Research in Japan #1
catching nature

a school upgrade for hyderabad, india

A competition entry for the 2009 Open Architecture Challenge: Better Classroom Design

1. Introduction and Design Process

“Humans are creative beings.”

When thinking about designing and an environment for children, imagination becomes the key to their world, where fantasy is everything and nothing. Our design team welcomed the children as vital in the process of designing an environment, where they are going to spend many fruitful years of their young life. So as their physical participation was not possible, we accepted the visual expression of their ideas and creations transported by the drawings and videos provided as their virtual representations. We utilized as much as possible and after listening and watching the videos about the different schools we started using word-snippets from teachers and children to channel our intuition and craft. We used a cooperative sketching and brainstorming method during the whole time, just to mention one method of how to include the children. Drawings from the children were taken and successively amended by all team members. Thus the creative input and ideas from the children are incorporated into the design process, productively reflected and nurtured by all team members working together. It became a collaborative and fluid method employing the expertise of different people and fields.

2. Building as environmental device

“Teaching should always be joyful, fun and easy.”

Rather then seeing the building as a simple envelope for certain school functions that happen inside, we wish to create a learning environment that helps to activate the basic understanding of the human natural and built environment. The building shall become an environmental device where natural occurrences like wind and rain and sunshine and shadow can be directly experienced in its rich diversity. Furthermore, the building shall make maximal use of natural lighting and ventilation to optimize the spatial conditions. In overlaying rich spatial environments with technically sustainable and affordable solutions we wish to create and provide inspiring learning environments where children and teachers love to be. We aim to amplify the status of each school as being a part of and a big chance for the community and each child individually.

2.1 Reclaimed inner yard

Due to site constraints and the function of the perimeter walls as closed boundary walls, where no

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The competition entry was done in collaboration with students of Prof. Kazuhiko Namba laboratory: Ryo Ishida, Sato Takashi, Kuroda Mashu, Fukuda Hiroshi, Tan Toon Cheng and Rina Kellermann.
windows are provided, the existing ground floor gives a very underground or autistic impression. The connection to the outside world can only be maintained through a long and narrow entrance passageway and narrow openings in the ceiling. When looking at them from a different perspective, the ceiling openings are like windows toward the exterior, through which daylight and fresh air and even rain can enter. By extending the amount of these openings in series along the outer wall, they start to form a space which is neither fully inside nor outside. It is a kind of courtyard along the vertical perimeter of the building’s envelope. In comparison to a compact inner courtyard this perimeter yard can affect much more of the inner space by the simple fact of the yard’s longer boundary. To put it simple this perimeter yard is a retrieved exterior space that was forgotten during the construction of the school building, a space where environmental conditions like sun and rain and wind can be freely experienced, where nature and people start to grow and blossom.

2.2 Wind and ventilation

Wind is the best natural air conditioner, its movement accelerates temperature exchange. In a hot environment a slight breeze can add to the comfort. Our research has revealed that wind in Hyderabad is coming from different directions, Northwest in summer and Southeast in winter. To utilize the wind movement for natural ventilation of the building we install four wind towers which connect to ground floor and define the end points of the perimeter yard. These towers work basically as chimneys to siphon used air from inside the building. They are equipped with chimney cowls to support their function using the speed of wind by the Venturi effect. Fresh air can enter through the ceiling openings and circulate throughout the building.

2.3 Sun and lighting

Beside the fresh air also daylight can reach the ground floor more naturally through the perimeter yard. To maximize the amount of natural lighting the perimeter wall will be painted with a silver color, which is very effective but nevertheless cheap. The wind towers are painted black to boost their convection capability by transforming solar radiation into heat.

2.4 Rain and spatial renaturisation

When rain falls it will freely pass through the openings down to ground floor. Beside air and sun this is the last ingredient needed to assure the growth of flowers or plants. As natural green is the most refreshing and calming color, flower pots can be freely put into the perimeter yard or even attached to the wall. Their presence will enhance the overall quality of the adjacent
interior spaces dramatically, in terms of air quality, like amount of oxygen and cooling by water evaporation, and friendliness. Empty pots can store excessive water for additional evaporation.

3. Learning spaces

"Children can only learn what they are ready to learn."

In our opinion the school should be organized as much as possible like an open-plan school, which means that fixed separations between learning spaces (e.g. "classrooms") should be minimized. An open-plan school provides much more flexible arrangements for teaching and learning. In cases like a growing class where number of pupils are increasing or combining classes in case a teacher is ill, the size of the learning spaces can easily be altered. Furthermore, "open-plan" can also be interpreted to mean that the school is open to both the pupils as well as the rest of the community. So taken from the many possibilities of how to arrange the learning spaces, on the floor plan drawings we are showing just some options.

