SUMMER TRAINING REPORT

BY

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Index

ACKNOWLEDGEMENT

I thanks Mr. MDAN K. KULKARNI for his kind acceptance for me as a trainee designer in his company. I also thank him for helping on each moment for developing my line of thought in fabrication works. I also like to thank the developement engineer Mr. Mahesh Ozarde for his valuable practical guidence & great help while working with my final prototype. I also thank the supervisores of kalakruti steel furnitures pvt. ltd. for tolerating my developent activities during thei production works & providing me necessary manpower.

Last I like to thank the office staff for llet me use thier computer during their working days & taking my prints in the middle of their prints.

INTRODUCTION TO KALAKRUTI STEEL FURNITURES PVT. LTD.

The company is located in the industrial area called gokul shirgaon midc. This is one of the only one big steel furniture manufacturing company in this region. This unit is around 12 kms away from the kolhapur city. The major products that this company produces are the hospital furniture & kitchen equipments. This company started by mr. Madan k. Kulkarni around 12 years ago as a small fabrication shop. He is also a excellent designer qualified from the idc's third batch. Now this company has four units in this industrial area. One unit handles the all development activities such as die development & all machined components. Other one handles the total production of the hospital bed & other two handles the kitchen furniture & non standard as well as standard furnitures for hospital. Next they are starting the furniture range for the academic & educational institutions. This is the one of the reason why I gone there for training. The company turnover for a month is around 40 to 60 lakh rupees. Right now they don't have design department as such, as recently the company has developed so fast. But the design activities under the guidance of the director mr. madan kulkarni are very strong. The company owns a good manufacturing setup & is the biggest major suppliers of the hospital furnitures in this part of the country. They had developed around the 82 products in the hospital furniture alone. I worked in the unit named kalakruti.

MANUFACTURING SETUP

The various manufacturing fascilities available in this unit are as follows:–

Shearing machine :–

This units has two types of the shearing machines. One is manual type & other power driven (motorized). The panels or big sheets are cut on the power shear. Manual shear is basically used for small & development activities. Power shear handles the all production activities.

The sheet metal bending machines :–

Here also two types of the machines are available; manual & power driven. Now a days they use mostly power driven press. This is a hydraulic powered machine & all production activities related to bending are carried on this machine. Sometimes the small hand driven press are also used for the small bending works with little modification.

The punching press :–

This is a big noisy, heavy machine. this is a electric powered & all the processes such as punching the corner profiles in sheet metals or punching holes at the corner of square pipes are done on this machine.

Pipe cutting machines :–

These are the small machines located near the pipe storage. They are motorized with a thin cutting wheels attached similar like a hand grinder. All the small rods upto 12 mm & pipes around the 2" dia can be cut on this machines.

CO2 welding :–

This is the welding machine uses co2 as the inert gas. This is used for the all mild steel fabrication work with fair control over the line of weld.

Argon welding :–

This also a inert gas welding basically used for the stainless steel welding. This uses argon as a inert gas & has good control over the line of weld & fine welding is possible with this welding machine.

Arc welding machines :–

These are for the rough welding works & for temporary welding of the structures. This is also used when the precise control over the line of weld is not required.

The pipe bending machine ;–

This is the motorized electric pipe bending machine. they have some standard bending dies developed. They use this dyes & standard radius for bending. This is one of the constraint that has to be considered for the detailing of the design constraint.

Buffing machines :–

These are used for polishing of the stainless steel pipes & prod–ucts. All elements in stainless steel elements after the all processes come to the buffing machines for shiny & polished surface. These are electric motor driven machines.

Grinder & lathe machine :–

There is also small tool grinders near the lathe, welding & pipe cutting machines for grinding the burr. The lathe machine is used for machining small bushes & spinning the metal sheet as well as spinning the pipe ends.

MANUFACTURING LIMITATIONS

Limited variety of materials :–

The setup is developed specifically for all the steel fabrication work. So mostly the material available is steel pipes, sheets & few lami–nates such as the mdf board & plywood, abs sheets as well as the ecolink boards (these boards are manufactured from the waste of tetrapacks). That's why all the design has to be thought in terms of these materials so that it is possible to manufacture in the existing setup. Specifically there is great constraint about the material of structural elements.

Standard machine accessories :–

This was specifically true for the pipe bending machines. They are using standard set of set of bending dies with some fixed radius. So for design purpose this has to be considered & the radius cho–sen for the pipe bend. Same was there for punching machine.

Technical limitations of the manufacturing pro–cesses :–

This was critical about bending. As we cant bend the pipe below certain radius in order to avoid the wrinkles, we have to stick to some minimum radius considerations depending on the thickness & size of the pipe.

WHY I DECIDED TO GO THERE ?

As the steel furnitures are relatively simple to manufacture com–pared to other products, they take less time to develop. Besides the prototype cost for trials are not so high as in other cases. Also these products take comparatively less time to develop. What I was expecting from training is to understand in detail the compli–cations of the relation between the manufacturing setup & the design of product & how much the variation can come between the final product & initial concept. As they were developing the educational & academic furnitures which is totally new to them, they had to start from the beginning of the concept to the final prototype. This was may be the best opportunity for me to seek my answers. This is why I decided to go there for training.

THE DESIGN PROBLEMS

1) The classroom benches for college students :–

If we observe the existing classroom benches in colleges, we will found that they are for 3 or 4 people. This is the problem. The middle boys can not get out when all are seating & one wants to go out. Besides the entry into the seating posture is also a problem. Al–ways something hits you as you get in. many of the benches don't have backrest. To the some extent two's module is good but the problem again comes when the class is combined & benches are brought together for more space. In practise nobody cares about the possible layout while manufacturing benches. The main prob–lem with the layout is that it don't allow the easy movement of stu–dent as well as the teachers in different scenarios such as exams, combined classes etc with the existing designs. Still the materials used are either wood or ms angles. The design are also so regular that it didn't changed much for years. Good looking economic de–signs are still not in the market.

