

Opinion of Students on Seating Furniture Used in Classroom

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ABSTRACT Classroom furniture is an important facility that helps in providing a conducive, comfortable and functional classroom environment for students in an educational institution. The comfort and functional utility of the classroom furniture depends on its physical design in relationship to the physical structure and biomechanics of human body. Furniture in classroom should suit the anthropometrical demands of user and the task demands. An observation cum evaluation study was made to explore the types of furniture used by graduate students in classroom environment and were drawn their opinion on the design. The outcome of the study revealed that four types of furniture were found in use and each type differed in its design features and its dimensions. Some of the features like seat pan width and height, backrest height, thigh clearance, footrest, lumbar support were found to be incompatible to the users.

INTRODUCTION

The classroom is a formal environment for learning. A conducive and comfortable classroom environment motivates the students to perform better and encourage the learning process. A study conducted by CBRI (1990) found that the seating furniture adapted to body dimensions increased the learning effectiveness. Care should be taken to see that the furniture is designed appropriately to the student's anthropometry. It should permit space for flexible movements of the body, provide place for all the education activities and possess adequate storage for their personal belongings used by them during their work in classrooms. While all the components of classroom environment are important, furniture for seating require special attention as it facilitates the functioning of students in a classroom.

Amitabha De et al. (2001) who studied on Indian classrooms, observed the need for focusing on the furniture design for seating the students, as majority of the sample felt difficult to sit in furniture, due to insufficient space and lack of storage provision to keep their belongings. Studies on seating furniture has revealed that the mismatch between school furniture and body size as a causative factor for musculo-skeletal disorders and low back pain amongst school students (Balague et al., 1988; Parcels et al., 1999; Lin and Kang, 2000; Whittfield et al., 2001, 2003; Murphy, 2003; Legg et al., 2003). There are studies in which students have experienced musculoskeletal pains, headache and low back pain due to incompatible seating furniture in a number of

schools (Zinchenko and Munipov, 1989; Chaffin and Anderson, 1991; Kroemer and Grandjean, 1997). According to Pheasant (1986) the purpose of seating furniture is to provide stable body support in a posture that is comfortable over a period of time, physiologically satisfactory and is appropriate to the task or activity being considered. Chakrabarti (1997) also stated that one should consider appropriate anthropometrical requirements for sitting, for seat and work surface dimensions, legroom and clearances for getting in and out. The surrounding free movement space should also be present.

Thus arose the ergonomist's need to treat the issue of furniture design for students as a necessity and educational institutes should treat the selection of right kind of furniture as social responsibility towards the student community. This study, was therefore taken up to elucidate student's opinion on the design of the furniture used.

METHODOLOGY

In the current study, classroom environment meant for Degree college students were studied to explore the types of classroom furniture in use and design compatibility to users needs. Ten colleges located in and around Hyderabad city were randomly selected. The study involved collection of information from the college authority on classes and classroom furniture and students opinion on classroom furniture design. The most regularly used classrooms were identified to observe the design features of

furniture viz., dimensions, materials and finishes and other special provisions. A total of 100 students i.e 10 from each college who were the regular user of students furniture, were selected as respondents for this research to explore the opinion on the design of furniture and design compatibility. An interview schedule cum observation sheet and an opinionnaire was developed to collect information.

RESULTS AND DISCUSSION

From the ten colleges studied, it was found that 5 colleges used sled desk and 3 other used chairs with arm tablet. Table with chair and table with bench combination units were used only by one college each.

Design Features of Each Model and its Compatability to Users Needs

Different types of furniture used and the variations in different models of each types are discussed separately along with opinion of ten users of each model.

Sled Desks: This bench cum desk was a combined unit to seat three to four members. The desk had 10 degrees inclination to facilitate writing and the bench had a backrest with an angle of 100 degrees to facilitate relaxed sitting. The photographic illustration of all the five models of sled desk found in the study are shown in figure 1.

