the case of a children's storage product, this means paying close attention to what children require in terms of functionality, safety, and comfort [1]. Human-centered design (HCD) is an approach that grounds product development in information collected about the people and settings that will ultimately use those products. Our authentic lives have engendered a growing interest in life quality and the concept of well-being related to health [2]. They need for innovative solutions to address this issue has prompted a growing interest in designing furniture for children that not only adheres to safety standards and aesthetic considerations but also facilitates organization and tidiness. Child-friendly furniture is now expected to go beyond basic functionality and actively contribute to creating a conducive environment for learning and creativity [3].

These furniture items serve dual purposes. The child's interactions with the tangible information to times when an adult is available to provide help [4]. They are designed not only for comfortable seating but also to provide ample storage space. Examples include benches with built-in compartments, ottomans with hidden storage, or beds with drawers underneath. Recognizing the challenges posed by the increasing prevalence of scattered toys, this research focuses on enhancing child-friendly furniture design with a specific emphasis on multifunctional pieces that seamlessly integrate storage and seating solutions. Such interventions not only address immediate housing needs but also contribute to the broader agenda of sustainable urban development, emphasizing the importance of human-centric and context-sensitive design principles [5]. Embracing human-centric design principles becomes imperative in this pursuit, as prioritizing the needs and preferences of young users ensures the creation of furniture that not only serves utilitarian purposes but also elevates the overall experience for children.

2. Method

Human Centric Design is more accurately described as a framework rather than a strict method. It emphasizes understanding and empathizing with users to create solutions that meet their needs effectively. Human Centric Design involves iterative processes, such as user research, ideation, prototyping, and testing. It encourages collaboration and user involvement throughout the design journey. The study involved a total of 30 mothers with children in the age range of 2 to 7 years, each with diverse backgrounds. Data collection took place over one week through interviews. In a framework of urban resilience challenge, it is important to guarantee thermally comfortable conditions to dwellers in outdoors but also to preserve cultural heritage masterpieces for tourism and local socio-cultural identity [6]. The research subject for improvement is a multifunctional storage space for children's belongings with an integrated chair. Data analysis techniques include identifying user needs, pain points, and creating journey maps.

2.1. Human Centric Design

Human-centered design (HCD) is an approach to problem-solving that prioritizes the needs, behaviors, and preferences of the people who will use the product. It involves understanding the human perspective in all steps of the design process and continually involving users in the design and development of a product. For example, it was a craftsman who suggested making a fully enclosed rexine cover, considering that in India, dust could easily make the prototype dirty during travel. Even though, as a designer, I should have considered the practicalities and local conditions, it is worth mentioning that the collaboration with the local craftsman in a participatory approach was useful not only for the creative outcome but also as an opportunity for the designer to learn from their local experiences [7]. This approach aims to create solutions that are more effective and desirable for the people who will use them. HCD is often used in fields such as user experience, instructional design, and healthcare to ensure that the product meets the users' needs and is easy and enjoyable to use. Here are the key steps in Human-Centered Design[9]:

1. Understand user needs: Identify and understand the needs, preferences, and behaviors of the users through methods like interviews, observations, and surveys.

2. Define user goals: Based on the understanding of user needs, define the user's goals and objectives to set the design criteria.

3. Create design concepts: Generate design concepts that address the user's needs and goals, ensuring they are innovative and user-friendly.

4. Iterative prototyping: Test and refine design concepts based on user feedback, identifying and addressing any issues or concerns.

5. Develop and refine: After iterative prototyping, develop and refine the product or service based on user feedback, incorporating new features, improving user interface, or making other adjustments.

6. Evaluate and validate: Assess the effectiveness and usability of the product or service to ensure it meets the user's needs and goals.

2.2. Customer Journey Map

A customer journey map is a tool used to visualize the sequence of events and touchpoints that a customer experiences when interacting with a company's products or services. It provides a comprehensive understanding of the customer's interactions, emotions, and motivations throughout their entire journey. Customer journey mapping has become an innovative and effective technique to increase companies' knowledge of their customers, allowing for the improvement of the customer experience at an end-to-end level [10].