So my mission there was to come with the concept that solves the above problems. The data survey was carried here in iit bombay before leaving to the training. All above problems were studied with the existing designs. For each bench type the merit & demerit were studied & then I moved towards the concept genera–tion.

2) Design of hostel room furniture system :–

Like the bench concept this was also a design task involving chal–lenges of space & convenience. In typical hostels they provide a flat bed & probably a table (if space is available) & if possible one big cabinet. But if all is provided then one person takes a lot space or more persons are having this fascilities in same room then the no space is left in room. Even in the normal room with 3 to 4 beds we can see how less space is left. Besides the beds are used only in nights & whole day they are the dead weight lying in the way, eating space. Also a student needs a lot more than this, such as the book rack along with a small table, A small space for keeping his daily used object such as toothpaste, soap, brush, a small watch etc etc, a locker to keep their dress. All that is always they don't consider carefully.

This is specially true with the private hostels around the engineering colleges all over the country & lots of with the pri–vate schools. Here my challenge was how to bring all above con–cepts with the furniture system that I am designing & want it to be beautiful & economic. For data survey I visited a site of a hostel which was under construction . they were interested in this new concept of hotel furniture system. Studied their plan & also discussed with the architectures for various room spaces they builds for hos–tels.

DESIGN SOLUTIONS FOR CLASSROOM BENCHES :–

Concept 1 :–

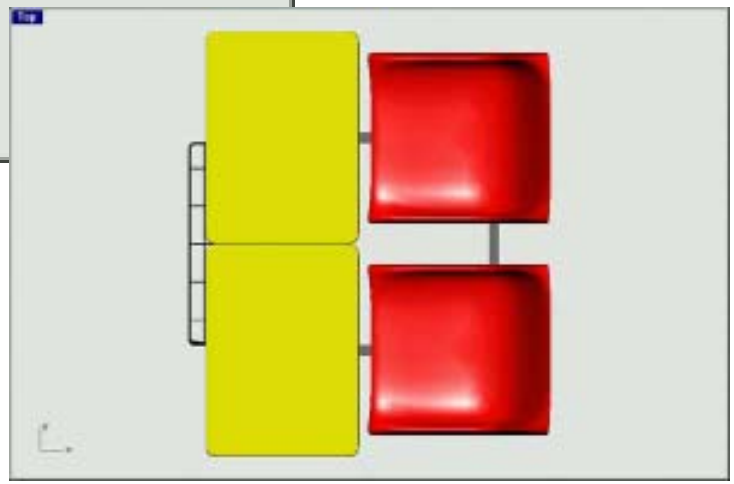
The basic considerations for this was as follows that I decided after the data survey □

* Two's module is the one best option for individual rows or for combination.
* There must be space around the each student that may again will be useful for getting in or for used when two benches are combined.
* Each bench should have backrest.
* As far as possible keep all the detailing such that it's possible to manufacture in existing setup.
* Tryout different material for cost & asthetic purpose.

Based on this the first concept developed. It uses the injection moulded seat with backrest. This can be purchased as a standard item in market. Besides the all design issue's regarding the seat design is resolved with the standard plastic seat module available. The structure is made from 1.25□*1.25□square MS pipe so that the strength is more than the equal size round pipe.the square pipes are better where the torsion comes. They supposed to be later on powder coated. The top will be made from the new type of boards which are made from the wastage of tetrapacks. This boards are quite cost □ effective.

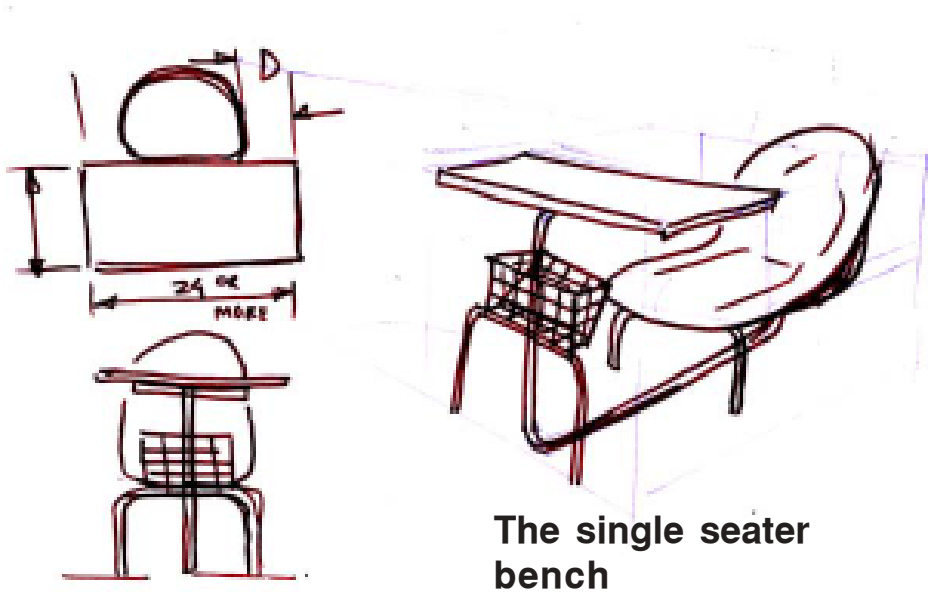
The top also pivoted at outer end so that at the time of entry one can lift away & get in to the seat. A small wireframe basket is provided in such manner that it is easy to put & take out the belongings kept in it. The space around the seat is so kept that the entry & leaving the seat is possible even when they are combined. Actually this will not much convenient but its better than what is available with existing benches.


