

A study of effects of heavy schoolbag on students and to develop a new bag concept for reducing difficulties

Devanarayanan TG¹, M.Parameshwaran²,

¹M.Tech Manufacturing Systems Management Student, GEC Thrissur

²Professor, Dept. of Production Engineering, GEC Thrissur

Abstract – This study aims at investigating the various difficulties faced by students while carrying heavy schoolbags, to identify their needs, and to propose a new concept for schoolbag design so as to reduce the difficulty. A cross sectional survey is conducted in a sample of 100 students in the age group 8-12 years, across various parts of Thrissur district, Kerala. The survey found that nearly 81% of school students uses dual strap backpack type schoolbags. It has also been observed that more than 80% of the students faces some of the musculoskeletal discomfort while carrying heavy schoolbags. Student's requirements are consolidated and then transferred into technical specifications. Many free hand sketches were drawn and the best one was selected by considering its aesthetics. Economic feasibility and ergonomics. The three dimensional geometry of the selected concept was then drawn using CATIA V5 and rendered to maximum realistic quality using KEYSHOT 4.

Key Words: students, Musculoskeletal discomfort, Ergonomics, Rendering, schoolbag type, CATIA V5, Key Shot.

1. INTRODUCTION

In Recent years the weight of student's schoolbags has become a source of some concern to persons with an interest or involvement in aspects of education. This concerns centers on the possibility that heavy school bags represent health hazard to pupils whose spines are susceptible to injury during the formative years. There is ongoing concern regarding the weight of children's schoolbags and the negative consequences of such heavy loads on the developing spine. There is particular concern for the junior students in secondary schools, as the spine is at a critical stage of development in children between 8 – 12 years of age. This is the stage at which the bag weight to body weight ratio is likely to be high as some students are still quite small but carry loads similar to larger and older children. Children carrying this kind of weight are vulnerable to develop serious back pain and other musculoskeletal problems. Risks include muscle strain, distortion of the natural S curve of the spine and rounding of the shoulders, chronic shoulder pain and even neck pain. To manage the load, children sometimes arch their backs or lean forward, causing them to develop poor posture as they grow. Wrong posture while bending and lifting can result in the rupture of the disc. There are

many researches being conducted in this particular area across the world and several proposals were also composed.

1.1. Weight of the Schoolbags

School students usually carry their belongings to, from and around school each day. Text books, Lunchbox, water bottle, sports equipment, jackets, musical instruments and more recently laptop computers are among the items that may be carried. Cumulatively, these items can represent a substantial weight. There has been considerable concern from students, parents, and both education and medical professionals regarding schoolbag carriage. There are many direct and indirect factors which lead to the heavy weight of the schoolbags.

1.2 Effect of heavy schoolbag on student

There are many problems associated with carrying heavy schoolbags. They are multifactorial in nature as effects are highly dependent on heavy loads, mode of carrying, mode of travelling and time spend on carrying the bags. Many solutions were proposed various researchers like using weightless bags, providing hip belts to reduce the stress acting on the shoulder, shifting the CG shifter method etc. The main aim of this paper was to identify the needs and difficulties of the students in the respective age group and propose a suitable concept for reducing those difficulties also by meeting their requirements. The specific objectives were

- To identify the needs of the students
- To identify the different MSD faced by the students
- To identify the type of bag used and mode of transportation of the students.
- To propose a concept for reducing the difficulties
- To construct a 3D model of the concept with help of CAD software.

1.3 Hypothesis

Students suffer musculoskeletal discomfort due to heavy weights of their bags.

2. METHODOLOGY

This research work was conducted with an author assisted questionnaire, body comfort as well as demographic survey and development of a new concept for schoolbag.

2.1 Sample selection

A convenient sample of 100 students , age group 8-12 years from different part of the Thrissur district were selected .The sample consisted of 65 boys and 35 girls.

2.2 Tools for assessment

An author assisted questionnaire sought general information including demographic questions (name, age, school name) and core element questions for analyzing the type of backpack used, contents of schoolbag , mode of transportation, and type difficulties faced etc. The results of the survey are tabulated and charts are made for analysis.

2.3 Tools for Modelling and Rendering

Initially the concepts are developed as free hand sketches. The selected concepts was then constructed in three dimensional geometry using CATIA V5 CAD software. All the feature were included in the design phase itself. The final designed product was then rendered in to maximum realistic quality and feature in KEYSHOT graphics rendering software.

2.3 Procedure

Random survey was conducted to collect data. A well written questionnaire was made from the data reported from the literatures seeking the information about the mode of transportation, type of schoolbag used, various difficulties faced by them, contents in the schoolbag etc. The students were asked to write their own suggestions, needs and requirements descriptively. All the results were then tabulated.

The design of new product starts with concept generation by considering the needs and requirements of the students. The needs of the students are converted into technical specifications and a structured Product Design Specifications was developed. From the generated concepts one was selected for 3D modelling. The entire new bag concept was then drawn in CATIA V5. Though the CAD software itself has graphics rendering options, in order to achieve more realistic features the final product was then rendered according to aesthetics and features.

3. SURVEY FINDINGS

3.1 Student participation

Out of 100 forms issued, all the hundred were returned. It included 65 boys and 35 girls of age 8-12 years.

3.2 Types of bags used

49 out of 65 boys and 29 out of 35 girls used dual strap backpack type model schoolbags.

