

STUDIES OF GENERAL TOYS DESIGN DEVELOPMENT FOR REHABILITATION THERAPY

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Abstract: Stress, injuries, and emotions are typical components that determine the outcome of the day in everyday people's lives. This study delivers the pre-process development stage of toy products for rehabilitation usage based on actual design requirements to meet the effectiveness, properties, and prototype usage results before introducing the new design to the public. The focus of this research is to produce rehabilitation toys based on therapeutic requirements for hand manipulation since that is the key method of stress release. In addition, applying this type of technique can help decrease general stress as well as provide less energy utilization to the hands, fingers, and joints. Some demand is to improve, strengthen and rehabilitate hands. Secondly, to increase enjoyment of therapeutic aid based on the therapeutic values of the product itself.

Keywords: rehabilitation, toys therapy, therapeutic value, design development.

Introduction

During the toddler period, play is highly distinctive. Young toddlers use their mobility to engage in independent play that allows them to move freely in their environment. Manipulation of items is a typical component of play. Toddlers engage in pretend play and start to copy others (Dauch et al., 2018). They know what common objects are used for and tend to employ those objects in play. They may engage in pretend use of the objects on their own, with others, and in combination with other things such as home items and toys. In later phases of toddlerhood, the same skills are applied but in a more advanced and developed form. Toddlers become more social and interested in what their classmates are doing, which results in play alongside other youngsters.

The method to rehabilitate the injury is called rehabilitation process. The patients have to follow the procedure of the approach until they recover. An important feature of rehabilitation treatment is maximum restoration of compromised functions and skills (Huang et al., 2021). Rehabilitation process is the design of treatment to aid recovery from accident, disease, or illness to the condition as normal as feasible (Fabio et al., 2021). The objective of rehabilitation is to recover part or the full patient's physical, sensory and mental capacities that were lost due

to injury, illness, or disease (Palanivel & Burrough, 2021). Rehabilitation also can help an individual be as independent as possible in everyday tasks and enjoy significant life responsibilities (Mohd et al., 2021). Rehabilitation method includes helping patients to compensate for deficiencies that cannot be rectified medically. Opposable thumb is a trait of an uncommon architecture of the hand that will increase the flexibility of the hand (Ekin et al., 2018). Thumb opposition, comprising flexion, abducting, and medial rotation so that the surface of the pulp can summon another digit.

There are several critical aspects before producing the new design. The factor contains the data about the tools, machines, tasks, processes and human factors/ergonomics. Consistency design is a major problem in the product development cycle (de et al., 2020). The other purpose in the development needs to be cost-effective design to be affordable for low-income patients. It needs a basic shape of the design, an affordable and accessible production technique. Moreover, a small and portable design suited for home usage should be satisfied by the proposed design (Molaei et al., 2022). These aspects can ensure the service, dependability, lower the life cycle cost of the product, and improve comfort during maintenance. Rehabilitation toys also can be used for educational objectives. They provide an interactive setting, in which children acquire social, cognitive, and emotional talents (de et al., 2021).

Material and method

The information acquired through observation, interview session and data collecting from a surveillance visit to a rehabilitation facility was used to create this study. Ideas were screened, concepts generated and selected, and then the design was refined through several stages of development. The flowchart of the development stage as shown below.