Perspective

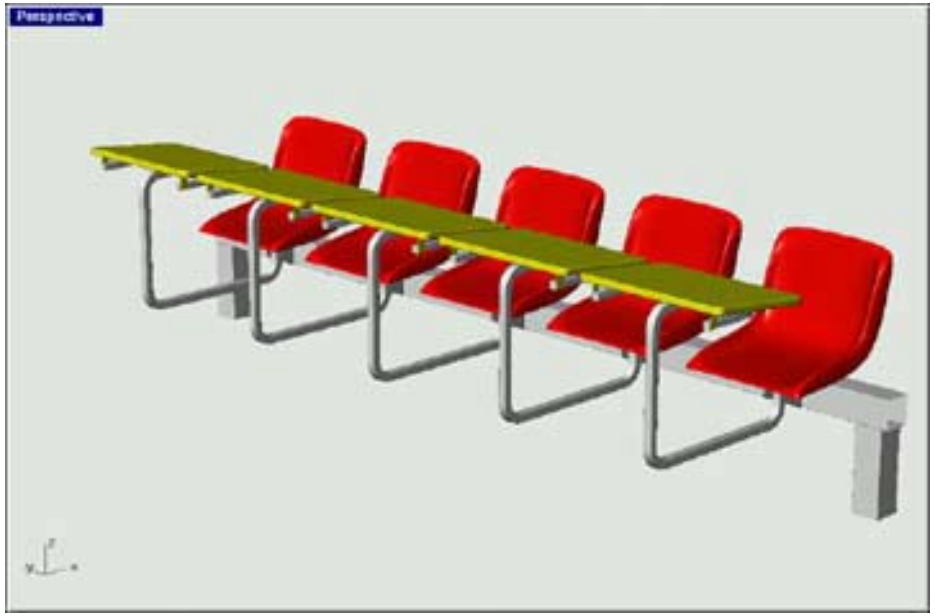


Concept 2 :–

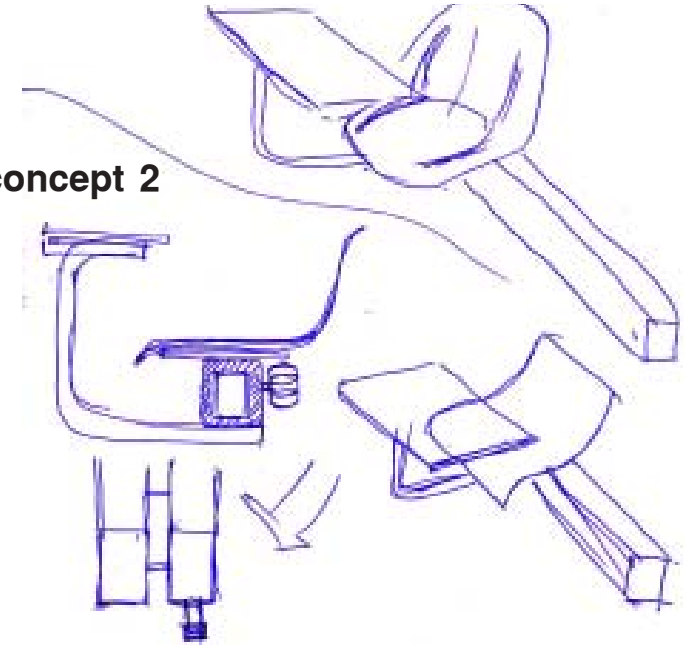
As by above few considerations mentioned few things are kept con–stant such as the top & seat. The injection moulded seat has ad–vantages of having backrest & a sufficient required space around it. Besides it is standardized item so that consistancy in the quality of the product. Top has minimum required area & can be increased based on the how much space is left around the chair. In concept 2 the major change is with the structural member & the way they are put together. In second concept the individual module is developed for a single student & then they are clubbed together in one row. These modules can be adjusted for the space around over a hori–zontal square beam.

