

iCon

e-zine for architecture, culture and media

no. 2

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."*<sup>1</sup>

When thinking about designing and an environment for children, imagination becomes the key to their world, where fantasy is everything and money 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 brain storming 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 than 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

written  
on May 31, 2009

The 2009 Open Architecture Challenge: Better Classroom Design competition was hosted by Architecture for Humanity, <http://openarchitecturenetwork.org/competitions/challenge/2009>

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

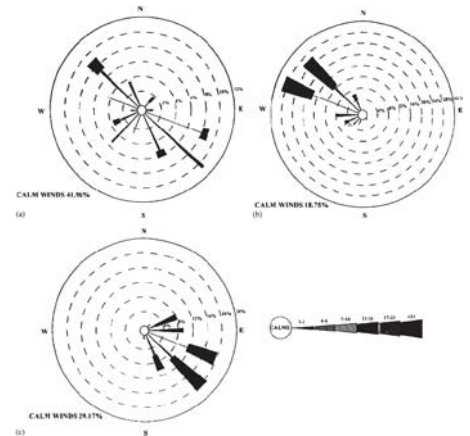


Figure 1: Windrose Hyderabad

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 renaturation

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<sup>rd</sup> 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 city scape 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 play“ground“ 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 every-day-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.

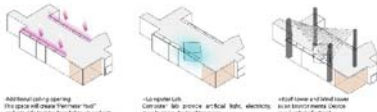
So to conclude, with such many and diverse spaces we wish to provide a rich learning environment that is ideal for all different kinds of subjects. Thus the architecture itself will have a positive impact on the curriculum and functions as learning aid, simply incorporated by the building upgrade.



**Design Principal**

A school upgrade, designed by IFA architects.

As the design team we needed to take into account the children's close relationship with nature. We needed to ensure that the school was not only a place of learning but also a place of play and discovery. We needed to create a space where the children could learn, play, and discover. We needed to create a space where the children could learn, play, and discover. We needed to create a space where the children could learn, play, and discover.



**Operation**

The school is designed to be a place where the children can learn, play, and discover. The school is designed to be a place where the children can learn, play, and discover. The school is designed to be a place where the children can learn, play, and discover.

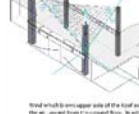
**Perimeter Yard**

The perimeter yard is a central space where the children can learn, play, and discover. The perimeter yard is a central space where the children can learn, play, and discover. The perimeter yard is a central space where the children can learn, play, and discover.



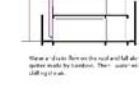
**Environmental System**

The school is designed to be a place where the children can learn, play, and discover. The school is designed to be a place where the children can learn, play, and discover. The school is designed to be a place where the children can learn, play, and discover.



**Rain/Water**

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**Sun/Light**

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**Floor/Plan**

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**Symbol of Community**

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**Ground Floor**

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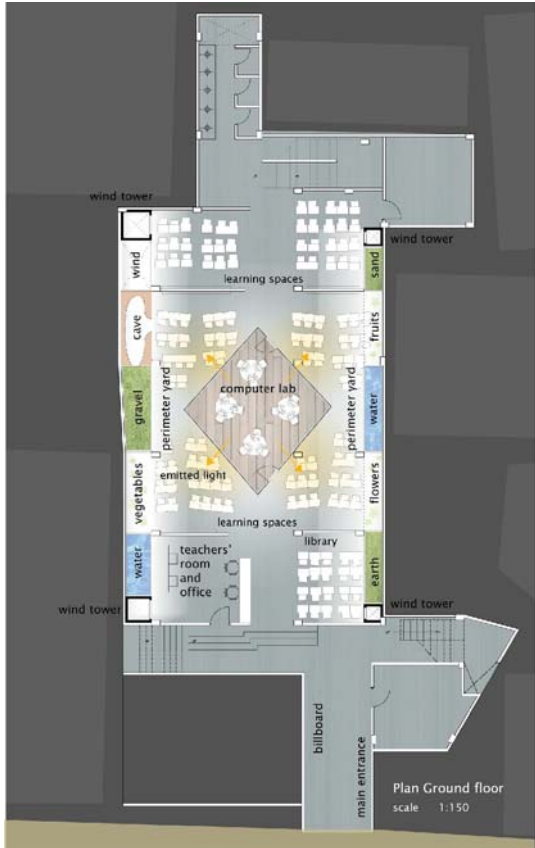
**First Floor**

