Project II

Sustainability awareness kit for children in an Indian urban environment

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Approval sheet

The Industrial Design Project - II, entitled

"Sustainability awareness kit for children in an Indian urban environment"

by Priyanka Vinay Marawar,

approved for the partial fulfillment of the requirements for the Degree of Masters of Design in Industrial Design

Guide .....

Chair Person .....

External Examiner .....

Internal Examiner .....

Acknowledgement

The journey of my project II hasn't been a one way drive to my destination. At times I felt lost as I came back and forth on my path. I thank Prof. Sandesh for his utmost patience and keeping me motivated time and again as I drifted into undiscovered arenas. He kept me grounded and focussed towards my cause. I also appreciate the creative freedom I experienced under his guidance. At no time in the process did I feel pressured as I got to explore my own creative potential. The best part about being at IDC has been the various forums provided to interact with the diverse expertise of faculty present here. Their views have played a vital role in looking at the project in a completely different light.

One of my greatest strengths has been the endless support and inputs provided by my classmates who are like family now, owing to the amount of time spent with them.

I am also grateful to the Kendriya Vidyalaya school IIT Powai. Constant interaction with children from this school during the research and the concept development process helped me look at the project in a very realistic and practical point of view.

I also want to thank Prof Athavankar whose experience with children helped me look at the problem as if I was a child. His unique way of looking at things differently was immensely helpful.

Last but not the least I would like to thank my family who have always been my "pillar of support".

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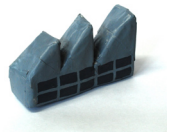
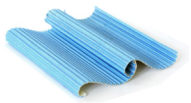
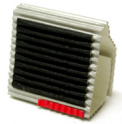






1.Introduction

The choices one makes in life are most often based on experiences from ones past life. Since last couple of years I have developed an interest in the worldwide spoken subject called *"sustainability"*. This interest took me to Auroville *"a universal city in the making"* which was one of the best experiences in the 23 years of my life. It was one of those experiences that one calls *"life changing"*. Totally inspired by this new way life I came back to my mundane urban life. Then I wondered, what I could to do to translate those ways of living in this urban scenario. This thought lingered on.

The intention to find these ways that could make urban ways of living more sustainable and happier was a reason enough for me to choose my Project 2 topic as *"Healthy and Sustainable ways of living"*. It was much later after I explored the meaning of health and sustainability did I find potential for my design intervention by designing a tool to make sustainability a value system in children. This report shows that enjoyable yet tough journey where my design capability finds a purpose.

2. Abstract

Health and sustainability always interested me as subjects of study. Here we see the journey of my exploration through these subjects until I found my design intent which was *"to design a sustainability awareness kit for children"* in an Indian urban environment.

Our urban lives contribute the most adverse impact on the environment. Today's *youth* is completely negligent to this fact and continues to lead a *"careless lifestyle"*. Today's *children* are the youth and *decision makers of the future*, hence its our duty to educate them about out flawed lives. Through research its established that values of sustainability should be taught at early age such that it becomes part of a value system and not a mechanical activity.

I studied their existing curriculum to understand what they know and how they are taught things. I also looked at existing methods of inculcating values and teaching in existing products and systems.

Here I have explored these possibilities where sustainability can become a part of the child's life. I looked at schools as an important place to make this design intervention because sustainability is best imbibed by *"collaborative learning and responsibility"*. We find the multitude of children here. I worked closely with children during this project. They helped me get valuable insights into the problem.

I have also looked at aspects of *sustainable manufacturing* of the product. I explored materials and methods on that front.

The final solution uses the methods of *"do and learn"* and story telling to imbibe sustainability values in children. The child indulges in sustainable activities which are engaging and aid in this process. Through this kit I am trying introduce multiple levels of sustainability to children at an early age. Foster sensitivity and collective responsibility for the environment. I also tried to design a way by which this activity is not just restricted to a school but taken home too. *"Home"* can become a place where the child applies the values of sustainability.

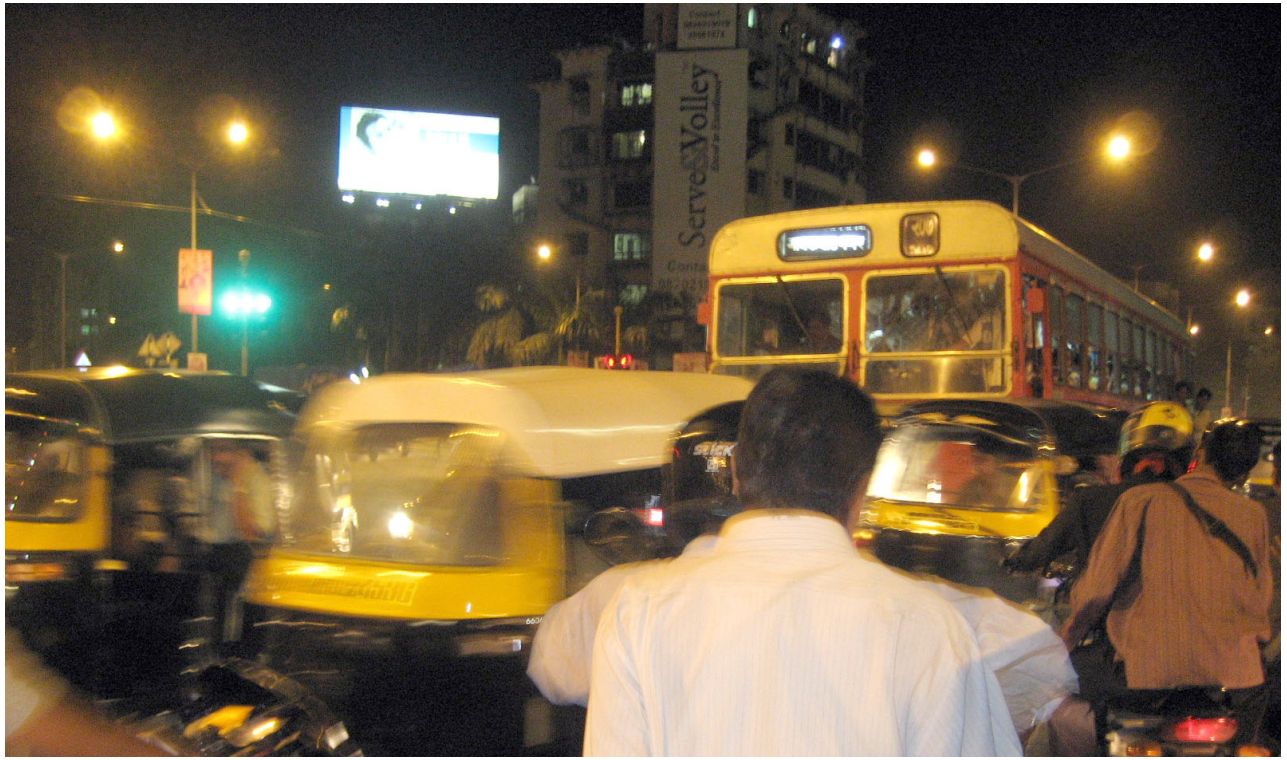


image 3a

3. Research - Finding the need

Healthy and sustainable ways of living is something we need to turn to in *desperation* in today's age. The issue being, most people are not well informed or educated about these ways of living. Even if informed about the environmental issues, they don't know what to do about it. I spent a considerable amount of time in understanding the various aspects of *health and sustainability and their relation to urban living*. The result was the identification of various areas where design intervention was necessary to solve the problem.

Mind mapping

"Positivity"

Image 3b

self worth

Image 3c

Knowing thyself

"Balanced life"

Mind and Body

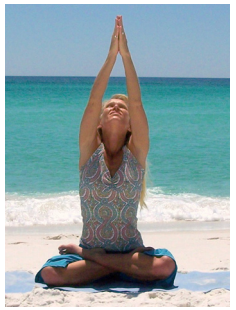


Image 3d

Happy + useful life= personally satisfying life

Health

"Health we discover is a systemic indicator of resilience and viability of a system"

Cleanliness

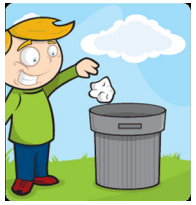


Image 3f

Image 3e

"Environmental hazards"

"adverse effects of social and economic progress"

Social

"Food and fitness"

Mental

Physical

stress
+ve and -ve
- social adjustments
- inability to perform

Image 3g

Image 3h

Image 3i

3.1 Health

"Health we discover is a systemic indicator of resilience and viability of a system"

Health is a quality resulting from the total functioning of the individual that empowers him to achieve a *personally satisfying and socially useful life*. Good health is also ensured when one's life is happy and useful and hence a personally satisfying. It is achieved by the ability to strike a *balance between activity and relaxation*. Health also encompasses aspects of physical or *clinical health and mental health*.

Clinical health- this looks at maintenance of a healthy body such that all parts of the body are efficient in performing their function. This means eating balanced meals and exercising of all body parts and avoiding factors that might hamper this balance.

Mental health- It is the interrelationship of *mind, body and soul* to achieve a happy and content mind. Mental health is about feeling comfortable about yourself, feeling comfortable about others and meeting the demands of life. A very important step in attaining this mental health is knowing yourself. It would involve *realizing your capabilities, shortcomings* and coping with it.

There are various factors affecting health in an urban environment. The *population explosion* has lead to competition at every front of life. May it be finding a job, surviving it, buying a house and coping with the growing needs in life, this has lead to high levels of stress. People have long working hours, travel long distances fighting traffic and cope up with the fast life in a fast growing urban environment. Most of us experience increased *anxiety* as we fear failure and try to fit into our socio- economic system.

People live in nuclear families where both the parents have to work to earn a livelihood and children grow with lack of parental love. Elderly are left in isolation.

The *socio economic disparities* are growing larger. The *slums* are expanding. Here we can see the constant struggle between a developing and a developed world. People in slums don't have clean water to drink and people in high rises bathe in bath tubs. There is lack of planning and inability to cope up with the needs of the people who actually build our houses and run our factories. *Architects* have drifted away from their prime purpose which was to provide *homes to the multitude*. A town plan far from being so simplistic as that, must embody a broader vision of an environment in which peace becomes an appendage to an aesthetically enriching experience.

The cities are getting polluted as the cars on the roads increase by the day. This air, water, soil and noise *pollution* is one major factor that affects the health of the people adversely in an urban environment. As our cities are getting over crowded, the true *essence of nature is disappearing*. Children no longer grow in the company of nature. Open spaces have been replaced by malls. Children are becoming a victim of the *growing consumerism*. In this environment adults are unable to train children in good health practices and keeping their surroundings clean. As we are moving towards the *western ways of living*, we sadly neglect the *loss of rich Indian culture*.

Health can also be referred to a *community*. A healthy community embodies happiness and *collaborative living* where every individual's thoughts and aspirations find a place.

3.2 Sustainability

Sustainability by definition can be explained as follows *"it's the capacity to endure, ability of an ecosystem to maintain ecological processes, functions, biodiversity and productivity into the future"*

Sustainability means *sustenance of self, society, culture and your environment.* It becomes vital to understand the principles of ecology in order to understand sustainability completely.

Principles of ecology

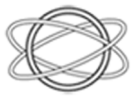
Networks - All members of an ecological community are interconnected in a vast and *intricate network of relationships, the web of life*. They derive their essential properties and, in fact, their very existence from these relationships.

Nested Systems - Throughout nature we find *multi-leveled structures of systems* nesting within systems. Each of these forms an integrated whole within a boundary while at the same time *being a part of a larger whole.*

Cycles - The *interactions* among the members of an ecological community involve the *exchange of energy and resources in continual cycles.* The cycles in an *ecosystem intersect with larger cycles* in the bioregion and in the planetary biosphere.

Flows - All organisms are *open systems*, which mean that they need to feed on a *continual flow of energy and resources to stay alive.* The constant flow of solar energy sustains life and drives all ecological cycles.

Development - The unfolding of life, manifesting as development and learning at the individual level and as evolution at the species level, involves an interplay of creativity and mutual adaptation in which organisms and environment co evolve.



Dynamic Balance - All ecological cycles act as feedback loops, so that the ecological community regulates and organizes itself, maintaining a state of dynamic balance characterized by continual fluctuations.

Image 3j

Hence we understand that nature exists in *multiple levels (macro and micro)*. It becomes extremely important for each individual to realize his position and responsibility in maintaining this difficult balance. Every small action taken by an individual is like a *butterfly effect*. One *action shows reaction* on the other side of the world.

In this current era where the progressive human being is moving towards a so called developed bright future the *existence of nature has become more like an abstraction.* The nature's *resources are exploited* to the extent that they soon will disappear. In this journey for the so called developed future we find a certain set of people who live in over growing abundance at the expense of some less fortunate who fight for basic self sustenance. Every individual fends for himself. People are *fighting for less and less on every front in life*. People are moving into isolation as they *drift away from family life*. Their sense of responsibility towards one another and the environment seems to be diminishing. The multitude is becoming a victim to the *consumerism and capitalism*. There seems to be a relation between the climate crisis referring to *global warming* and other climate irregularities to the *unemployment crisis*. Some people believe that *industrialization(capitalism)* has lead to *social, cultural and environmental distortion*.

Problems related to sustainability cannot be solved by using the same kind of thinking that created them. One needs to realize the *importance of a community in attaining sustainability.* It comes as a result of surviving together for thousands of years. A self interested individual doesn't engage in collective action when the impact of his or her action is negligible. Attaining sustainability requires using *collaborative intelligence, realization and responsibility*. It means cultivating competencies of *head, hands and spirit in children* and the young people to become citizens capable of designing and maintaining sustainable societies in the future.

We have existing proven examples of communities working towards a healthier sustainable living in the form of *eco communities.*

3.3 Eco - communities

These communities practice the activity of *"Co- housing"* which means active participation and building of the environment and the community. They are generally smaller compared to cities. These communities have a *mission and a value system*. The people residing in these communities believe in these values and *common well being of the people and nature*. Preserving nature in its truest form becomes their priority over personal benefits. They spend time in understanding systems and nature. Efforts are taken to *preserve local culture and wisdom*. People share *mutual respect and responsibility*. They engage in group activities which ensure *sharing experiences and knowledge*. There is emphasis on *sustainable livelihood* which means providing livelihood to the *local people* of the community.

There is *compact and efficient land use*. Buildings are built with principles of *sustainable architecture* which helps in energy conservation and generation. Enough resources are invested into research and development activities in the area of sustainability practices. They indulge in *organic farming* where the water usage is efficient and usage of pesticides, fertilizers is avoided. This agriculture is also sustainable as it provided employment and livelihood to the people of the community. The *waste is recycled.* They use *fewer automobiles* which use conventional sources of energy. The children are trained to *use head, heart, hands and spirit to nurture a sustainable society.* People are happier and healthier adopting this new lifestyle.

Image 3k

Image 3l

Image 3m

Image 3n

Image 3o

Image 3p

Image 3q

3.4 Indian villages

Indian villages can be an important insight into *sustainable living*. Indians by and large in the previous generation adopted a sustainable life style. People lived in *joint families* which meant *sharing* lots of things in common. People of the village were a *close knit community* where they *shared experiences and knowledge*. There existed a democratic way of the people of the village working towards its betterment. Nature was a very well integrated part of their lifestyle. People were mostly vegetarian and used *organic methods of farming*. The water would be drawn out of the well manually. It was a part of the lifestyle where people *never threw away things* until they could not be reused for something else. The great grandfather's watch would come to the grandfather who would pass it on to the father. The father would pass it on to the son. *Life was simple*. Strangely these values are disappearing with the *growth in buying power of Indians*. People look to the west for inspiration when *inspiration lies within*.

Image 31

3.5 Health and Sustainability- A Systemic approach

It's quite evident that health and sustainability are problems of systemic nature. They go hand in hand and *cannot be isolated*. The scale being so large they can be attained only by adopting a holistic systemic approach. It requires *collaborative intelligence and efforts*. It requires *"solving for pattern"* which means creating solutions to multiple problems. One needs to look at *health, society and habitat in its full complexity*. It requires *shift in perceptions*. It requires thinking in terms of relationships and context, quantity to quality, structure to process, and from contents to pattern.

3.6 Relating Eco - communities and Urban lifestyle

Eco-communities and their way of living is an *inspiration* for us. Their systems model to deal with the problems of sustainability and health are *idealistic*. These eco communities have been *evolved from scratch* where there is a culmination of *like minded people* who believe in the same vision of nurturing nature and devising ways of living which have minimum impact on it. In contrast is our *urban scenario* where a system of doing things already exists. The *people are not like minded*. Their ways of living *affect nature in adverse ways*. Personal benefits are given priority over nature's needs and greater good. So what does one do in such a scenario is the question I asked myself. Hence I could identify specific problem areas where there could be design intervention.

3.7 Identifying problem areas

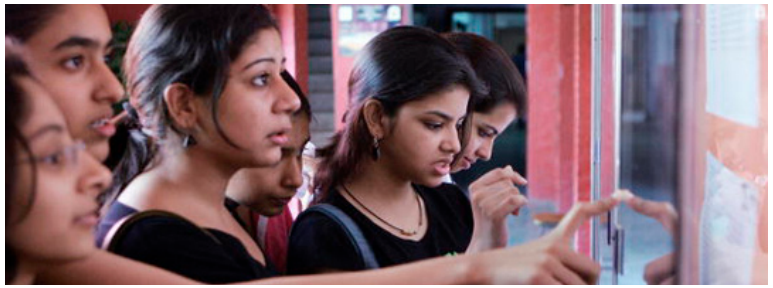


Image 3s

1.Health problems in college youth – Today's youth in schools and colleges faces very peculiar problems which affect their health in adverse ways. With the population explosion they face lot of *competition* firstly getting into a reputed college, and then surviving the *high academic standards of the college*. There is extreme *peer pressure, odd and late working hours, unhealthy eating habits* which affect their physical and mental health. The *stress* generated is a result of *peer pressure, fear of failure, social, emotional and intellectual adjustment*. Academic difficulties could be a reason of poor study habits, improper budgeting of time, inadequate reading ability, and failure to learn. Very few can cope up with these problems.

