



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN IMPROVEMENT OF CORNER CHAIR FOR
CEREBRAL PALSY KID**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Product Design) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing and Mechanical Engineering Technology (Product Design) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Projek ini bertujuan untuk merekabentuk konsep kerusi sudut baru untuk kanak-kanak Cerebral Palsy (CP) dan membezakan reka bentuk baru ini dengan kerusi komersial yang terdapat di pasaran dan kerusi di sudut sebelumnya. Alasan mengapa konsep baru direka kerana tidak semua kerusi di sudut komersil adalah mudah alih dan mudah alih. Mudah alih hanya untuk memudahkan pengguna membawa kerusi dari satu ke lokasi ke lokasi lain seperti dari Unit Pemulihan ke rumah mereka. Projek ini telah bekerjasama dengan Unit Pemulihan Cara Kerja, Hospital Melaka. Ahli terapi memberi maklumbalas mengenai kerusi sebelumnya. Maklum balas memberi dianalisis dan menghasilkan konsep baru kerusi di sudut. Harga kerusi yang sedia ada di pasaran terlalu mahal dan ibu bapa tempatan kebanyakannya tidak mampu memiliki kerusi di sudut untuk meneruskan aktiviti pemulihan di rumah. Dengan mempunyai konsep reka bentuk baru, kos fabrikasi dikurangkan. Kos anggaran adalah lebih murah berbanding kerusi yang sedia ada di pasaran. Objektif projek ini dicadangkan satu reka bentuk kerusi yang boleh memenuhi keperluan ahli terapi dan cerebral palsy. Prototaip berfungsi telah dibangunkan dan direka dengan menggunakan kaedah dan bahan yang sesuai. Dan menjalani ujian pada pengguna sasaran dan maklum balas produk baru telah berkumpul. Seperti yang dinyatakan sebelum ini, penulis telah mengumpulkan beberapa maklum balas dan merangka konsep baru kerusi. Proses reka bentuk konsep baru dilakukan dengan menghasilkan beberapa jenis konsep seperti konsep Lego, konsep lipatan rata, konsep tali pinggang ditarik balik dan konsep Origami dan reka bentuk konsep Origami telah dipilih. Reka bentuk yang dipilih telah menjalani proses pemodelan dengan menggunakan perisian reka bentuk berkaitan kejuruteraan. Pemodelan telah digunakan dan membuktikan konsep reka bentuk. Selepas pemodelan telah dilakukan, kerusi telah direka dengan menggunakan bahan yang sesuai. Kerusi tersebut telah menjalani ujian dan mengumpulkan beberapa maklumbalas mengenai produk baru. Ahli terapi telah memberi maklumbalas positif bahawa kerusi tersebut telah melebihi jangkaan mereka. Dan ahli terapi juga memberikan beberapa cadangan mengenai peningkatan ke arah reka bentuk kerusi penjuru. Akhir sekali, projek ini telah berjaya direka dan memenuhi keperluan dari ibu bapa dan penjaga CP.

ABSTRACT

This project is aimed to design a new concept of corner chair for Cerebral Palsy (CP) kids and distinguish this new design with the commercial corner chair which available in the market and the previous corner chair. The reason why was the new concept is designed because not all the commercial corner chair is portable and mobile. Portability is just to ease the user to bring the corner chair from one to location to another location just like from Rehabilitation Unit to their home. This project has collaborated with Unit Pemulihan Cara Kerja, Hospital Melaka. The occupational therapist gave their feedbacks about the previous corner chair. The feedbacks gave was analyzed and generated new concepts of corner chair. The price of the current corner chair which available in the market is too expensive and local parent mostly not afford to own a corner chair in order to continue the rehabilitation activity at home. By having the new design concept, the fabrication cost is reduced. The estimated cost is way cheaper compared to the current corner chair which are available in the market. The objectives of this project were proposed a new design of corner chair that can meet the needs from the therapist and cerebral palsy parent. Functional prototype has been developed and fabricated by using suitable method and material. And having a field test on the target user and feedbacks of the new product has gathered. As mentioned earlier, the author has gathered several feedbacks and designed a new concept of the corner chair. New design concepts' process was done by generated several types of concept such as Lego concept, Flat folding concept, Retractable belt concept and Origami concept and the Origami concept design has selected. The selected design has been undergone solid modelling process by using engineering related design software. Solid modelling was used and proved the design concept. After solid modelling has been done, the corner chair has been fabricated using suitable material. The fabricated corner chair has been undergone the field test and collected several feedbacks about the new product. The therapist has given positive feedbacks that the corner chair has exceed their expectation. And the therapist also gave some suggestion on improvement towards the design of the corner chair. Lastly, this project has successfully fabricated and fulfill the requirements from the caretaker and CP parent.

