



Md. Furkan Malik

Furkan Malik completed Bachelor of Architecture from Ganga Institute of Architecture and Town Planning, Jhajjar, Haryana (2017), Master of Design from Jamia Millia Islamia, Jamia Nagar, Okhla, New Delhi(2023), He is passionate about design and he began by working for a prominent custom homebuilder, involving himself in all facets of home construction. It was through this experience he first realized his passion for the industry, and his desire to learn more. Under his leadership, the firm has completed a significant number of built projects including custom homes, additions and renovations. Now he is working as a product designer in a company IDAS.



Arch Vipul Singh

Vipul Singh is a renowned architect and an interior designer with a professional experience of over 25 years. He has graduated from Government College of Architecture Lucknow and SPA New Delhi. He heads a design consultancy called Design Accord, which worked on projects with organizations like CPWD, IIM, Delhi Gymkhana Club, Rashtrapati Bhawan, Apollo Tyres, ITC, etc. At DDI Jamia, he teaches Retail Design.

School furniture for better learning

Md Furkan, Vipul Singh

Abstract

The process of teaching and learning is changing in many learning centres today with an emphasis on a holistic approach to learning. Schools worldwide have changed their teaching methods and students can choose a suitable method of learning from the various sources and approaches available within the campus and outside the school. Some schools have even changed the environment of the classroom to place that inspires and aids in the development of the child; after all, that is where a major part of learning takes place. Furniture forms a considerable part of the classroom environment as well as the component with which students interact during most activities in class.

A student spends 5 - 6 hours in school every day, with most of the time being spent in the classroom. As he progresses from the primary to the middle school, he is at a growing stage where he undergoes physical, cognitive and emotional development. In the 'teaching and learning' methods that is evolving the time being spent in the classrooms, it is essential that classroom furniture evolves and aids in the process of learning as well as compatibles with the physical development of the student.

The schools in Delhi are of diverse nature because they are managed by different organizations and follow different curricula. Government schools and private schools function differently, have different infrastructure and follow different methods of teaching

and learning. Some of these Government schools are gradually inclining towards new methods of teaching and learning. But the furniture in these schools of Government or private has not evolved enough to aid in the learning process, physical development or the activities that take place in the class. School students are exposed to a world of technology where internet and cell- phones form essential parts of their learning. Even with the shift from 'teaching based' to 'learning based' approaches, it is difficult to maintain the attention span of students inside the classroom

Aim of the Research

The aim of the research is to find the various parameters or aspects that are essential for classroom furniture so that it can aid in better learning for students, considering the activities that take place in classrooms and the human factors associated with it. The objectives of the research are to understand:

- 1. How the process of teaching and learning is changing in schools*
- 2. Different types of schools following different systems*
- 3. How children grow in their primary and middle school years and the variation in growth*
- 4. The activities that take place inside a classroom and the role furniture plays in carrying out the same*
- 5. The activities/physical movements that the furniture allows the student/teacher to do; the limitations*
- 6. The human factors I ergonomics associated with furniture for classrooms*

7. How classroom furniture has changed with respect to new methods of learning

Methodology

In order to meet the objectives of the research and be able to come up with the parameters/characteristics that would guide the design, the following methodology have been used (Figure 1):

