

**ERGONOMICS DESIGN OF WALKING CHAIR FOR DISABLE
CHILDREN IN CLASSROOM**

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**ERGONOMICS DESIGN OF WALKING CHAIR FOR DISABLE
CHILDREN IN CLASSROOM**

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**A report submitted
In fulfillment of the requirements for the degree of
Bachelor of Mechanical Engineering with Honours**

Faculty of Mechanical Engineering

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2019

DECLARATION

I declare that this project report entitled “Ergonomics Design of Walking Chair for Disable Children in Classroom” is the result of my own work except as cited in the references

Signature : _____

Name : _____

Date : _____

APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering with Honours.

Signature : _____

Name : _____

Date : _____

DEDICATION

To my beloved father and family

ABSTRACT

The purpose of this research project is to design and perform structural and ergonomics analysis on the walking device for the children with physical disabilities. In accomplishing this study, the literature review was implemented and there are few types of method that have been conducted such as internet research, concept design, concept selection, detail design and software analysis. For the first stage, all of the information or research data for this study have been gathered as the reference. Next, the further study is continued based on the information collected from the observation and interview at Pusat Pemulihan Dalam Komuniti (PDK). The information and data must be related to the objective of the research project. The research is carried on by studying the existing conceptual design of the walking device. The purpose of study the existing concept design is to find the solution based on customer requirement. The ideas of new conceptual design were generated based on the observation and survey at PDK. Moreover, the next stage is analysis of the design. For this project, there are two types of analysis which are Finite Element Analysis and RULA Analysis. Both of this analysis can be performed by using the CATIA analysis software. The selection of material and the load acting on the parts are the main things to consider in order to calculate the factor of safety. RULA analysis is used to investigate the position of body when using the walking device. This analysis will determine either the device is safe to use or not. For this project there are two mannequin used which are man and woman. The result obtained from existing design of standing shows the final score 3 in standing and sitting position. Regarding to the result, the design concept design was created for the improvement. After improvement have been make, the final score for standing, sitting and pushing position is 2 so, the conceptual design was accepted. The study was concluded by finding the future research limitation and identifies the current limitation of the product design.

ABSTRAK

Tujuan utama projek penyelidikan ini dijalankan adalah untuk merekabentuk dan melaksanakan analisis struktur dan ergonomik pada 'Alat Bantuan Berjalan' untuk kanak-kanak yang cacat fizikal. Dalam melaksanakan kajian ini, pelbagai kaedah telah dilaksanakan dan terdapat beberapa jenis kaedah yang telah dijalankan seperti penyelidikan internet, reka bentuk konsep, pemilihan konsep, reka bentuk terperinci dan analisis perisian. Untuk peringkat pertama, semua maklumat atau data penyelidikan untuk kajian ini telah dikumpulkan sebagai rujukan. Seterusnya, kajian lanjut diteruskan berdasarkan maklumat yang dikumpulkan dari pemerhatian dan temuduga di Pusat Pemulihan Dalam Komuniti (PDK). Maklumat dan data mestilah berkaitan dengan objektif projek penyelidikan. Penyelidikan ini dijalankan dengan kajian reka bentuk pada bahagian alat untuk berjalan. Seterusnya, idea reka bentuk konsep direka dengan memenuhi konsep reka bentuk kejuruteraan. Selain itu, kaedah seterusnya adalah dengan melakukan analisa ke atas produk berkenaan. Untuk projek ini, terdapat dua jenis analisa yang merupakan Tekanan Analisa dan Analisa RULA. Kedua-dua analisa ini boleh dilakukan dengan menggunakan perisian CATIA. Pemilihan bahan dan beban yang bertindak pada bahagian-bahagian produk adalah perkara utama yang perlu dipertimbangkan untuk mengira faktor keselamatan. Analisa RULA digunakan untuk menyasat kedudukan badan apabila menggunakan alat untuk berjalan. Analisa ini akan menentukan sama ada alat ini selamat digunakan atau tidak. Dengan semua penyelidikan, peningkatan struktur baru yang dihasilkan memenuhi semua aspek dan alat untuk selamat untuk digunakan.

Reka bentuk produk yang telah dicadangan telah diuji dan boleh diteruskan berdasarkan keputusan daripada hasil analisa struktur dan ergonomik. Keputusan hasil ujian analisa ergonomik terhadap alat untuk berjalan yang terdahulu, ialah 3. Berdasarkan keputusan tersebut terdapat banyak kekurangan kepada alat untuk berjalan dan perlukan perubahan Hasilnya, setelah melakukan beberapa perubahan, akhirnya, keputusan ujian analisa ergonomik telah berkurang daripada 3 menjadi 2 Jadi, reka bentuk yang baru selamat untuk digunakan Akhir sekali, kajian ini dijalankan bagi mengenalpasti had semasa reka bentuk produk dan mencari batasan penyelidikan masa hadapan.

