

ERGONOMIC SCHOOL BAG FOR KIDS

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Ergonomic School Bag For Kids

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APPROVAL

This thesis submitted to the senate of UTeM and has been accepted as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design). The members of the supervisory committee are as follow:

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ABSTRACT

School children are more at risk than ever before of developing back pain because they carry overweight school bags. Their bag is called upon to perform a variety of actions. It can be everything from an over-sized lunch box to a portable locker. Consequently, an ergonomically designed backpack is created to solve this problem. The main objective of this project is to do some survey, study a suitable design and generate its product concept. The project covers the suitable design of school bag for 7-9 years old kids, the importance of an ergonomic school bag and also a survey about school bag nowadays. The methodology chapter is divided into two categories which are Projek Sarjana Muda 1 and Projek Sarjana Muda 2. These two categories have same steps but the conceptual design of the product is different. The concept of Projek Sarjana Muda 1 which is backpack is revised and as a result, the better concept, trolley bag is developed. First and foremost, survey through questionnaires is done. Then, the design concept is determined. Some observations are done and the existing design of the concept is studied. After that, some designs are created. The best design of trolley school bag is selected through selection matrix. This bag is added some features, such as padded shoulder strap waistband strap, air cushion system, compartment for water bottle, food and school stationery and reflector for safety purposes. As a conclusion, this study would help students due to overload carriage to school. It is recommended for further studies on this topic to prevent back pain among children.

DEDICATION

For my beloved mother and family members.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

CAA	-	Chiropractors' Association of Australia
PSM	-	Projek Sarjana Muda
BDC	-	Body Discomfort Chart
FVC	-	Forced Vital Capacity
FEV	-	Forced Expiratory Volume
PEF	-	Peak Expiratory Flow
DSB	-	Double Strap Backpack
SSB	-	Single Strap Backpack
MSD/BP	-	Musculoskeletal Discomfort and Back Pain
LBP	-	Low Back Pain

CHAPTER 1

INTRODUCTION

1.1 Introduction

Ergonomic is the study of human capability and psychology in relation to the working environment and the equipment operated by the worker (McGraw-Hill Dictionary of Scientific and Technical Terms, 2003). For the ergonomic school bag project, it can be summarized that the school bag must be designed according to the human capability and psychology. There are a lot of school bag designs and patents in the market nowadays, such as sling bag, back pack, trolley school bag and so on. People always choose something by its looks without concerning about its shape and its impact to their body. The question is, do they know the effect of their choice? 70% of the children are now using unsuitable school bag which in the long term is a serious concern for many parents (Ergonomic School Bag United Kingdom Ltd., 2007) “Backcare” - The charity for healthier backs reports that as many as 50 per cent of children are experiencing some level of back discomfort by the age of 15 as a result.

Therefore, in this project, the school bag is designed to lighten the load and avoid the back pain. Some aided part will be included to reduce the force of the bag. There are some added features such as stationary case, water bottle and food compartments.

1.2 Objectives

The objectives of this project are:

- a) To study the need of an ergonomic school bags.
- b) To do some survey of the customer need.
- c) To study the real condition for school going children.
- d) To study a suitable design.
- e) To generate product concept.
- f) To create the product using CATIA solid Modeling.

1.3 Scope of the Project

The scopes of this project are:

- a) The suitable design of school bag for 7-9 years old kids
- b) The importance of an ergonomic school bag.
- c) A survey about school bag

1.4 Problem Statements

There is growing concern these days that children are carrying way too much weight on their backs. Some kids may strain their backs from lugging around their schoolbooks. A 1999 study of 237 Italian school children found that chronic low back pain was associated with the weight of their school bags. A January 2002 study in the journal *Spine* found that nearly half of grade school kids who carried bags that weighed 20 pounds on average while walking to school had a history of back pain. In addition, more than two thirds said their packs made them feel tired. (Laurie Udesky, 2007)

More children than ever are currently paying visit to chiropractors, pediatricians, physical therapists and other medical professionals. They are citing muscle aches, fatigue, numbness and pain in the shoulders, neck and back as complaints. (Barisso et al, 2000)

The Chiropractors' Association of Australia (CAA) National President Dr Dennis Richards says, "As children's spines are growing and developing, it is vitally important to prevent stress and dysfunction as a result of poorly designed school bags. Incorrectly carrying a school bag can interrupt the natural curve of the spine resulting in strain of the shoulders and neck, even the hips can be pulled over to one side." (Early Childhood Australia Inc, 2006)