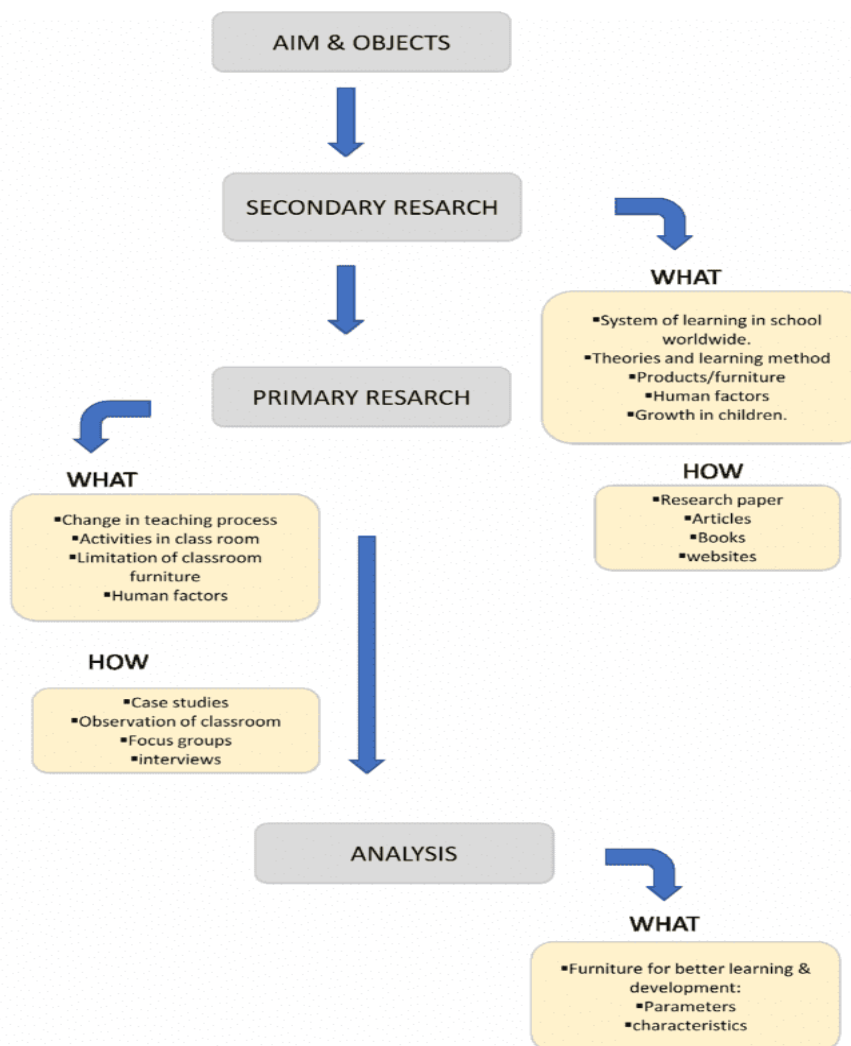


Figure 1: Methodology

School furniture – part of learning environment

What role does furniture play in classroom learning? The classroom is a place where a student spends a considerable amount of time learning; the furniture being an inevitable part of that environment. With the methods of learning gradually changing, it is necessary that the environment also changes. Some education societies and schools worldwide are changing the learning environment where the classroom discards the 'conventional look' and is adaptive to new methods of learning. In this project, the Intent is to explore what role the furniture can play while schools are trying to adopt new techniques of teaching. An example where an organization has attempted to change the way students learn in classrooms is the Vittra 'Telefonplan' School in Stockholm, Sweden. The Swedish free school organization 'Vittra' generally strives to develop innovative teaching and interaction methods for educational purposes, incorporating digital media and digitally- based teaching and learning methods. Going beyond the conventional classroom-based teaching, their concept of teaching is organized around teach groups which are structured according to achievement level and which follow the school's specific educational principles. The principles Centre on ideas such as 'the cave', 'the campfire', 'the show-off', 'the watering hole' and 'the laboratory'

Ergonomics

The average sixth grade student in Delhi spends 6 hours a day in school. He attends 8 classes of 35 minutes duration each out of which 1 class is a curricular subject. So, he is inside the classroom for 245 minutes, doing all the required activities around the furniture, constantly interacting with it. So, what are the best ways to interact with furniture in classrooms for the healthy

physical development of the child? For the last century, work chairs in schools, factories and offices have been designed for sitting upright, with the hip, knees and ankles all at right angles. Until recently, it was widely believed that people sat with a 90-degree bending of the hip joint while preserving lordosis (concavity) of the back. The erect posture looks very nice, but it is impossible to sit this way for long and there is no scientific basis for it. (A) sitting posture that approaches the natural resting position is a more suitable position and allows the spine to carry the body weight in a more comfortable way. This is "Balanced Seating" in position (B). A seat that tilts forward encourages this natural posture. Please refer Figure 2-3.