DEDICATION

To my beloved, irreplaceable family.

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LIST OF ABBREVIATIONS

CP Cerebral Palsy

CHAPTER 1

INTRODUCTION

1.1 Introduction

This project started with the background study and followed by the problem statement that will look onto the product. Then it is followed by an objective which is to identify the aim of this product. And lastly is followed by the scope of the project which describes the most suitable method to use in order to achieve the objective.

1.2 Background

According to Bethoux et al., (2017) corner chair is a device that offers exterior support for kids with inadequate postural control of the head, neck, and trunk and who are inclined to fall sideways or back if they overstretch. It's important for daily functions such as breathing, speaking and eating. This positioning control also keeps kid's shoulders 'channeled' so they can focus on their daily activities at home or at therapy center.

There are variety types and brands of corner chair design which available in the market made by various manufacturer. All of them are intended for rehabilitation process for kid patient who lack in postural development. This project developed a new concept of corner chair that is to satisfy the needs of CP kids as per listed by the occupational therapist and parent. This is the innovation project with the collaboration between UTeM and Unit Pemulihan Cara Kerja, Hospital Melaka. This project is also a continuation from previous project where it has run a survey on the potential corner chair user, fabricate a portable model

and was subjected to a field test and received a thorough feedback from the therapist professionals from Unit Pemulihan Cara Kerja Hospital Melaka. This project is aimed to design a new concept of corner chair that has good portability, light, and cheap.

The design of current corner chair has been improved to be mobile, easy to set up and way cheaper from the available corner chair in the market. By the improvement made, it is easier the parent to extend the rehabilitation routine at home. (Galil et al. 2001) said that, home therapy by professionals and parent is a recommended option. This is because once parent is involving in home therapy, would make them become more active as they feel more comfort at their own home. Moreover, home therapy provides the opportunity for these patient and parent interactions to occur within the context of everyday task performance. Besides, home therapy also helps to prevent the declination of activity of daily living.

1.3 Problem Statement

Due to the corner chair which available in the market, new design concept is developed in order to distinguish the commercial corner chair with this new design concept. The reason why was the new concept is designed because not all the commercial corner chair is portable and mobile. Portability is just to ease the user to bring the corner chair from one to location to another location just like from Rehabilitation Unit to their home. One more thing, the commercial corner chair is way too expensive and this would be the problem to the parent who got financial problem. By having the new design concept, the fabrication cost is reduced. Suitable design and material selection also contributed to low fabrication cost.

1.4 Objectives

The objectives of this project are:

1. To propose a new design concept that can meet the needs from therapist and cerebral parent.
2. To develop and fabricate a functional prototype using affordable method and materials.
3. To conduct a field test on the targeted user and gather their feedbacks on the new product.

1.5 Scope

This project is about designing new concept of corner chair. This project is done with the collaboration with Rehabilitation Centre at Hospital Melaka. The collaboration involves getting the feedbacks on the commercial corner chair and previous corner chair by the previous author and make it as the reference in designing new design concept. After designing the new concept of corner chair, it will undergo a solid modelling process using engineering related software, Solidwork. Solid modelling is used in order to design the product and motion study is used in order to prove the concept in real model. Once the solid modelling process is done, the design is then fabricated using the plywood and High-Density Upholstery Foam Seat Cushion Replacement Firm Pad. The fabricated corner chair is then brought to the Rehabilitation Centre, Hospital Melaka in order to have a field test. This project takes about 12 months to complete.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter introduces the background of the product and obtaining the prior works related to the project. There are several researches found which was discussed in this chapter that are related to this project. Journals, books, newspaper, and etc. are the source used to provide enough information regarding this chapter.

2.2 Definition of Cerebral Palsy (CP)

According to Bethoux et al., (2017) Cerebral Palsy (CP) is a group of syndromes of the development of motion and postures that contributed to non-progressive troubles that happen in developing fetal or infant brain. Bilateral spastic CP (BSCP) is a sub-sort of spastic CP in which limbs on two sides of the body are involved. Even though some of BSCP person are able to sit and stand or even walking with or without support aids, this kind of person might have the difficulties to control their body while standing.

CP is a disorder that caused from a non-progressive lesion or damage to the brain development. CP is categorized according to the predominant type of movement disorder as spastic, dyskinetic, or ataxic.



Figure 2.1: Definition of Cerebral Palsy (CP)

(Source: < <http://tsukinegradprogram.blogspot.my>)

2.3 Corner Chair

According to Bethoux et al., (2017) corner chair offers exterior support for kids with inadequate postural control of the head, neck, and trunk and who are inclined to fall sideways or back if they overstretch. It's important for daily functions such as breathing, speaking and eating. This positioning control also keeps kid's shoulders 'channeled' so they can focus on their daily activities at home or school.