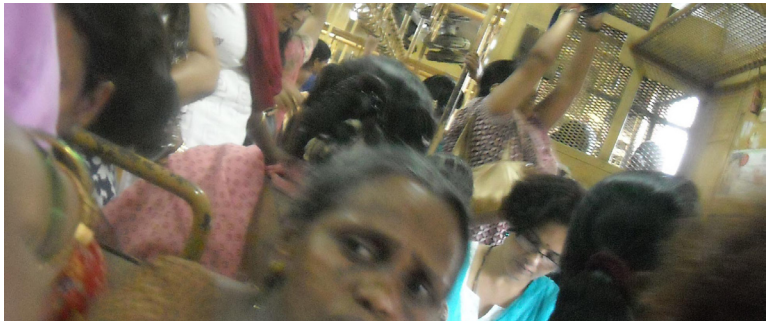


Image 3t

2.Working and travelling women in cities – A large number of women in urban environments *struggle between their domestic responsibilities and their professional lives*. They are torn between the two. One the *need to bring up their children* right and the other to *earn enough to provide the basic necessities* to their family. They *travel long distances* to work. They have to cook no matter what time they come home. They have to clean and take care of their children. It's a *constant race for time*. They barely sleep and rarely have a social life. Their health also gets affected because of *physical strenuous lifestyle and mental stress.*

Image 3u

3.Human energy as a renewable energy resource- With the *advent of technology* and industrialization the *human energy has been replaced by machines*. Machines use non renewable sources of energy. Hence in these dire times where our energy *sources are getting replenished*, we need to turn to *alternative sources of energy*. Internal energy of a *human spiritual, cultural, emotional, intellectual and physical* is an *inexhaustible, replenish able and ever enlarging energy resource* which is waiting to be tapped

Image 3v

4. Slums- As the *gaps between the fortunate and the deprived are increasing*. Our *urban planning is proving inadequate* to accommodate the *growing population* in cities. People are resorting to living in slums and slums are growing. People live in *unhygienic constrained spaces*. Sewers are left open. People drink *unclean water*. Children don't have anything to eat. They are *deprived of their basic right to education*. The unhygienic environment is the cause to many *fatal diseases* that kill these people every day.

Image 3w

5. Lack of parental attention and love for children in an urbanized society – In these times where *both the parents have to work* in order to provide the basic necessities to their family *children often spend most of their time in a cresh* or alone at home with the *lack of parental love*. This condition creates *psychological trauma* that leaves a lasting impact on the children. The safety of the children without their parents is also compromised

Image 3x

6. Noise pollution – There is so much unwanted noise around us. One might stand on a *crowded road but still feel lonely*. Noise pollution can *ruin ones peace of mind*. It can cause other health problems like *insomnia, neurosis, peptic ulcer and hypertension.*

3.8 Need for the project- Sustainability awareness for children

"Sustainability awareness for children" was the chosen problem area.

Through my research it has been established that sustainability in its truly holistic sense can be achieved by looking at it in a systemic point of view. Considering the human impact on the environment, it becomes very vital for humans to *understand the implications of his acts on the environment*. Nature exists as a system containing countless components which have *complex interdependencies and relationships.* It hence seems like a *complex issue to comprehend and implement*

When we look at the past present and the future, the *interrelationship of humans with nature seems to be degrading*. We find the youth of today alienating themselves from nature. Owing to this age of industrialization, the nature and its resources are depleting. If we continue to lead this careless, inconsiderate lifestyle, bow to the capitalism and consumerism that exists today, soon enough the *future generations won't have their basic necessities fulfilled.*

One of the *responsibilities of our generations* is to *educate the children of today* about the values of sustainability and aspects of the environment. It becomes absolutely essential for them to:
-Have respect for nature
-Take responsibility of their actions
-Spread the message and encourage others because they are the people of the future

4. User study

Children are my favourite people to work with. They are an absolute delight and an incredible creative input.

Image 4a

4.1 Conclusions based observations

Children are taught about sustainability in very *theoretical manner.*

Children know terms but they *do not know what to do in daily life* to make a change

Children *forget over a period of time*

4.2 Piagets developmental psychology

According to Piaget intellectual development in children happens in *out bursts instead of smooth development*. They cannot undertake certain tasks until they are psychologically mature enough to do so. He saw these transitions as taking place at about *18 months, 7 years and 11 or 12 years*. This has been taken to mean that before these ages children are not capable (no matter how bright) of understanding things in certain ways, and has been used as the basis for scheduling the school curriculum. Whether or not should be the case is a different matter.

Assimilation is the process by which a person takes material into their mind from the environment, which may mean changing the evidence of their senses to make it fit.

Accomodation is the difference made to one's mind or concepts by the process of assimilation.
Note that *assimilation and accommodation go together*: you can't have one without the other.

Schema is the representation in the mind of a set of perceptions, ideas, and/or actions, which go together.

Sensori-motor (Birth-2 yrs)

Differentiates self from objects

Recognises self as agent of action and begins to act intentionally: e.g. pulls a string to set mobile

Achieves object permanence:

Pre-operational (2-7 years)

Learns to use language and to represent objects by images and words

Thinking is still egocentric

Classifies objects by a single feature: e.g. groups together all the red blocks regardless of shape or all the square blocks regardless of colour

Concrete operational (7-11 years)

Can think logically about objects and events

Achieves conservation of number (age 6), mass (age 7), and weight (age 9)

Classifies objects according to several features and can order them in series along a single dimension such as size.

Formal operational (11 years and up)

Can think logically about abstract propositions and test hypotheses systemtically

Becomes concerned with the hypothetical, the future, and ideological problems

4.3 Counter theories to Piagets theory

The accumulating evidence is that this *scheme is too rigid*: many children manage concrete operations earlier than he thought, and some people never attain formal operations (or at least are not called upon to use them).

Piaget's approach is central to the school of cognitive theory known as *"cognitive constructivism"*: Other scholars, known as *"social constructivists"*, such as *Vygotsky and Bruner*, have laid more emphasis on the part played by *language,culture, social influences and other people in enabling children to learn.*

"Piaget believed in general stages of development that cut across contents (Space, time, number); I now believe that *each area of content has its own rules and operations and I am dubious about the existence of general stages and structures.*

Piaget believed that intelligence was a single general capacity that developed pretty much in the same way across individuals: I now believe that humans posses a number of *relatively independent intelligences and these can function and interact in idiosyncratic ways*,

Piaget was not interested in individual differences; he studied the *'epistemic subject.'* Most of my work has focused on individual differences, with particular attention to those with *special talents or deficits*, and unusual profiles of abilities and disabilities.

Piaget assumed that the newborn had a few basic biological capacities — like sucking and looking — and two major processes of acquiring knowledge, that he called assimilation and accommodation. Nowadays, with many others, I assume that human beings possess considerable innate or easily elicited cognitive capacities, and that *Piaget way underestimated the power of this inborn cognitive architecture*.

Piaget downplayed the importance of historical and cultural factors — cognitive development consisted of the growing child experimenting largely on his own with the physical (and, minimally, the social) world. I see development as permeated from the *first by contingent forces pervading the time and place of origin*.

Finally, Piaget saw language and other symbols systems (graphic, musical, bodily etc) as manifestations, almost epiphenomena, of a single cognitive motor; I see each of these systems as having its own origins and being heavily colored by the particular uses to which a systems is put in one's own culture and one's own time."

- Howard Gardener *Psychologist, Harvard University; Author, Changing Minds*

4.4 Choosing an age group

Accessing the learning capability of children based on Piagets developmental theory, I chose the *age group of 7-11 years*. I inferred this age group was appropriate as before 7 years the child thinks he's the centre of the world and after 11 years the child's mind becomes concrete and too difficult to mould. For teaching values of sustainability this age group was ideal. For the sake of this project I am following Piagets developmental theory which I will validate based on my research findings.

4.5 Meeting the teachers

The next step was to meet the teachers to understand their perspective to children and their ways of teaching and learning in children. I also got an insight into how and what is taught in schools exactly.

No of teachers interviewed 4

Where? Kendriya Vidyalaya IIT Powai

Reni Thomas *Subject taught- English*

"Repetitive inputs at regular intervals"

"Children are not taught at home, they get confused. Design something for parents" she believes that even though children are taught things in school they are often contradicted at home

"As they are kids, teachers are always right" she has experienced that children above the age of 11- 12 have a mind of their own and do not necessarily listen to the teacher.

Ideal age group- 7yrs onwards

Anindita Chakravarty *Subject taught- Social studies*

"Lot of difference between teaching and practising" she was of the opinion that children dont practise what is taught

"Health hygiene and self consciousness is primary" she believes that consciousness and respect starts from oneself

Ideal age group- 8 to 11 yrs

Rupalata Reddy *Subject taught- Science*

"Observing and experiencing should be a priority"

"Practicality in science works" she has observed that children learn much better through a practical medium

"Qualitative education over quantitative"

Ideal age group- 9 to 11 yrs

Sangita Nair *Subject taught- All subjects*

"Progressive repetitive inputs are required" she recommends that sustainability values should be done over a period of time and repeated inputs

"socioeconomic background might affect attitude towards the issue"

Ideal age group- 8 to 11 yrs

Analysis

Observation and insights

- Early age is easy to mold.
- There is a *lack of observational attitude* in children
- *Difference between* what is taught at *home and in school.* Often children learn something in school but parents negate the learning. eg. in school children are asked to switch of the fan and lights when not in use while parents are negligent regarding this issue at home.
- Knowledge should be *reinforced at regular intervals* to ensure *better absorption* of concepts
- There is difference between what is taught and what is actually imbibed and practised
- There is a need to *affect the conscience of the children*
- Children like *making and building things*
- Importance to health and hygiene. *Consciousness starts from self*
- Children like playing together
- Learning is *quantitative than qualitative*. Children often run after marks and grades and not what was the actual essence of the learning

Inferences (desirable attributes of the product)

- Appropriate age group for this kind of learning would be 8-11 yrs
- Element of fun
- Progressive learning, repetitive inputs
- Collaborative learning
- Simplify information
- Learning through experiences
- Design for 'children and parents'
- Do and learn
- Relate to daily examples and experiences

4.6 Teaching in schools

CBSE

Grade

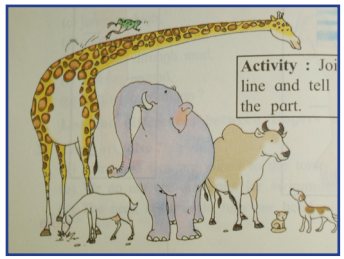
2nd

What is taught?

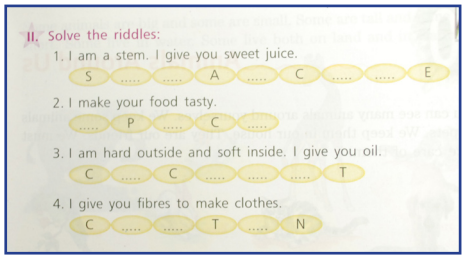
Growth in living things, non living things
Shapes, colours, size, spatial knowledge
Body parts and functions
Respect and love for family, plants, animals
Festivals, games
Fitness, food and hygiene, balanced diet
Water- where it comes from
Earth- pollution in brief

Image 4b

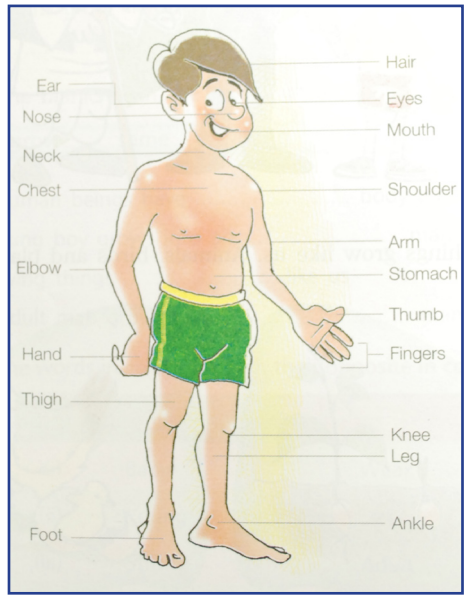
How its taught?



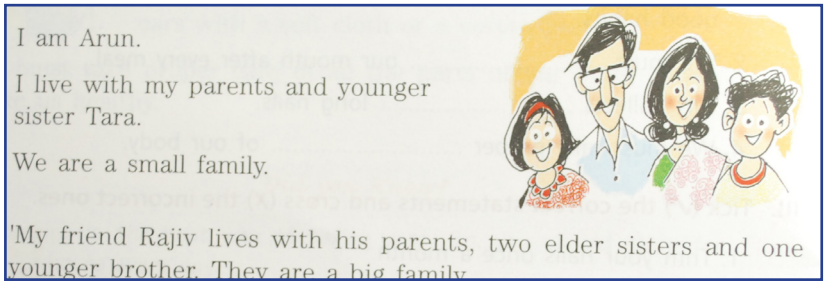
Little exaggeration from the realistic to make it more funny and interesting for children



Playful tests like riddles are provided to make validation of their learning more fun



Pictorials and labels- Children are introduced to the concept of labelling and naming objects



Simple sentences are used in the text books. E.g. I am Arun. I live with my parents and younger sister Tara.

Activity- certain activities are recommended to improve learning. Like matching images based on where they come from. E.g. Milk comes from the cows, honey comes from honey bees.

Relating to daily experiences- Children are taught by giving examples of things around them so they understand and relate to things better.

Grade

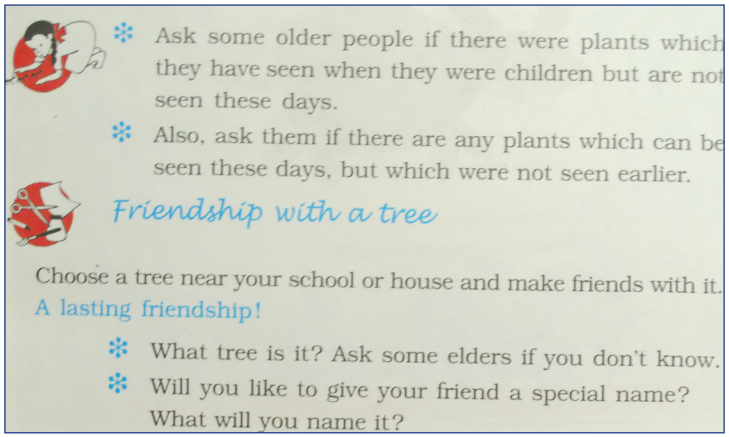
3rd

What is taught?

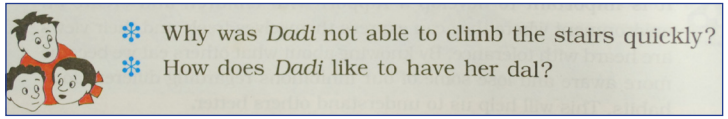
- Relationships with plants and animals and nature
- Water- uses sources
- School, relationships between people
- Heredity, community work, changes between past and present
- Socio - economic disparities, gender roles and biases
- Importance of interaction with people, People of the world
- People with disabilities, sensitivity towards them
- Objects and sound
- Urban environment, Houses and habitat

Image 4c

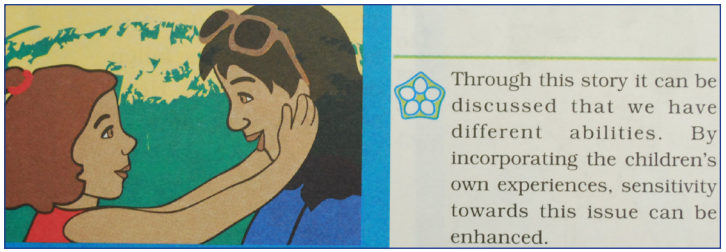
How its taught?



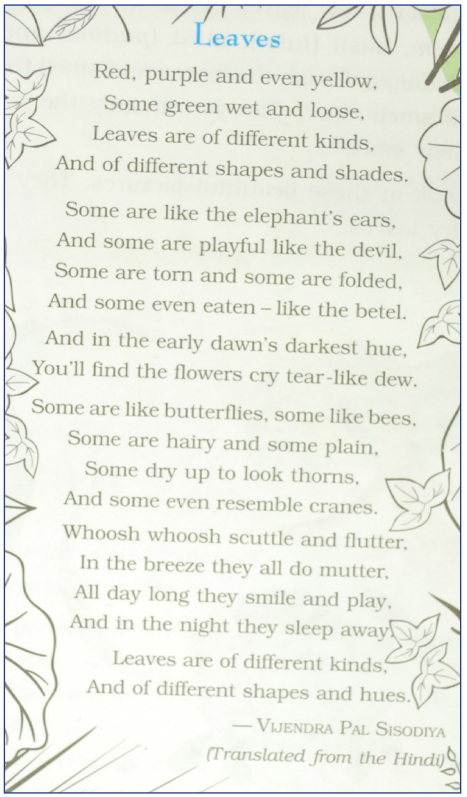
Write, think observe- learning through observing and writing is encouraged and followed. E.g. Ask your grandparents about certain plants that they have seen but you do not see anymore.



Discussion, narration- certain learning is encouraged by discussion between students. E.g. Why does dadi climb the staircase slowly?



Expressions and body language is used an important tool for learning. E.g. student's eyes are tied for them to experience how a blind person might feel.



Poetry is introduced to children as a tool for learning.

craft and art are used to make the learning more enjoyable and memorable

Grade

4th

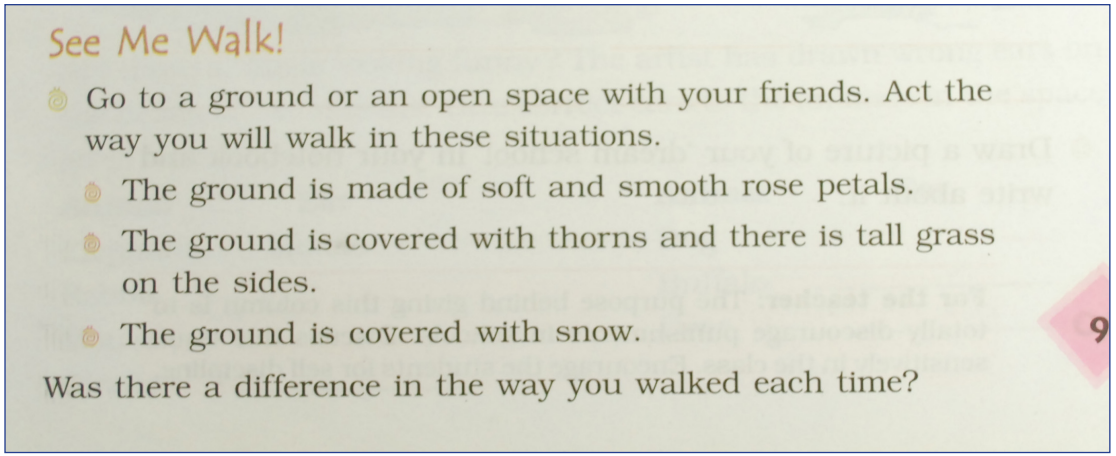
What is taught?