2.3. Interview

An interview is a conversation between two or more people where one person asks questions and the other person answers them. Interviews can be conducted for various purposes, such as to gather information, to assess a person's qualifications for a job, or to understand a person's experiences and perspectives. Interviews can be structured or unstructured, and can be conducted in person, over the phone, or online. The information gathered from interviews can be used for research, journalism, or decision-making [11].

2.4. Ideation

Ideation is the process of generating new ideas, and it is an essential aspect of creativity. Ideation can be based on modifying existing ideas or creating entirely new ideas from randomized elements. There are many ideation techniques including SCAMPER which is This is a universal ideation technique that enables the creation of new ideas based on existing products through a set of basic operations (Substitute, Combine, Adapt, Modify/Magnify, Put to Another Use, Eliminate, Rearrange/Reverse), brainstorming a well-known technique that involves group members freely exploring multiple solutions and generating many ideas. Brainstorming can be done without any specific prompts or constraints, allowing participants to rely on their existing game ideas or use familiar techniques without additional cognitive effort and many more [12].

3. Result and Discussion

3.1. Identifying User Needs and Pain Points

Customer Journey Maps (CJMs) visually depict the entire lifecycle of a customer’s interaction with a product or service. These maps capture touchpoints, emotions, needs, and pain points from initial awareness to post-purchase interactions. The goal is twofold to understand how the customer experience evolves over time and to create a shared understanding within the organization. By empathizing with users and mapping their journey, businesses can enhance products, improve services, and build stronger connections. In identifying user needs and obstacles or pain points, users can use techniques with visual tools, namely customer journey map (CJM) which is a visual representation of the customer experience when interacting with products or services from beginning to end. This journey map helps businesses to understand customer feelings, needs, and interactions throughout the entire life cycle of a product or service [13]. The goal of a customer journey map is to understand how the customer experience evolves over time and demonstrate it in a form that everyone in the organization can understand.

3.2. Conducting Interviews

After identifying the questions in the empathy map, the team conducted interviews with questions from various factors including ergonomics, functionality, aesthetics, use environment, quality, price, and effectiveness.

3.3. Creating User Profile and Personas

Through the interviews conducted, the researcher can generate a user profile that includes name, user demographic information, profile, goals, personal characteristics, hobbies, needs, brands related to the user, and so on. Meanwhile, a user persona is a specific representation of various types of individuals targeted by the system or service being developed. In this study, user personas are divided based on user profile groups such as brace users, retainer users, and those who have a hobby of traveling. These are a few examples of user profiles and user personas that have been generated based on interviews.