From the figure - 1, it can be observed that

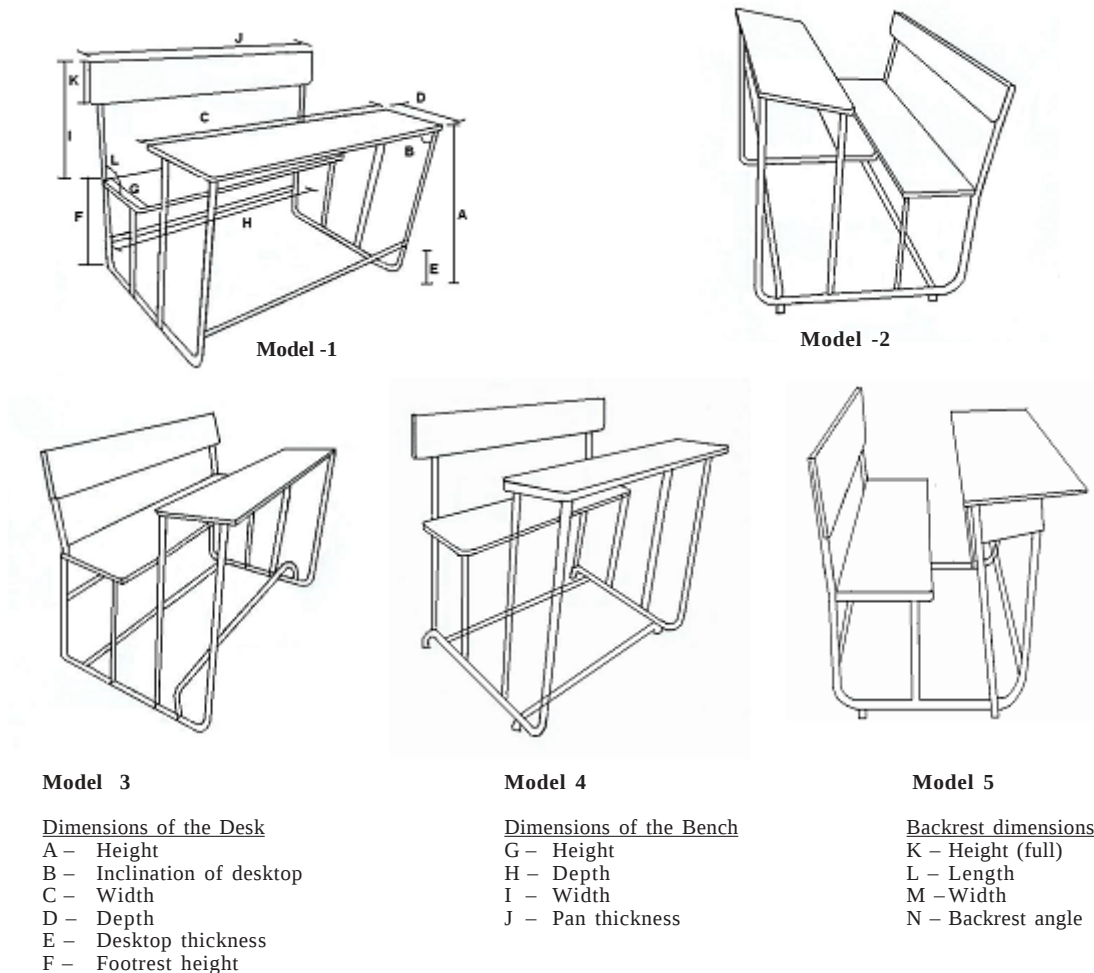


Fig. 1. Different models of sled used observed in classrooms

Table 1: Dimensions of sled desks and student's opinion on the comfort of each part of the furniture (Measurements in mm)