- Building things, structures,
- Animals and their habits
- Dependencies on plants and animals, Protecting them
- Going to school and value of money
- Travelling, global, migrating people
- Changes with generations
- Courses of a river, water pollution, Habitat conservation
- Farming and agriculture
- Diseases and how to prevent them
- Festivals, public eating, traditional arts

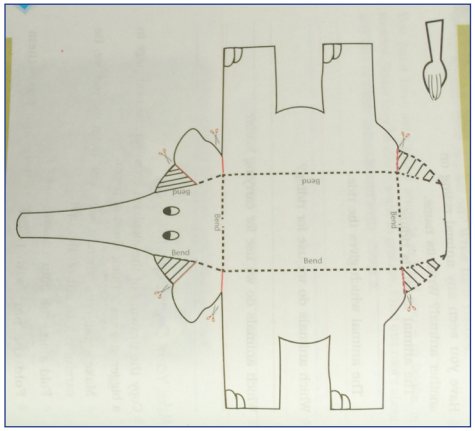
Image 4d

How its taught?

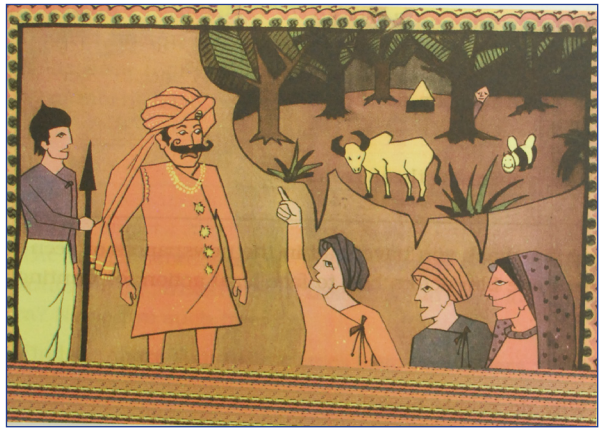
Language becomes a little more elaborate



Learning through observation and experience. E.g. Go to a ground and act the way you will walk in these situations. 1. Ground is made of soft and smooth petals, 2. Ground is covered with thorns, 3. Ground is covered with snow.



Making things is used as a tool for making learning a fun activity e.g. Making an elephant out of paper



Story telling is used as a tool as all children like listening to stories and fantasizing.

Grade

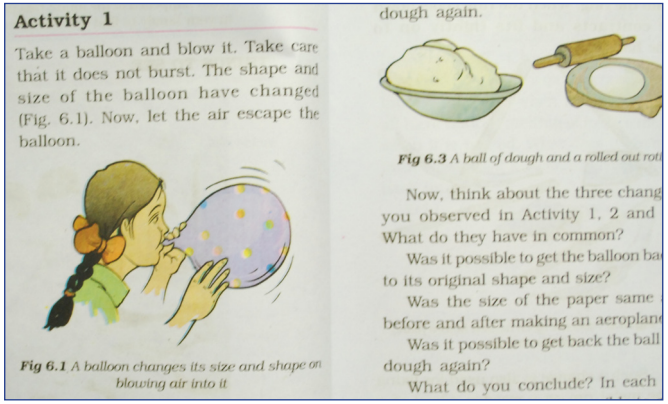
6th

What is taught?

- Food cycle, food components and deficiencies
- Object and material properties
- Reversible and non reversible changes
- Plants- scientific facts , importance of forests
- Human body, growth
- Living organisms, surroundings (habitat and adaptation),
- Elements of an environment
- Water cycle, conservation, rain water harvesting
- Air- source of energy
- Garbage(compost, vermi compost, recycling)

Image 4e

How its taught?



Activity 1

Take a balloon and blow it. Take care that it does not burst. The shape and size of the balloon have changed (Fig. 6.1). Now, let the air escape the balloon.

Fig 6.1 A balloon changes its size and shape on blowing air into it

dough again.

Fig 6.3 A ball of dough and a rolled out roti

Now, think about the three chang you observed in Activity 1, 2 and What do they have in common?

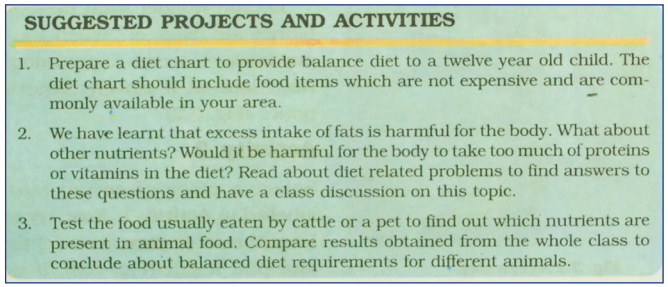
Was it possible to get the balloon ba to its original shape and size?

Was the size of the paper same before and after making an aeroplan

Was it possible to get back the ball dough again?

What do you conclude? In each

Examples (daily experiences) - teaching is done through daily life examples E.g. balloon changes size and shape on blowing air into it.



SUGGESTED PROJECTS AND ACTIVITIES

1. Prepare a diet chart to provide balance diet to a twelve year old child. The diet chart should include food items which are not expensive and are commonly available in your area.
2. We have learnt that excess intake of fats is harmful for the body. What about other nutrients? Would it be harmful for the body to take too much of proteins or vitamins in the diet? Read about diet related problems to find answers to these questions and have a class discussion on this topic.
3. Test the food usually eaten by cattle or a pet to find out which nutrients are present in animal food. Compare results obtained from the whole class to conclude about balanced diet requirements for different animals.

Suggested projects and activities- Prepare a diet chart for a 12 year old using food available easily in your area.

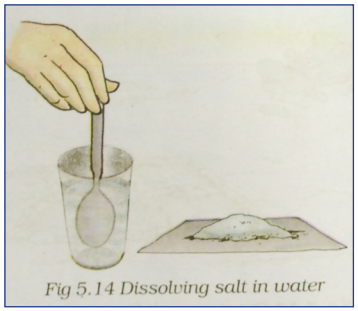
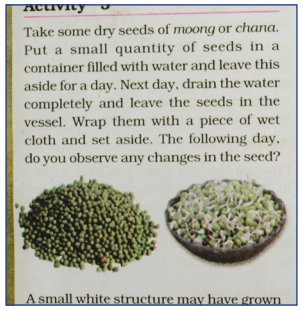


Fig 5.14 Dissolving salt in water



Take some dry seeds of *moong* or *chana*. Put a small quantity of seeds in a container filled with water and leave this aside for a day. Next day, drain the water completely and leave the seeds in the vessel. Wrap them with a piece of wet cloth and set aside. The following day, do you observe any changes in the seed?

A small white structure may have grown

Activities to reinforce teaching using experiments like the phenomenon of dissolving substances in water by taking salt and dissolving it in water. or to show the phenomenon of germination of seeds by using dry seeds of moong and chana and soaking them until they start sprouting.

THE EARTH IN THE SOLAR SYSTEM

watch the sky after sunset! One or two bright dots shining in uld see the number increasing. em any more. The whole sky is objects – some are bright, others sky is studded with diamonds. twinkling. But if you look at ll notice that some of them do do. They simply glow without moon shines.

right objects, you may also see e days. It may, however, appear ifferent shapes and at different the full moon only once in about **ull moon** night or *Poornima*. A nnot see it at all. It is a **New** *ya*. On this day, you can watch vided it is a clear night.

can't we see the moon and all s during day time? It is because e sun does not allow us to see of the night sky.

nd all those objects shining in **celestial bodies**.

s are very big and hot. They They have their own heat and large amounts. These celestial The sun is a star.

stars in the night sky are we do not feel their heat or ry because they are very very far

Let's Do

You'll need : 1 torch, 1 sheet of plain paper, pencil and a needle.

Step :

1. Place the torch in the centre of the paper with its glass front touching the paper.
2. Now draw a circle around the torch.
3. Perforate the paper with the needle within the circled area.
4. Now place the perforated circle part of the paper on the glass front and wrap the paper around the torch with a rubber band.
5. Take care that the switch of the torch is not covered.
6. In a dark room, stand at some distance facing a plain wall. Switch off all other lights. Now flash the torch light on the wall. You will see numerous dots of light on the wall, like stars shine in the night.
7. Switch on all the lights in the room. All dots of light will be almost invisible.
8. You may now compare the situation with what happens to the bright objects of the night sky after the sun rises

The pages have less images, longer sentences

Food Item	Ingredients	Sources
Idli	Rice	Plant
	Urad dal	
	Salt	
	Water	
Chicken curry	Chicken	Animal
	Spices	
	Oil/*ghee*	Plants/ Animals
	Water	
Kheer	Milk	Animal
	Rice	Plant
	Sugar	

Tables(rows and columns) are used to show comparisons and relations between things

SSC

grade

3rd

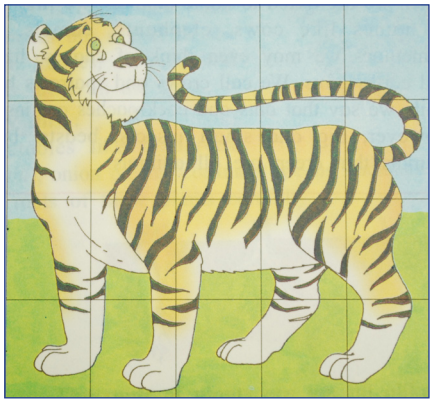
What is taught?

- Growth in living things, non living things
- Our body, sensory organs
- Parts of plants and animals, how they live
- Food and water (health aspects)
- Fitness, food and hygiene, cleanliness of surroundings
- Natural resources, natural disasters

Image 4f

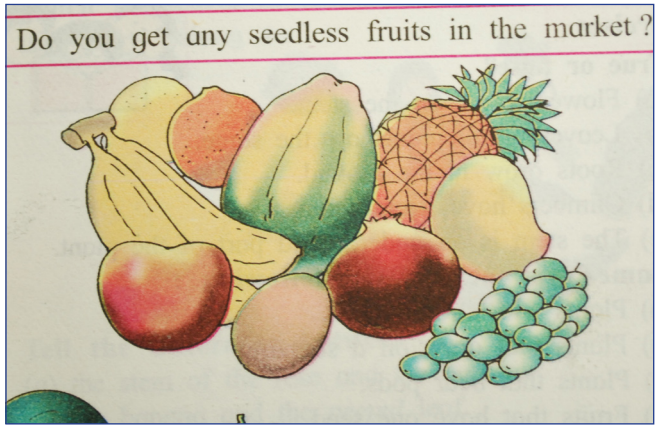
How its taught?

Pictorial story telling- illustrations are used to make the text book more playful for the child. He is told stories which relate to his immediate environment.

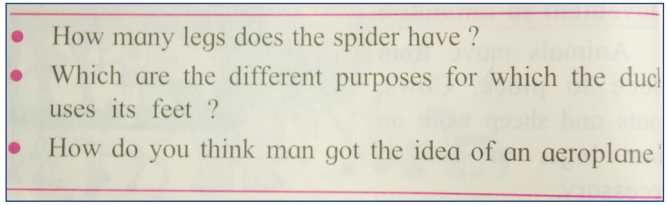


Quizzes and puzzles are used to improve learning of things and their parts e.g. Tiger and his body parts

Certain values are taught indirectly. Children are taught about vandalism and respect for historical monuments



Observe seedless fruits in the market



Asking questions to improve observation and learning in children.

Grade

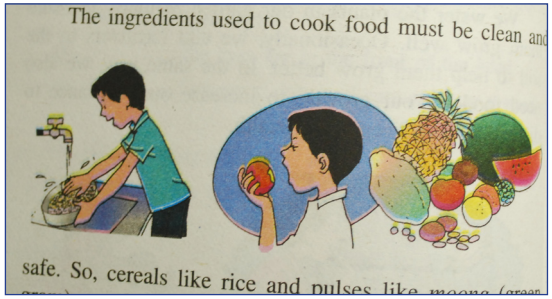
4th

What is taught?

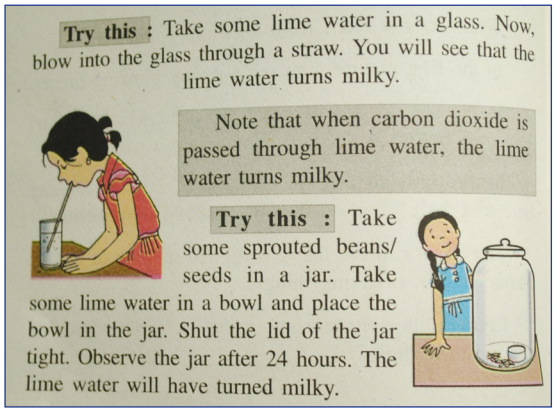
- Living non living things
- Human body parts, muscles, bones
- Water sources, conservation
- Health hygiene, community health
- Separation of waste
- Weather
- Properties of substances
- Agriculture
- Clothes- cultural diversity
- Shelter- calamity resistance

Image 4g

How its taught?

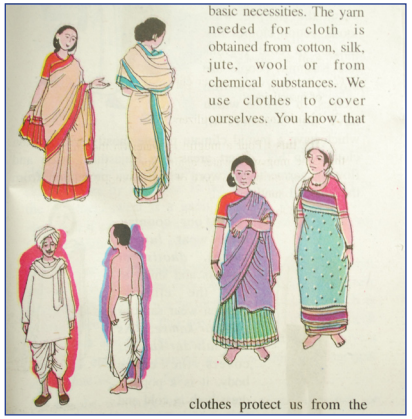


Teaching through daily experiences that they can relate to e.g. Wash your hands and fruits, vegetables before eating.



Small experiments to demonstrate phenomenon e.g. Take some lime water in a glass. Now blow into the glass through the straw. You will see that the lime water turns milky. note that when carbon dioxide is passed through lime water, the lime water turns milky.

Pictorial depictions of thoughts.



Placing child out of immediate surrounding e.g. the child is pictorially shown the various ways of clothing of people in the country.

grade

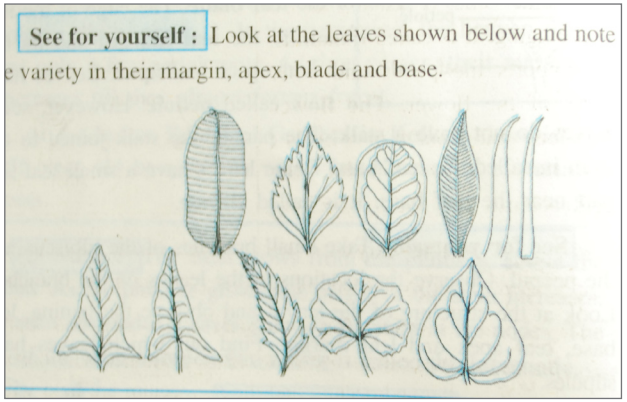
6 th

What is taught?

- Characteristics and classifications of living things
- Plant structure
- Measurement, force, types of motion
- Work and energy
- Organ systems
- Our earth and environment
- Social environment

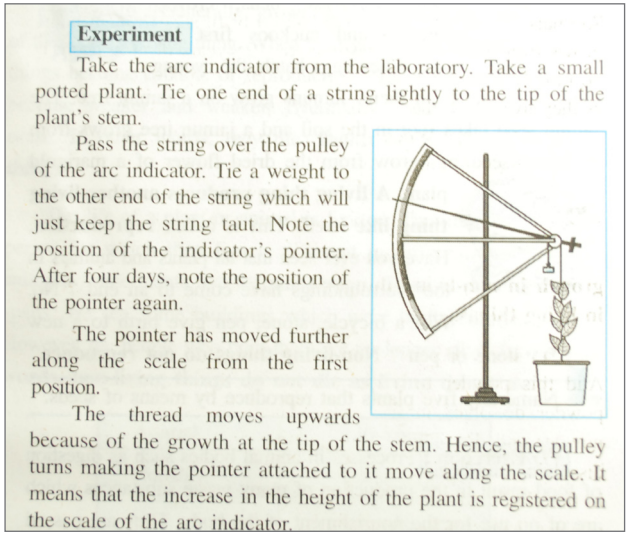
Image 4h

How its taught?


See for yourself : Look at the leaves shown below and note
e variety in their margin, apex, blade and base.

Observation to improve sensitivity of things around them. E.g. looking at different leaves and their features

Play games and learn


Experiment

Take the arc indicator from the laboratory. Take a small potted plant. Tie one end of a string lightly to the tip of the plant's stem.

Pass the string over the pulley of the arc indicator. Tie a weight to the other end of the string which will just keep the string taut. Note the position of the indicator's pointer. After four days, note the position of the pointer again.

The pointer has moved further along the scale from the first position.

The thread moves upwards because of the growth at the tip of the stem. Hence, the pulley turns making the pointer attached to it move along the scale. It means that the increase in the height of the plant is registered on the scale of the arc indicator.

Experiments to demonstrate a phenomenon e.g. Growth in plants

ICSE

Grade

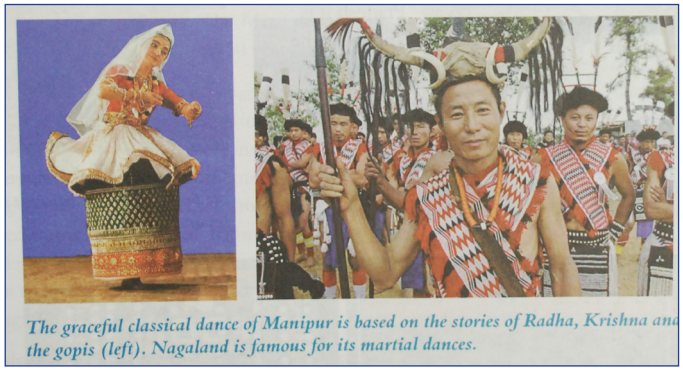
4th

What is taught?

- Regions on India (climate vegetation, soil, culture, food, industries)

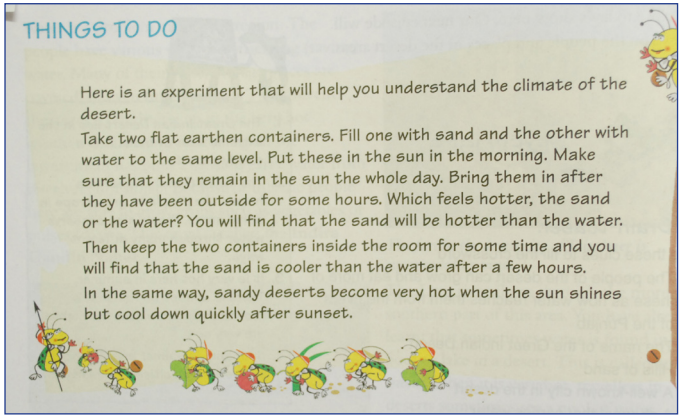
Image 4i

How its taught?