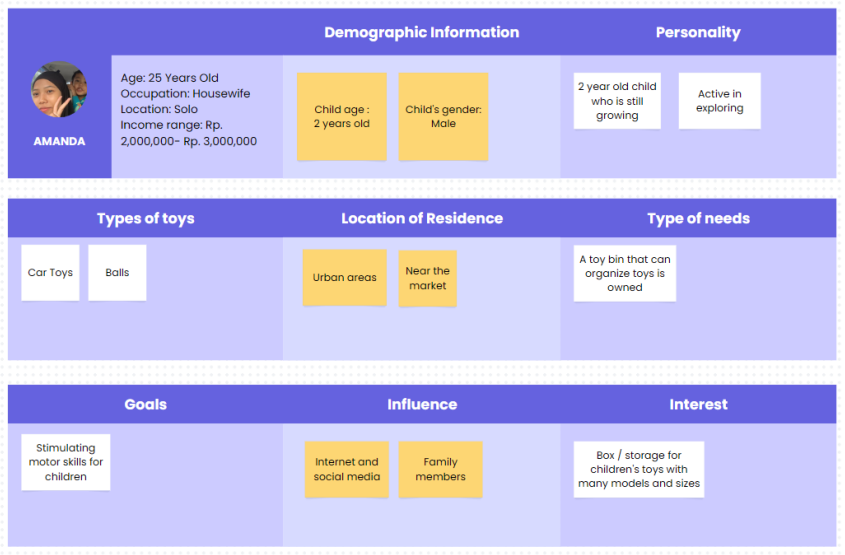


Figure 1. User Profile

Figure 2. User Persona

3.4. Creating User Journey Maps and Task Analyses

	AWARENES	CONSIDERATION	DECISION	DELIVERY & USE	LOYALTY
CUSTOMER ACTIVITIES	Hear information from friends, see offline & online advertisements, and read newspapers	Compare and evaluate alternative solutions	Place an order/purchase goods	Receive or pick up according to orders.	Make reorders and share experiences.
CUSTOMER GOALS	there is no goal at this stage	find the main solution to the problem of storing toys	Order goods and find goods easily	Receive/Take orders easily and when needed.	Provide a good customer experience and share feelings and provide feedback.
TOUCH POINT	Ads on social media such as Facebook, Instagram and YouTube.	Product demo videos that demonstrate product features and benefits.	Special offers or discounts for first purchases.	Product usage instructions are clear and easy to understand.	Loyalty or reward programs for customers who make repeat purchases.
EXPERIENCE	interested and curious	Requires effort but enthusiastic (interested)	Excited / excited	Requires effort and pleasure when receiving orders	I have to share this.

Figure 3. Customer Journey Map

3.5. Defining Design Requirements Based on User Insights

Through the process that has been carried out in the previous stages, researchers can compile the needs felt by the user and user needs, in this form into a model of provisions that must be present in the product, to be able to justify products that suit the needs of users. These are the design requirements of the product.

Table 1. Design Requirements

No	Requirement
1	The time it takes to open and close the product cover
2	The number of parts present on the product
3	This product is equipped with security features
4	The thickness of the foam on the seat mat
5	Ergonomically designed seating pad surface area
6	The height of the ergonomically designed seat board
7	The number of features provided by the product
8	This product is available in a wide selection of colors
9	Product Size according to needs
10	Product Material is safe for use by children
11	Duration of use of the product.
12	The diameter of the wheels attached to the product.

3.6. Generating Ideas Through Brainstorming and Ideation Techniques

Ideation is the comprehensive process of generating ideas. It encompasses all necessary steps to identify, develop, and test new ideas. Ideation can involve a variety of techniques and methods to stimulate creativity and innovation. The primary focus of ideation is to create novel ideas that can be applied in specific contexts, such as product development, business process improvement, or problem-solving.

One method of ideation is SCAMPER. The SCAMPER method is a creative approach that aids in generating fresh ideas by revisiting an existing concept or object. SCAMPER is an acronym for Substitute, Combine, Adapt, Modify, put to another use, Eliminate, and Reverse [12].

3.7. Concept Sketching and Storyboarding

Based on ideation process, the ideas that have been generated are documented with concept sketching and storyboarding. Concept Sketching is the main stage in the design process within the scope of product design, industrial design, architecture, and others. Concept Sketching is the process of making sketches quickly to explore and convey ideas and storyboarding is the process of creating sequential images or illustrations to plan or visually illustrate a story. This process is commonly used in the production of films, video, animation, and some other forms of visual media.

The following is the process of determining the initial design with concept sketching.

1. Concept A

Concept A	Function											
	Product is easy to use	Product is safe to use	Product is comfortable	Product is multifunction	Product is aesthetic	Product is easy to repair	Product is easy to move around	Product has durable materials	Product works according to its function	Product is made from safe materials	Product is durable	Product saves space
Option 1	Lid design with clip lock	Equipped with backrest	Foam seat cushion	Product has 1 function	No color otpion	Product has less than 15 parts	Integrated wheel design	HDPE material	Storage volume is less than 125.000 cm3	Recycleable material	Less than 5 years usage span	Dimensions are 40 x 40 x 45 cm
Option 2	Buckle lock design	Equipped with wheellocks	Styrofoam seat cushion	Produk has many function	2 color option	Product has more than 15 parts	Long arm wheel design	PPE material	Storage volume is more than 125.000 cm3	Hard to recycle material	More than 5 years usage span	Dimensions are 55 x 60 x 50 cm
Option 3	Sliding lock design	Equipped with backrest and wheellocks	Dacron seat cushiom		More than 2 color option		Extended wheel design	PVC material		Non recycle material		
Option 4			Gel seat cushion					Polycarbonate material				
Option 5												