The first floor is designed to be a place where the children can learn, play, and discover. The first floor is designed to be a place where the children can learn, play, and discover. The first floor is designed to be a place where the children can learn, play, and discover.



**Top Floor**

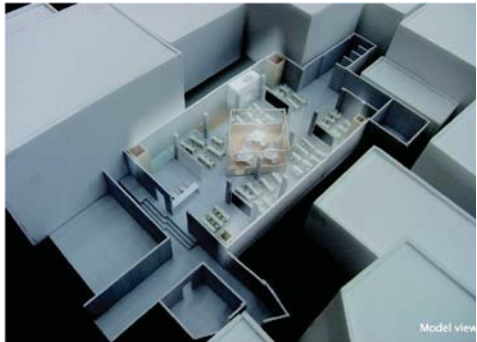
The top floor is designed to be a place where the children can learn, play, and discover. The top floor is designed to be a place where the children can learn, play, and discover. The top floor is designed to be a place where the children can learn, play, and discover.



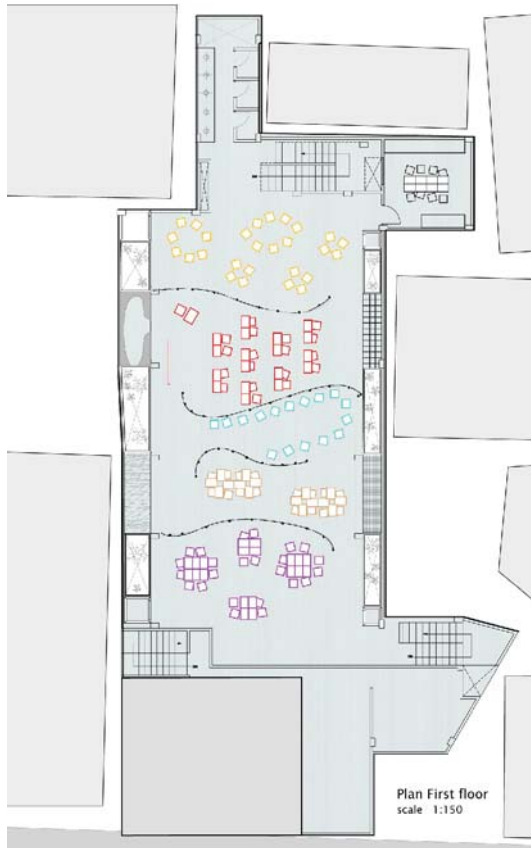
**Ground Floor**

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

Starting from the ground floor, we suggest a rather strict layout to complement more specific subjects as a contrast to the upper levels. The computer lab is proposed as a main diamond shaped space, surrounded by 4 learning classes. In addition, the openings along the sides of the ceiling flood the classrooms with light. This space, perimeter yard, which runs along both lengths of the building has water and green spaces. The central location of the computer room helps in diffusing the light outwards, also, it encourages the children to run around. As this computer lab is open to the public, this gathering of the people forms a community.



