

Analysis of Secondary School Furniture's based on Ergonomic Considerations

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Abstract - School furniture is an essential element in the education process. Children remain seated at school for a considerable amount of time. Student's sitting posture is influenced by the activities performed in the classroom. Most of the furniture in school does not follow ideal sitting posture. Improper classroom furniture's affect performance at school and contribute to the appearance of musculoskeletal problems among students. Due to this proper ergonomic design of school furniture is very important. In this paper, the existing compatibility of school furniture's is being studied to the anthropometric requirements of students.

Index Terms - Ergonomics, Anthropometry, furniture, performance.

I. INTRODUCTION

Many researchers found that a musculoskeletal problem for students starts at an early age due to improper seating and mismatch of furniture with student. It is a matter of concern for school going children. Using furniture that promotes proper posture is more important to children than adults because it is at this young age that sitting habits are formed. Classroom furniture therefore plays an important role in maintaining good sitting posture. The design of the school furniture must be such that it doesn't cause any inconvenience to the students and also provide the necessary comfort.

II. BACKGROUND

The main purpose of the study was to conduct survey amongst the school students, examine the musculoskeletal pain and estimating the adequacy of classroom furniture in relation to anthropometric characteristics, thereby providing the necessary insight of the existing scenario of schools.

The objectives of the study are as follows:

- 1) To study the existing musculoskeletal pain among students in school furniture.
- 2) To find out whether students were comfortable with the existing furniture designs.
- 3) To analyze the problems the students face due to the existing workstation design.
- 4) To study existing sitting posture of students.

III. METHODOLOGY

The study was carried out in the following order:

- 1) To study the existing musculoskeletal pain among students in school furniture.
- 2) To setup ergonomics problems survey plan at educational institutions.
- 3) Sample selection.
- 4) Self-prepared questionnaire and to distribute questionnaires to the sample.
- 5) Gathering data from Students/respondents of Questionnaire.
- 6) Analysis and Presentation of data.

IV. DATA COLLECTION AND ANALYSIS

In accordance with the objectives of the study, the major focus was to identify whether a significant percentage of the students faced discomforts or pains due to the existing workstation design. A survey was conducted of students from the secondary schools to obtain the data. The sample size of this study was 200 students, aged between 13 to 16 years belonging to class 8th, 9th and 10th respectively. Based on the sample size and the data required, questionnaire was found to be the most suitable mode of data collection.

A. Data Collection

As the respondents of this questionnaire were students aged between 13 to 16 respectively, the questions were framed in an easily understandable manner with simple Yes or No response. Further clarification and assistance was provided to the students in case of any doubts. The questionnaire used in this study is given below and includes the following categories.

- A. Musculoskeletal Disorders (MSDs)
- B. Nature of Work
- C. Workstation Ergonomic Hazard Analysis

Questionnaire

QUESTIONNAIRE TO HELP ASCERTAIN CAUSE OF WORK RELATED MUSCULOSKELETAL DISORDERS

Name: _____
 Age: _____
 Gender: _____
 Name of school: _____
 Class: _____

Instruction: Tick (✓) to which ever you think is your opinion.

A.	MUSCULOSKELETAL DISORDERS (MSDs)	YES	NO
1.	Have you ever had pain or discomfort in your :- Neck		
	Upper back		
	Lower back		
	Shoulders		
	Elbows		
	Wrists/Hands		
	Hips/Thighs		
	Knees		
	Ankles/Feet		
2.	When did you first notice the pain or discomfort:- Recently?		
	Months ago?		
3.	Have you had this pain or discomfort in the last 7 days?		
4.	Do you think pains are related to the school furniture design?		

B.	NATURE OF WORK	YES	NO
1.	Do you feel fatigue during class work?		
2.	Do you sit constantly on the bench for long duration?		
3.	Do you stress on any one joint or muscle more than any other?		