Figure 4. Concept A

2. Concept B

Concept B	Function											
	Product is easy to use	Product is safe to use	Product is comfortable	Product is multifunction	Product is aesthetic	Product is easy to repair	Product is easy to move around	Product has durable materials	Product works according to its function	Product is made from safe materials	Product is durable	Product saves space
Option 1	Lid design with clip lock	Equipped with backrest	Foam seat cushion	Product has 1 function	No color otpion	Product has less than 15 parts	Integrated wheel design	HDPE material	Storage volume is less than 125.000 cm3	Recycleable material	Less than 5 years usage span	Dimensions are 40 x 40 x 45 cm
Option 2	Buckle lock design	Equipped with wheellocks	Styrofoam seat cushion	Produk has many function	2 color option	Product has more than 15 parts	Long arm wheel design	PPE material	Storage volume is more than 125.000 cm3	Hard to recycle material	More than 5 years usage span	Dimensions are 55 x 60 x 50 cm
Option 3	Sliding lock design	Equipped with backrest and wheellocks	Dacron seat cushiom		More than 2 color option		Extended wheel design	PVC material		Non recycle material		
Option 4			Gel seat cushion					Polycarbonate material				
Option 5												

Figure 5. Concept B

3. Concept C

Concept C	Function											
	Product is easy to use	Product is safe to use	Product is comfortable	Product is multifunction	Product is aesthetic	Product is easy to repair	Product is easy to move around	Product has durable materials	Product works according to its function	Product is made from safe materials	Product is durable	Product saves space
Option 1	Lid design with clip lock	Equipped with backrest	Foam seat cushion	Product has 1 function	No color otpion	Product has less than 15 parts	Integrated wheel design	HDPE material	Storage volume is less than 125.000 cm3	Recycleable material	Less than 5 years usage span	Dimensions are 40 x 40 x 45 cm
Option 2	Buckle lock design	Equipped with wheellocks	Styrofoam seat cushion	Produk has many function	2 color option	Product has more than 15 parts	Long arm wheel design	PPE material	Storage volume is more than 125.000 cm3	Hard to recycle material	More than 5 years usage span	Dimensions are 55 x 60 x 50 cm
Option 3	Sliding lock design	Equipped with backrest and wheellocks	Dacron seat cushiom		More than 2 color option		Extended wheel design	PVC material		Non recycle material		
Option 4			Gel seat cushion					Polycarbonate material				
Option 5												

Figure 6. Concept C

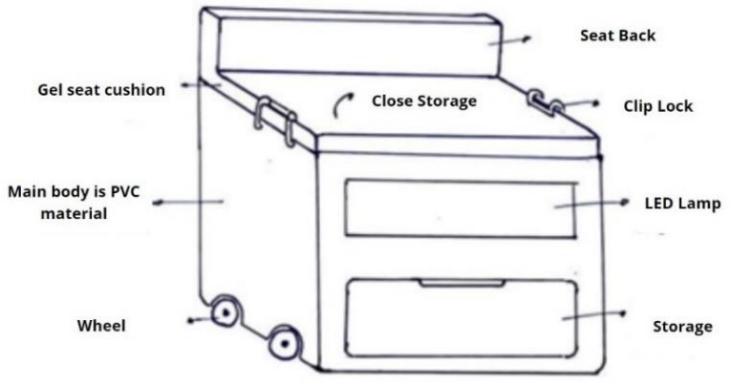
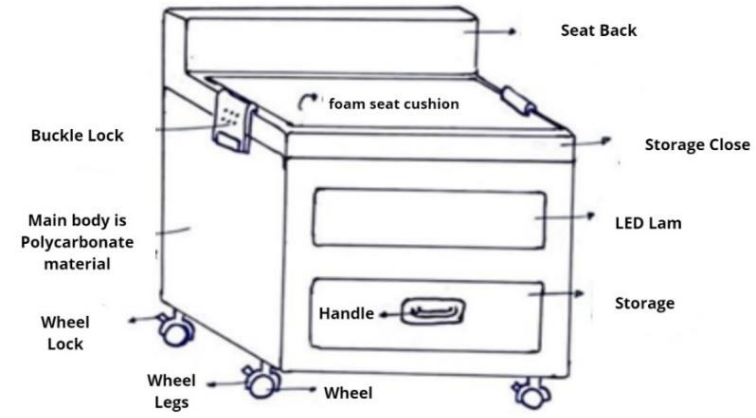
4. Concept D