Computer lab will be the only specifically dedicated learning space in the whole school. Maximizing the artificial light, the glazed walls allows for views and light to enter freely at all time, while also emitting light into the adjacent classrooms. In addition, this lab also functions as the home base for all computers based learning, teaching and auxiliary functions. The computers here are mobile which allows them to be moved around, allowing for flexible learning spaces. All cabling, water pipes, electricity distribution also originates from the perimeter yard (spaces which forms along the lengths of the building). Hence, due to the intimate size of the learning spaces on ground floor we imagine them ideal for subjects (both students and topics) that need intensive supervision and advice from the teacher like information technology and science subjects. The wind tower at each corner of the building draws up the air, increasing the ventilation in the packed condition of the interior.



**First Floor**

"Teaching should always be joyful, fun away."

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 spanned with bamboo sticks. Thus the size of each space is adjustable to the required size based on the number of students.

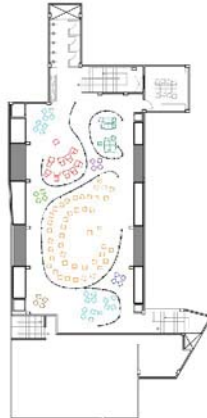
Space partitions made of soft fabric are good for sound insulation. Here we can easily imagine language classes that require intensive interaction and communication between the students. The possibility of changing the shape of classrooms enable different types of teaching methods.

As in the ground floor, the outside walls reaches up to 2/3rd of the floor height and the absence of permanent internal partitions allows a natural ventilation.

Plan First floor scale 1:150



Model photo



Variation 2



Variation 3

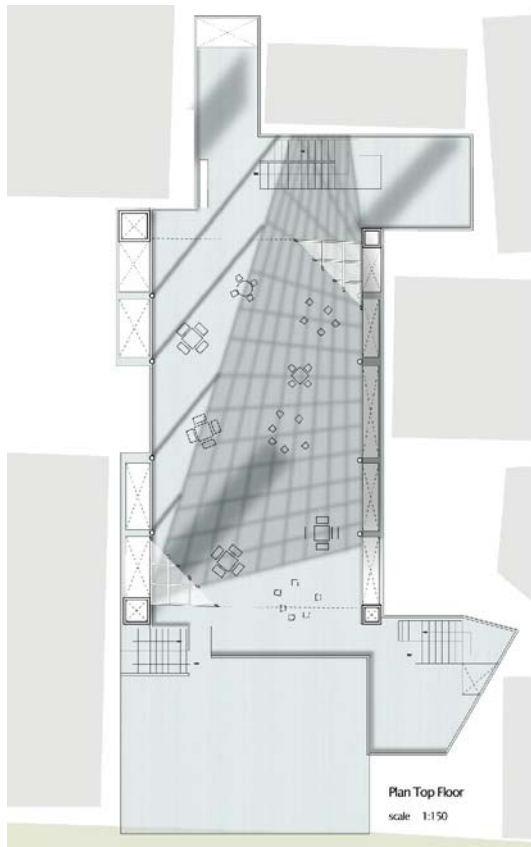
These are three possible variations on how to divide the classrooms.

Variation 1 separates the space only partially. The fabric walls are standing in the direction of the wind flow to allow for maximum natural ventilation. A limited separation provides a very open atmosphere in which students can easily communicate.

Variation 2 uses free shapes for different sized spaces for big as well as small groups. The seamless boundary between the inside and outside allows for many different kinds of learning. It is possible to listen and discuss in a big group or to do pair work or individual work.

In variation 3 the floor is being split into six equally sized spaces to accommodate as many students as possible as in similar group sizes. This type is appropriate for subjects where the teacher is speaking in the front.