C.	WORKSTATION ERGONOMIC HAZARD ANALYSIS	YES	NO
1.	Do you feel comfortable using the existing furniture setup?		
2.	Has the present furniture setup caused any injury to you?		
3.	Is the height of the bench & desk adjustable?		
4.	Can the bench & desk be tilted or angled?		
5.	Is the surface of the table uneven with sharp edges?		
6.	Are hands and arms free from pressure from sharp edges on bench & desk?		
7.	Are your thighs parallel to the floor?		
8.	Is the front edge of the seat rounded to avoid pressure on the underside of the thighs?		
9.	Does the bench have a stiff backrest?		
10.	Does the existing seat pan allow your lower back to contact the backrest?		
11.	Does the backrest support your entire back including the lumbar (lower back) region?		
12.	Does the bench have arm-rest?		
13.	Does your feet rest flat on the floor while sitting?		
14.	When sitting on bench, are your upper legs parallel with the floor?		
15.	Are your legs are at right angles while sitting?		
16.	Are metal parts of bench corrosion resistant?		
17.	Is the bench stable in all reasonable postures?		
18.	Does the bench allow comfortable hand or body motions?		

This questionnaire will be used in gathering data for the purpose of M.Tech project by Industrial Engineering student. The project aims to identify the causes behind musculoskeletal disorders amongst school students. Your participation completing the questionnaire will highly be appreciated.

B. Data Analysis

Response of questionnaire were collected, tabulated and represented graphically with the help of Microsoft Excel. Each questions percentages of Yes and No's of population are then tabulated and through chart it is been represented graphically.

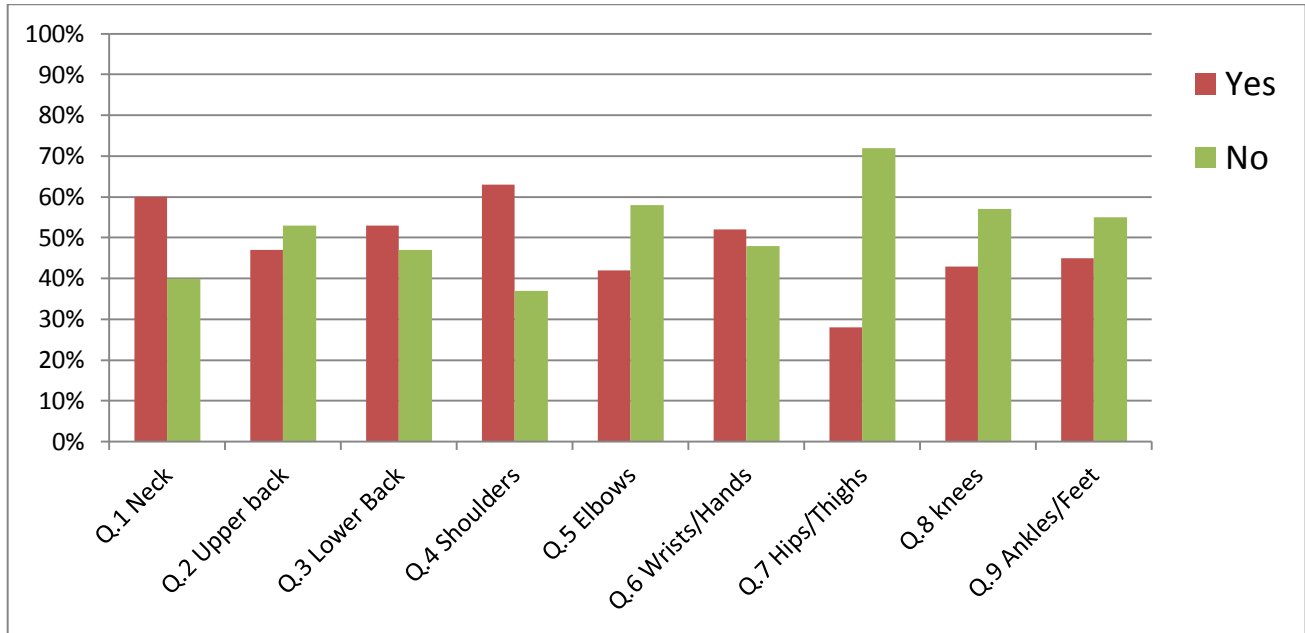


Figure 1.A: Representation of Percentage Response – Have you ever had pain or discomfort in yours?