Moreover, corner chair is more towards aiding the CP kids to perform their daily activity under minimum care of adults. However, corner chair is not a view symbol of illness and loss of ability but the one of the equipment that been used for treatment process. The corner chair may come in different shapes and sizes to enhance the comfort and convenience for users. Some corner chair only has back rest and a seat. This kind of corner chair might have the supportive feature like adjustable back rest and such a comfort back rest. Different features can be different in price. Some corner chair might have a back rest, a seat and a head support.

2.4 Case Study



Figure 2.2: The design of previous corner chair from previous student

Based on the previous corner chair project by the previous student, the design is just suitable for mild CP kids which aged below than 2 years old. This project was actually being done with the collaboration with Rehabilitation Unit at Hospital Melaka. This design is not suitable for kids aged 3 years old and above. Plus, the design of the corner chair is a bit square in dimension which not fully solved the problem of CP kids. In order to improve kids minimal care from adults, the design of the corner chair should be improved.

Below are the feedbacks gathered from the therapist at the Rehabilitation Unit of Hospital Melaka and from parent:

1. The back rest of the corner chair is in plane shape.
 - Plane back rest is not suitable for CP kids in order to keep their posture straight. The back rest of the corner chair is compulsory to be in corner shape. Corner shape would help the kids to maintain their posture straight.

2. The tray design of the corner chair is not suitable. This feature would cause difficulties to adults while placing the kids into the corner chair.
3. The design of leg separator of this corner chair is too small and not suitable for rehabilitation process. They would experience leg cross if there got unsuitable leg separator.
4. This corner chair does not have a head support.
 - Head support is important. According to hospital's staff, if the CP kids are able to control their head movement, they are directly able to keep their posture straight. This would help the CP kids are easier to perform their activity.
5. This corner chair is does not have enough padding even it is fabricated with a layer of soft material, but it is said that the corner chair does not comfort the kids.

By the way, previous author has conducted several surveys in questionnaire form. The respondents of the survey are from rehabilitation unit from the hospital and CP kids' parent. Below are the findings about what kind of characteristics on the existing corner chair that are not satisfactory and others.

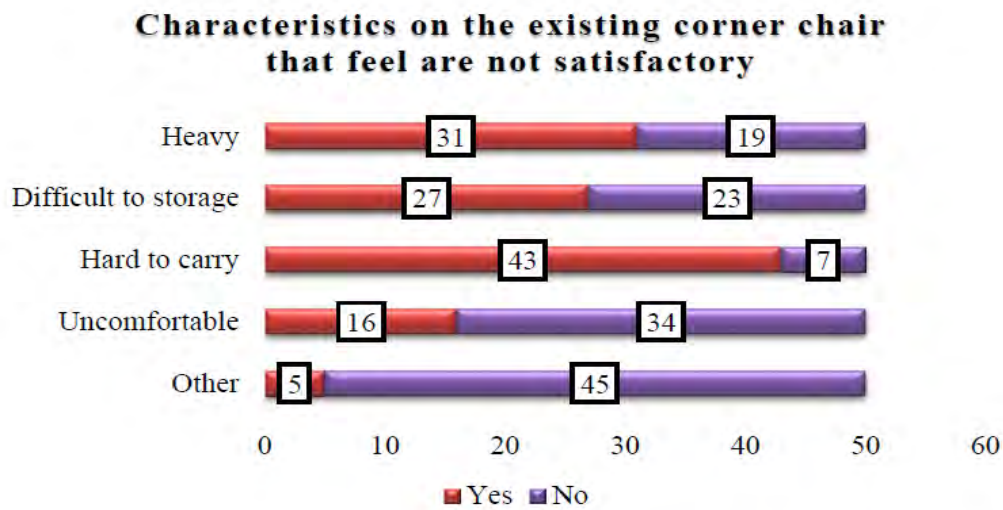


Figure 2.3: Percentage of current corner chair that available in market

Figure above shows the characteristic of the existing corner chair that available in market. Based on the survey conducted by the previous student, the main characteristic that shows the higher percentage of dissatisfactory is the current corner chair does not have mobile feature. After that, respondent also concern about the weight of the corner chair. The chair shows that 31% of the respondent says that it is heavy to be bring. The other limitation of the current corner chair is, it is difficult to store. Difficulties while storing the corner chair might cause by the design of the corner chair, whether it is foldable or not. Plus, there 16% of the respondent says that CP kids might uncomfortable while sitting on the current corner chair. Some respondent also mention that existing corner chair are limitation to size and age of cerebral palsy patient. They also want the new design of corner chair include the multi-function to help them more comfortable to sitting, eating and learning process.