Lifting heavy burdens for a long time or distance is not good for anyone, least of all children. Carrying a heavy bag on the back causes forward leaning and bad posture, which can lead to improper weight bearing on the spine and pains and aches in the back and shoulders. Carrying a backpack weighing 15% of body weight makes a child unable to maintain proper standing posture. (Mehta, 2007) Children could get into bad habits like poor posture and slouching. Forward bending at the back (also called kyphotic posture) can even make breathing harder. Children carrying bags weighing more than 10% of their body weight have been found to have poorer lung function. (Mehta, 2007)

Children who use one strap bags (which put weight on one shoulder only) have particular problems. These bags cause sideways deviation of the spine (scoliosis) because of the asymmetric weight distribution and this can cause long lasting back aches and damage.

So, a prevention step must be taken to avoid this long-term injury. As a result, an ergonomic school bag is designed to make students comfortable with their bag. The students will feel more comfortable and physically and mentally stressed out with the heavy bag and hard rigid shape of a school bag.

1.5 Rational of the Project

From the problem statement, the rational of the project is:

- a) Lighten the load of the bag
- b) Prevent the backache, back pain and long-term injury
- c) Create a healthy lifestyle

1.6 The Gantt Chart

The Gantt chart explains and clarifies the planning time for the activities which is carried out during the study. There are two Gantt Charts; which is for Projek Sarjana Muda 1 and Projek Sarjana Muda 2. For Projek Sarjana Muda 1, the planning and actual time columns were filled. On the other hand, for Projek Sarjana Muda 2, only the planning time column was filled. It is because Projek Sarjana Muda 2 will be carried in the next semester.

Table 1.1: The Gantt Chart for Projek Sarjana Muda 1

ACTIVITY	WEEK																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Choose the Project	P																
	A																
Search the Information	P																
	A																
Do the Introduction	P																
	A																
Do the Literature Review	P																
	A																
Do some Surveys	P																
	A																
Do the Methodology	P																
	A																
Prepare the Report	P																
	A																
Submit the Report	P																
	A																
Have a Seminar and Presentation	P																
	A																

P = Planning Time

A = Actual Time

Table 1.2 : The Gantt Chart for Projek Sarjana Muda 2

ACTIVITY	WEEK																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Do Survey and Observation	P																
	A																
Do the Data Analysis	P																
	A																
Design the Product	P																
	A																
Prepare the Full Report	P																
	A																
Submit the Report	P																
	A																
Have a Seminar and Presentation	P																
	A																

P = Planning Time

A = Actual Time

1.7 Conclusion

It is hoped that the positive result will be gained through this project. The expected result for the project:

- a) Produce the school bag for children.
- b) The ergonomic design is created to lighten the load and avoid the backache problem.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review is the information that is gained through previous study or survey which is important in supporting the project fact. This information is very helpful in performing the best result for this project.

2.2 Influence of Backpack Straps on Pulmonary Function

Carrying heavy loads in backpacks compresses the chest causing a restrictive ventilatory impairment in lung function. It is not known if a lighter backpack load typically carried by students or whether backpacks of different strapping styles, such as a popular single-strap backpack, will have a similar effect. This study examined Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), $FEV_1/FVC^{-1}\%$ and Peak Expiratory Flow (PEF) in 13 university students wearing 6 kg backpacks, one with two shoulder straps (a Double Strap Backpack-DSB) and the other with a single strap (a Single Strap Backpack-SSB) worn across the shoulder and chest. In comparison with the control of no pack (N), SSB reduced FVC (by 3.94%, $p < 0.01$) but there were no significant differences for FEV_1 , $FEV_1/FVC^{-1}\%$ and PEF. The DSB also reduced FVC (by 1.97%, $p < 0.05$) but there were no significant differences for FEV_1 , $FEV_1/FVC^{-1}\%$ and PEF. In comparison with DSB, the SSB was associated with a lower FVC (by 2.05%, $p < 0.05$) and FEV_1 (by 1.88%, $p < 0.05$) but there were no significant changes in $FEV_1/FVC^{-1}\%$ and PEF. It is concluded that a backpack load of 6kg can produce a mild restrictive type of ventilatory impairment in lung function. This effect is greater for a single cross-chest strap than for a more conventional double strap harness. (Legg et al, n.d.)