3.1 Ground Floor

Starting on ground floor we are showing a rather strict or partitioned layout. Some existing brick walls aligned to the position of the columns are maintained. In the center we are proposing the new computer lab as a diamond shaped space. The computer lab will be the most artificial space in the whole school. The lab is the home base for any kind of computer based learning and teaching, but if needed and thought beneficial mobile stations can be easily taken to adjacent classrooms. For security reason it is enclosed by brick and glazed walls up to a height of 2/3 of the floor height, which allows for natural ventilation of the lab space and will keep running costs down. The glazed walls limit free movement but neither view nor light. Due to the position of the lab centrally on ground floor and the transverse orientation within the rectangular space, the ground floor is segmented into four similar sized spaces each facing one of the glazed walls. This provides for better ventilation air flow around the enclosed space. The lab will be lighted artificially. As we think the computer lab to be in use for the whole school day, it is emitting light into the adjacent classrooms. They on the contrary rely fully on external lighting sources, natural from the perimeter yard and artificial from the lab. This will help to keep running costs down.

The lab functions also as the building’s central power distributor, as a kind of hub where all cabling starts or terminates. Horizontal distribution runs along the ceiling but vertical to the upper floor through the perimeter yard. Here it forms part of the vertically rising nature of the perimeter. Similarly the distribution of water to ground and upper floor is intended to run in the yard as well. Therefore the provision of all open classrooms with sun light, air, electricity and water originates in the perimeter yard. Due to the intimate size of the learning spaces on ground floor we imagine them ideal for subjects that need intensive supervision and advice from the teacher like information technology (in the computer lab) and science subjects (rooms are equipped with electricity and water).
3.2 Upper Floor

The upper floor in contrast is utilizing free form or floating space partitions made of fabric which is spanned with bamboo sticks. Thus the size of each space is adjustable to the required size based on the number of pupils. Furthermore, an open sitting arrangement emphasizes a more open teaching method. Space partitions made of soft fabric are good for sound insulation. Here we can easily imagine language classes that require intensive interaction and communication between the pupils.

3.3 Top Floor and Roof as fifth facade

The existing roof top is for future expansion. Here for the first time after circulating through the building a view to the surrounding cityscape opens up. The feature of the top floor is its openness, its generosity of free, yet undefined space. The least we can imagine here is a plain addition of merely another floor. Furthermore, as the whole school building is on the back of the residential part facing the street, a proper street facade or “storefront” seems to be rather difficult to establish.

Instead we think the roof shall become the highlighted fifth facade, representing and advertising the schools identity. We imagine it to be a landmark for the school and the community.

The chosen hyperbolic paraboloid or “hypar” is a doubly ruled surface, in simple terms it is shaped like a saddle. In contrast to other roof constructions, this type doesn’t need any secondary supports like beams or ridges, it is self supporting.

Nevertheless and despite its bend surface it is easily constructed from straight sections of timber or other conventional materials. Our intention is to utilize bamboo as a local and cheap but easy to use material.

Furthermore, the roof shape emphasizes the openness of the top floor and forms an integral part of the overall climatic concept. As it shades the concrete floor, the heat mass which is yet exposed to direct sunlight and responsible for heating up the whole building will be reduced significantly. Its corners are directed to the four ventilation towers. The high corners emphasize the wind supported natural ventilation by directing more wind to the top of the towers and increasing the Venturi effect explained earlier. The low corners emphasize the sun supported, heat driven natural ventilation by exposing them fully to direct sunlight.

The prominent roof will amplify the school’s presence and emphasize its role as a focal point of the community’s activity. We can easily imagine this partition free floor to provide an arena for assembly or large group teaching as well as to be used for much wider activities, like performing art shows, music, dancing or theater play including children, teachers, parents and guests.

3.4 Play wall

“Play is the engine that drives true learning. Play is not idle behavior. It is a biological imperative to discover how things work.”

Last but definitely not least is the perimeter yard. Beside its function for natural lighting and ventilation the perimeter yard is designed to address the children’s wish for a
playground. In contrast to a usual playground, it is rather a vertical play wall, a space where the children can roam freely, play and relax. We imagine the play wall to be an adventurous and explorable world in miniature, an environment that provides for rich sensory experiences. In addition to the normal vertical circulation with stairs, which is logical, technical, even digital and pretty much sensible, the play wall provides a more natural and analogue way of climbing. Here sports education to train motor skills can take place. Furthermore, because of a very diverse provision with light and shadow it is an ideal space for gardening and biology subjects.

3.5 Furniture and storage space

“Education in its etymological sense means to lead someone to knowledge.”

We are proposing the use of a modular design for the furniture, where with only a few and very simple elements like straight tubes, corner connectors and flat boards a wide range of different furniture is possible. The basic elements are simple in design and cheap to manufacture, but powerful when considering their many possible combinations.