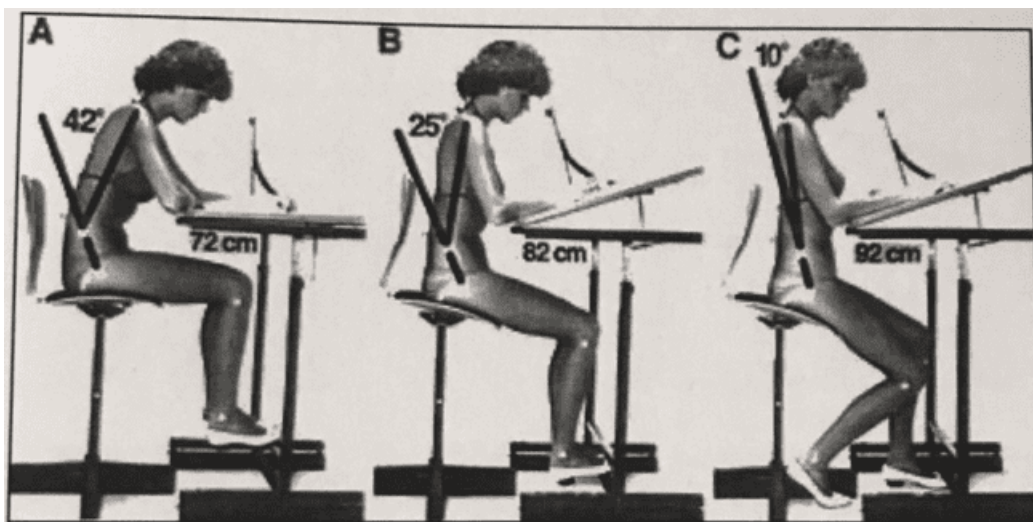


Figure 2: Ergonomics

The final position 'C' with feet lowered simulating higher seat and work surface, is exactly the same as the natural resting position where the muscles are relaxed and the body is in a perfect posture for "Balanced Seating", the most suitable position for long periods of sitting. The slope and heights of tables, keyboards and monitors are particularly important for the upper back, neck, viewing distance, and viewing angle. Active sitting provides a protective lumbar curve in the lower back. Expend considerable

energy and can therefore not to be maintained for long, unless one is trained to do so. Passive sitting is much less tiring because it expends little energy. The big danger is though, is that it quickly puts a load on the discs, which practically happens in every situation due to the lack of real lumbar support or the non-use of such a support when it is there (slumping/sliding bottom forward).

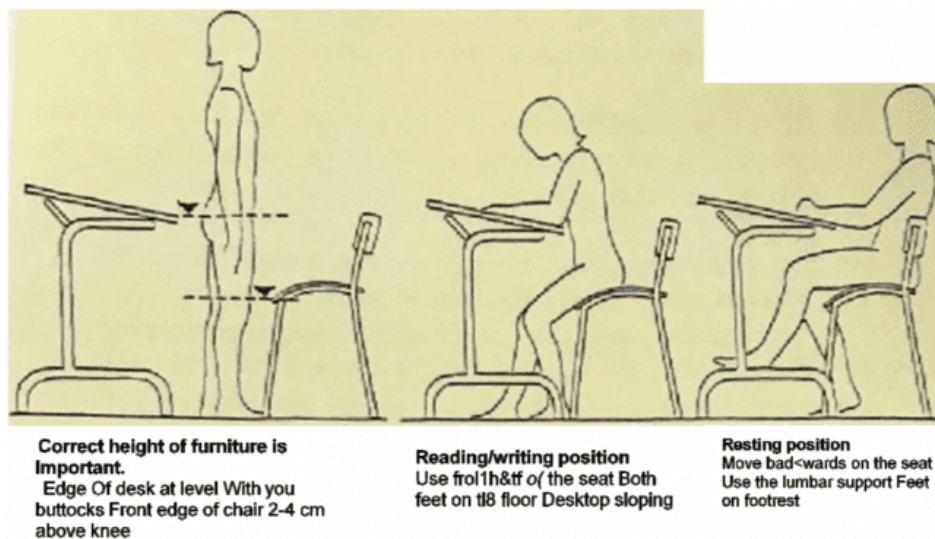


Figure 3: Ergonomics

According to Smith System, a leading manufacturer of school furniture, who give a lot of emphasis on research related to ergonomics, have identified the following factors for seating in classrooms -

- 1. Right size:** *Classroom seating should support healthy posture from a young age, especially since young bodies are developing rapidly. It should also decrease fidgeting.*
- 2. Right fit I Adjustable:** *It's not enough to provide a buffet of chairs, desks and tables and let students randomly choose. It's essential to ensure that chairs and desks are properly scaled to fit the size of the individual student. A*

chair should fit the person who sits in it, and a desk should fit to his or her height.