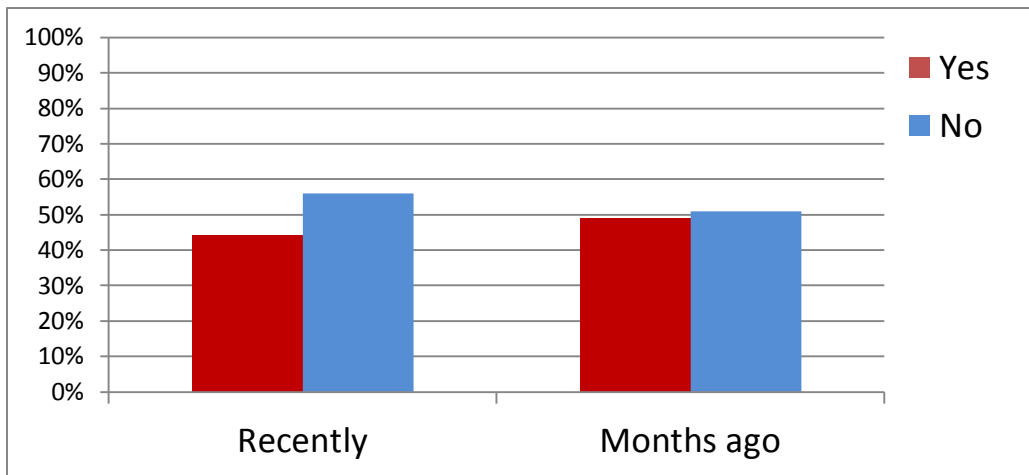


Figure 2.A: Representation of Percentage Response - When did you first notice the pain or discomfort?

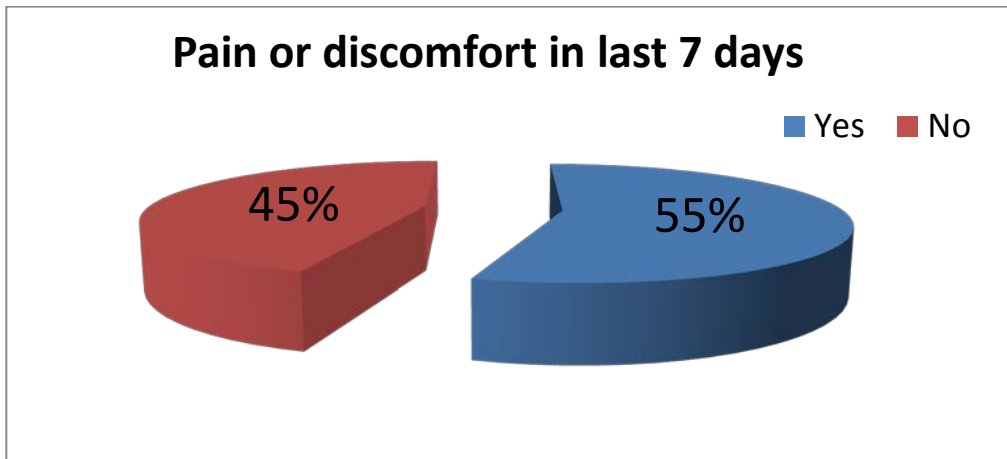


Figure 3.A: Representation of Percentage Response - Have you had this pain or discomfort in the last 7 days?