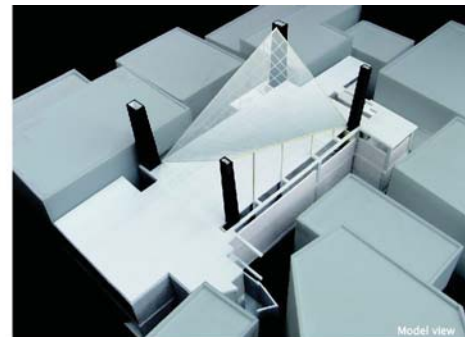
4688\_Classroom



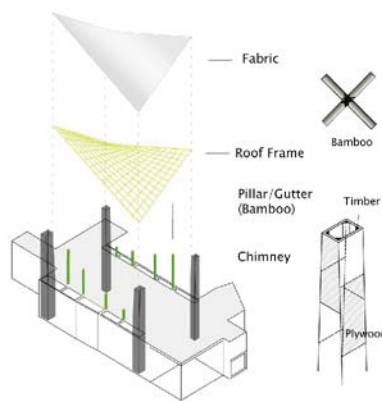
**Top Floor**

In contrast to the existing state on the top floor, we are proposing a flexible open space. As the bottom floors do not have enough space for a schoolyard, hence, this top floor will function as a breakout space for the students. In between and after classes, this space for play hopes to encourage friendly bonding between all members of the school. In addition being high up, it offers the children a beautiful view of their own neighbourhood, incultivating more self-pride. This open space with its soft dappled lighting attempts in creating an environment where learning can also take place outside the classroom. 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.

Plan Top Floor scale 1:150



Model view



**Structure**

The Roof is made of simple structure. Roof Frame is composed by 2way of Hyperbolic Paraboloid. Simply bind bamboo stick forms dynamic figure. The frame is sustained by bamboo pillars, also functions as gutter, and covered by fabric which diffuse the light and gives pleasant shadow for children. Wind tower is also composed of light and low-cost material. Plywood panels are combined alternately to get a strength.

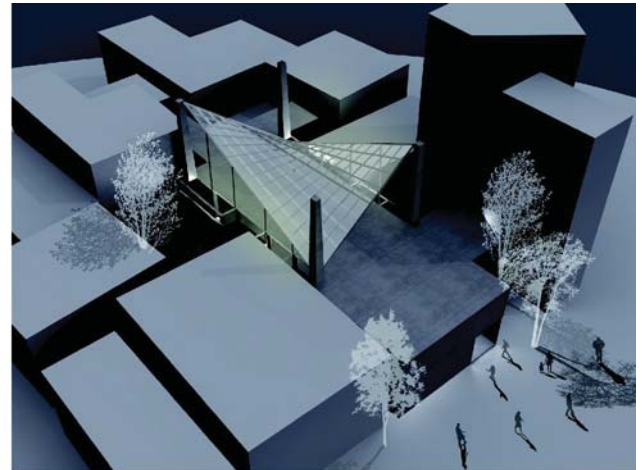
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During the day

The top floor of the school functions as an open playground for the students. The tight entry of the site conditions means that our roof acts as the 5th 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 semi-outdoor space filled with the lively and youthful activities of the children can also contribute to reenergizing the urban surroundings. From afar, the 4 wind towers would be the landmarks of this neighbourhood

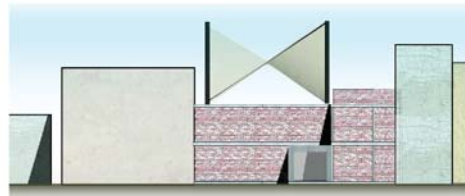


During the night

The roof lights up like a lamp in the darkness, illuminating the surroundings. The thin fabric allows the light to shine through exposing the underside structure of the bamboos; this easily reorganisable features helps in drawings people to the public computer lab. This school hopes to create a conducive environment not only for the youths during the days, but also among the public adults during the night. The funds from this service can be used in any extra expenses of the school, encouraging a sustainable learning environment



East Elevation



South Elevation



4688\_Classroom



Perimeter yard

**Play wall**

The perimeter yard acts not only as an environmental device, but also as a play wall. Located in an over populated city, it is difficult to get enough space of playground for students. So we designed the wall as a vertical playground and connected it to the roof top playground in an exciting way. In this space students can roam freely, play and relax. And students can enjoy the whole school running around. We imagine the play wall to be an adventurous and explorable world for students to expose everyday. In addition, this wall functions as an educational device. At the bottom of the wall, there are some ponds and plants space, and teachers can utilize it for their biology class and gardening. Water and electricity are supplied from the wall and students can use it in every classroom.