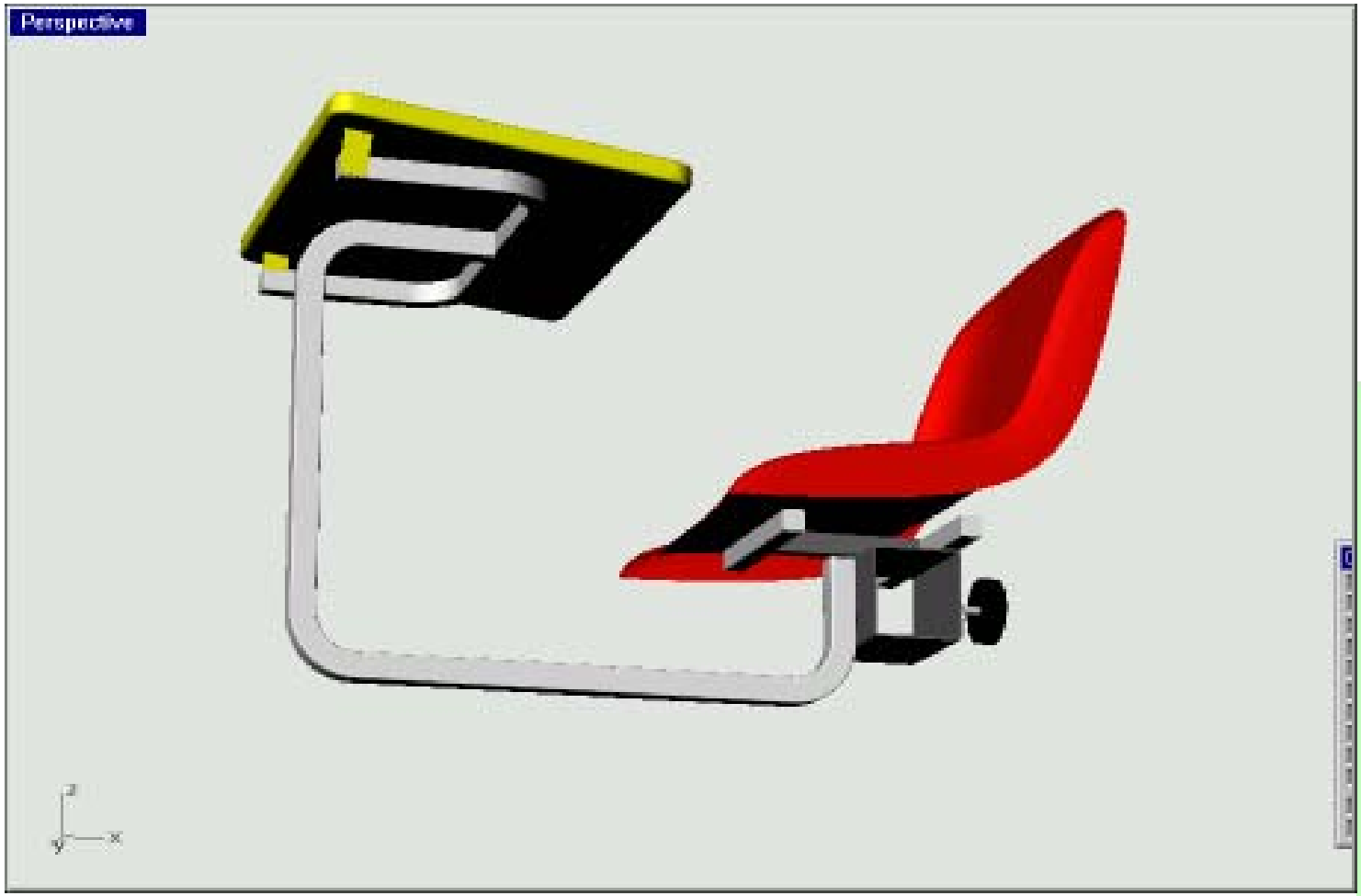


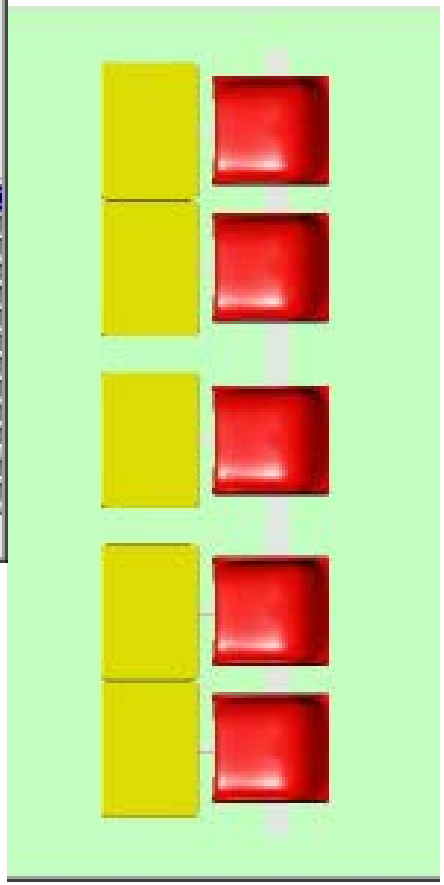
The single seater bench



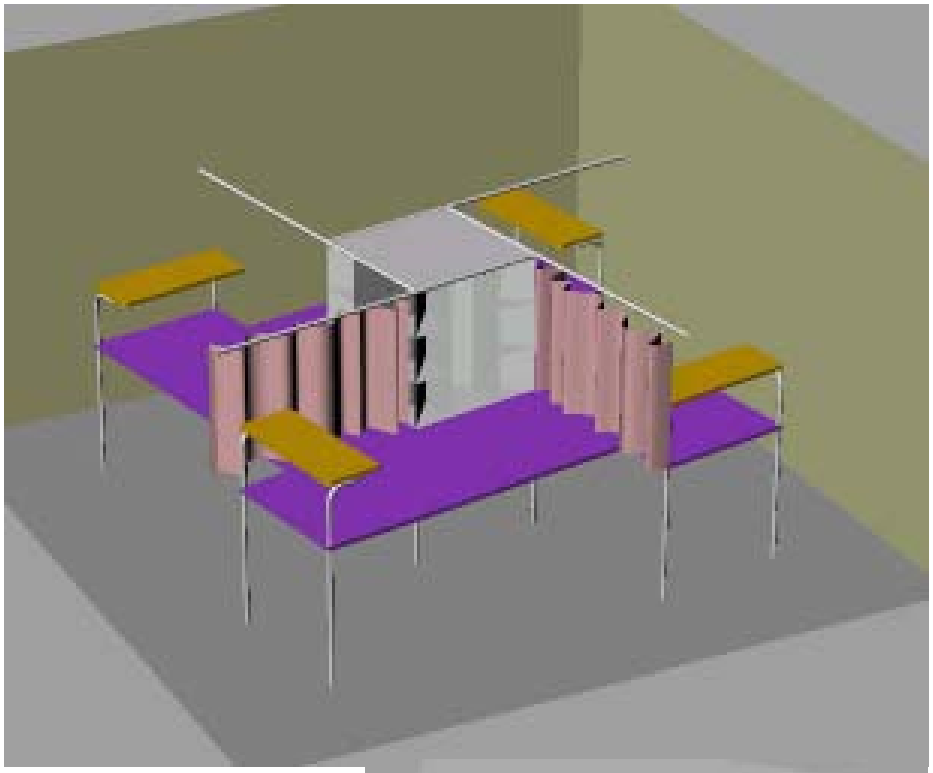
details of concept 2




Perspective



DESIGN SOLUTIONS FOR HOSTEL FURNITURE

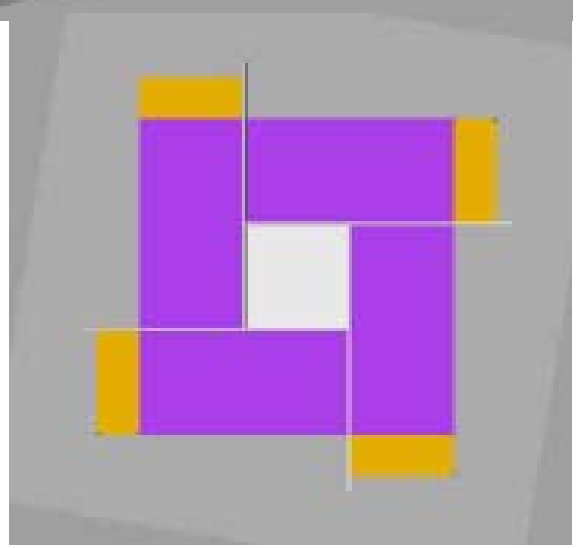


Concept 1 :–

The basic requirement of a student living in a hostel are as below:–
* A bed to sleep
* A cabinet to keep his clothes
* A table & book rack
* A small rack for keeping toothpaste, & all similar things.