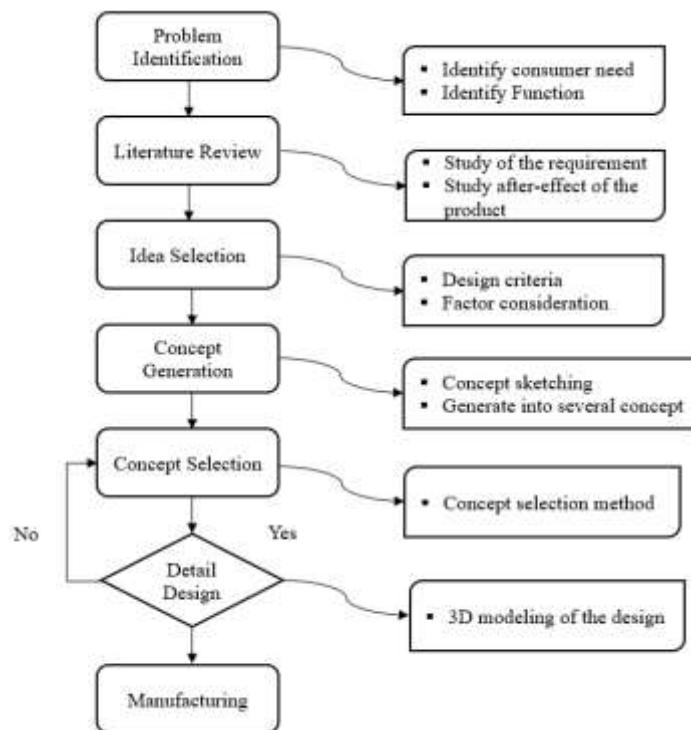


Figure 1: Process flow for product development stage.

Initial Toys Design Consideration Checklist

Table 1: Toys design checklist

No.	Toys Design Checklist	
	Design aspect	Assumption Application
1	Durability	Is the toy machine washable? Will it continue to function well after several months of heavy use? How much will it cost to repair missing or broken parts or pieces, and how long will it take?
2	Creativity	Toys that provide an infinite number of possibilities can encourage users to be more creative.
3	Sensing	Users' attention can be captured by toys that are brightly colored and have sounds or lights, or have distinct textures or pieces that move. These toys are typically simple to use, stimulate users to play in new ways, and allow them to play for an extended period of time without feeling frustrated.
4	Solving skills	Toys that allow users to use their hands and fingers in various ways aid in the development of the tiny muscles and coordination required for tasks such as writing, computing, drawing, coin counting, and other related activities.
5	Appearance	The toy's color, shape, size, and popularity when making your decision. Users will be able to play with the toy on a regular basis and for an extended period of time if it is designed well.
6	Therapeutic Values	Enhance the user creativity and constructional abilities as well as manipulation of thinking and hand skills development of the user.

Table 1 shows the result of design consideration factor need to be comply when developing the product itself. Result above is generate based on observation of patient behavior and oral interview with physiotherapist with several patients in group of 5 people at rehabilitation facility during visit. The continuation of this studies goes further with conceptual design generation.

Conceptual Design Generation

When it comes to concept generation, it refers to the process of coming up with ideas that will be put into the product in order to answer the problem stated (de et al., 2020). To develop ideas, several activities such as brainstorming ideas based on the information received, discussion, and consultation were carried out. Immediately following the invention of the product concept based on the design consideration checklist and the concept would be generated and evaluated in perspective of the design requirement factor consumer preference as well (Levesque et al., 2022). Following that, several concepts were chosen to be designed in order to convey the concept in a visual approach (de et al., 2019). The process of designing a product based on a concept that has been developed and validated previously is known as embodiment design.

SOLIDWORKS 2021, a 3D CAD software platform, was used to create the design. Upon completion of the design, the concept can be expressed visually, which allows for a more accurate visual representation of the final product that was inspired by the concept (Jin et al., 2020). In this stage, several thoughts were developed in a visual format before moving on to the next stage. The concepts were reviewed through the use of graphical images of the ideas,

and if one of the designs of the concepts meets the satisfaction of the experts, the concept is selected. The conceptual design is represented in the following image.