3. Seating that moves: *The most notable advancement in classroom seating is seating that moves. Designers and engineers now understand how various degrees of movement, rather than rigidity, of the chair itself can promote learning*

4. Function: *While ergonomics is essential, classroom seating must fit functionality. In other words, it has to complement the curriculum. Because 21st Century learning often takes place in groups numbering from two to six students, classroom furniture must be flexible enough to be configurable into groups.*

Case studies - Schools in Delhi

Case studies were conducted in the following schools in Delhi to understand the change in the teaching learning processes and how they have responded to new methods of learning. Visit to the schools of so gave on insight on various factors like ergonomics. Materials, storage etc.



Figure 4-6: Kendriya vidyalaya, Vikaspuri

Insights (Figure 4-6): *The furniture is heavily exposed to wear and tear because of the double shift system. The damage makes*

the furniture unsafe, often causing damage to the school uniforms. Furniture sizes in middle school are unsuitable for the age group. Scribbling and damaging is much more compared to single shift schools.

Insights (Figure 7-8): *The fixed furniture discourages participation of students as it is difficult to move around. The heavy and uncomfortable furniture makes the students fidgety sometimes. Storage of bags and book not catered to. Teachers often want to reconfigure the arrangement into horse shoes or a circular one. But the furniture does not allow for rearrangement that suits the functioning of the class.*



Figure 7-8: B.R INTERNATIONAL PUBLIC SCHOOL, LAXMI PARK



Figure 9-10: Insights

Insights from interviews, focus group discussions and observations are (Figure 9-10): *There is a gap between the new methods that the school has adopted and the furniture that they still use. Classes are dynamic in nature where students*

constantly interact the furniture does not complement that. Student of middle schools often attend classes in senior classrooms due to the lower number of Information and Communication Technology classrooms: furniture not suitable for their height and body. No classroom is equipped with furniture that is meant for a group with variation in growth rates and body sizes. Moving around in the classes is difficult; the ledge connecting the bench and desk is hindrance in movement. Methods of teaching is changing but the furniture arrangement is traditional. This is contradicting the idea of interaction, participation, collaboration and peer learning. Difficulty in sitting for 40 minutes class duration and sometimes they were attending double class periods; factor like back support, posture while writing and space between bench and desk is problem.

Popular Designs of School Furniture and existing design analysis



Figure 11: Peter Opsvik's school desk; Figure 12-13: Node by Steelcase

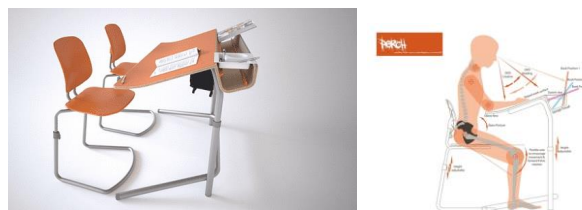















Figure 14: Perch Desk By Simon Dennehy

	Collaborative	Adjustable	Movement	Comfort	Adaptive
	Difficult to move around and reconfigure	No, same size	Joined bench and desk hinders in movement	Non adjustable distance	Suits traditional lecture mode of teacher
	Chairs can be moved, collaboration possible	no	Does not hinder movement	Separate seat and table ,no comfort	To an extended lecture mode arrangement
	Seat and desk joined	No	Hinder movement	No , narrow seat	No
	Seat and desk joined	No	Hinder movement	No, narrow seat	No
	Yes. can be moved easily and turned	Table can be turned	Does not hinder in movement	Yes. backrest profile	Yes, to various teaching ways
	Yes, single seater desk and chair	No	Does not Hinder in movement	Yes	Yes, to various teaching ways
	No seat and desk joined	No	Hinder in movement	Non-adjustable distance between seat and desk	No. suits traditional way of teaching