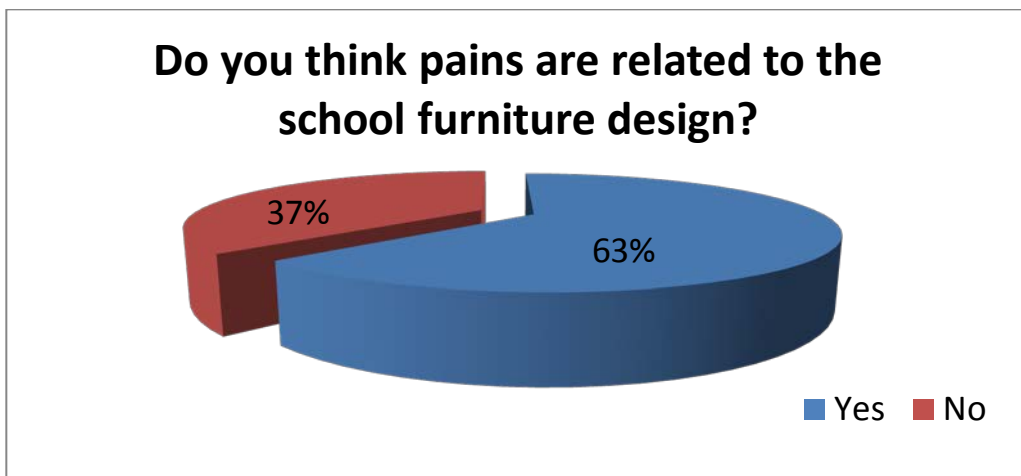


Figure 4.A: Representation of Percentage Response - Do you think pains are related to the school furniture design?