The graceful classical dance of Manipur is based on the stories of Radha, Krishna and the gopis (left). Nagaland is famous for its martial dances.

local culture and crafts are exposed to the child to look at a larger perspective of things and understand their importance



THINGS TO DO

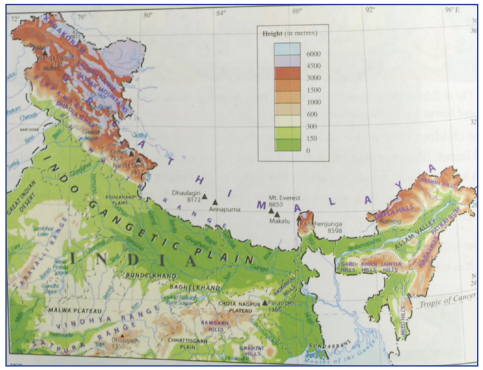
Here is an experiment that will help you understand the climate of the desert.

Take two flat earthen containers. Fill one with sand and the other with water to the same level. Put these in the sun in the morning. Make sure that they remain in the sun the whole day. Bring them in after they have been outside for some hours. Which feels hotter, the sand or the water? You will find that the sand will be hotter than the water.

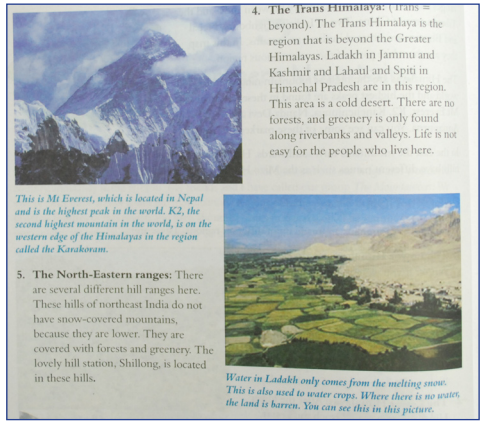
Then keep the two containers inside the room for some time and you will find that the sand is cooler than the water after a few hours.

In the same way, sandy deserts become very hot when the sun shines but cool down quickly after sunset.

children are encouraged to do additional activities like cooking or weaving to engage them and make learning a fun filled activity.



Graphical representation through maps and symbols



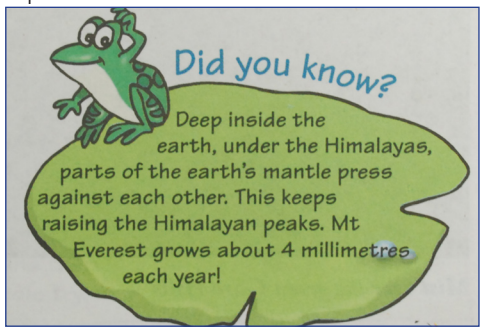
4. **The Trans Himalaya:** (Trans = beyond). The Trans Himalaya is the region that is beyond the Greater Himalayas. Ladakh in Jammu and Kashmir and Lahaul and Spiti in Himachal Pradesh are in this region. This area is a cold desert. There are no forests, and greenery is only found along riverbanks and valleys. Life is not easy for the people who live here.

This is Mt Everest, which is located in Nepal and is the highest peak in the world. K2, the second highest mountain in the world, is on the western edge of the Himalayas in the region called the Karakoram.

5. **The North-Eastern ranges:** There are several different hill ranges here. These hills of northeast India do not have snow-covered mountains, because they are lower. They are covered with forests and greenery. The lovely hill station, Shillong, is located in these hills.

Water in Ladakh only comes from the melting snow. This is also used to water crops. Where there is no water, the land is barren. You can see this in this picture.

Large images, actual pictures replace pictorial depictions



interesting facts

Grade

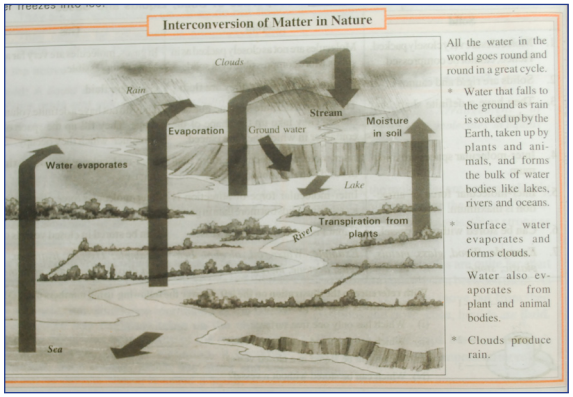
6th

What is taught?

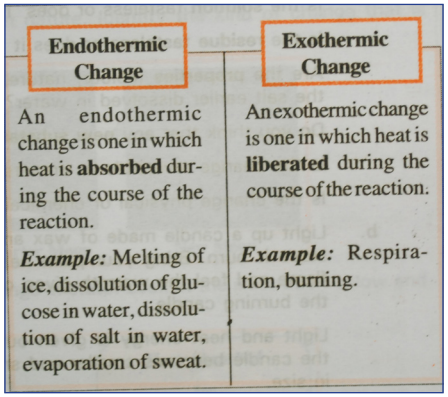
- Water cycle
- Atoms model
- Separation of mixtures, states of matter, properties
- Earth system, our environment
- Food chain, biome
- Air and balance of gases
- Importance of components in nature (processes, effects, cycles)
- Pollution,
- Importance of forests
- Health and hygiene
- Plant and animal classification
- measurement, force, simple machines

Image 4j

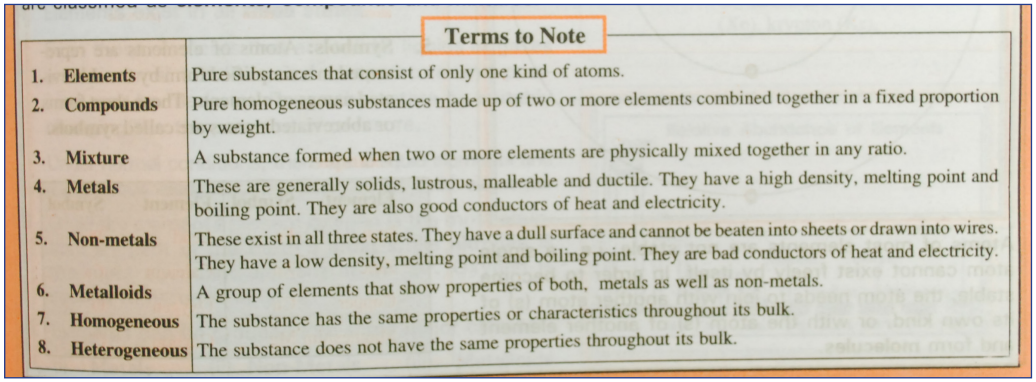
How its taught?



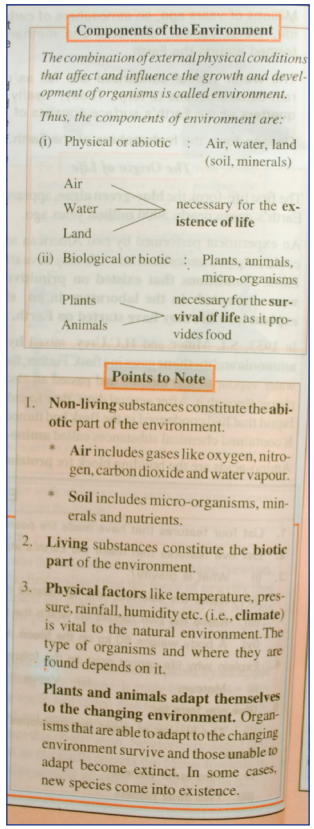
Cycle diagrams to show a certain phenomenon or a process



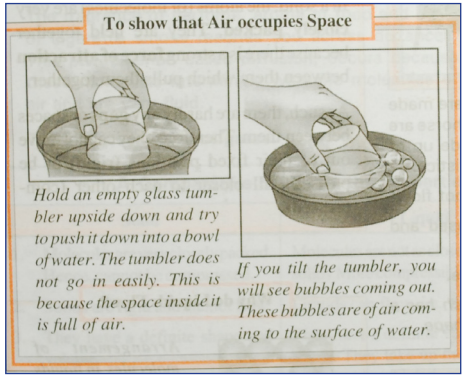
Comparative studies using columns



Important pointers are provided as a revision for children



Boxes are provided to emphasize important points



Easy experiments to demonstrate certain phenomenon

Analysis

Current methods of teaching

2nd-4th- exagerrated pictorials, story telling, relating to daily examples, simple sentences, use of art and craft, observation and asking questions, puzzles,certain values are taught indirectly, interesting facts, small activities

5th- 6th- realistic images, maps, cycle diagrams, increased text, comparitive studies, boxes to emphasize importance, usage of technical words, small experiments

Problems

Difficult words.
Attention span of children is very low.

Activities reduce, text makes study monotonous, learning as a group is almost nil. multisensorial experience is absent.

Insights

Difference between what is taught in *CBSE,ICSE and SSC schools*. ICSE then CBSE then SSC in order of difficulty

ICSE has *project method of teaching* before the 4th std. There are no textbooks. *(art, craft, poetry, essays, field trips)*

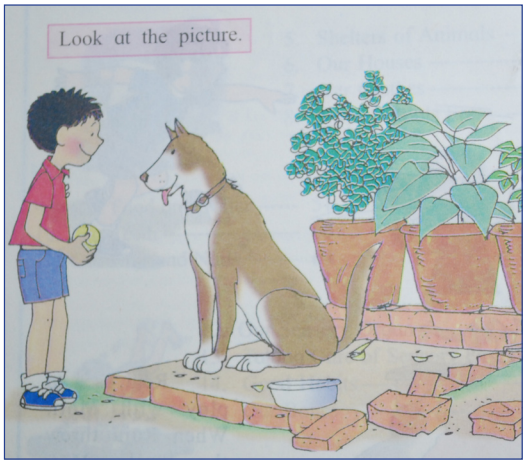
3rd-4th std still have suggestions for some practical activities to impart knowledge.
Mostly *activities are left for the children to do.*

Certain topics are not taught in conjuction to each other. Interrelationships are crucial. Topics related to the environment.

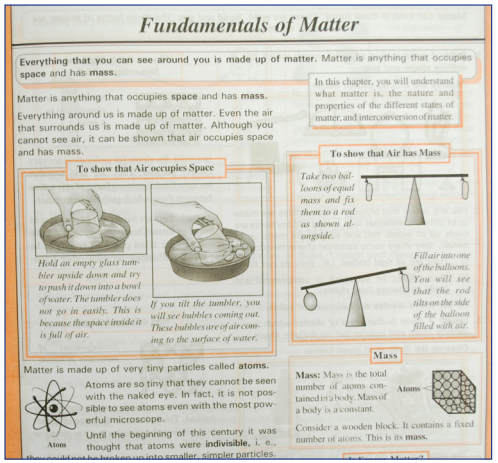
There is a vast *difference i*n the way *things are taught to 3rd std and 6th std. (Design challenge)*

Certain ICSE and CBSE schools have *nature clubs* and SUPW (socially useful and productive work)

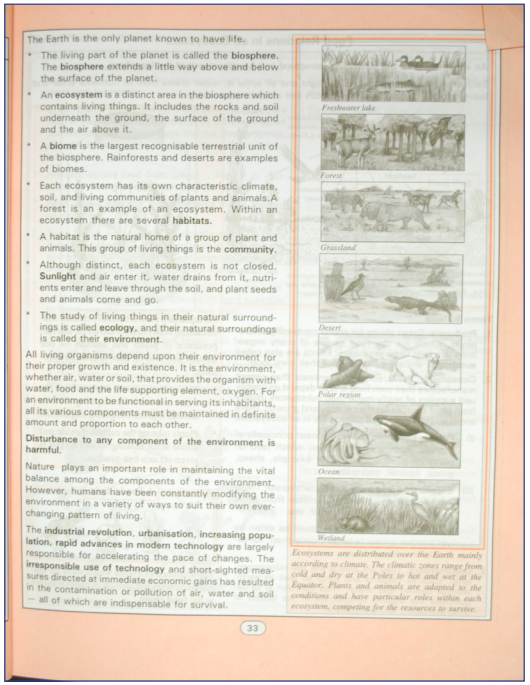
In all cases the *education for sustainability is limited and mostly adopt theoretical ways of teaching.*



3rd std



6th std



Environmental studies ICSE

Environmental studies CBSE

The ways of teaching in this age group corraborated with Piagets developmental psychology.

Concrete operational (7-11 years)

Can think logically about objects and events

Achieves conservation of number (age 6), mass (age 7), and weight (age 9)

Classifies objects according to several features and can order them in series along a single dimension such as size.

Formal operational (11 years and up)

Can think logically about abstract propositions and test hypotheses systemtically

Becomes concerned with the hypothetical, the future, and ideological problems

Cognitive psychology of concrete operational age group

- mental imagery, memory games, drawing
- can solve inclusion and conservation problems
- cannot think in abstract

Development motor skills

- using tools, making models, working with fabric, wood clay
- long range eye and hand coordination
- increase in physical activity

Developmental play

- cooperative play
- outdoor play
- memory games, jigsaws, dice games

4.7 Alternative methods of teaching

Dissatisfied with the current ways of teaching sustainability to children, I started looking at alternative methods of teaching that could get me some insights.

Navnirmiti is an organization dedicated to acquiring, developing, innovating, producing and disseminating high quality, low cost/no cost (LCNC) learning methods, tools and systems to bring about universalization of *elementary mathematics and science skills and competencies*. Navnirmiti (NN) conducts a number of mutually complementary activities to achieve the above objective. Navnirmiti reaches all those who otherwise would not have access to good education.

Its their speciality in teaching mathematics and science by unconventional methods.

Interaction with Navnirmiti teachers

No of teachers interviewed 5

Where? Navnirmiti office, community centre

Teachers interviewed :

Harish
Bhavna
Unda
Asha
Raju

Navnirmiti methods

- Learning through *understanding and experiencing*

- *Do and discover* method

- Focus on smaller children

- Teaching alongside schools

- Educate children in rural, tribal areas

- Workshops for parents to create awareness of education and new methods

- Group activities, summer camps are organised for children

- Encouraging *scientific and mathematical attitude*

- *Group teaching* for better learning

- Dialogue method to constantly get feedback of the learning from children

- *Low cost* solutions

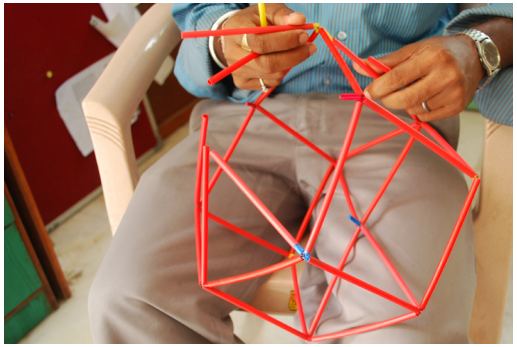
- Use of *bright colours*

Counting, tables using a grid of cubes which can be fixed to each other

Counting, addition, subtraction using colourful balls on a string for younger children

Counting, addition, subtraction, squares
Multiplication using small foam squares to make squares of numbers.

Counting, addition, subtraction,
Multiplication, handling money using coins



Shapes in geometry, 3d objects using straws which can be made into structures. e.g. cubes, pyramids etc.

Counting, addition, subtraction, squares
Multiplication using stubs that fit into a square mat.

counting, addition, subtraction, squares, multiplication, 3d structures using cubes of plastic.

Teaching concepts of *science* by the usage of *posters* which have some phenomenon illustrated. The methodology followed is *observe and answer*. The children are encouraged to *arouse questions*

Language is taught using methods of *show and tell*, *show and write*. They believe writing something one time equals to 3 times reading. Some other methods of teaching language are word Antakshari to make it more interesting.

Image 4k

Image 4l

Image 4m

Dinosaur- understanding levers joints
Develops spatial abilities and interrelationships in components

Image 4n

Helps a child understand principles of Electricity. Also look at renewable sources of energy

4.8 Study of existing tools

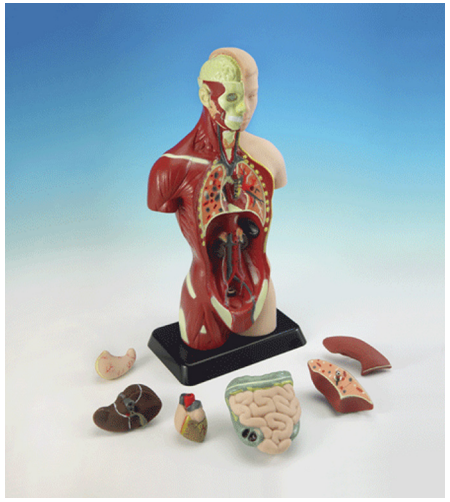
1. Educative

2. Teach values of sustainability

Image 40

Ecology- understanding concern for the earth, ecological relationships

Image 4p



Human body, placement and relationships between organs and organ systems

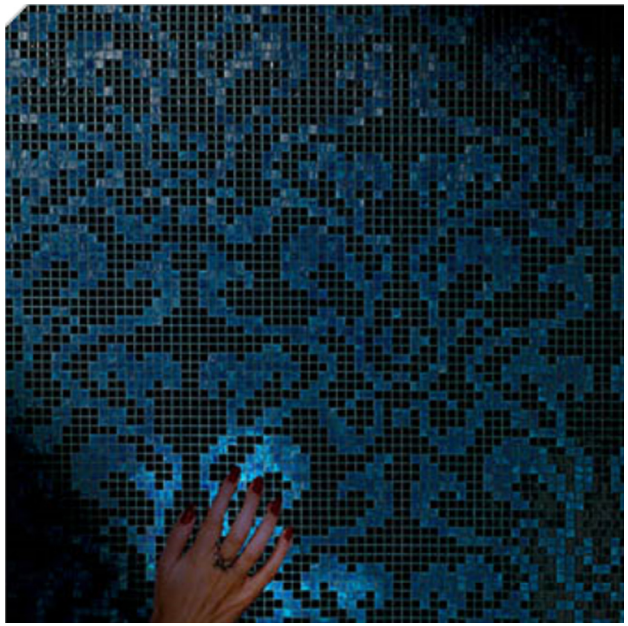
Image 4q

Understanding concepts of solar energy by experiments

Image 4r

MXR cubes- Interactive story telling
this is a new way of story telling where two children could own 2 different cubes. When brought together in the presence of a interactive surface, a certain story is told. It encourages new ways of interaction with friends. Improves linguistic skills.