	Material	Maintenance Difficult To	Storage	Cleaning	Stackability
	Wooden frame laminated top	Difficult to mend broken edges	Under desk. Used to throw rubbish	FIXED seat and desk. Difficulty in cleaning class	Cannot be stacked
	Mild steel frame, mdf top	Replaceable ports	No book rock, no storage for bogs	Classroom cannot be easily cleaned	Cannot be stacked
	Mild steel frame wooden top	Broken Lipping, edges	Under desk. Difficult to clean, closed	Fixed seat and desk, difficulty in cleaning class	Cannot be stacked
	Mild steel frame ,laminated top	Difficult mend broken edges	No storage for book and bag	Fixed seat and desk ,difficulty in cleaning classes	Cannot be stacked
	Laminate bent wood seat, stainless steel frame	Easily replaceable ports	Bog con be hung from choir	Easy to clean classroom	Chairs and tables separately stackable
	Mild steel frame, pvc sheet laminated table top	Easy replaceable ports	Book storage under table	Easy lo clean classroom	Stackable choirs and tables
	Stainless steel frame, pp seat, bent laminated wooden table	Easily replaceable ports	Book rock and bog storage under seal	Difficult lo clean classroom	Not stackable

DESIGN BREIF

To design furniture for classroom that aids schools in adopting new learning methods. **DESIGN SPECIFICATION: A Single Seater Desk and Chair, Desk 600mm X 450mm. Separate desk and seat. Storage for bag 350mm x300mm size(Stackable).**

DESIGN CONCEPTS



Figure 15: Chairs are fixed to the table through a track. Which help the chair slide in the table. Bag storage is underneath the table. Different configurations are possible.

Figure 16: A foldable table for collaborating and a chair that has its backrest converting to a workspace for individual work