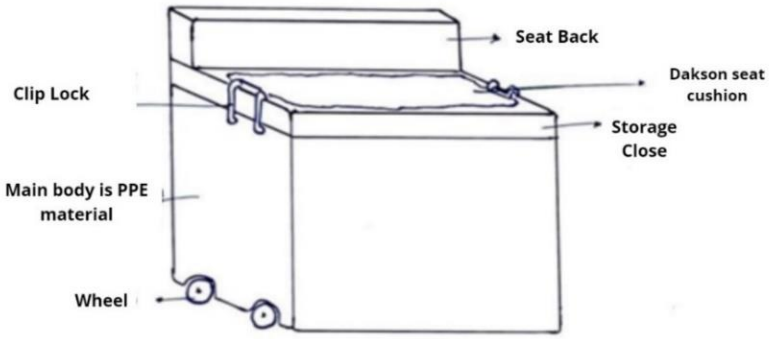
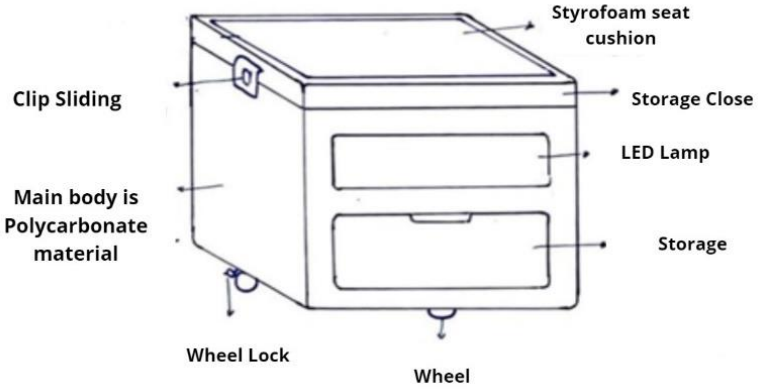
Concept D	Function											
	Product is easy to use	Product is safe to use	Product is comfortable	Product is multifunction	Product is aesthectic	Product is easy to repair	Product is easy to move around	Product has durable materials	Product works according to its function	Product is made from safe materials	Product is durable	Product saves space
Option 1	Lid design with clip lock	Equipped with backrest	Foam seat cushion	Product has 1 function	No color otpion	Product has less than 15 parts	Integrated wheel design	HDPE material	Storage volume is less than 125.000 cm3	Recycleable material	Less than 5 years usage span	Dimensions are 40 x 40 x 45 cm
Option 2	Buckle lock design	Equipped with wheellocks	Styrofoam seat cushion	Produk has many function	2 color option	Product has more than 15 parts	Long arm wheel design	PPE material	Storage volume is more than 125.000 cm3	Hard to recycle material	More than 5 years usage span	Dimensions are 55 x 60 x 50 cm
Option 3	Sliding lock design	Equipped with backrest and wheellocks	Dacron seat cushiom		More than 2 color option		Extended wheel design	PVC material		Non recycle material		
Option 4			Gel seat cushion					Polycarbonate material				
Option 5												

Figure 7. Concept D

After the process of determining the concept for the product, then a prototype 0 model is made using concept sketches, there are sketches for each concept design.

Table 2. Concept Sketch

Concept	Sketch
A	
B	

Concept	Sketch
C	
D	

3.8. Evaluating and Selecting Design Concepts

At the stage of evaluation and selection of concepts, it is carried out by involving 5 user representatives in voting to provide an assessment of the concepts that have been produced. The following are the results of the concept assessment.