S. No.	Furniture parts	Sled Desk Model 1 N=10	Sled Desk Model 2 N=10	Sled Desk Model 3 N=10	Sled Desk Model 4 N=10	Sled Desk Model 5 N=10
1	Bench height	455 (90)	470 (60)	485 (30)	505(20)	480 (30)
2	Bench depth	250 (90)	255 (60)	325 (30)	240 (60)	395 (70)
3	Back rest height	455 (100)	350 (80)	410 (50)	350 (70)	650 (100)
4	Desk width / number of users	1215/3(60)	1220/3(80)	1540/4(50)	1210/3 (60)	1155/3(20)
5	Desk height	765(90)	795(80)	790(60)	825(90)	820(100)
6	Desk depth	310(40)	305(40)	320(40)	280(40)	470(100)
7	Desk top slope	10°(100)	10°(100)	9°(100)	9°(100)	5°(10)

Figures in parenthesis indicate the percentage of users who felt it was comfortable

the body frame was made of metal and the seat and work surface area were fitted with laminated wood. Only model 3 was meant for four persons to sit while the other four were for three students to sit. The dimensions of each model of sled desk along with student's opinion on the comfort of each part during use are shown in Table 1.

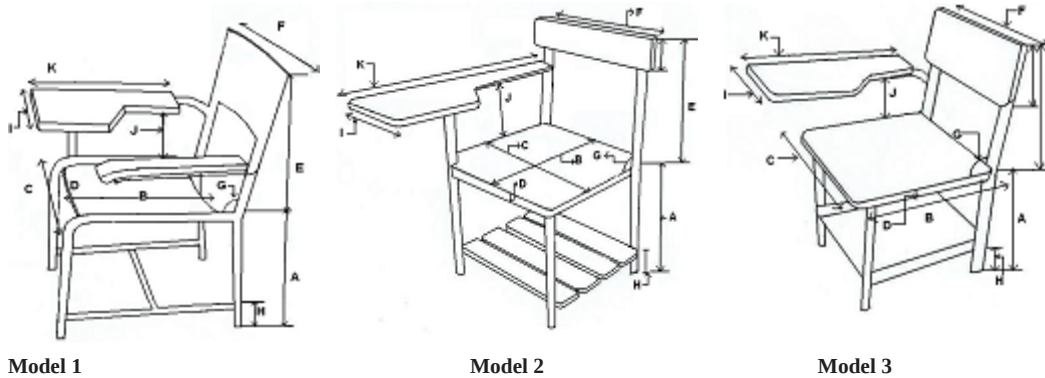
The information given in table 1 on furniture dimension that emerged out of physical observation of each model of furniture shows the distinct variations in dimensions of each model. With regard to the opinion of users it can be noticed that in the case of bench height that was above 470mm in four models, 80% expressed it as uncomfortable as it was not able to facilitate the foot to rest on the floor while sitting straight. Regarding the bench width 60%-80% opined uncomfortable with 240-325mm as it was not wide for complete body support of all users. A majority (80%) felt it to be very comfortable with the seat depth of 395mm. Majority of the subjects who used desk with the height 820mm – 825mm felt it was very comfortable. With regard to the depth of the desk, in the first four of the models, where the width was between 280-320mm, 60 percent opined as uncomfortable. In the model 5, where the dimension was about 470mm, all the users opined as very comfortable may be because it was convenient to reach and spread reading materials. The width of the desk differed in different models. From Figure 1 it can be noticed that a desk, which had the width of 1540mm, was considered uncomfortable by 50 percent of the sample as four students shared the desk. In the, the other four models which had the width of 1150-1220mm was shared by three students and almost 40-50 percent expressed as uncomfortable, as it did not provide sufficient clearance for the body movements.

Almost all the students expressed it as comfortable with laminated finish. Among the 5 different models only 2 models had a provision to keep books and among the users 80% expressed it to be comfortable. Ninety percent of the students opined comfortable with the smooth edges and rounded corners. Though all the models had smooth edges and rounded Corners, 10% felt them to be uncomfortable with the poor maintenance, as the decolium sheet pasted on it was peeling out and the edges were sharp and chipped off. All the models had footrest. But in all models except one, it was above 150mm and a majority felt it was very high, and 80 percent opined it as comfortable when it was at 50mm.