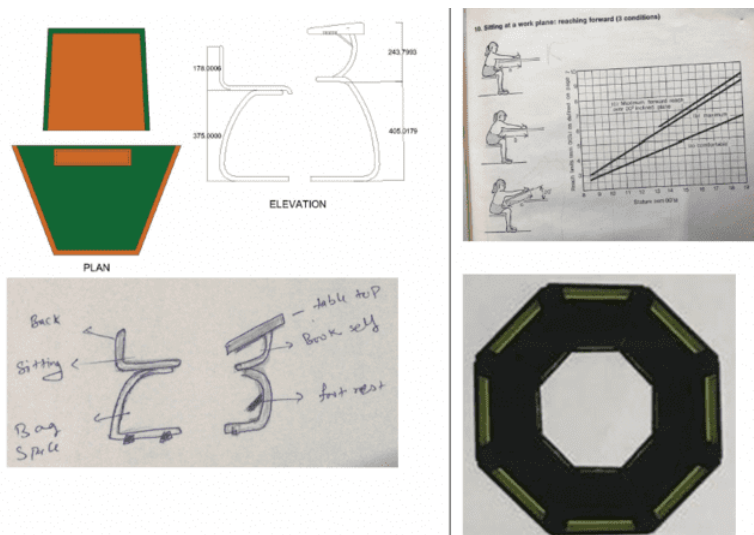


Figure 17: Shape of the table top help in reconfiguring in various way

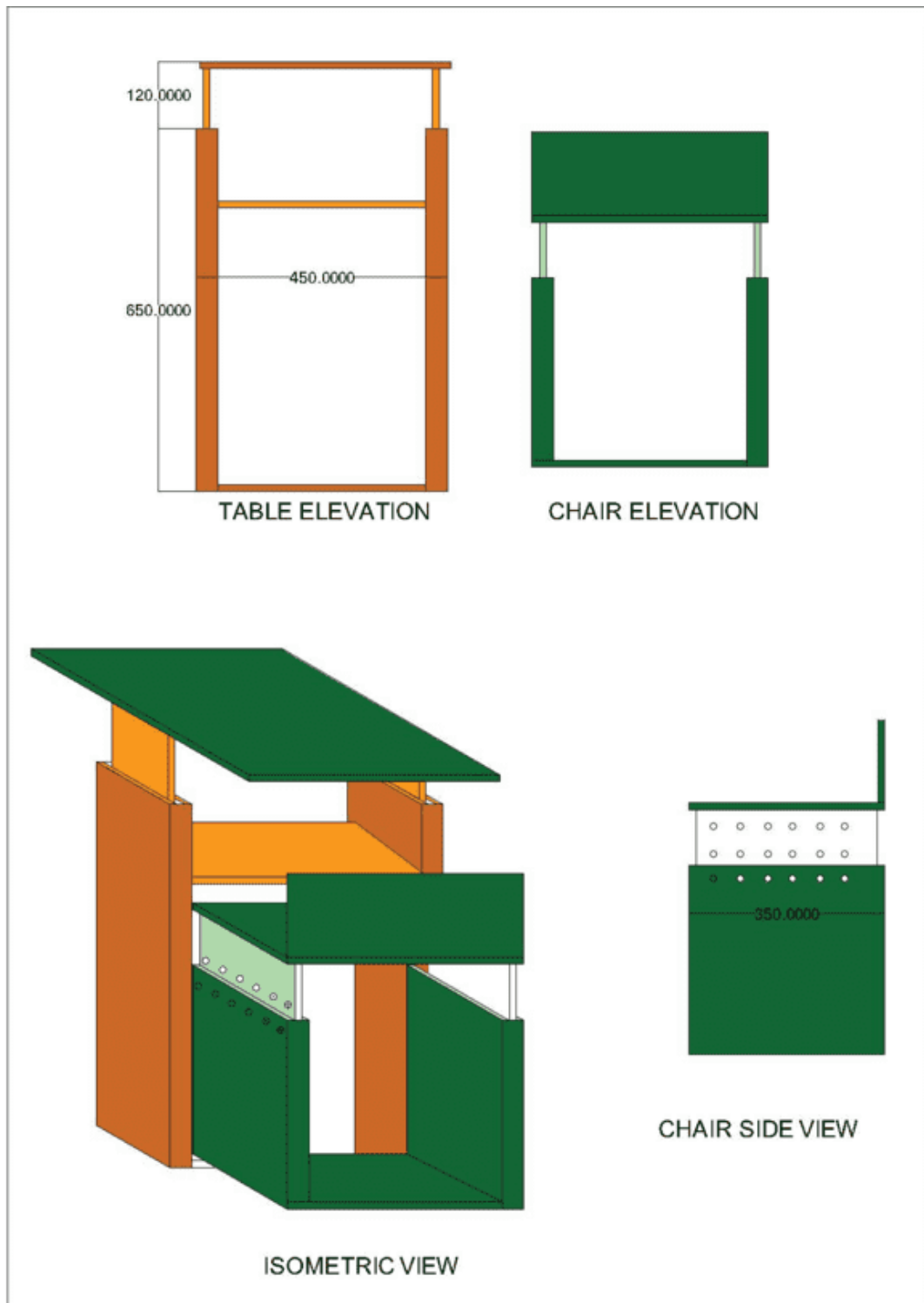


Figure 18: A telescope student table is to provide a comfortable and clear view of the telescope's eyepiece for students of all heights. By adjusting the height of the table, students can achieve the optimal viewing angle without having to strain or contort their bodies. This can help prevent discomfort

FINAL CONCEPT

The Co-Learning Reconfigurable Single-Seater Series, designed specifically for middle and senior schools to facilitate a collaborative environment that modern classrooms demand. This innovative furniture series addresses the need for versatile classroom furniture that can adapt to different learning styles. The design of this furniture series emphasizes the importance of creating a reconfigurable space that can be easily transformed to meet the changing needs of students and teachers. By providing a flexible and adaptable environment, the Co-Learning Reconfigurable Single-Seater Series helps promote a collaborative learning experience that enhances creativity and engagement. With this series, students can easily rearrange their workspace to suit their individual needs, while teachers can quickly transform the classroom layout to support a variety of teaching and learning activities. The single-seater design also helps students focus and minimizes distractions during independent work. Overall, the Co-Learning Reconfigurable Single-Seater Series is a versatile and adaptable furniture solution that supports a modern collaborative learning environment in middle and senior schools.