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LIST OF ABBREVIATION

WHO	World Health Organization
PWMD	Person with Mental Disabilities
CP	Cerebral Palsy
GMFCS	Gross Motor Function Classification System
PDK	Pusat Pemulihan Dalam Komuniti
QFD	Quality Functional Deployment
HOQ	House of Quality
CAD	Computer aided design
FEA	Finite element analysis
CATIA	Computer-Aided Three Dimensional Interactive Applications

CHAPTER 1

INTRODUCTION

1.1 Introduction

The Final Year Project or better known as 'Projek Sarjana Muda' (PSM) is referred as an academic research which related with the Mechanical Engineering course. This project is a part of major requirement for Degree level. This project covered certain scope which is has been learned such as mathematical engineering, design engineering and also related with the safety and sustainability. This chapter explaining about the background of the project which is covered the importance fundamental, objectives, scope, problem statement and a summary of the project. All of the information about the research project will be explained in this chapter.

For this PSM, the title of the research project is Ergonomics Design of Walking Chair for Disable Children in Classroom. A Person with Disabilities or known as OKU is also part of the community in Malaysia. There are various definitions for OKU. OKU is defined as a person who is incapable of self-determination of part of his or her own needs or is unable to live fully in society due to a lack of both physical and mental and requires assistance from others to continue their life (Ariffin, 2006). OKU is also a person who is obstructed by its movement function which requires specially designed facilities such as buildings, tools and equipment as well as outsourcing of areas to overcome their movement barriers. Regarding to Jabatan Kebajikan Masyarakat, there are many categories of disabilities registered in Malaysia such as Physical

Impairments, Spinal Cord Disability, Brain Disability, Vision Disability, Hearing Disability, Cognitive or Learning Disability, Psychological Disability Invisible Disability.

1.2 Project Background

This special children's school level is the same as other normal children starting with Pre-School, Primary School and Secondary School. The children start pre-schooling through the Pre-School Program at Special Education school when they are six years old and have fourteen years of age. They must be certified by medical practitioners as special children and can take care without the help of others and upon completion of pre-school, special education children may enter primary school according to the academic stream (Zainuddin, 2007).

After graduating from the primary school, this special child can enter secondary school and the requirement that need to fulfil is children aged from 13 to 19 years old and certified by a medical practitioner and can take care without the help of other. According to the definition given by the Department of Social Welfare of Malaysia (2008), OKU or Special Education children is a person who is unable to determine for themselves in acquiring the full or part of the ordinary needs of an individual or unable to live fully in society due to their weakness, whether it has occurred since birth whether it's happening since birth or later. Correspondingly to statistics from the Department of Social Welfare up to 2007, there are 220,250 disabled persons who have been registered with this department. Of the total registered, 20,039 people belong to the less category visual aids, 31,715 people with hearing impairment, 73,559 persons with physical disabilities, 85,812 persons with temporary disability education category 9,125 persons in disability category.

Nowadays, there are many successes of this group in education as the normal student. Those successes have opened the way for these groups to pursue to higher education level. However, the facilities for the disabled are very important to enable them to be in a friendly environment. The classroom environment should be appropriate to enable disabled people to move freely without assistance. The environment of the school with disabilities to be provided should meet the guidelines set by the Standards & Industrial Research Institute of Malaysia (SIRIM) and the Ministry of Housing and Local Government. This research project was carried out to identify barriers faced by students with disabilities in an institute of education in Malaysia. The project was focused on the disabled student who has physical difficulties to move freely in the classroom.

In this project, the research will definitely focused on the children with Cerebral Palsy. Cerebral Palsy (CP) is basically caused by brain damaged which is brain development in abnormal stage that transpire a child's brain which is still developing, before birth, during birth, or immediately after birth (MacLennan, 1999). The study of research project will identify the concept design that is multifunctional for the children and moderately an affordable yet economically walking device.

The main purpose of this project is to create a physical design of workstation and other facilities that included the design analysis of ergonomics. For this application of designed, it is specialized to set up areas of the classroom based on the needs of the students and classroom space and also to create environments that increase engagement and prevent challenging behaviours. By applying the design ergonomics analysis for this project, it will improve the design facilities of workspaces and environments to minimize risk of injury or harm.