So I did decided to design these as either as one complete unit which has all these above mentioned accessories or to provide different modules as such & then later we can put together as lay–out & availability of space. The concept one focuses on the first strategy of combining all the accessories in one whole unit again is assembled on site as a standard furniture. In this the cabinet is placed at the middle & each one gets a one prism kind of space which is a part of a cube. Now at each face one bed is bolted. This way all the four bed makes a full system for four guys. Now as per the no. of student allotted in a room, beds can be attached to the cube. The pipe at the top has curtains that provides the privacy if you want. At the end of the bed there is small table integrated with the bed legs. The space in every accessory may not be plenty but is sufficient. Also the below space of the bed can be used for keep–ing the bags & trunks. This is more advantageous when four stu–dents live in one room.

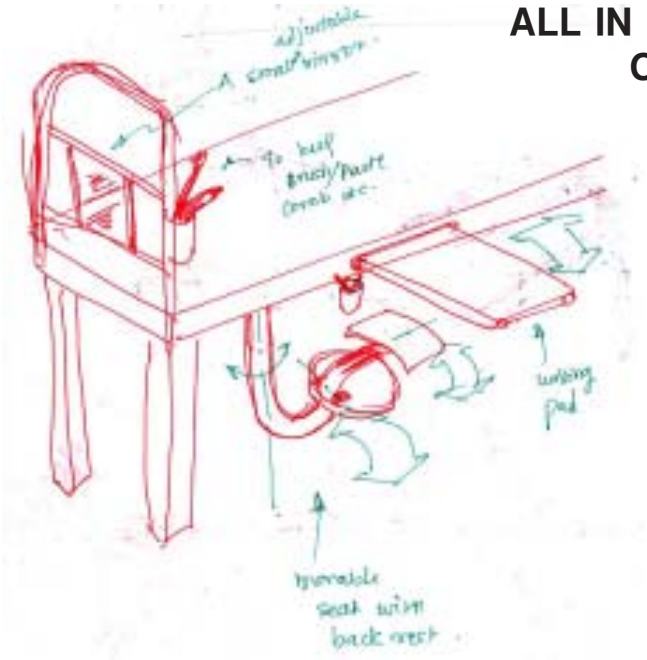
TOP VIEW

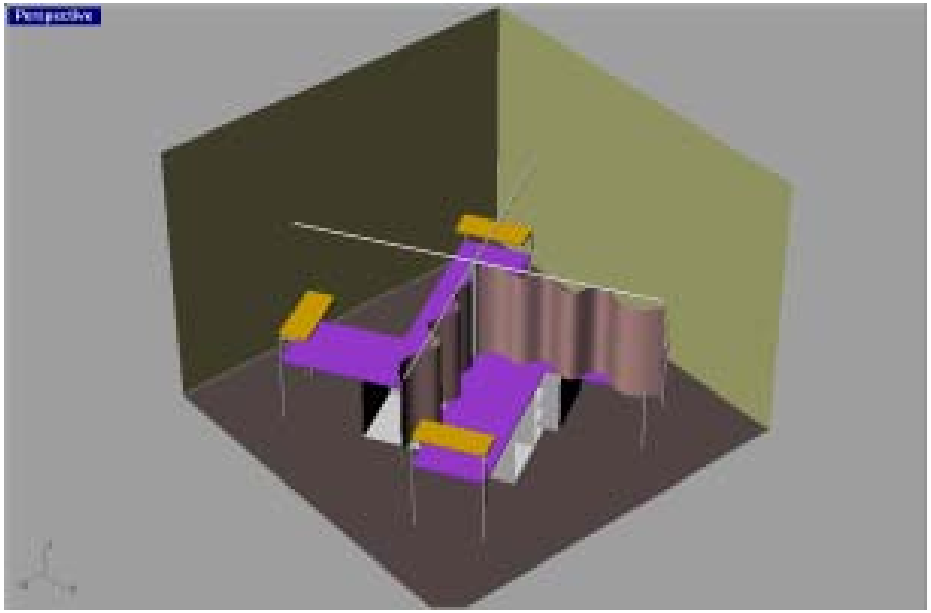


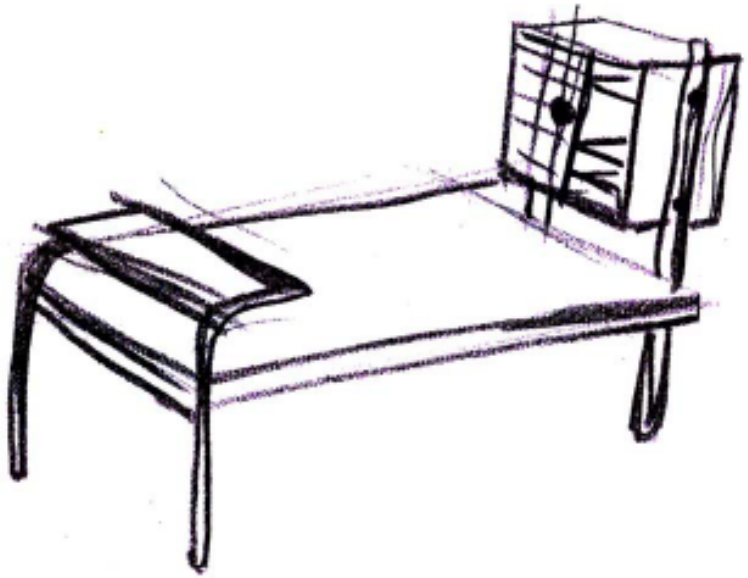
Concept 2 :–

Concept 2 is the modification of the concept one to step further. As I mentioned concept one is good for 4 student in a room but as per the room layout there may be two or three students in a room. Still the problem of space is not effectively solved. So the thought came that develop individual items such as one standard bed & one stan–dard cabinet & same way other accessories so that they can be combined together for one person or two, three persons. That way then this concept now became little superior. But for four, you may need four cabinet or separate design for fours cabinet or we have to keep solution one as a option for this case. This way the variety of accessories as well as structural complexity were increased a bit. Inbetween another idea popped that make a bed as individual to everybody & then provide a one complete all in one chair with inbuilt cabinet, rack, a table top & a night lamp. This chair will have the swivelling caster wheels so that it can be moved anywhere & kept in a corner when not used. But again the problem of space was still there. Here we are just providing the furnishing system with partial solution of the space.