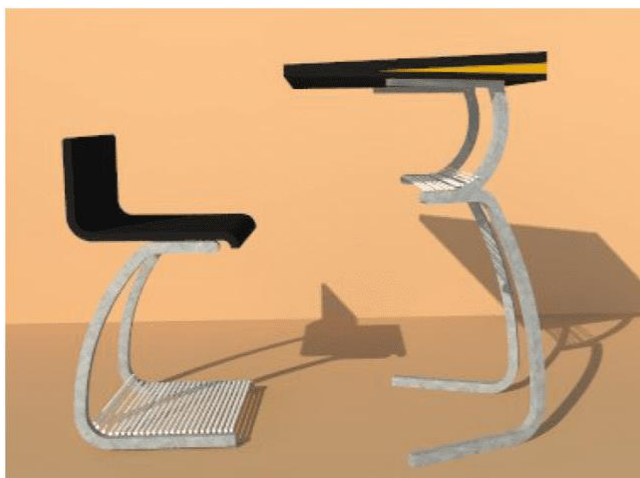
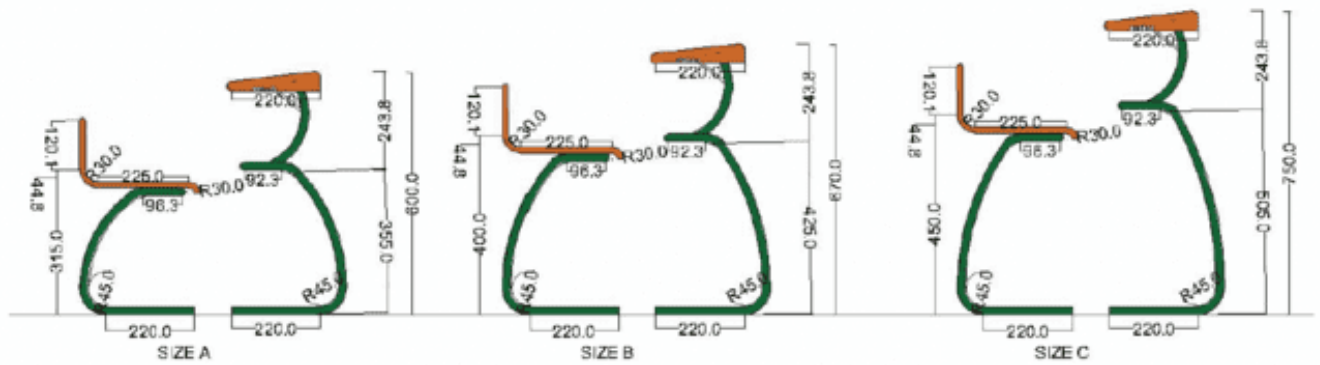


Figure 19: Final Design



NO LAST BENCHERS



A 7th standard classes configuration for 30-35 student :6 row

CLASSROOM CONFIGURATIONS: The foundation of the project was the need for the classroom to change in term of its configuration and ability to adapt to various learning and teaching way. The following classroom configuration is possible with the design in a classroom size of 8mx10m accommodating 36 students (Figure 20).

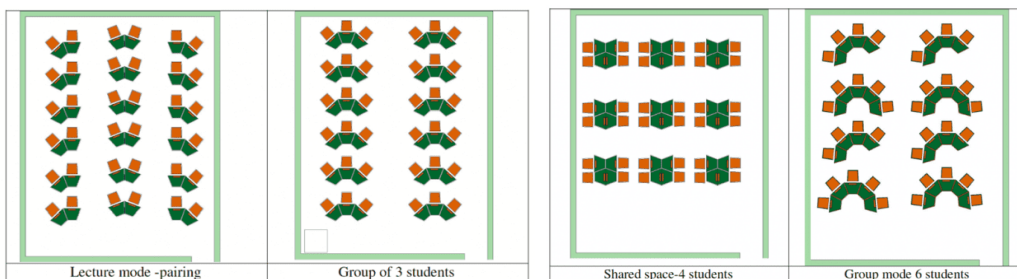


Figure 20: Classroom Configurations

MATERIALS

- ***Rubber wood table top***
- ***Injection molded polypropylene backrest and seat***
- ***Rectangular MS section***
- ***Catcher to lock the top tilt***
- ***Rubber glides***
- ***10 mm road for bag and book storage***



Figure 21: Materials and Class scenario

Bibliography

- 1. Indian Standards 4837.1990: School Furniture, Classroom chairs and tables -**
- 2. Recommendations**
- 3. Indian Standards 4838.1990: Anthropometric dimensions for school children age**
- 4. group 5-17 years**
- 5. Mandal, A. C. 1976: Work chair with tilting seat. Ergonomics 19, 157,164**
- 6. Mandal,A. C. The Seated Man -Homo sedens. Dafnia Publication, Denmark**
- 7. Manda!, A. c. 1997: Changing standards for school furniture. Ergonomics in design**
- 8. Opsvik, Peter.2009 : Rethinking Sitting**
- 9. UNESCO: School furniture handbook**