

Teenagers anthropometric measurement and furniture mismatchment

■ SANDHYA N. ADMANKAR AND H.L. SARAMBEKAR

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■ **ABSTRACT :** In the varied spheres of life various anthropometric mismatches are seen but are unknowingly being used and the physical problems arising from these are treated as if they were due to some medical problems, for example the height of some counters are such that interactions between the man behind the counter and visitor are obstructed. Writing stands, counter platform, which are sometimes used as writing surfaces in post offices and banks, are too high making it difficult to write anything. Anthropometry deals with the measurements of the human external body dimensions in static and dynamic conditions. Designs without due consideration to the body dimensional requirements of intended users do not serve their purpose and have less user acceptance value. There are numerous medical problems that have resulted because of the use of articles that do not match the anthropometry of the users. Lack of foot space may also be a problem for all workers. In this study the desk height, desk depth, length of desk, chair depth, chair breadth for girls and combined group was noted to be less than required. Inclusive of these dimensions the back rest height and breadth was less than required by the boys, result in uncomfortable feeling and pain due to use of furniture.

■ **KEY WORDS:** Anthropometry, Measurement, Furniture

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Many students are reported to have regular bouts of back, neck pain and headache. During the past decade, research in ergonomics has led to heightened interest in the technology of work and furniture design based on the biomechanics of the human body. Any study which is being conducted needs to be supported by the similar studies conducted during last decades. The review provides a guideline to formulate the problem precisely and hence account of studies is given below in brief.

Diep (2003) conducted study on evaluation of fitness

between school furniture and children body in two primary school on Halphongity, vitenam. A total of 240 student (120 boys and 120 girls) were investigated. Anthropometric measurement of the student and the existing furniture dimensions were measured. The result of study showed that there was a gradual increase in student body dimensions by age, but not significant differences by gender and locations. Majority of student found the set too high and too deep or too shallow depending on grades and school. Almost student were not fit to the existing chair-desk combinations. There were

20.8 per cent student in urban school and 22.5 per cent of students in subarb school who complained musculo-skeletal pain in different body parts.

Furniture is one of the important physical facilities provided in a classroom environment where the student spend most of their time working with different learning activities. The design of work plane for student should ensure effective learning process and comfort. The functional unity of the student classroom furniture is a result of its physical design in relationship to the physical structure and biomechanics of human body (Khanam *et al.*, 2006).

Gouvali and Boundolos (2006) examined whether school furniture dimensions match children anthropometry. It was found that desk and seat height were bigger than the accepted limits for most children (81.8 %). While seat depth was appropriate for only 38.7 per cent of children and the limited provision of one size per cluster of grades does not accommodate the variability of anthropometry even among children of the same age.

■ RESEARCH METHODS

The present study was conducted in order to appropriate the anthropometric measurement for evaluating furniture used to by teenager. This study was conducted in Parbhani city. Total 300 teenagers (150 each of girls and boys) within age range 13-18 years were selected randomly. The data was collected through survey method with the help of an interview schedule cum questionnaire. The dimensions of existing furniture which were used by teenagers were measured.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Existing furniture dimensions :

Table 1 Reveals the dimensions of existing school furniture. It is evident from the table that the desk height

in S_1 , S_2 and S_3 was 75 cm, 79 cm and 70 cm, respectively. The desks were not provided in (S_4). The depth of the desk was 29 cm in S_3 , 27.5 cm in S_2 and 39 cm S_1 . The length of desk in S_1 and S_2 was almost at par values being 104 and 103 cm. whereas, in S_3 the length of desk was 122 cm. Angle of desktop was found to be 15 degree in S_1 and S_3 while in S_2 it was 10 degree only. Backrest height from sitting surface was measured and it was found that in S_1 and S_2 the backrest height was 40 cm while in S_3 . The backrest height was less by 1 cm *i.e.* 39 cm. In case of backrest angle variation of 5 to 10 degree was noted, it was 100 degree in S_1 in S_3 105 degree and in S_2 it was 110 degree.