ALL IN ONE BED CONCEPT

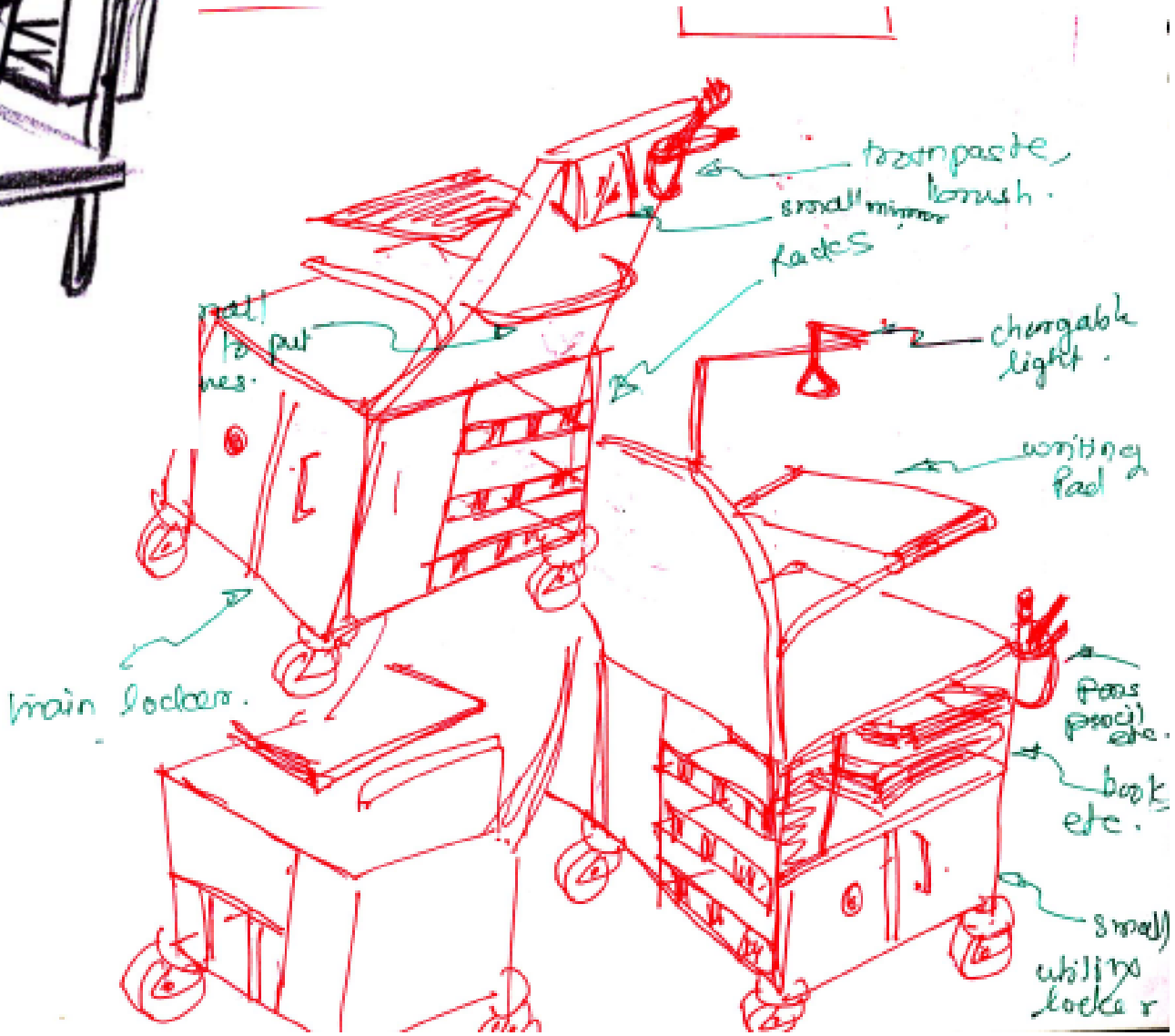






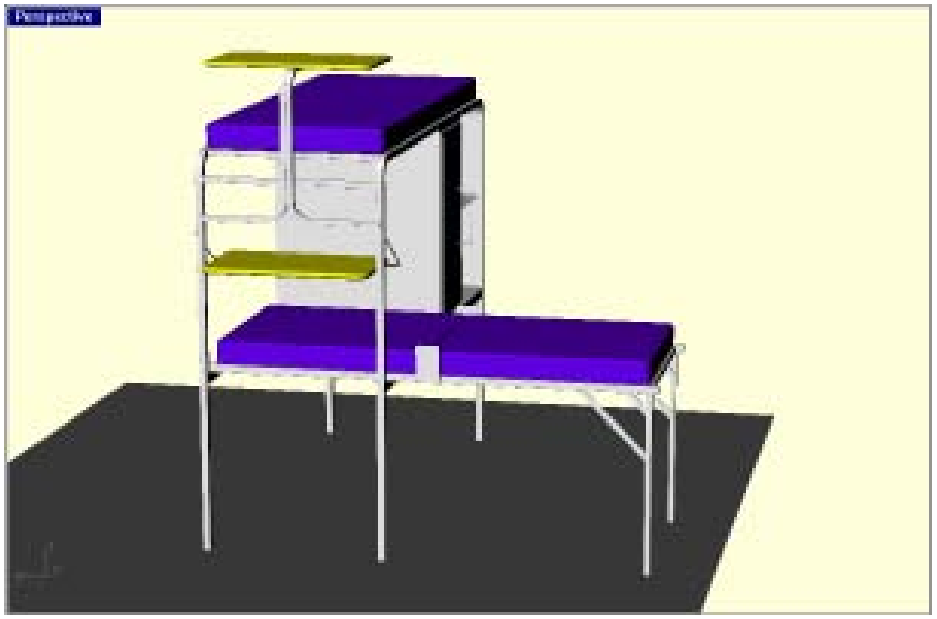
The single bed concept

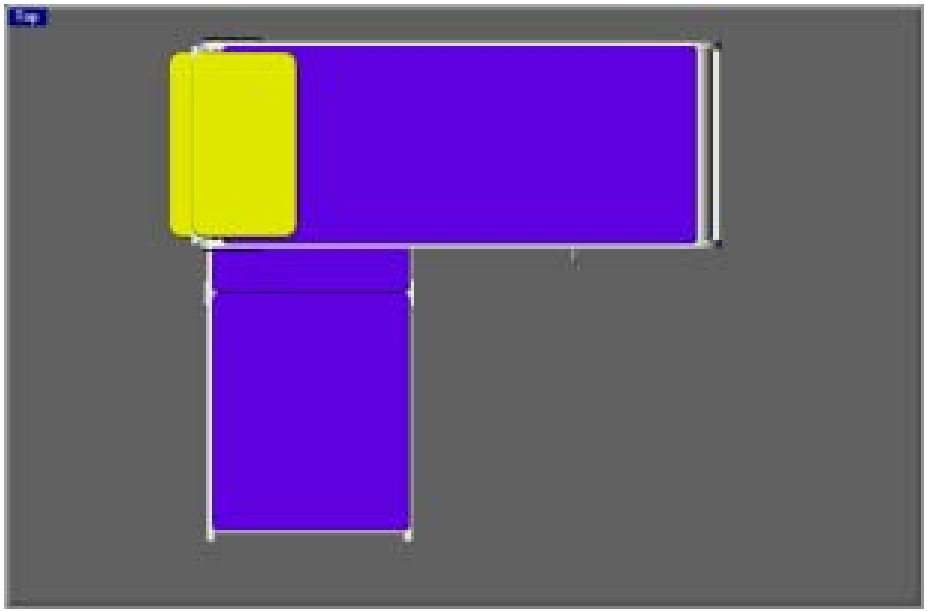
All in one chair



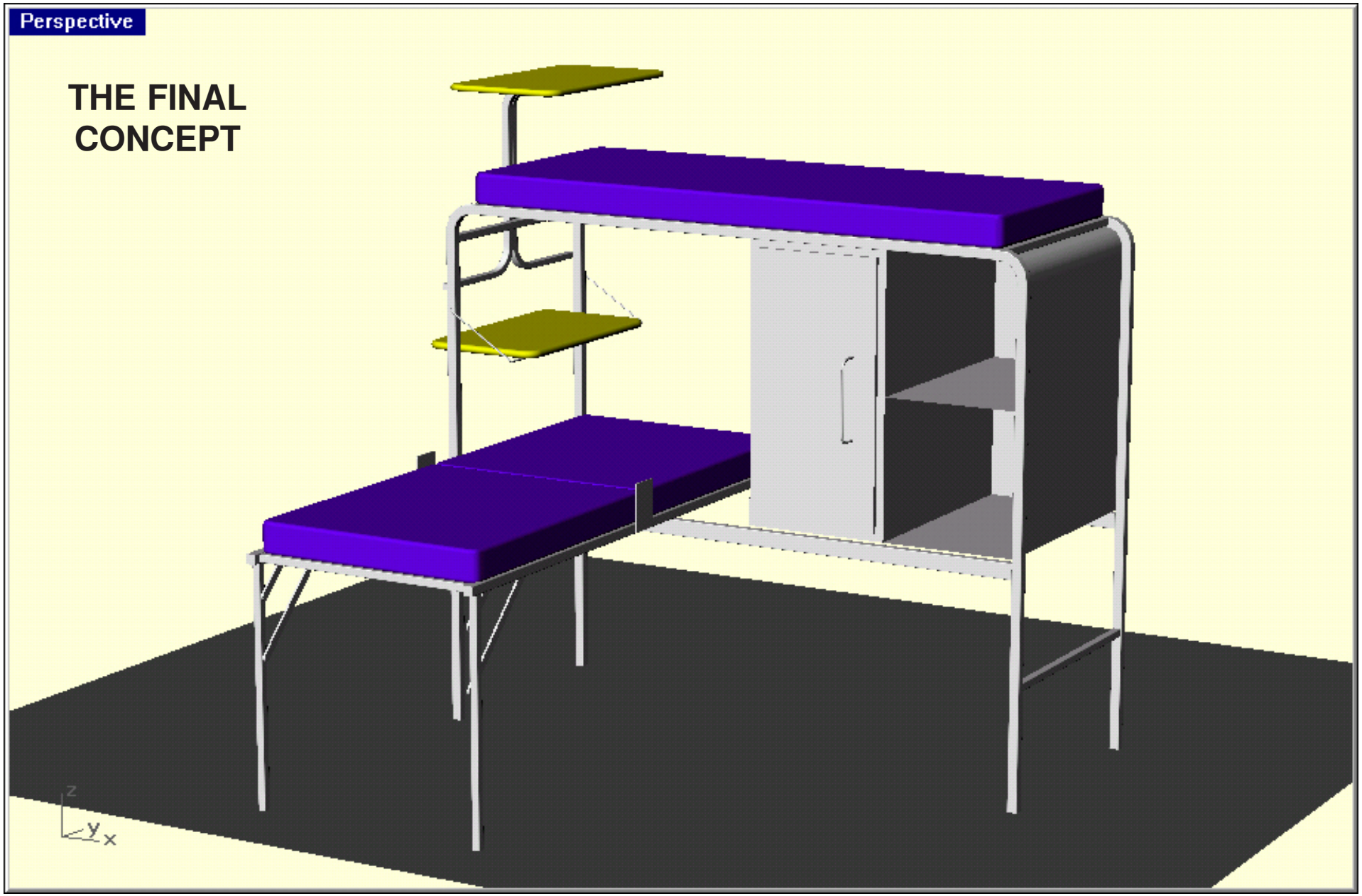
Concept 3 :–

In concept three, I changed the line thinking. For space saving gen–erally bunker beds are used. In bunker beds the beds are kept over each other so that in one bed space 2 or three persons can sleep. But the major problem with the bunker bed is that it feels very unconvenient to sleep below somebody's bed. Considering all the good & bad factors of all above solutions & borrowing few good concepts of bunker bed, I came with this third concept. What we do in bunker is that we put straight forward two or three beds one over the other. But what I did in my design that I placed two beds one over other but in at right angle. This way the inconvenience of sleep–ing exactly below the to person is avoided. Also at the other end cabinet & all accessories can be made. Besides the below bed can be made folded so that when its not used it can be folded in so that additional space is achieved. As I found mostly two guys sharing the rooms, this can be a good solution. This is also good for two as well as four person sharing the room. When three persons are shar–ing the room then one two's module can be given & one plane single bed whereas the third guy shares the cabinet with other two. Also at convenient places their table were integrated with this mod–ule. So this is I finalized as my final concept.