Image 4s



Active mosaic

On human touch, an action leads to a reaction. Creates interesting patterns on the mosaic depending upon the intensity of pressure exerted

Image 4t

Collective collision

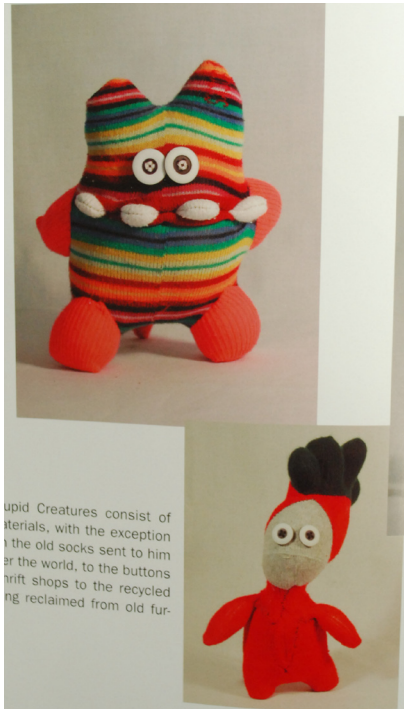
This is an interactive installation where the user throws pebbles which are chemically treated with different forces. It creates a certain kind of pattern on the surface based on the force, direction of throwing, distance of throwing from the wall, and colour of the pebble. Here we see how multiple parameters can affect a reaction.

These products embody certain values of sustainability. Hence stand for a cause and convey some message and awareness indirectly

Image 4u

Lego blocks improve spatial ability and creativity. Children can create and build things. Sustainable product values (reducing supply chain energy, social quality of labour, extending product labour)

Image 4v



Stupid creatures are toys for young children. Sustainable product (waste socks, polyester stuffing from old furniture)

Image 4w

Critters are toys which can be used for story telling. Sustainable product (providing livelihood to a community, handcrafted, each toy is unique)

Image 4x

Thames and cosmos ‘Power house’
Develops ecological intelligence. It shows a new way of living to children.
It also teaches harnessing and managing non conventional sources of energy.

Image 4y

Arvind Guptas educational toys
Develop scientific, mathematical, creative and ecological intelligence. These toys are made from junk completely. They are cost effective and available to the masses.

4.9 Case studies - Teaching Sustainability in schools

I studied some schools which believe in imparting sustainability education to their children. This education is started at early ages. The intention is holistic learning where the sustainability indirectly becomes a part of the value system of the child.

Math

Health

Culture

History

kitchen — school garden — classroom

Environment

Life skills

Science

Social sciences

Case 1.

This school is called the *edible school yard* for the reason that, children as a group grow and *nurture a garden* with variety of plants some of which yield *edible fruits, vegetables* etc. The *school garden* forms the *centre of all the learning*. Children grow, harvest and cook food on their own. All the *subjects are taught around this central activity of growing a healthy garden ecosystem*. Aspects about the environment, Nesting eco systems and dependencies of entities are taught through this garden. Other subjects like science and math are also taught through this garden. aspects of history and local culture are also taught.

Farming

Pond

school grounds

Restoration of watershed

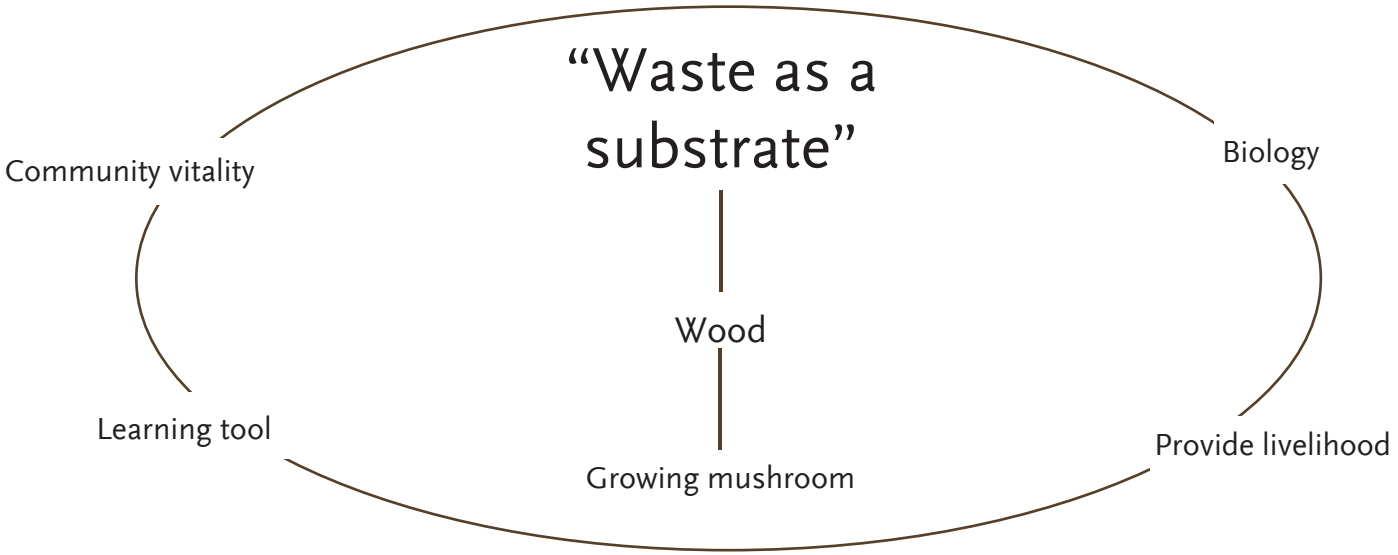
Butterfly garden

Compost system

Case 2. Eco stars, Mary. E Silvera community

Objectives of the school
- Teach and *practise principles of ecology*
- To *heighten child's environmental awareness and sustainability*
- To integrate science, math and social studies
- Instill a *sense of ownership, pride, and responsibility*

This was is done by again keeping the *school ground as a centre of all learning*. The children indulge in *farming*, they take *care of a pond* which is a home to lots of amphibians, fish and plants etc. They nurture a *butterfly garden*. Learn to *recycle waste* in a compost system. They also look a immediate environment that have restoration requirements like *restoration of the watershed*. Children here understand the functioning of smaller ecosystems in a larger one.



Case 3. Laytonville high school

The students of this school learnt to use a local abundant *waste material to provide a livelihood to people.* The people of this town were mostly lumberman. Lots of *wood waste* was generated which was of no use. This *school had a vision* and used this waste as a *substrate to grow mushrooms.* The age old profession of lumbermen in this town were fast was losing its existence. Lots of *people were losing their jobs*. This practice of *growing mushrooms* became a medium to provide *sustainable livelihood to these people*

The children understood aspects of *community livelihood, biology, feedback systems, waste management in nature.*

Case 4. Art of water sheds

This school creates awareness about environmental issues by looking at *immediate environment*. The children of this school *adopted a watershed* close by and spent regular time and efforts in restoring this water shed. They did *bird and insect monitoring, habitat mapping, water quality monitoring* hence learnt about ecosystems. This school also emphasizes on *articulation* which is done through *mediums of poetry and art.*

How to make sustainability a value system for children? Inferences

Expose children to ecological relationships

Expose children to local and other cultures

Encourage and show benefits of simple living

Encouraging group activities like Farming, cooking, which facilitate sharing experiences, learning and foster sensitivity towards each other

Use Art, Craft and Poetry as engaging articulation and tools to experiencing sustainability.

Progressive learning over long intervals to ensure larger impact on life.

Encourage them to ask questions

Introduce them to enriching multi sensorial experiences

Introduce them to aspects of sustainable livelihood

Involve parents and other community members

Use sustainable products methodology

Question where something comes from

Tell them simple things to do in daily life and why?

Relating experiences and values to home

5. Nature of a systemic approach

Its quite evident that a systemic approach to teaching sustainability is ideal but what if the system already exists as in the case of our urban scenario where we our schools already have a certain system of working and teaching. This thought gave rise to my product brief.

6. Design brief

"To design a sustainability awareness kit for children (age group- 8 to 11 years) living in Indian urban environment."

The learning should be fun and experiential such that the child imbibes the values of sustainability. The tool will be an addition to the existing curriculum of studies adopted in schools. The tool will be designed to fit into the existing system. The learning will be collaborative which encourages the 'do and learn' ways of making sustainability a value system. The teaching would be as progressive inputs at regular intervals.

7. Design objectives

Playful and fun learning
Learning in a group
Progressive learning, spread out over long intervals
Do and learn
Sustainable methods of making the product
Low cost
Simplify the information

8. What is being taught?

Since the scope of sustainability is so large. I narrowed down the topics I want to teach children to make it simpler for me to handle and for them to understand. The topics are as follows:

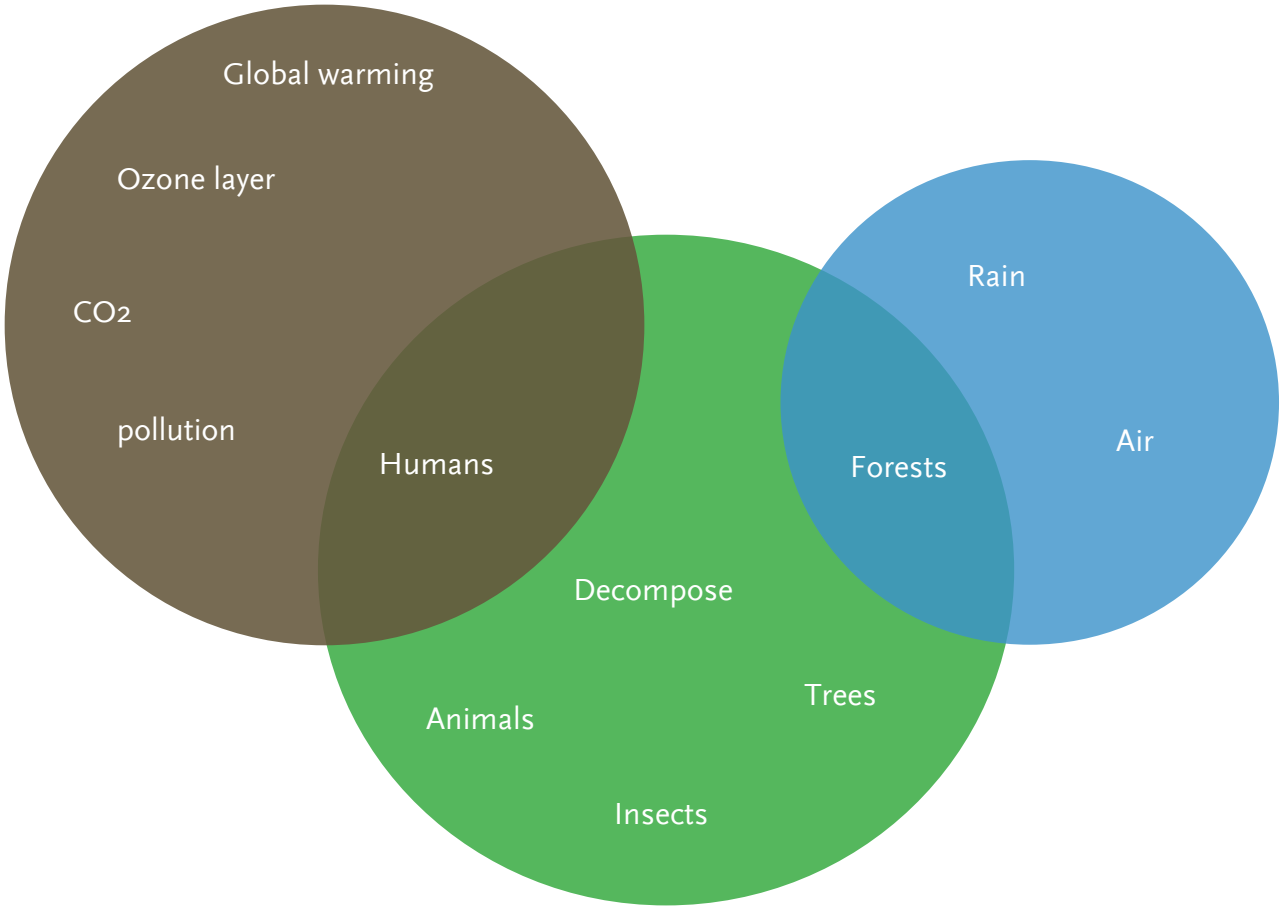
Reduce, Recycle, Reuse

Ecological cycles (water, land, air), interrelationships

Relating sustainability to daily experiences

Concepts of eco- housing

8.1 Relating Eco- systems



9. Ideation

This part of the design process is my personal favourite. It has its own share of struggles but it is the single most important component of any design project. The entire future of the project is mostly determined at this point. My ideas were mostly random yet I always had the design objectives of the project at the back of my head. Some efforts were conscious and some serendipity. I did experience mental blocks at times. I used methods of brain storming, Synectics to overcome these mental blocks. Some efforts were successful and some were not. Over a period of time I realized that my ideas can be more or less grouped into a few categories:

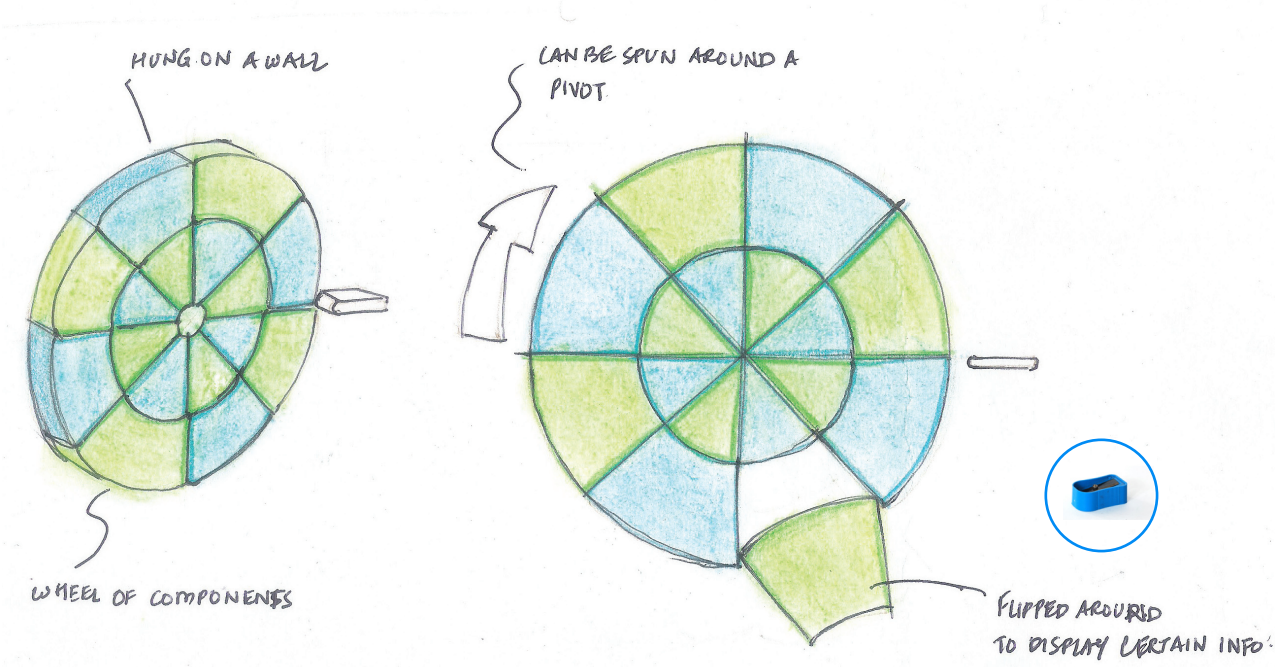
1. Ideas where physical activity shows the effects of certain human activity.
2. Additional products that reinforce the knowledge imparted
3. Ideas where making things which can be used for teaching and playing
4. Ideas related to eco - housing
5. Idea where one uses sustainable designed product to create a certain kind of awareness.

Proportion with respect to a sharpener
This visual has been used at places to show proportion

Group 1. Ideas where physical activity shows the effects of certain human activity.

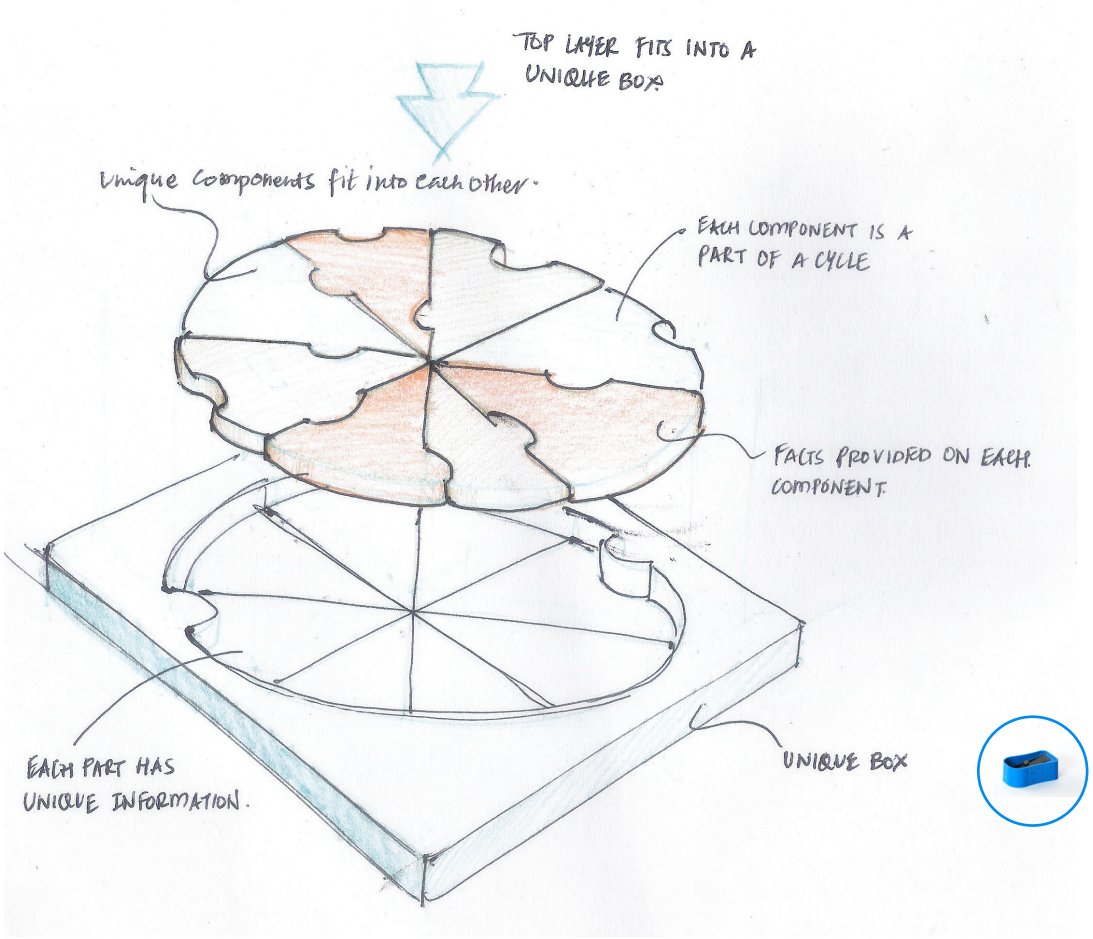
Idea 1.1

This product will be wall mounted. The children will be seated on their chairs or the floor. The teacher will interact with the product. Each sector of the wheel represents a component of the ecosystem. The whole wheel forms a cycle representing an ecosystem. In an ideal situation the wheel can turned around showing the perfect functioning of the cycle. There are hinges present along the periphery of the wheel such that each sub component of the sector can be rotated to expose the surface behind which shows the effects of trying to remove that certain component of the eco system from the cycle. Also when the wheel is rotated it will be stopped by a stopper showing that the cycle stops functioning if any component is removed from the eco system. E.g. Removing a tree would mean insects wont have anywhere to live. Frogs wont have insects to eat and they will die. Snakes wont have frogs to eat so they will die etc.