Regarding the bench height it was seen that the bench height in S_1 was 43.6 cm followed by 44 cm in S_3 , 47 cm in S_2 and 48 cm in S_4 . Depth of the bench was noted to be less in S_2 (27.5 cm) followed by 30 cm in S_3 and S_4 and more in S_1 *i.e.* 40 cm. Length of the bench was found to be measuring from 102 cm in S_2 followed by 105 cm in S_1 120 cm in S_4 and 123 cm in S_3 . The thigh clearance dimensions in S_1 , S_2 and S_3 were found to be 19 cm, 18 cm and 20 cm, respectively.

The desk height of existing observed furniture ranged from 70 cm to 79 cm Desk depth was noted to be 27.5 cm to 39 cm. Length of desk varied from 103 cm to 122 cm. Desk top angle was either 10 degrees or 15 degrees. Back rest height was 39-40 cm. Back rest angle ranged between 100-110 cm. Bench height ranged from 43.6 cm to 48 cm. depth of the bench was found to be ranging between 27.5 cm to 40 cm. Length of the bench varied from 102 cm to 123 cm and thigh clearance ranged between 18 cm to 21 cm.

The desk height, desk depth, length of desk, chair depth, chair breadth for girls and combined group was noted to be less than required. Inclusive of these dimensions the back rest height and breadth was less than required by the boys, result in uncomfortable feeling and pain due to use of furniture.

Legg *et al.* (2003) conducted study on “mismatch between classroom furniture dimensions and student

Table 1 : Existing observed furniture dimensions

Sr. No.	College and schools	Desk height (cm)	Depth of desk (cm)	Length of desk (cm)	Desk top angle	Backrest height (cm)	Backrest angle	Bench height (cm)	Depth of bench (cm)	Length of bench (cm)	Thigh clearance (cm)
1.	College (S_1)	75	39	104	15	40	100	43.6	40	108	19
2.	School (S_2)	79	27.5	103	10	40	110	47	27.5	102	18
3.	School (S_3)	70	29	122	15	39	105	44	30	123	20
4.	School (S_4)	-	-	-	-	-	-	48	30	120	-

anthropometric characteristics in three New Zealand secondary schools". This study quantified the level of mismatch between seated anthropometric characteristic and the dimensions of the furniture used by 189 student in three New Zealand secondary schools and reported that there is a high level of mismatch between the size of school furniture and the anthropometric characteristic of secondary students in three schools in New Zealand.

Correlation of existing furniture dimensions with selected anthropometric dimensions :

The Table 2 reveals the correlation of furniture

dimensions with selected anthropometric dimensions. It is evident from the table that the desk height is significantly negatively correlated with sitting height of girls ($r=0.82^{**}$). Implying that as the sitting height of girls increased the desk height decreased. The positively highly significant correlation values for boys ($r=0.83^{**}$) and combined group with the desk height explain that the desk height is related with the sitting height and therefore sitting height should be consider while deciding the desk height. Sitting popliteal height was found positively highly significant in case of girls meaning that the sitting popliteal height of girls should be taken in to consideration while deciding

Table 2 : Correlation of existing furniture dimension with selected anthropometric dimensions										
Sr. No.	Parameters	Gender	Desk height	Desk depth	Desk length	Chair height	Chair depth	Chair breath	Back rest height	backrest breadth
1.	Sitting height	G	-0.82**			0.62**				
		B	0.83**			0.65**				
		C	0.83**			0.62**				
2.	Sitting popliteal height	G	0.97**							
		B	0.064 ^{NS}							
		C	0.064 ^{NS}							
3.	Sitting elbow height	G	-0.89**							
		B	0.83**							
		C	0.83**							
4.	Forearm length	G		-0.93**						
		B		-0.98**						
		C		-0.93**						
5.	Span akimbo	G			-0.47**					
		B			-0.72**					
		C			-0.72**					
6.	Buttock- knee length	G					-0.73**			
		B					-0.39**			
		C					-0.73**			
7.	Buttock popiteal length	G					-0.47**			
		B					0.22**			
		C					-0.47**			
8.	Knee to knee close	G						-0.96**		
		B						0.25**		
		C						-0.96**		
9.	Kknee to knee relax	G						-0.57**		
		B						0.40**		
		C						0.10 ^{NS}		
10.	Shoulder height	G							-0.75**	
		B							-0.50**	
		C							-0.75**	
11.	Shoulder breath	G								.046 ^{NS}
		B								-0.72**
		C								