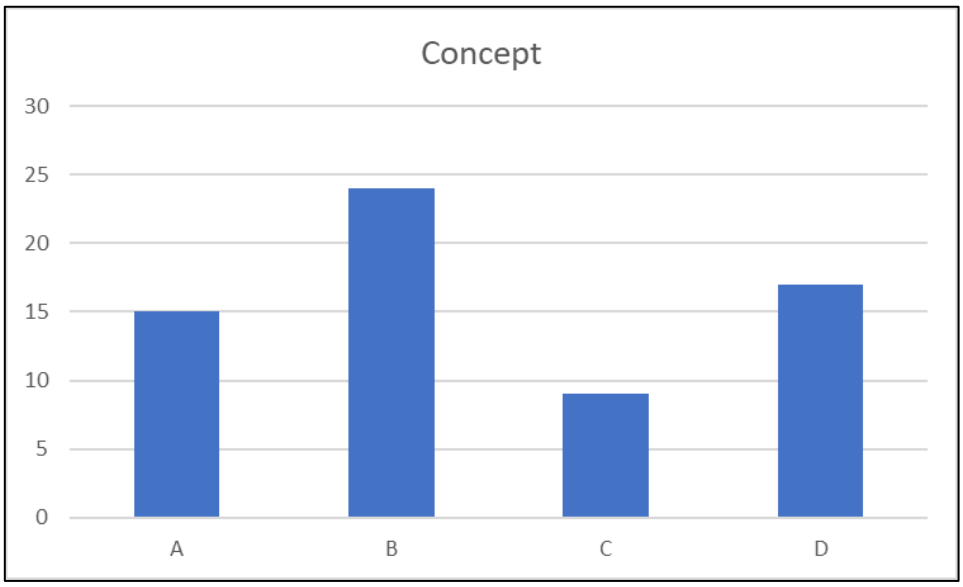


Figure 8. Concept Scores

In the voting, users gave scores based on several aspects such as ergonomics, aesthetics, ease of use, features and durability of the product. Based on the vote and the developer's considerations, here is the 3D design of the selected concept, concept B in Figure 9.

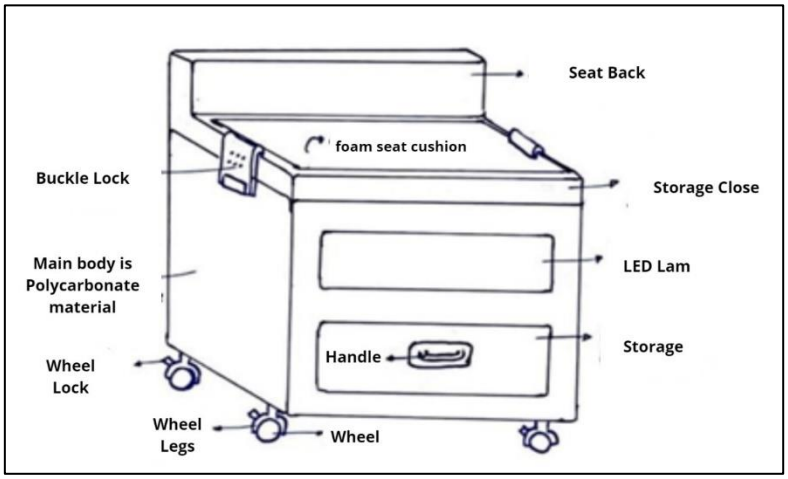


Figure 9. Selected Concept B

3.9. Prototyping

A prototype is an approximate example of a product (or system) or its components in some form designed to meet a specific purpose. This general definition differs significantly from the generally accepted concept of physical prototyping. It includes all types of prototypes used in the product development process, including objects such as mathematical models, pencil sketches, foam models, and of course functional physical methods or exact product replicas [14].

Following the selection of a concept in the previous stage, the team has built a prototype based on the chosen design concept, Concept B, which was the result of an ideation process involving users. Concept B has the following specifications and features:

Based on the detailed specifications of the selected Concept B, the following is a prototype of Concept B.