1.3 Objective

This project embarks on the following activities:

1. To design an assistive walking chair in the classroom that is suitable for student who has physical disabilities.
2. To perform an ergonomics analysis, stress analysis and safety for the users.

1.4 Problem Statement

Special education for children with disability not only need to be specified based on co-curriculum and teachers with specialized skills in related fields, but this special children also need a conducive learning environment appropriate to their level of ability. Lack of provision of facilities for disabled persons or special education at school and institute higher education level has been causing these people to not live a comfortable and perfect life like other citizens or students (Derek G. Shendell, 2004).

This situation causes disabled people to experience difficulties and difficulties in carrying out activities and learning. Furthermore, it is worrying and diligent in continuing to study at the highest level as it is thought that in institutions of higher learning also not concerned in providing facilities for them in continuing their ongoing learning on campus. In fact, some of the institutions that reject the application of OKUs with the most frequently used reason are that there is no basic facility for disabled people to continue their routine life. There are also students who have to move to other institutions of higher learning.

Nowadays, the level of awareness among the management towards providing OKU friendly access and facilities is considered at the lower state. There are many other weaknesses that still exist in almost every institutions of learning whether public or private in Malaysia with respect to the provision of access and facilities for disabled students.

Therefore, this study should be conducted to study the learning facilities to meet the needs of the disabled.

1.5 Scope of the Project

The outlined scopes for this project are:

1. Study and understand the problem that always occurs among the OKU students.
2. Study the classroom environment that is fulfils the safety requirement for OKU.
3. Study a suitable facilities used for the student with physical disabilities.
4. Design and analysis the selected design by using Computer Aided Design (CAD) software and analytical software

1.6 Organization of the Report

This report explains that design of chair for disable people in classroom consider as an important element for student to increase the focus and concentration in study environment. The first chapter in this report introduces the background and problem statement of this study. The second chapter provides the literature review of this study. The information data for literature review comes from the journal and other sources from internet.

Chapter 3 explains the methodology for this study. The methods used for this study are interview and observation at PDK to identify the customer requirements. All of the information data was explained in detail in this chapter. Chapter 4 and chapter 5 show the conceptual design and details design that have been proposed for this study respectively. The characteristic and functionality for each of the concept design was explained in this chapter. This chapter also highlights the final concept design functionality of the walking chair.

In chapter 6, there are two analysis carried out for this study. First is structural analysis and the next one is ergonomics analysis. The value for safety factor was identified to ensure the conceptual design is safe to use. Lastly, Chapter 7 discusses the conclusion and recommendation future work.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss more about the issues that related to the disable children (OKU). Disability awareness in school is kind of necessary nowadays as a result of to educate students to become a far better member of community within the future (McPherson, 2011). The definition of facilities and the disable children (OKU) has been explained more clearly so that the study can be done accurately. The categories and types of disabilities are also identified so that the need for provision of comfortable facilities is appropriate to this group. The convenient facilities and free-to-use environment are the things that need to be emphasized because of these disable students need to be independent to perform daily activities just like normal students. Therefore, accessibility facilities for creating a free-bound environment should take into account the needs of these disabled people.

In this chapter some previous studies have been outlined which have to do with the subject of this study. The information about these study can be archived through the trusted website, journal article and library books.

2.2 Definition of Disable People (OKU)

Generally, Disabled people (OKU) is someone that need an extraordinary advantage to encourage them to survive independently into a society. People with disabilities according to the World Health Organization (WHO) and the Organization of United Nations, defined as someone who does not want for themselves to amass fully or partially of the standard wants of a personal needs and can't board the community entirely due to a scarcity of either physical or mentally. Approximately, people with disabilities is about 15 percent of the world's population which is exactly more than one billion people around the world regarding to attitudinal, organizational and physical barriers, have restricted access to even-handed participation in family, community, and political life (World Health Organization,2015).

People with disabilities are often divided into classes. First, people with physical disability can be described as someone who loss or disfunction one among limbs like foot or hand and will conjointly cowl disfunction of the complete body (Verhaaen P, 1981). Vision disabilities regarding to the literature review from (Hewett, 1974) which has brightened up the definition of vision blindness used in the United States in 1961 stated that someone who has experienced maximum vision deficiency when the vision is 20/200 or less. Visual destruction does not fully happen when a person is able to see between 20/200 and 20/70 based on the Snellen chart for testing one's level of vision (Sacks, 1998). In addition, someone will be category as blind person if he has a field or border of sight (visual field) limited to 20 degrees or less determined solely by doctor or an eye specialist (Sacks,1998).