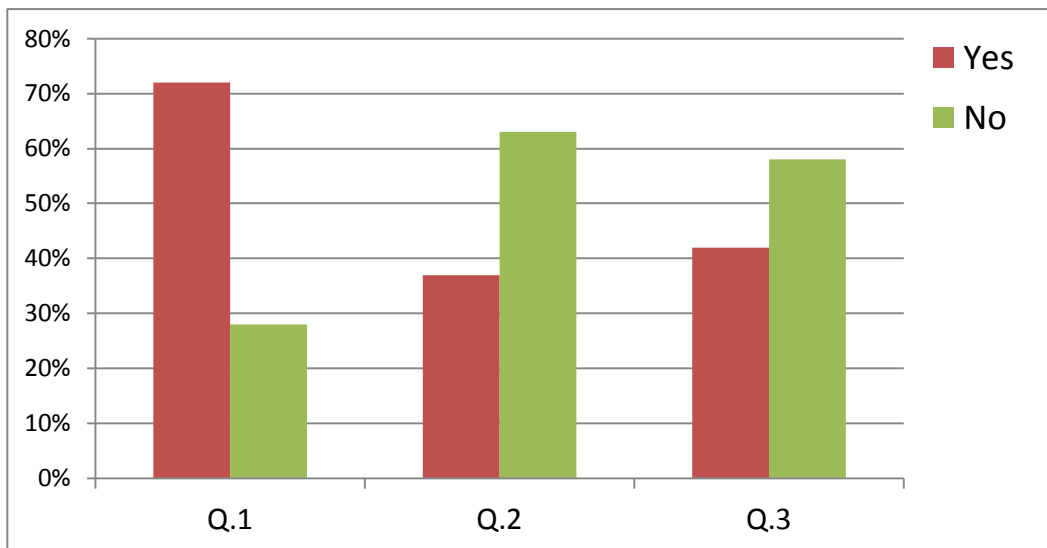


Figure 5.B: Representation of Percentage Response of Nature of work

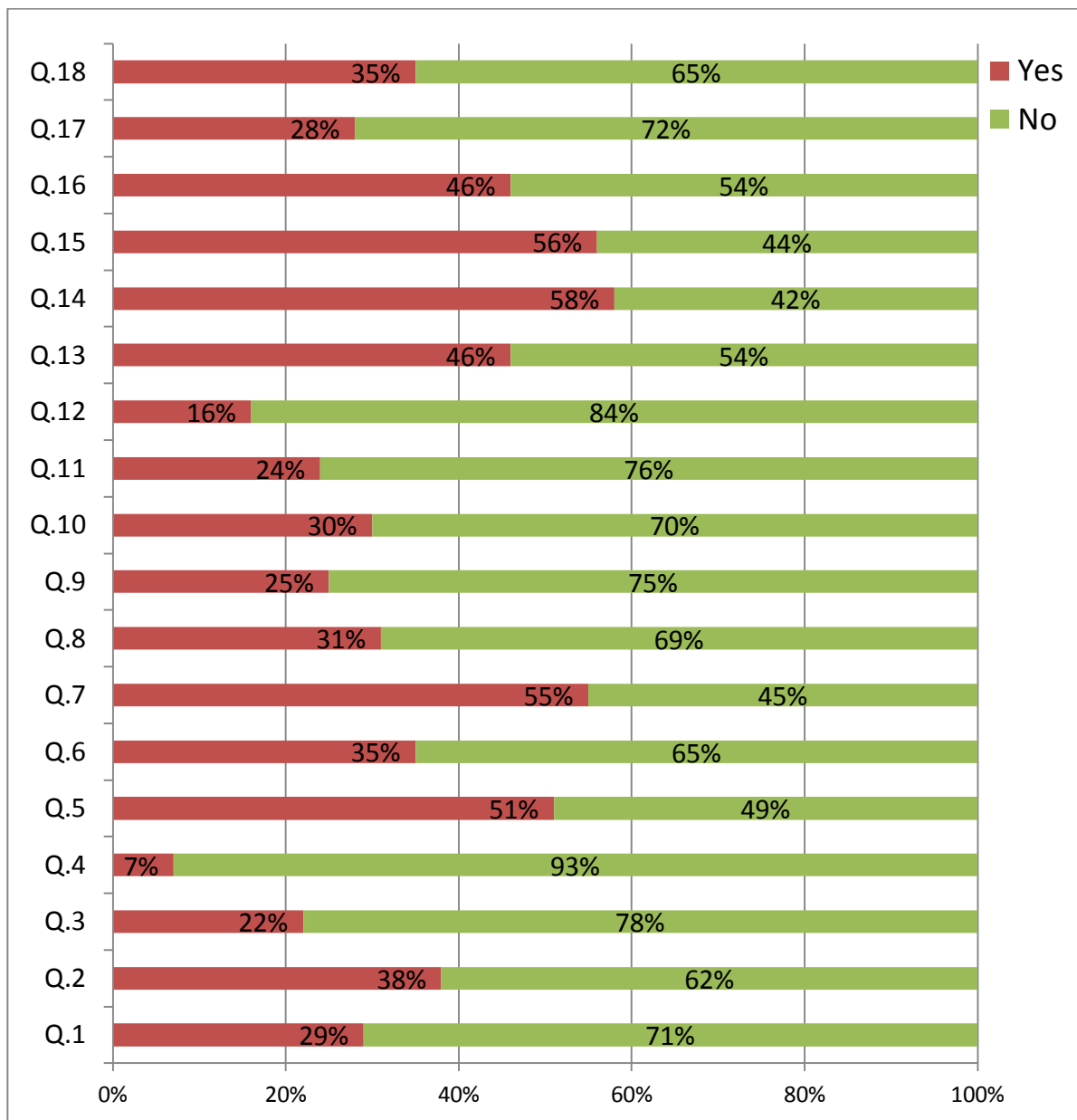


Figure 6.C: Representation of Percentage Response of Workstation Ergonomic Hazard Analysis

V. RESULTS AND DISCUSSION

Based on the responses obtained for musculoskeletal disorders, it is observed that the discomfort or pain in students was prominent in the neck and shoulders respectively, whereas the students indicated that the pain in thighs was not prominent. Majority of the students stated that their discomfort was first noticed recently. In total, 63% of students believed that their pains are related to the school furniture design. Around 72% of students experienced fatigue during class work. 71% of students don't feel comfortable while using existing furniture setup. 62% of students reported injuries due to existing setup. 75% and 84% of students stated that their existing school furniture does not have proper back-rest and arm-rest respectively. From the responses obtained it has been observed that the existing furniture design has many short-comings. Thus scope for improvement in the existing school furniture's is present.

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