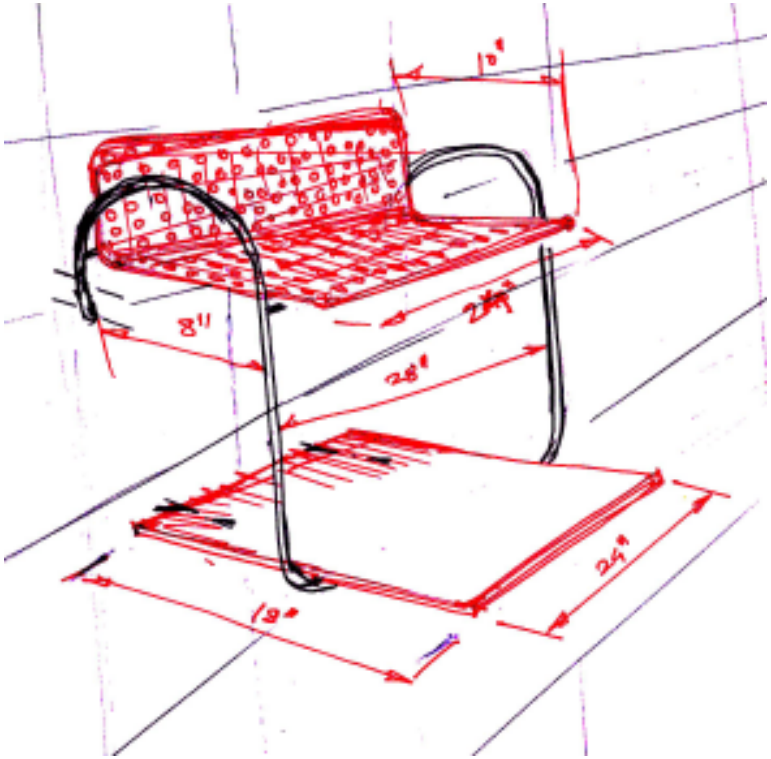


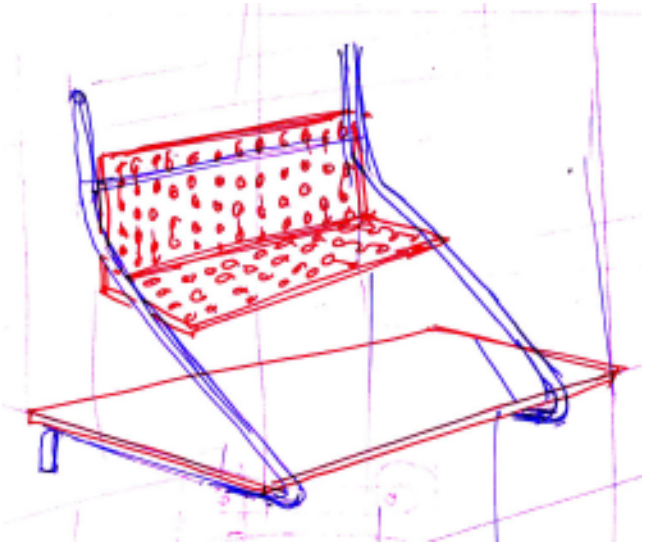
THE FINAL CONCEPT



Design of the table & book rack

After finalising the concept three, it was decided that the table & rack has to be made separate. hence two three alternatives were proposed to them. the table to considered were one & half feet wide & two feet long. the rack is kept above to table surface. basically the framework around these two elements were important. as it should be easy to manufacture & look good too





The final concept

THE FINAL DETAILING & PROTOTYPE :–

As I decided to work with the third design concept, I have to detail out the concept. With standard material available & by considering all the possibilities of manufacturing in this unit , I came with a de–tail drawing. But before to proceed for detailing we again had a discussion & some changes are made into the design. The first change we made is that we removed the folding concept. As rotat–ing & sliding members are not durable in daily use. Besides how much we use that in practice & with what frequency we use was the question. After discussion we found that its not so important to pro–vide this folding arrangement. Secondly the height considered was around 5 feet. This was necessary to have such a height. As its better if the top bed height as less as possible. Then that height we made it to 3 feet. & below bed height also brought down to around one feet. Also the table top was removed from the bed system & instead we designed a separate wall mounting table as well as book rack. The space utilization is such that it don't make the bed space too much tight.

In the first prototype with all other above mentioned modifi–cations we decided to hang a standard cabinet that company manu–facturing now a days for doctors to the legs. The legs are also kept minimum possible in no. legs are provided on middle of sides so that it held strongly to the top frame.

But after actual fabrication of the prototype we found that the strength is not good & it was not a good idea to hang the cabinet to the legs. Besides it was strong at one part & was weak at other end. So we detailed out another prototype. Now in this instead of hanging the cabinet, we designed a cabinet over which the top frame is supported at one end & other end end has a legs. Also it was absolutely not necessary to join two bed so another standard bed with less leg height can be fitted there.

The basic structure

visualisation

The basic structure

visualisation