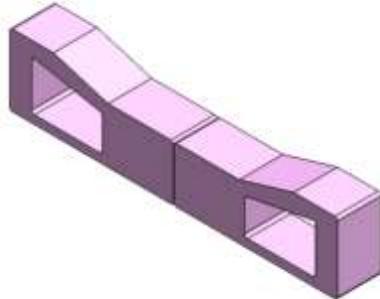


Figure 2: Conceptual design a

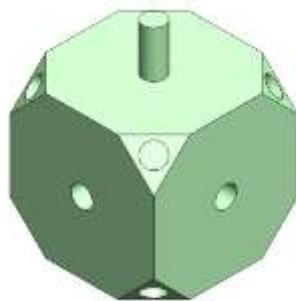


Figure 3: Conceptual design b

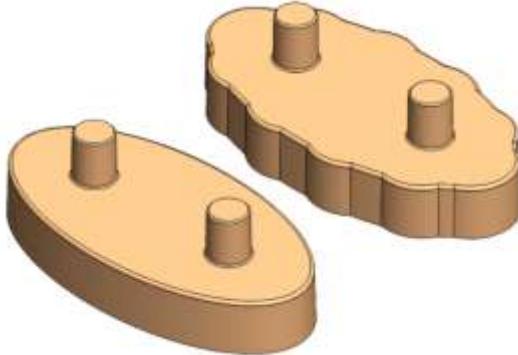


Figure 4: Conceptual design c

Design Selection and Evaluation

When selecting a design concept, the relative strengths and weaknesses of each design concept are compared in terms of additional concept investigation, functional optimization, testing, and other considerations, among other things (Kara & Cagiltay, 2020). Concept generating, screening, and scoring were carried out initially, followed by concept selection, in order to acquire the most relevant and best concept idea possible. The Pugh Method is the most often used concept selection method, and it uses the relative scores of +, -, or a coloured dot as the criterion. For this project, the scoring value system of +1, 0 and -1 was used to progress forward in the decision-making process. It is necessary to set the datum value to "0" in order to get a fair result output since "0" represents a single feature of a factor being compared.

Table 2: Pugh Matrix Method Result

No.	Criteria	Datum	Conceptual Design		
			Design a	Design b	Design c
1	User friendly	0	-1	-1	+1
2	Durability	0	+1	0	0
3	Creativity enchantment	0	0	+1	+1
4	Appearance	0	+1	0	0
5	Low cost	0	0	+1	+1
6	Operation efficiency	0	-1	+1	+1
7	Part maintenance	0	-1	+1	+1
8	Service life	0	0	0	+1
Total Point		-1	+3	+6	
Rank		3	2	1	
Decision (Proceed)		No	No	Yes	

From Table 2, it demonstrates that the highest weighted notion is conceptual design c. The matrix score was +6 comparing conceptual design b carrying only +3 with dice block toys design at this point, the best criterion stated both concepts selected and selection make given the high ranking weighted among the other concept. Simplicity of development is in which the capability of the product in meet the customer requirement and cause patient felt pleasure while using the toys as well as achieved various design criteria. The toys need to be basic as possible because the operation capability and production procedures still required a lot of cost and effort (Verdine et al., n.d.).

Results

Finding

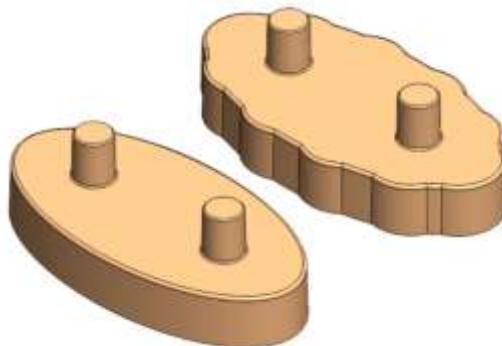


Figure 5: Selected final product

The figure above illustrates the selected product for development. The design criteria are expected to be back with the design parameter approach and design consideration criteria that were gathered on data collection previously. This design includes two different textures and will be produced with different colors, which will be used to train users to recognize color when playing around with this toy. Other than that, this product can be used to train users in constructional design skills and as a teaching material. The design's strength lies in its user-friendly design, low manufacturing costs, and operational efficiency. On the other hand, compared to design b, the effectiveness of operating toys is lower than design c. In terms of

creativity enchantment criteria, design c is more practical than design a. In conclusion, design c filled most of the design criteria compared with design a and design b.

Limitations and Future Study Recommendation

Several limitations need to be taken into consideration when generalizing the results of this study. The use of a convenience sample of participants resulted in limited usage of the material, social communication, and number of participants itself. The study's sample was also comprised of mostly younger participants. The results of this study can only be generalized by typically developing rehabilitation toys. Future studies could be conducted in a variety of age groups to determine if the design, material, shape, and function of the toys can improve the effectiveness of rehabilitation therapy among patients. Further design, simulation, and application analysis can be conducted as a continuation of this paper.

Conclusion

The development and design of toys for rehabilitation has offered great consequences, and the aims of this project have been successfully achieved. In order to fulfil the aim of this project, various objectives have been specified, and they include designing and building a toy that is able to show therapeutic benefit. In reality, the advantage of the product is that it helps manufacture something that can assist in boosting the user's creative and constructional abilities. Not only that, the toys are believed to offer patients a way to boost engagement, cooperation, and social skills.

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