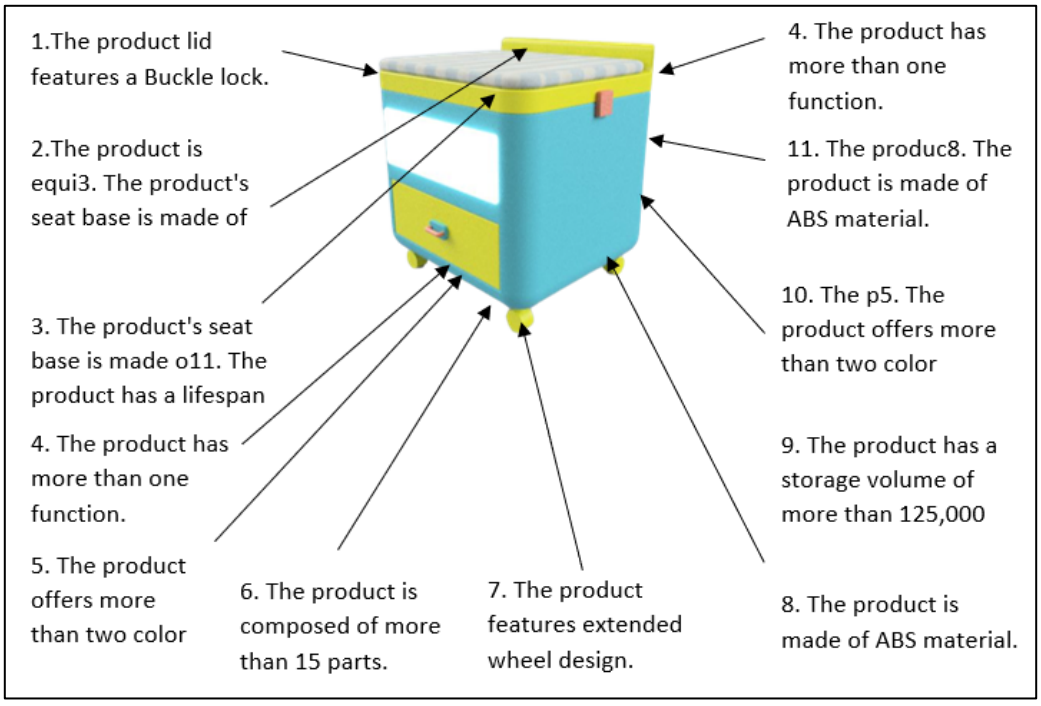


Figure 10. Prototype

4. Conclusion and Recommendation

4.1. Conclusion

The human-centered design (HCD) approach prioritizes understanding and addressing user needs throughout the design process. One practical application is in the development of multifunctional children's storage products. By actively involving children and parents as end-users, the design can better meet their

ergonomic needs while ensuring the product is safe, comfortable, and supports intended activities. Rather than solely focusing on maximizing storage space, an HCD perspective highlights how the product itself can stimulate child development and enable play and learning, underscoring the innovative use of the product beyond just storage.

Close collaboration with consumers allows for seamlessly integrating both aesthetic appeal and practical functionality. The resulting design becomes an effective organizational solution that also facilitates children's motor skills, play, and educational activities. This user-oriented approach ensures the product effectively organizes items and supports user's activities [15]. Implementing HCD principles through iterative methods like prototyping and user testing cycles builds trust with consumers, allowing progress to be demonstrated and goals exceeded [16].

This user-centric methodology underscores the innovative potential of designing products that go beyond just storage to holistically enhance lives. The human-centered approach translates consumer insights into impactful solutions that can stimulate development while still meeting practical needs. While this conclusion focuses on children's products, the HCD principles could be applied to design for monitoring the activities and needs of other demographics as well [17].

CJMs provide a shared understanding within organizations, helping teams align with evolving customer experiences. Through this approach, user needs become the top priority and are highly considered. One application of this method is in the development of a multifunctional children's storage product. By paying attention to the needs and preferences of children, and involving parents in the process, the resulting design is ergonomic, safe, and comfortable. Close collaboration with consumers produces aesthetic and practical design elements. Thus, the product can be a solution that meets family needs, especially for children and parents, in organizing items and supporting children's play activities.

4.2. Recommendations

Customer Journey Maps (CJMs) visually depict the entire lifecycle of a customer's interaction with a product or service. These maps capture touchpoints, emotions, needs, and pain points from initial awareness to post-purchase interactions. Ergonomics and Design, precisely the relationship between Human Centered Design (HCD) approach and Design for Innovation methods, represent a concrete growth strategy. European Union suggests design as a key discipline and activity to bring new ideas to the market, transforming them into user-friendly and appealing products or services [18]. By empathizing with users and mapping their journey, businesses can enhance products, improve services, and build stronger connections. The goal of a customer journey map is to understand how the customer experience evolves over time and demonstrate it in a form that everyone in the organization can comprehend. In this way, the product can better compete in the market. In addition, user feedback can also help identify areas that need improvement. This could include product features, design, or other aspects that may not fully meet user needs. By understanding and responding to this feedback, Kids Space Seat will not only become a better solution for user needs but can also continue to evolve and adapt to changes in their needs and preferences. Therefore, this approach will ensure that Kids Space Seat remains an innovative and user-oriented product, which can better meet user needs.

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