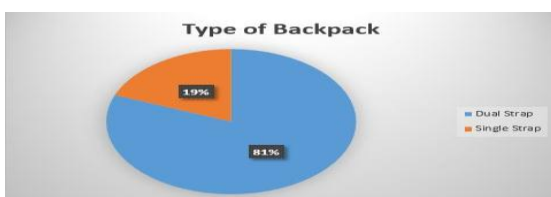


Chart -1: Type of backpack used by students

3.3 Type of Musculoskeletal discomfort

82% of both girls and boys suffers with backpain , it was also observed that 80% students faces with any of the discomfort.

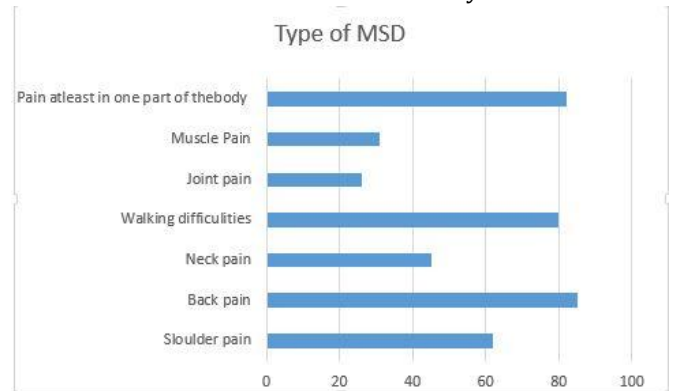


Chart -2: Type of Discomfort faced by Students

3.4 Mode of transportation

The carriage duration and mode of transportation are the main factors which affects the body.It was observed that majority of students goes to school partly by bus and partly by foot.

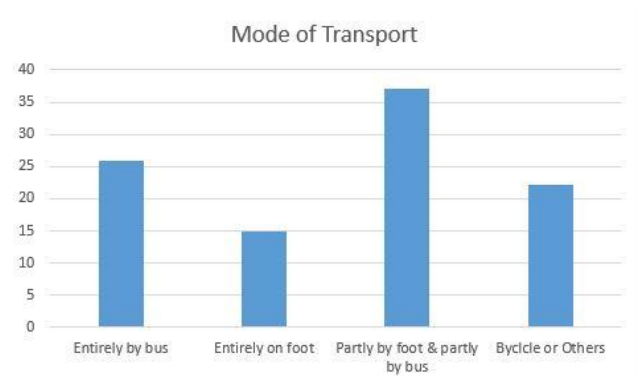


Chart -3: Mode of transportation

3.5 Students requirements

60% of the students opted for new bag concept which would reduce the present difficulties and suggested the following needs and specifications in it

- More storage space
- Water proof
- Durabilty
- Easy to handle
- Colour
- Small size and weight less
- Economical
- Flexibility

4. DEVELOPMENT OF NEW SCHOOLBAG CONCEPT

After doing the survey the concept generation process started by considering the difficulties faced with the present model and their expectations and requirements for a new concept. Product Design Specification for the new concept was then devolved from the needs of the students. Several free hand sketches were drawn with different features and positives. Best concept was chosen on the basis of its aesthetics, economic feasibility and ergonomics. The selected concept was then drawn in 3D geometry in CAD software.

4.1 3D Modelling

CATIA V5 was chosen for 3D modelling. CATIA is the world's engineering and design leading software for product 3D CAD design excellence.

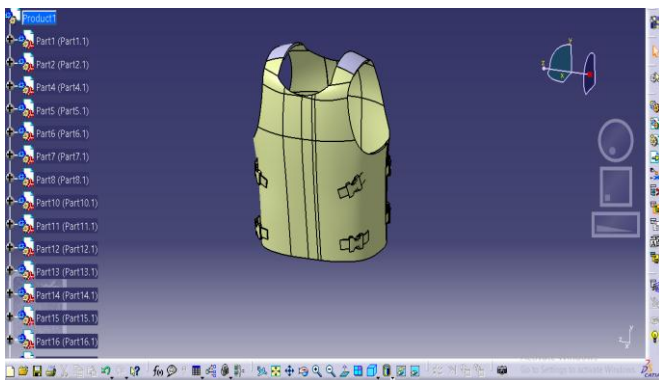


Fig -1: Body of the bag drawn in CATIA V5

4.2 Rendering

KeyShot was chosen for rendering. It is a standalone real-time rendering application that makes creating amazing renderings and animations fast and easy, with support for the widest number of 3D file formats on both Mac and PC. Features like aesthetics, colour, and style and material type are incorporated in this phase.

Fig -2: Final Schoolbag concept rendered in KEYSHOT



4.3 Features of the Schoolbag

The proposed concept has many features like

- The bag is made with maximum weightless material
- Reduced stress on the shoulders – pouches are clipped to the bag body using adjustable clips
- Water proof and dirt resistant
- Extra provision for accommodating water bottle, lunch box and umbrella
- Modular in nature- the back pouch can be detached from the body can be used as a hand or shoulder bag when travelling in bus.
- Since the weight is distributed both in front and back pouches the stress acting on the back and shoulder get reduced.
- Inside compartments of the bag are made with net like material to achieve weightlessness

5. CONCLUSION

The aim of the research was to identify various difficulties faced by the students while carrying heavy schoolbags, to understand their need and to propose a new concept for the schoolbag for reducing their difficulties by considering their needs. According to the results of the survey, nearly 82% of the students faces with any type musculoskeletal discomfort, and majority of the students dual strap backpack model schoolbags. It was also identified that more than 60% of the students suggested for a new schoolbag model leaving the present setup. Several concepts for a new model is drawn and the best one was selected by considering its aesthetics, economic feasibility and ergonomics. The selected concept was then drawn in 3D geometry in CATIA V5 design software and rendered in to maximum realistic quality using Key Shot graphics rendering software.

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