The modular design provides a simple solution for quickly assembling additional furniture and enable teacher and children to use the elements as a learning aid. If shown the advantages of a flexible and modular design on an everyday-in-use object, the children can study how to alter and upgrade their personal environment using existing materials without consuming any new resources, a kind of “Froebel’s gifts” for the creation of real life objects. Storage space can be easily incorporated into the shape of a chair for instance, by adding a rack underneath the seat. These modular elements provide the basis, but are neither meant to fully encompass or limit other creative ideas. Their strength is the provision of a simple framework that follows simple rules for assembly but can be freely extended by customization, like shortening tubes to their desired size or any kind of imaginable addition.

3.6 Billboard to the street

At the entrance a billboard shall be installed, to inform children and parents about the school, its curriculum and interest groups as well as passers-by about after school activities. The school could function as a general education center, with main focus on children but offering tutoring and courses for adults as well. This can help to intensify the intergenerational discourse on education, to establish a knowledge exchange center based on the community itself, its many people’s interests as well as its many people’s skills. Thus a sustainable learning environment can be formed.

So to conclude, with such many and diverse spaces we wish to provide a rich learning environment that is ideal for all different kinds of subjects. Thus the architecture itself will have a positive impact on the curriculum and functions as learning aid, simply incorporated by the building upgrade.
Ground Floor

"Children can only learn what they are ready to learn."

Starting from the ground floor, we supply a rather rich blend of complementaried spaces, specific to each subject. In addition, the openings along the wings allow the classrooms and the courtyard to enjoy a natural light. The space, perimeter yard, which runs along both sides of the building, has water and green spaces. The central location of the computer rooms below in the library allows the children to use them for their studies. The children can also use the computer labs in the public spaces, this gathering of the people forms a community.

Computer labs will be the only specifically designed learning spaces in the whole school. Illuminating the artificial light, the central walls allow for views and light to enter freely at all times, while also creating a sense of the adjacent classrooms. A central core, housing the computer labs, can be used by teachers and students. The computer labs are mobile, which allows them to be moved around, allowing for flexible learning spaces.

All seating, water points, and washrooms are designed specifically for children, ensuring their comfort and safety. The islets and courtyards, which form along the length of the building, invite students to explore and interact. The concept of the building is to be integrated into the landscape, forming a part of the city fabric. The school is designed to be energy-efficient and sustainable, with emphasis on the use of natural materials and innovative construction techniques.
First Floor

"Teaching should always be joyful, for yours..."

The first floor in contrast to the ground floor utilizes a more free form or floating space partitions. The partitions are made of fabric which is inspired with natural and traditional materials. The use of fabric space is adaptable to the varying room use based on the number of students.

Space partitions made of soft fabric are good for sound insulation. Here we can easily integrate language classes that encourage oral communication between the students, the possibility of changing the shape of classrooms enable different types of teaching methods.

As in the ground floor, the corridor wall is hollowed out. 1/2 of the corridor wall is hollowed out, and the other 1/2 of the corridor wall is solid. The hollowed out partitions allow for a natural ventilation.

There are three possible variations on how to divide the classrooms.

Variation 1: Divides the space only partially. The fabric walls are standing at the direction of the wind flows above the students. This limited separation provides every group of students to create the context. There are three possible variations on how to divide the classrooms.

Variation 2: uses the space as a bigger space to accommodate more students and as possible to a similar group size. This type is appropriate for subjects where the teacher is speaking in the front.

Top Floor

In contrast to the existing style on the top floor, we are proposing a flexible open floor plan, and a large hall and living space for a woodwind, hence this top floor will function as a break area for the students. In between and after classes, this space for play helps to encourage friendly bonds between all members of the school.

This open space functions as a safe community area for the students to engage in their own neighborhood, resulting more self-actualization.

This open space with its softangled lighting attempts to create an environment where learning is also made possible in a classroom. The type is appropriate for subjects where the teacher is speaking in the front as well as to be used for much larger classes.

Structure

The roof is made of simple structure. Roof frame is covered with bamboo. Bamboo frame is formed with sticks that can be separated by bamboo slats, also functions as a spayer, and ground to facilitate the light and open porous structure for children. And roof cover is also composed of light and low-cost material, such as timber and bamboo.
During the day
The top floor of the school functions as an open playground for the students. The right entry of the side
conditions means that one roof acts as the 4th facade of the building. In addition, the sail like roof protects
the children from the intense heat of the hyderabad sun and allows for the wind to flow through. The
same outdoor space filled with the lively and youthful activities of the children can also contribute to
rejuvenating the urban surroundings. From afar, the 4 wind towers would be the landmarks of this
neighbourhood.

During the night
The roof lights up like a lamp in the dark, illuminated by the surroundings. The fabric allows the light
to shine through, revealing the underside structure of the bamboo. This easily renewable facade helps in
evolving people to the public computer lab. It is made to promote interactive environment not only for
the youths during the day but also among the public all day long.