Chair with Arm Tablet: This was an individual chair with flat surface plank referred as arm tablet fixed on to the right side of the chair to facilitate writing. The photographic illustration of different models of chair with arm tablet are shown in figure 2.

The above figure denotes the variation in different models viz., dimensions, materials, position and shape of arm tablet, storage facility for books and design of the seat pan and backrest. The dimensions of each model of chair with arm tablet along with student's opinion on the comfort of each part during use are shown in Table 2.

It was established that when the seat height was around 450mm, it brought in satisfaction to almost 90%-100% of them felt that the seat height was comfortable. Similarly, when the seat pan depth and width was above the standard of 400mm, about 90 percent of the sample felt it was comfortable. But where these were around 350mm, only 40 percent opined it to be comfortable. This may be due to the fact that body is adjustable even to the uncomfortable position, though it may



Dimensions of Chair

A – Seat height
B – Seat depth
C – Seat width
D – Bench thickness
E – Backrest height (full)

Dimensions of Arm Tablet

F – Backrest width
G – Backrest angle
H – Footrest height
I – Armrest height
J – Height from Bench
K – Length till backrest
L – Length
M – Width

Fig. 2. Different models of chair with arm tablet observed in classrooms

Table 2: Dimensions of chair with an arm tablet unit studied in the survey along with percentages of students opinion. (Measurements in mm)

S. No.	Furniture parts	Model 1	Model 2	Model 3
1	Seat height	450 (100)	450 (90)	465 (80)
2	Seat width	350 (40)	425 (90)	455 (90)
3	Seat depth	350 (10)	450 (70)	455 (90)
4	Backrest height	500 (60)	400 (80)	410 (70)
5	Armtablet length	270 (20)	305 (80)	300 (80)
6	Arm tablet height from seat	220 (30)	240 (70)	240 (90)

Figures in parenthesis indicate the percentage of users who expressed comfortable

have an impact on human health like back ache, muscle pain etc at a later date.

Eighty percent of the sample opined it as comfortable when the arm tablet length was 300-305mm. regarding the arm tablet height of 240mm from seat pan, it was felt to be comfortable by all. About 80 percent of the sample used book storage provision below the seat pan as footrest. But when the same feature was placed at a height of 100-150mm, it was felt uncomfortable by 80-90 percent as it was obstructing thigh clearance. Only one model had left armrest and this feature was felt uncomfortable by almost 70 percent of the users. This could be because it interfered with the body while moving in and out of the chair. In the case of backrest height, 70-80 percent expressed it to be comfortable when its height

was around 400mm.

The location for books keeping provision did not appeal to 80-90 percent of the users. Many did not use this facility, as they did not prefer to keep the books at foot level. They also expressed this location for books required side bending and awkward posture.

When the edges and corners of the furniture were rounded (as seen in model 3) it was yielding satisfaction to all. In two of the models where some parts were having sharp corners, their impression was not satisfactory as it was the source of accident while moving in and out of the chair. Regarding the material used for fabrication, all the users of first model expressed it as uncomfortable as the whole unit was made of metal and had rusted and sharp edges and surfaces, while all the users of model 3 were totally satisfied because of its smooth and round edges. The users did not feel the unique feature of providing concaved curve in the seat and backrest in model 1 as a convenient feature. Almost 80-90 percent expressed it as comfortable when the metal frame and the wooden surface was finished with lamination, painted metal body did not please upto 80 percent of the students as the paint was peeling away due to rust and was leaving the coarse appearance.

Table with Chair and Table with Bench:
Table with chair is a unit which had a conventional

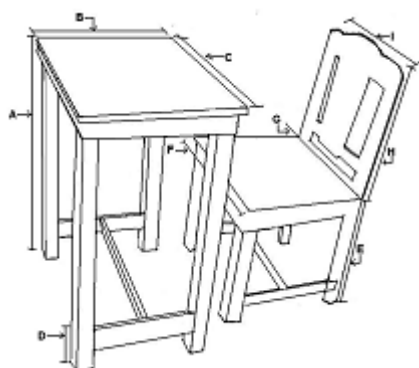


Table with chair

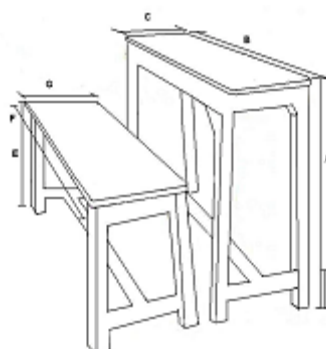


Table with bench

Dimenstions of Table

A - Height of Table
B - Depth of the Table
C - Width of the Table
D - Foot rest of height