Advantages
- Compact
- Good visibility as its wall mounted
- Can teach a large group of children

Disadvantages
- very little engagement for children
- no repeat value
- structure is too rigid to expand concepts
- abstract ways of depicting certain ideas might be difficult for the child to understand e.g. Turning of a wheel representing the harmonious functioning of an eco- system

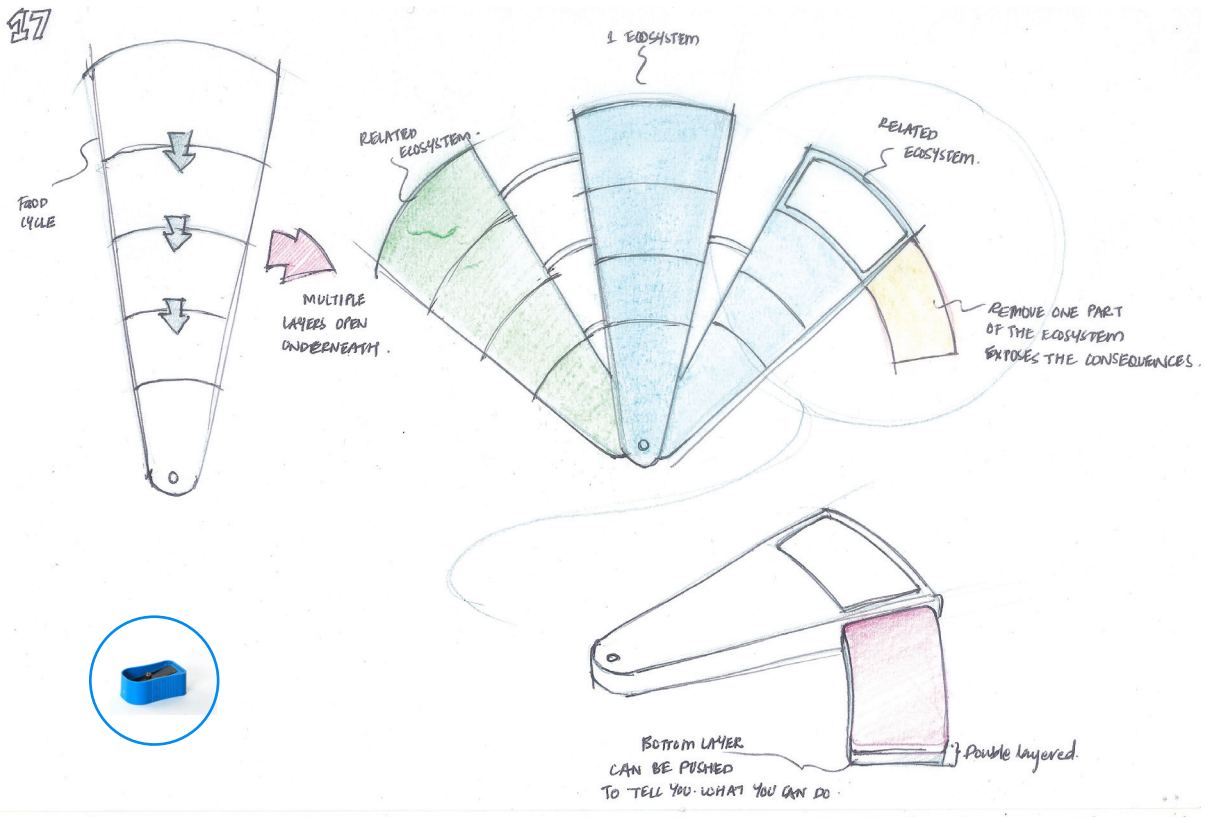


Idea 1.2

This product starts as a puzzle for the children, where each sector of the circle is a unique piece and unique component of the eco- system. The complete puzzle represents the eco system. The children have to put the puzzle together and fit it into a unique box. The teacher starts teaching about the specific eco- system and the role played by each of its components. She demonstrates the removal of one component of the puzzle and the part of the box exposed by the removal of the component contains some text which informs the children about the harmful effects of removing the specific component from the ecosystem.

Advantages
- child enjoys the puzzle
- the child knows the consequences of removing a certain component of the eco system.

Disadvantages
- not large enough to engage a large group of children
- too rigid a structure to expand the learning
- repeat value is low

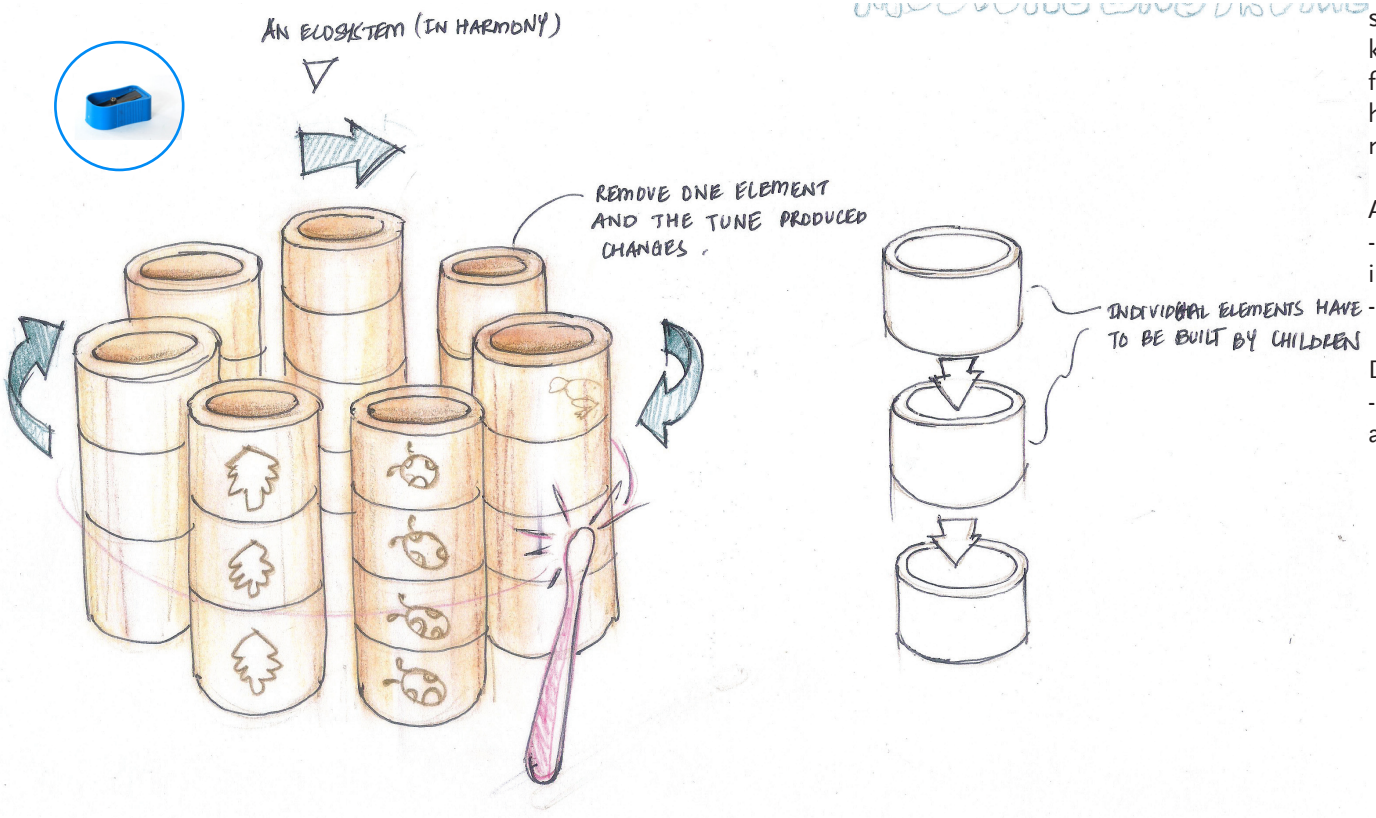


Idea 1.3

This product is handy tool that the teacher can carry. Each wing of the fan represents an eco- system. Each wing is further divided into sub divisions. Each sub- division represents a component of an eco system. Each sub- component has 2 bottom layers. When the top layer of any sub component is removed which represents removal of a component from the ecosystem, it exposes the bottom layer which shows the adverse effects of removal of that component. When this second layer is removed it exposes the layer under the 2nd layer. This 3rd layer tells the children what they can do to make things better.

Advantages
- one product can teach about multiple eco-systems
- its a compact handy product

Disadvantages
- the impact is very low
- there is no engagement of the child
- there is no fun element for the child

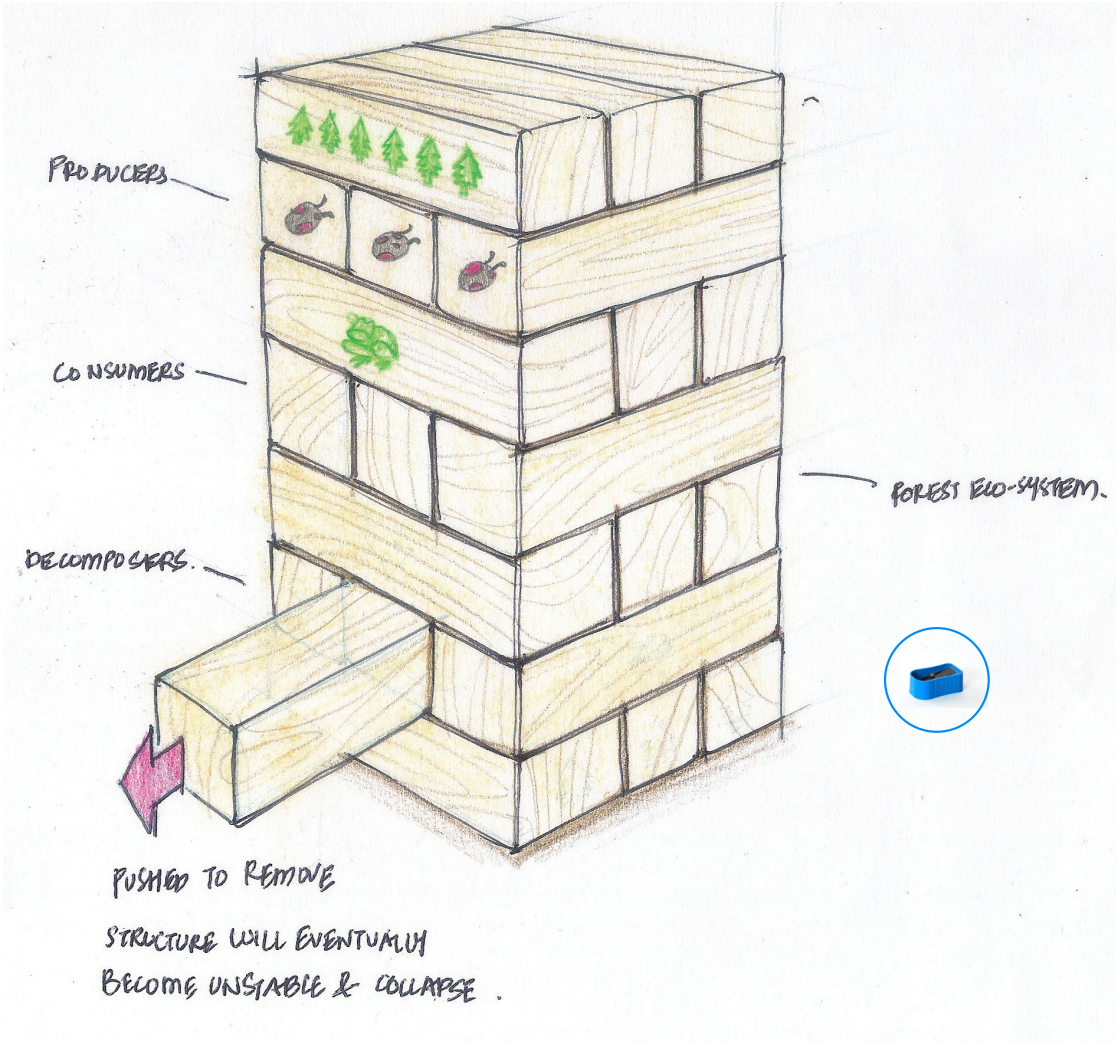


Idea 1.4

This product comprises of multiple cylinders which are split into parts. Each large cylinder represents a component of an eco system. E.g. One cylinder is a tree and its parts are multiple trees. When the teacher starts explaining the role of the components of an ecosystem, she removes one part of the tree cylinder representing removal of few trees from the forest. She then uses a stick and rings it on all the cylinders to create a certain kind of tune. As she keeps removing components from the cylinders the tune changes and becomes less harmonious. This symbolically shows the harmony in nature being disrupted.

Advantages
- there is an element of interest created by the musical intervention
- children build the cylinders

Disadvantages
- the definition of harmony and noise is very subjective and is dependant on individual perception

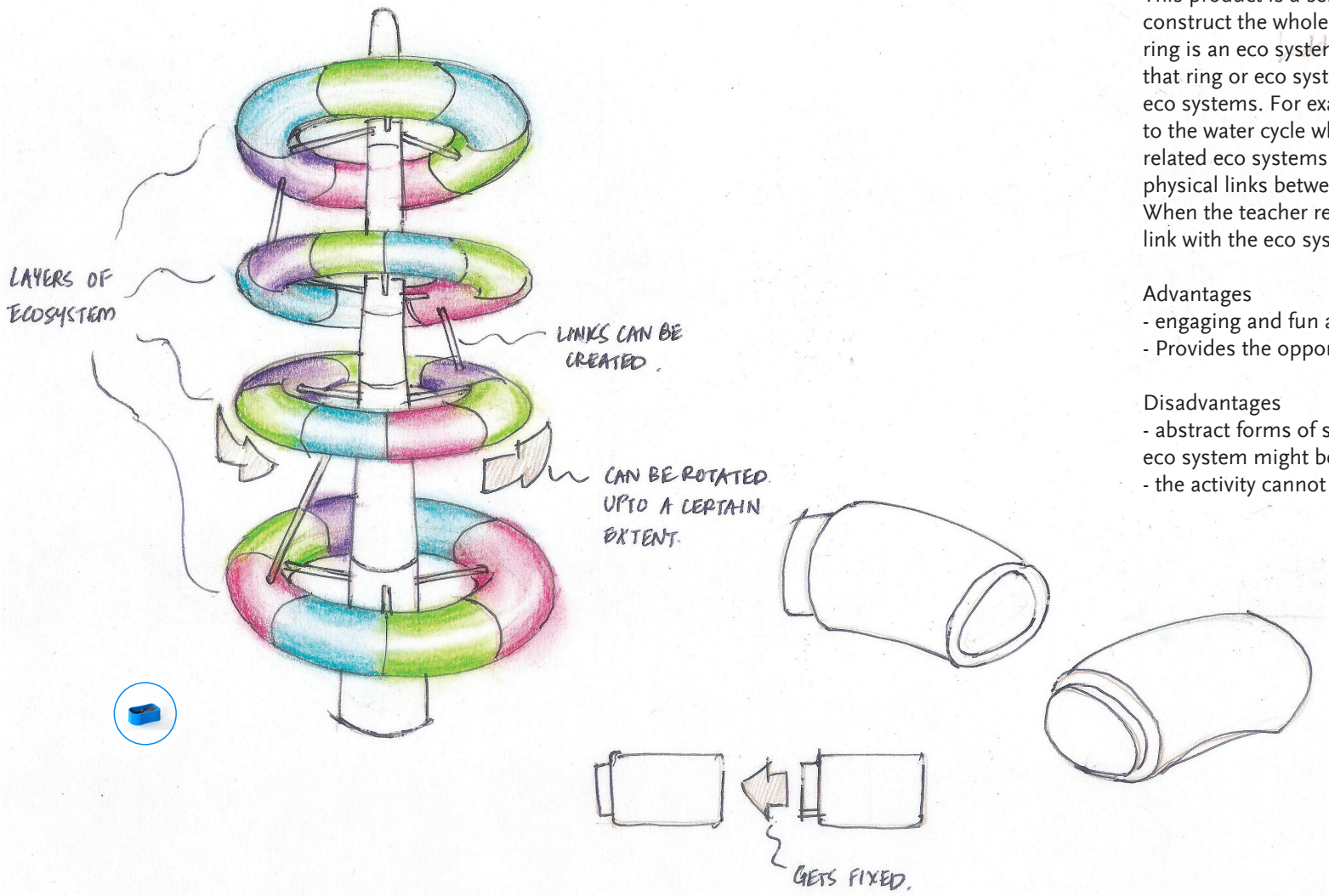


Idea 1.5

This product resembles a jenga in structure. Each face of the cuboidal structure represents different levels or components of an eco system. the teacher first asks the children to build the structure which is like a puzzle to them. When the teacher removes a certain part of the eco system represented by a brick in the structure, the brick reads a printed message about the effects of removal of that particular components and it also has further instructions about which block should be removed next and why. For e.g. Removing a tree brick would contain a message saying an insect wont have a home so the insect disappear hence you remove the insect brick. hence slowly the teacher keeps on removing blocks from the structure. Slowly the structure becomes unstable and collapses. Hence shows how an eco system can collapse if any components are harmed.

Advantages
- its engaging for the children to build the structure
- its a fun way of learning

Disadvantages
- the challenge of arranging the entire structure such that all the surfaces depict their respective eco systems might become too difficult for children
- the event of the structure falling and its correspondence with the failing of the eco system is too abstract to understand



Idea 1.6

This product is a self assembly product. The children construct the whole structure as a building puzzle. Each ring is an eco system and each building block is a part of that ring or eco system. The consecutive rings are related eco systems. For example the forest eco system is related to the water cycle which is one more eco system. These related eco systems are linked using sticks which act as physical links between components of related eco systems. When the teacher removes any component the respective link with the eco system will break.