Play wall
The perimeter yard acts not only as an
environmental device but also as a play
wall. Located in an urban environment, it
acts as a playground for students. To design
the wall as a vertical playground and
connected it to the roof top playground in
an exciting way, we integrate bamboo
in a simple family, play and relax. And students
can enjoy the entire school in seeing
adventure and exciting world for
students to explore everyday. In addition,
this wall functions as an educational
decor. At the bottom of the wall, there
are some plants and plants space, and
students can utilize it for their botany
learning. A separate water supply system
are supplied from the wall, and students
are able to use it in every classroom.

Function of the perimeter space

Water wall: Light from top and lightness inside. Water also makes the air cool and
accelerates ventilation from the chimneys.

Plants can grow along the wall and they
are in a variety. Students can use this
space for gardening.

Case study
The quality of space of former ground floor. But now it is filled with
light and children can explore inside.

Spaces can stand up the roof and move
between upper floor and lower one. It's
totally different experience than using a
desine.

Watter pipe
Water plants are inspired, so students can
feel the connection between the flowing
water and the natural. Students can also
participate the guardian in the first

Watter
Electricity lines are also exposed but covered with bamboo. Students can use
electricity in every classrooms.
Environmental Device

The main feature of this building, "The Graduate House," functions as an Environmental Device to keep the school comfortable even in such a packed site condition. These devices include air conditioning, sunlight, and rainwater harvesting.

Section Diagram

Natural ventilation

Wind Towers

These towers work by allowing the wind to pass through them and create a flow of air, which cools the surrounding area. The towers are equipped with chimneys to remove exhaust gases and improve air quality.

Wind Tower

In summer, the wind blows from north to south.

In winter, the wind blows from south to north.

Wind circulation

These towers work by allowing the wind to pass through them and create a flow of air, which cools the surrounding area. The towers are equipped with chimneys to remove exhaust gases and improve air quality.

MATERIALS AND CRAFTS

Flexible separation of classrooms

The main idea is to have a flexible way of separating the floor into classrooms. According to the type of teaching and number of classes, the shape of the classrooms should be able to be changed quickly and easily.

We support a semi-modular system with bamboo and fabric furniture, where the act of changing the classrooms itself should be an enjoyable and transformative experience.

There are elastic elements located at the top of the bamboo poles. At the bottom, there is a tightening mechanism, with which the bamboo poles can be fixed between the floor and the ceiling. The idea is to have some poles with fabrics which are movable as the other poles. This allows for a flexible location of the fabric walls and also an easy change of old fabric and new ones. When the fabric is pulled out, it is to be fixed to further poles by binding the fabric to poles by strings.
4. Beyond Architecture

“True education must help children to understand their true nature as creative beings.”

With our proposal we aim to provide a base for further discussion and development in a very broad sense. We are fully aware that further improvements will bear the most fruit only when further feedback from as many of the future beneficiaries will be incorporated. We especially intend to engage the children as the main beneficiaries but also as the main designers. Usually most design labeled “for children” is done by adults, but is it really appropriate? In our opinion the Open Architecture Network opens up a door for a once-in-a-lifetime chance, to listen to the voices of millions of children as creators and not only as consumers, their needs and wishes but even more their ideas with regard to school design. As a start for easy feedback we imagine an extended Open Architecture Network Online Platform where the proposals of this competition are presented.

Every school that wishes their facilities to be upgraded, shall initiate a regular review of the state of their school and publish it. An online recommendation system for children shall be introduced. They shall be encouraged to present their own ideas in drawings, pictures or models. By the time of future school upgrades a canon of highly rated thus highly recommended design elements or entire school layouts may provide a basis for more child appropriate school backed by the voices of millions of children. Such an open platform can quickly and directly trace emerging new trends the children will express that are at present difficult to predict. Thus its knowledge base will be receptive for future changes and proposals. It will provide a rich database for continuous research.

To make this online platform truly open and democratized it shall function as an upgrade or plug-in itself, to be easily connected and accessed by any kind of social network platform, offering entrance and advise for everybody who cares to ask and listen to the children’s voices.

5. Resources

1 This quote and all the other quotes in this design documentation are from the Froebel Foundation, see http://www.froebelfoundation.org/philosophy.html; Friedrich Froebel, a German pedagogue, created the concept of “kindergarten” and also coined the word, see http://en.wikipedia.org/wiki/Friedrich_Fr%C3%B6bel

6. Figures

1 Wind roses at Hyderabad, see Fig.3, http://www.sciencedirect.com/science?ob=ArticleURL&udi=B6VH3-4GP1VT2-6&user=136130&ndoc=1&fmt=&orig=search&sort=d&view=c&acct=C000010979&version=1&urlVersion=0&userid=136130&md5=23a82368ab2884bba7f520f0c1d8088d