**Function of the perimeter space**

**Water:** Water reflects light from top and lightens inside. Water also makes the air cool and accelerates ventilation from the chimney.

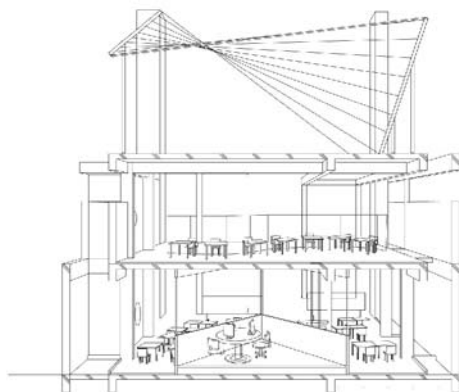
**Green:** Plants can grow along the wall and they supply oxygen. Students can use the space for gardening.

**Cave:** The Cave inherits the quality of space of former ground floor. But now it is full of light and students can explore inside.

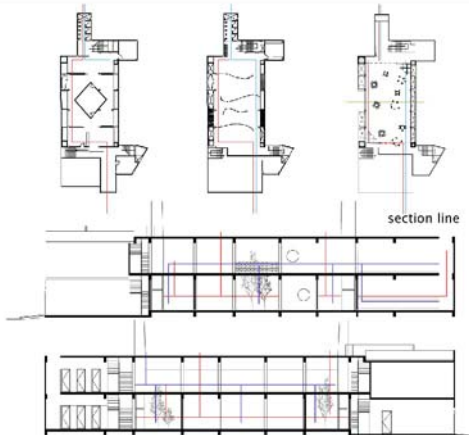
**Nets:** Students can climb up the nets and move between upper floor and lower one. It's a totally different experience from using a staircase.

**Water pipe:** Water pipes are exposed, so students can feel the connection between the flowing water and the water they use. The pipes are partially also the guardrail in the first floor.

**Electricity:** Electricity lines are also exposed but covered with bamboo. Students can use electricity in every classroom.

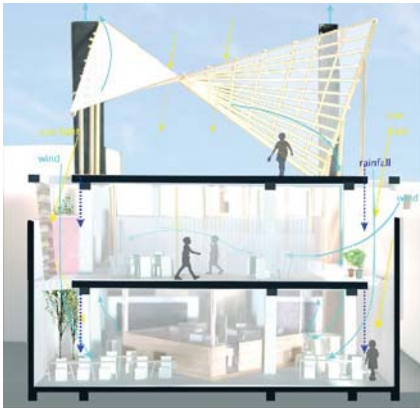


short section and perspective



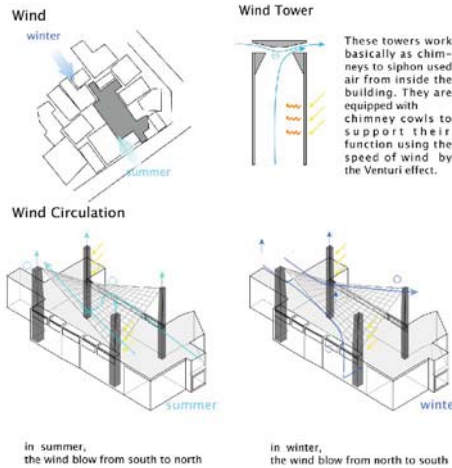
water and electricity line

4688\_Classroom



**Environmental Device**

The main feature of this building, "Perimeter yard (Vertical play ground)", and "Winter-roof" functions as Environmental Device to keep the school comfortable even in such a packed site condition. Three devices interest and control wind, sunlight, and rain.