Advantages
- engaging and fun activity for children
- Provides the opportunity to expand levels of teaching

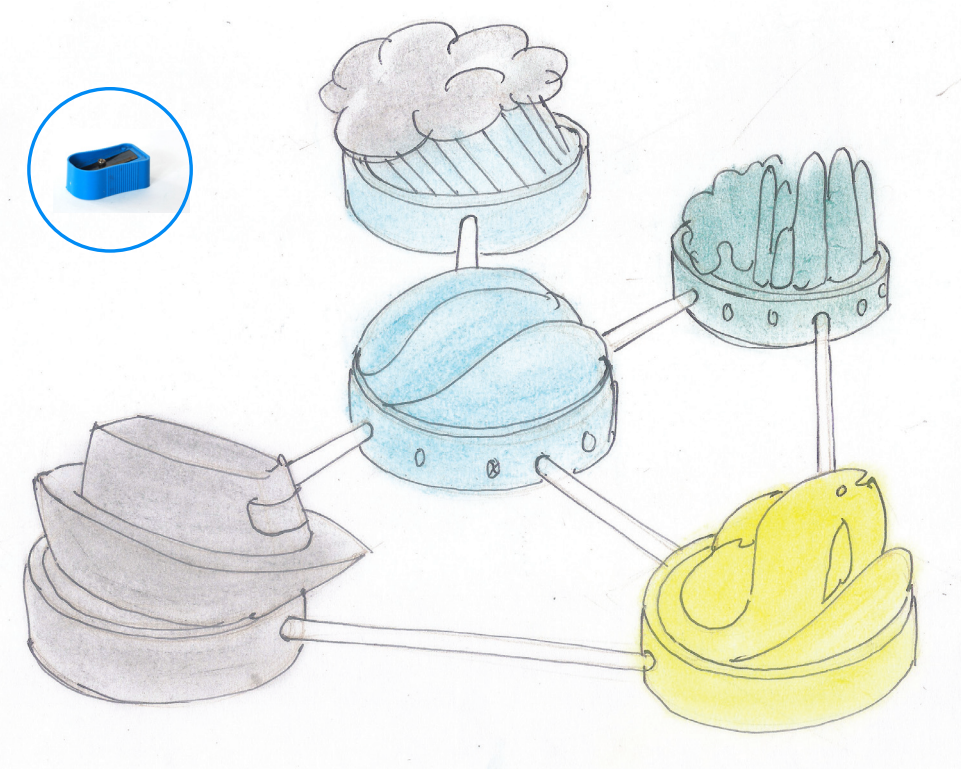
Disadvantages
- abstract forms of showing working or non working of an eco system might be difficult to understand
- the activity cannot involve a large number of children.

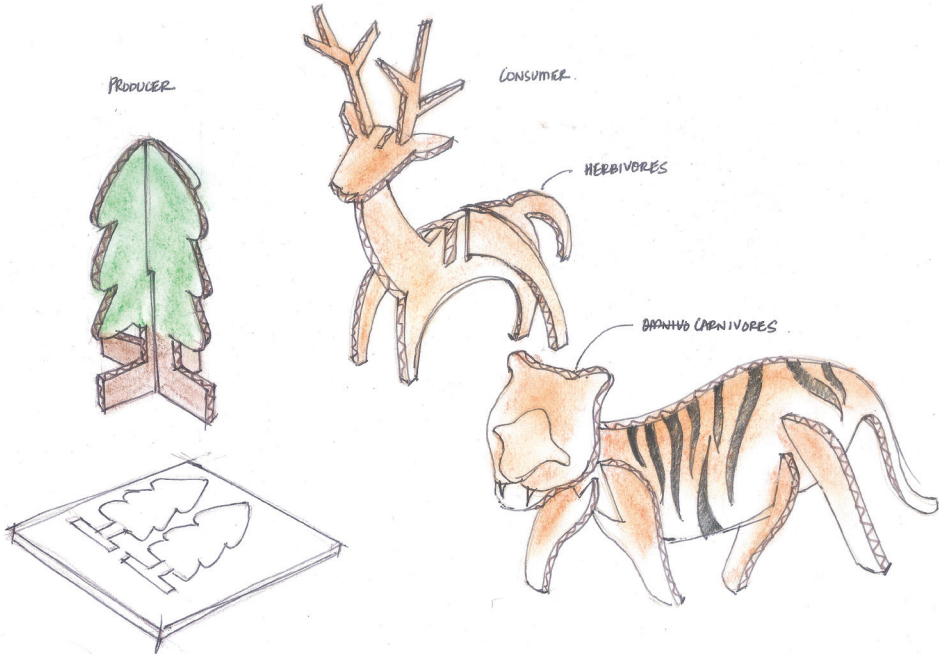
Idea 1.7

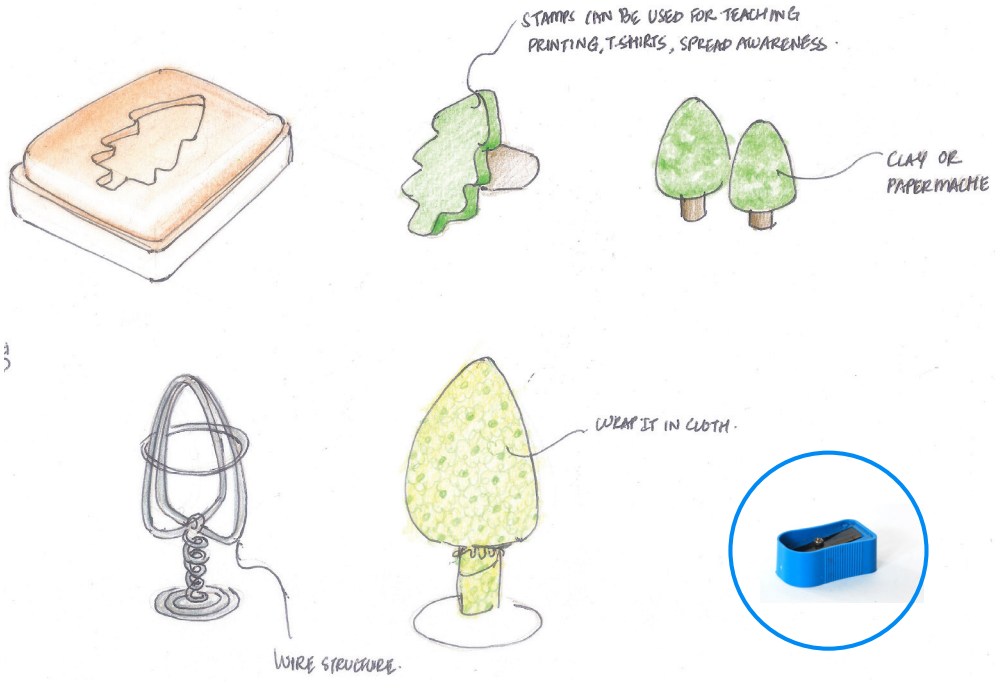
In this product the entities of the eco-system are plastic components which have a base rim with certain number of holes. There are many such entities and the relationship between them is demonstrated with the help of these physical sticks that attach their bases. Any component will have a specific number of holes on the bottom hence there is a limitation to how much a certain component can yield. These components also could be made in some inflatable material such that any entity of the eco-system gets maximum links and over exploited gets deflated because the links take away the air from the component.

Advantages
- engages child in a playful craft activity
- these multiple entities can be used to make multiple eco systems hence the teaching can be expanded.

Disadvantages
- joining all these links can become a little complex as a structure



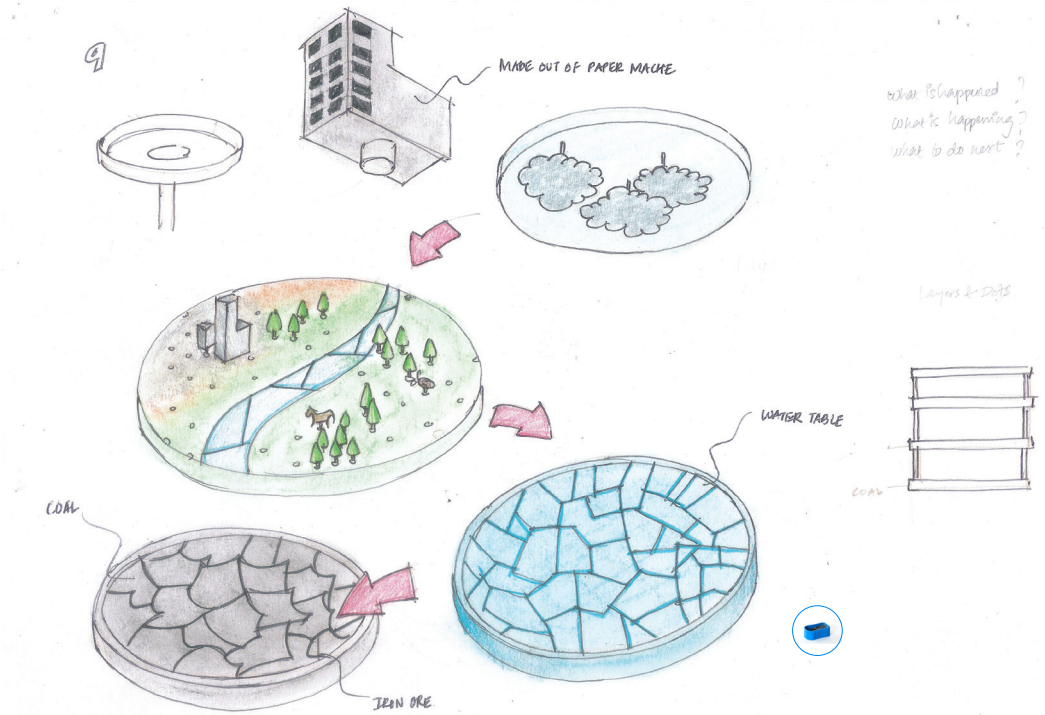




Group 2. Ideas where making things which can be used for teaching and playing

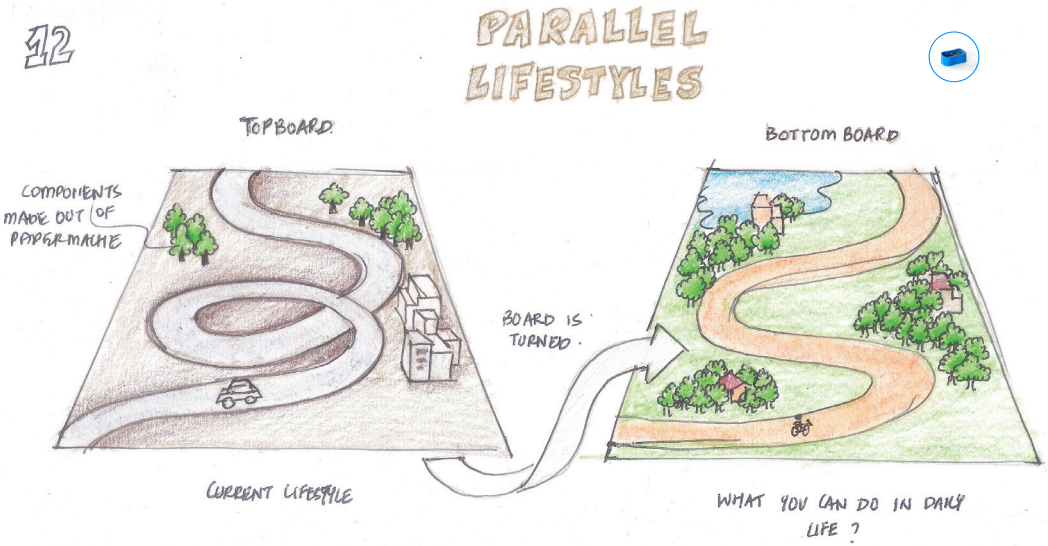
Idea 2.1

The children first involve in a craft activity of making these entities. Their components will be provided in the form of parts which the child might have to assemble. They could be made in cardboard or could be made in paper mache or clay. They could also be made in old clothes collected from home. the intention is that the children develop some responsibility and attachment to the things they make. These entities are then used by the teacher to tell a story about eco systems and demonstrate values of sustainability.



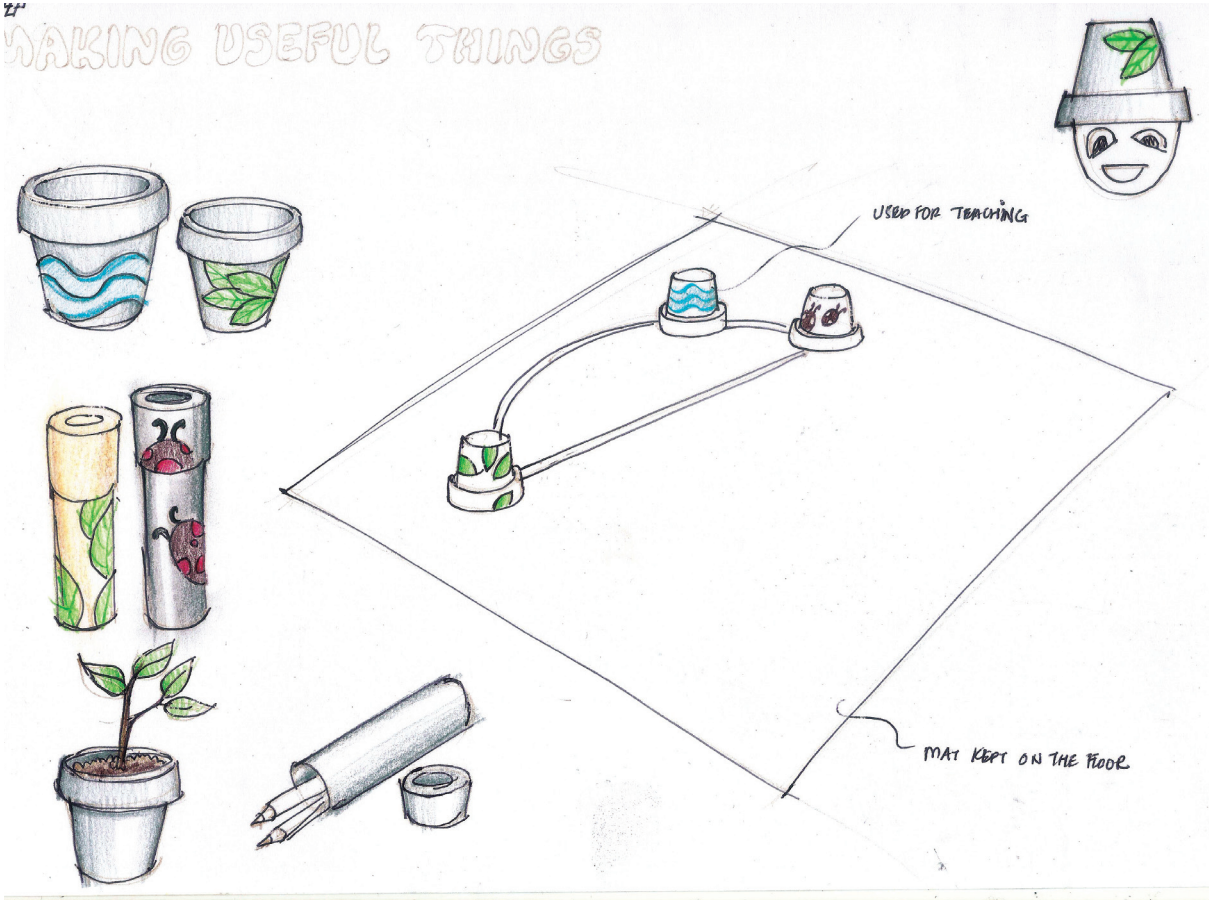
Idea 2.2

The entities produced from the idea 2.1 can be placed on boards to tell a story. There can be multiple boards to represent various layers of the earth e.g. Water table, land, coal, and atmosphere. First an ideal system can be shown where there are enough trees on the board with animals in the forest. Then slowly the buildings can come, trees can reduce, animals can reduce, coal can reduce, water table can fall etc. This can be physically demonstrated.



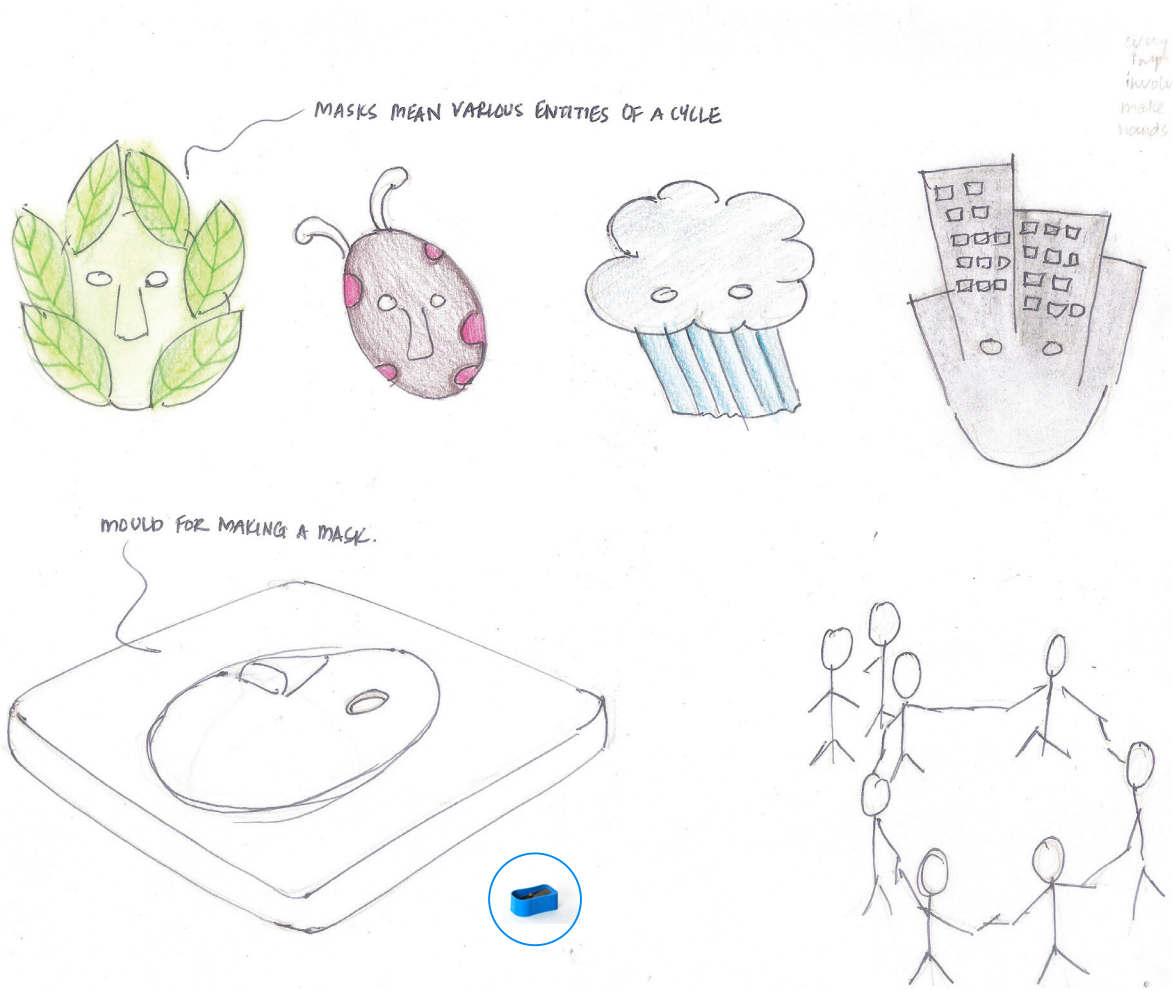
Idea 2.3

The next idea consists of a board which has two sides. The entities of idea 2.1 can be used to tell a story of parallel lifestyles. One a careless, unsustainable one and the other side of the board showing a sustainable lifestyle. The children here learn what they can do in daily life to make things better. The understand how smallest of actions they perform on any normal day can affect the whole environment.