Dimenstions of Chair

E - Seat height
F - Seat width
G - Seat width (back)
H - Backrest height
I - Backrest width

Dimenstions of Table

A - Height of the Table
B - Width of the Table
C - Depth of the Table
D - Footrest height

Dimenstions of Bench

E - Width of the bench
F - Height of the bench
H - Depth of the bench

Fig. 3. Dimensions of table with chair and table with bench

furniture unit having a separate table and a chair and the other type was an individual unit of separate desk and bench with a three member capacity unit. Bench was a simple plant resting on legs frame (Fig. 3).

From table 3 it is revealed that from the table with chair type of seating furniture, 80-90 percent of the sample opined it was comfortable with the dimension of table height, table depth and table width. The footrest located at the height of 120mm gave discomfort to 60% of the users. Similarly on the table dimensions, 80 percent were comfortable with the dimensions of seat height, seat width and seat depth; as there were very close to the recommended value. The low backrest was not considered as a comfortable feature in the design. Forty percent of sample-expressed dissatisfaction. It could be because it was not providing adequate back support. Only 60 percent of the samples were comfortable with the edges as they were not very sharp in both chair and table. This unit of furniture was made of pure teak wood, and the impression of comfort was felt by 70 percent of the sample. This furniture did not include the provision for keeping books.

In the design of table with bench type seating furniture it was inferred that 80 percent of the sample opined it to be comfortable with depth of the table and its width. In case of the footrest 80 percent expressed it to be uncomfortable, since it

Table 3: Dimensions of table with chair unit and table with bench unit studied in the survey along with percentages of students opinion

S. No	Dimension particulars	Dimensions of table with chair (in mm)	Dimensions of table with bench
1	Chair seat height	425 (80%)	-
2	Chair seat depth	455 (80%)	-
3	Chair seat width	400 (70%)	-
4	Back rest height	420 (60%)	-
5	Bench height	-	530 (60%)
6	Bench width	-	1340/3 (100%)
7	Bench depth	-	320 (100%)
8	Table width	605 (90%)	1340/3 (100%)
9	Table height	755 (100%)	840 (80%)
10	Table depth	415 (90%)	320 (100%)

Figures in parenthesis indicate the percentage of users who expressed comfortable

was located at 120mm height and this may be because it caused strain on thigh muscle when kept at higher level while sitting on bench without a back support. When the bench height was 530mm it was found that 60 percent of the sample opined it as uncomfortable. Since the bench width was 1340mm to accommodate three students, 70 percent of the sample opined it to be comfortable. None of the feature in this combination furniture appealed to the users and 90 percent expressed dissatisfaction with the material and surface finish. This unit also did not fulfill the basic need of

providing support for the back or provisions for keeping books. Though the edges were smoothly curved and this feature appealed to only 60 percent of the users.

CONCLUSION

Analysis on the opinion of students on the types of furniture revealed the true opinion of students as they considered their physical requirement while opining on different parts of furniture and it's utility to users. It was found that the dimensions of furniture, yielded the feeling of discomfort. Students realized the importance of features that contribute to good furniture design and recommended some valid suggestions. They preferred furniture height to be adjustable. Other recommendations were broad seat, lower back support, clearance space for thighs and legs, provision for footrest, wide work surface, provision for books / bags and water bottle, strong and durable furniture with rubber bushes to prevent noise. Since ergonomic evaluation of the existing classroom furniture proved mismatch in many respects to the users, it is necessary to improve the furniture design and make it user friendly

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