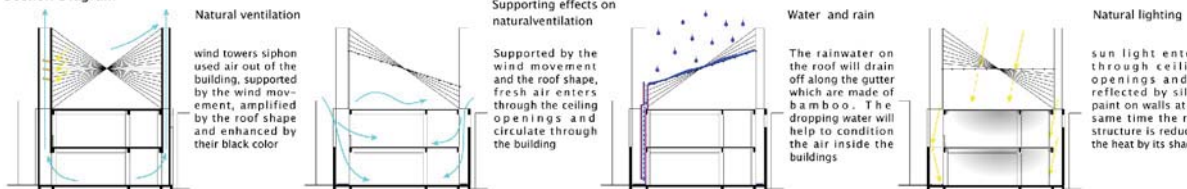


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**Section Diagram**

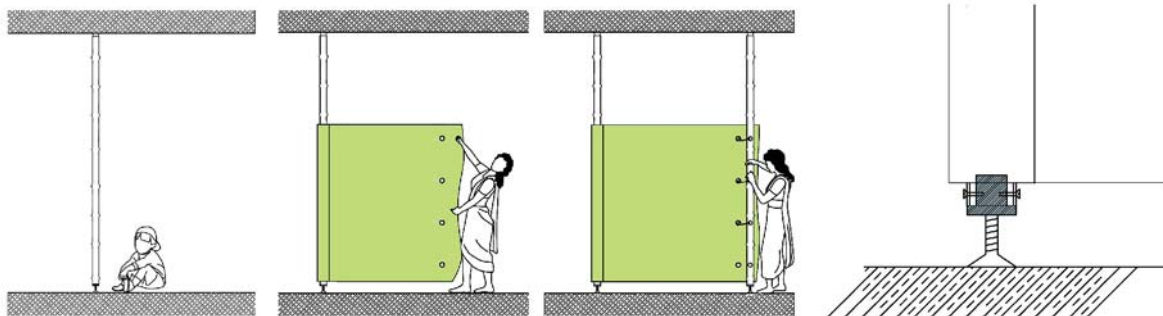


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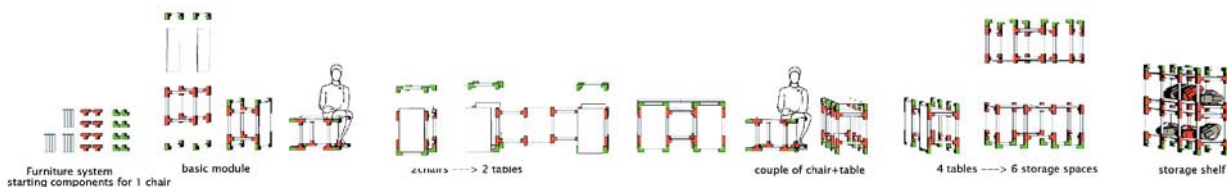
**MATERIALS AND CRAFTS**

**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, shapes of the classrooms should be able to be changed quickly and easily. We suggest a separation system with bamboo and fabric and furniture, where the act of changing the classroomsizes itself should be an interactive and communicative process. The bamboo sticks can be placed anywhere in the room. The furniture is transformable from a chair to a table and then to a storage shelf - made from just two connector joints.



There are elastic elements located at the top of the bamboo sticks. At the bottom part there is a tightening mechanism, with which the bamboo sticks can be fixed inbetween the floor and the ceiling. The idea is to have some poles with fabric which are moveable as the other poles. This allows 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 has to be fixed to further poles by binding the fabric to poles by strings.



4688\_Classroom

#### 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 a 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 advice 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](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&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&\\_view=c&\\_acct=C000010979&\\_version=1&\\_urlVersion=0&\\_userid=136130&md5=23a82368ab2884bba7f520f0c1d8088d](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VH3-4GP1VT2-6&_user=136130&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000010979&_version=1&_urlVersion=0&_userid=136130&md5=23a82368ab2884bba7f520f0c1d8088d)