NS = Non-significant; ** indicate significance of value at P=0.05

desk height. While non-significant results for boys and combined group were noted explaining that the sitting popliteal height has no concern with desk height. The 'r' value for sitting elbow height was found to be negatively significant correlated with desk height for girls (-0.89**) whereas positively significantly high 'r' values for boys ($r = 0.83^{**}$) and combined group ($r = -0.83^{**}$) were noted indicating that the sitting elbow height is related to the desk height and needs to be considered while deciding the desk height.

The existing depth of desk was found to be negatively significantly correlated with ($r = -0.93^{**}$, -0.98^{**} and -0.93^{**}) with forearm length of girls, boys and combined group, respectively. Suggestive that as the forearm length increased the depth of desk of existing furniture decreased. Length of desk was also noted to be negatively highly significant with the span akimbo of girls (-0.47^{**}), boys ($r = -0.72^{**}$) and combined group ($r = -0.72^{**}$) referring that as the span akimbo increased the length of desk decreased.

Sitting popliteal height was noted to be positively significantly high with chair height for girls ($r = 0.62^{**}$), boys ($r = 0.65^{**}$) and for combined group (0.62^{**}) suggesting that the sitting popliteal height is a measure for deciding the chair height.

Buttock knee length correlated with chair depth was found to be negatively significantly high for girls ($r = -0.73^{**}$), boys ($r = -0.39^{**}$) and combined group ($r = -0.73^{**}$) implying that as the buttock knee length of girls, boys and combined group increased the chair depth decreased.

Buttock popliteal height of girls and combined group were noted to be negatively highly significantly correlated with the chair depth explaining that as the buttock popliteal length increased the chair depth decreased. Whereas in case of boy's highly positively significant 'r' value was noted *i.e.* $r = 0.22^{**}$.

These findings indicate that the chair depth is of concern for comfortable seating the buttock knee length and buttock popliteal length should be considered while selecting or deciding the chair.

Knee to knee closed and knee to knee relaxed was found to be negatively significantly highly correlated with the chair breadth for girls ($r = 0.96^{**}$ and $r = -0.57^{**}$) indicating that as these two dimensions increased the chair breadth decreased. Non-significant results were noted for boys, while for the combined group negatively highly

significant correlation value was found for knee to knee close and chair breadth. Non-significant correlation was noted for knee to knee relaxed with chair breadth for the combined group.

Backrest height of chair was exhibited to be negatively significantly highly correlated with seat height for girls ($r = 0.75^{**}$) boys ($r = -0.50^{**}$) and combined group ($r = -0.75$) suggesting that as the seat height increased the backrest height of chair decreased.

Correlation of back rest breadth and shoulder breadth revealed that the shoulder breadth of girls was positively highly significantly correlated with back rest breadth while for boys highly negative significant value was obtained ($r = -0.72^{**}$), implying that as the shoulder breadth of boys increased the back rest breadth decreased but non significant correlation was noted for the combined group for shoulder breadth with back rest breadth.

On the whole it can be said the desk height, depth of desk length of desk, chair depth, chair breadth, for girl and combined group, back rest height of chair and back rest breadth for boys were less than the required measurements therefore resulting in uncomfortable feeling.

Mismatch between the size of the furniture and the anthropometric data of its use for children between 7-14 years the chair is too high and too deep and the table is too high (Panagiotopoulou *et al.*, 2004) on the other hand for age group 12-18 years it was found that the smallest student had the best fit. Taller student were more at risk of developing spinal pain (Milanese and Grimmer, 2004). Shinde *et al.* (2009) worked on the assessment of anthropometric measurement with suitable of table and Sarambekar and Admankar (2011) worked on anthropometric measurements of teenagers and the results found were more or less similar to the present investigation.

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