Idea 2.4

In this idea the children are taught how to use paper mache to make useful things hence recycle paper. These things made can be painted in different ways eg. tree, mountain, rain. These things can then be used for telling a story that teached the children certain values of sustainability. After teaching these objects for example. Pots can be used to grow plants which is a sustainable activity.



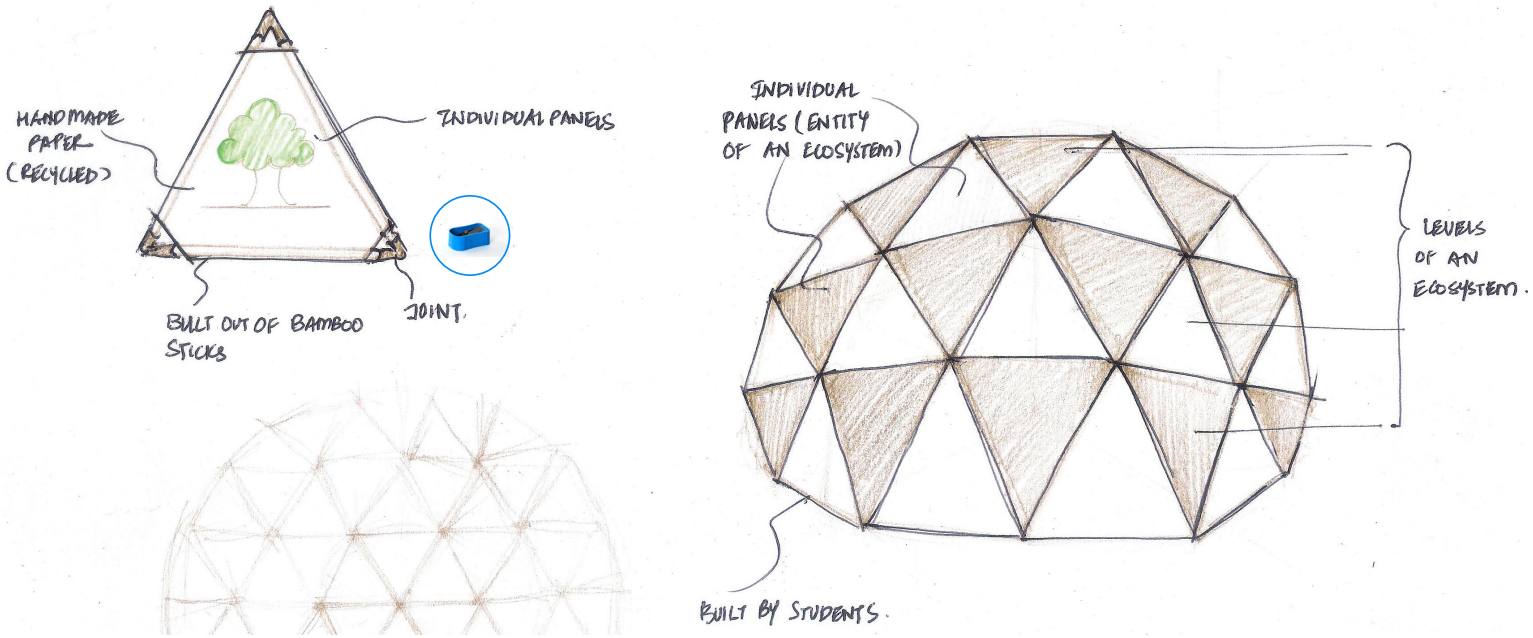
Idea 2.5

In this idea, the Kit will contain a template that aids children to make masks out of paper mache that they can paint in multiple ways such that they become an entity of an eco system. E.g. Cloud, rain, tree etc. Children can wear these masks and become characters of a story which teaches sustainability. This could be a playful way of teaching.

Group 2

Advantages
- Ensures engagement of a large group of children
- There is an underlying sustainable activity in making things e.g. utilising packaging waste to make things
- These entities offer flexibility to teach multiple things. They are like characters of a story.
- Its a fun activity for children

Disadvantages
- The activity of making things could be time demanding



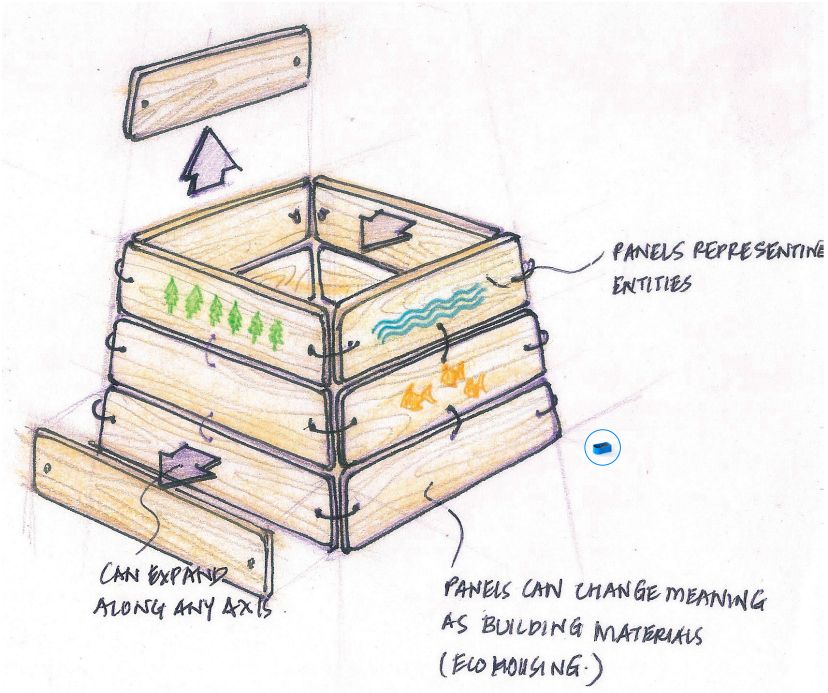
Group 3. Ideas related to eco-housing

Idea 3.1

This product kit would contain building blocks that make a geodesic dome. The children would build this. Each triangular element becomes an entity of an eco system. So each triangular panel would have the respective graphic. Once the geodesic dome is constructed one can see there are concentric networks which represent related eco systems like nested eco systems in nature. The back surface of each panel can act as a component of a eco house. E.g. Solar panel, rain water harvesting. So when the child is young (std. 3 and 4) he can be taught the eco systems and their interrelationships once he becomes a little older (std. 5 and 6) he can be taught about concepts of sustainable housing. The scale of this structure could be worked such that it becomes life size and children could use it as a green house to grown plants and learn the green house effect.

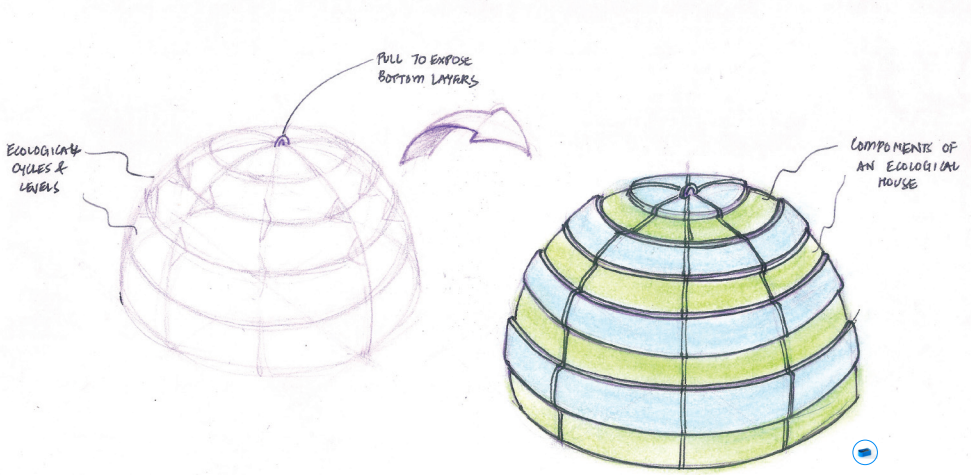
Advantages
- The activity of building is interesting for children.
- Children like playing with life size things
- Can be used to teach about multiple aspects in sustainability e.g. ecosystems, sustainable housing.

Disadvantages
- The components are an abstraction of what they represent which might be difficult to understand.
- if the dome is used as a green house it cannot be disassembled.



Idea 3.2

This product consists of rectangular panels. Each panel is a component of an eco system. Hence while forming one ecosystem, components of an eco system are attached to each other and related ecosystems or components are attached in all axis. The result would be a structure similar to what is shown in the figure. The back surface off these rectangular panels represent components of a sustainable house. Once the child becomes a little older he can be taught how to construct a sustainable home.



Idea 3.3

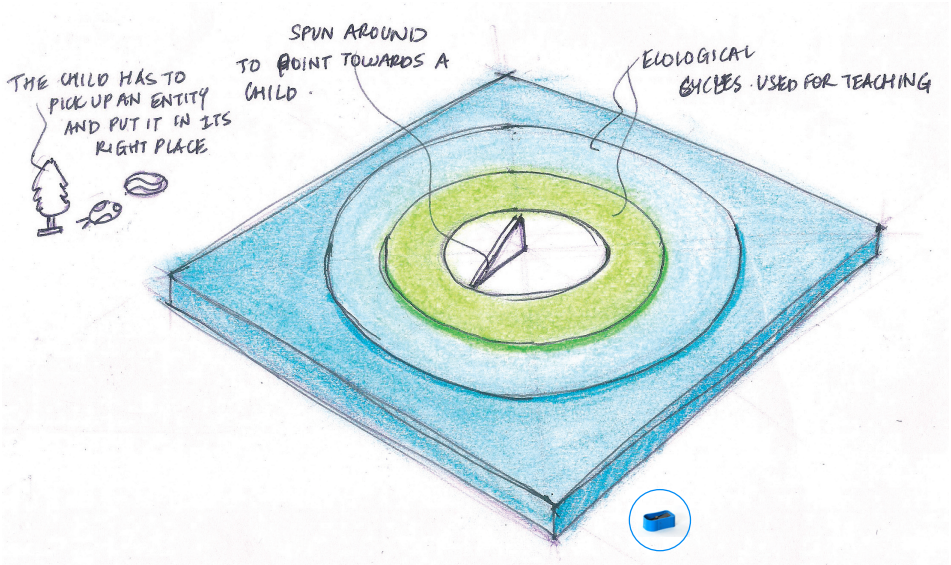
This idea is similar to the idea 3.2 only the mode of construction is different but their function is quite similar.

Ideas 3.2 and 3.3

Advantages
- allows teaching of multiple levels of sustainability.
- allows one to expand eco systems in any direction, hence it can handle the dynamic nature of ecosystems
- allows teaching of multiple aspects of sustainability

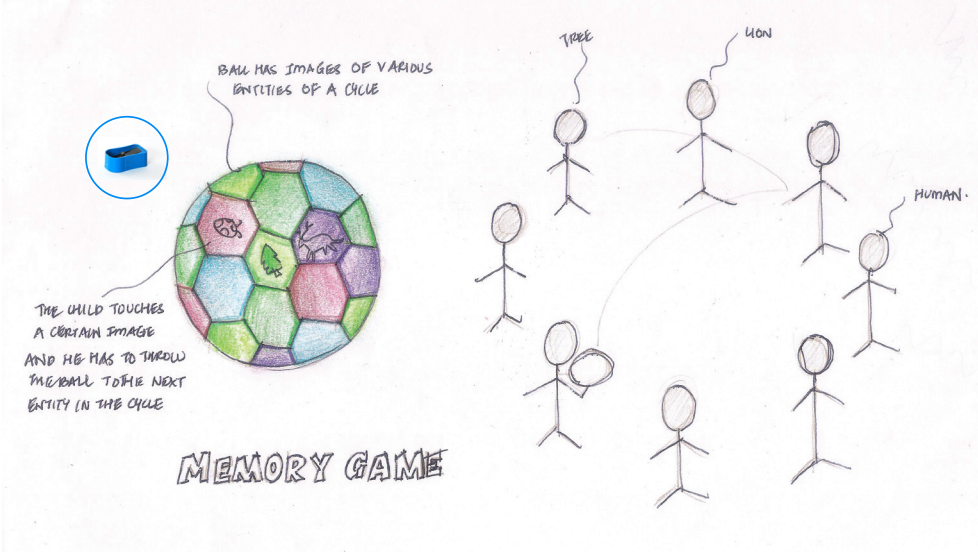
Disadvantages
- the entities of an ecosystem are abstract in nature

Group 4. Additional products that reinforce the knowledge imparted



Idea 4.1

This idea consists of concentric rings on the board which represent nested eco systems. The entities made by the students are placed at their respective place in the eco system. The teacher explains with these entities. After the teaching activity, the entities are taken off the board and the middle wheel is spun. The middle wheel has a pointer such that when spun points to a student who is supposed to put his respective entity on the right place in the eco system. This is a kind of a memory game.



Idea 4.2

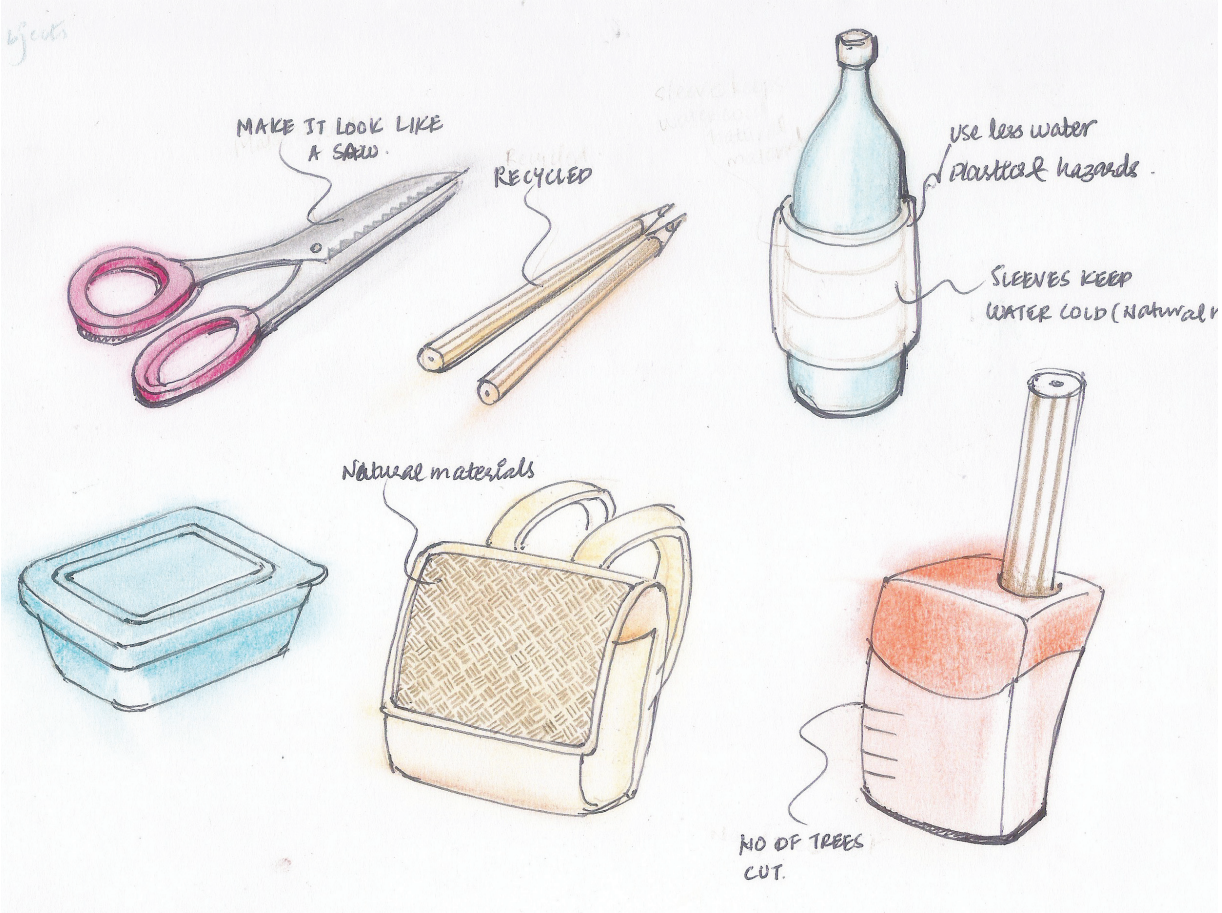
This is a ball of dynamic nature. The ball has segments representing various entities of the eco system. After the teaching activity is done. The teacher make children stand in an arrangement such that they themsleves entities of an eco system. When the ball is thrown at a person. a segment pops up. The person who has the ball is supposed to throw the ball to the corresponding entity that popped up on the ball.

Ideas 4.1 and 4.2

Advantages
- they reinforce the learning in a fun manner

Disadvantages
- they cannot teach basic aspects of sustainability, hence they are not independent

Group 5. Idea where one uses sustainable designed product to create a certain kind of awareness.



Idea 5

The idea was to identify certain objects that children use in their daily life and design them with sustainability in mind such that they evoke some thought when used. E.g. The sharpener container which collects the shavings could have calibrations that measure the number of trees cut when a certain pencil waste is created, the scissor could have visual attributes of a saw such that when cutting a sheet of paper one would think about the tree cut to produce that paper. Certain product could be design with sustainable processes in mind. The teacher can use these products to teach sustainability by questioning where they came from.

Advantages
- It teaches sustainability with a very practical point of view
- By using these sustainable products it would be a food of thought every time they use these products.
- they would be living and experiencing the advantages of living the sustainable ways

Disadvantages
- Designing the product becomes the primary task and teaching or awareness becomes a secondary task
- This learning is for slightly older children of age 11- 12 years.

9.1 Combining ideas

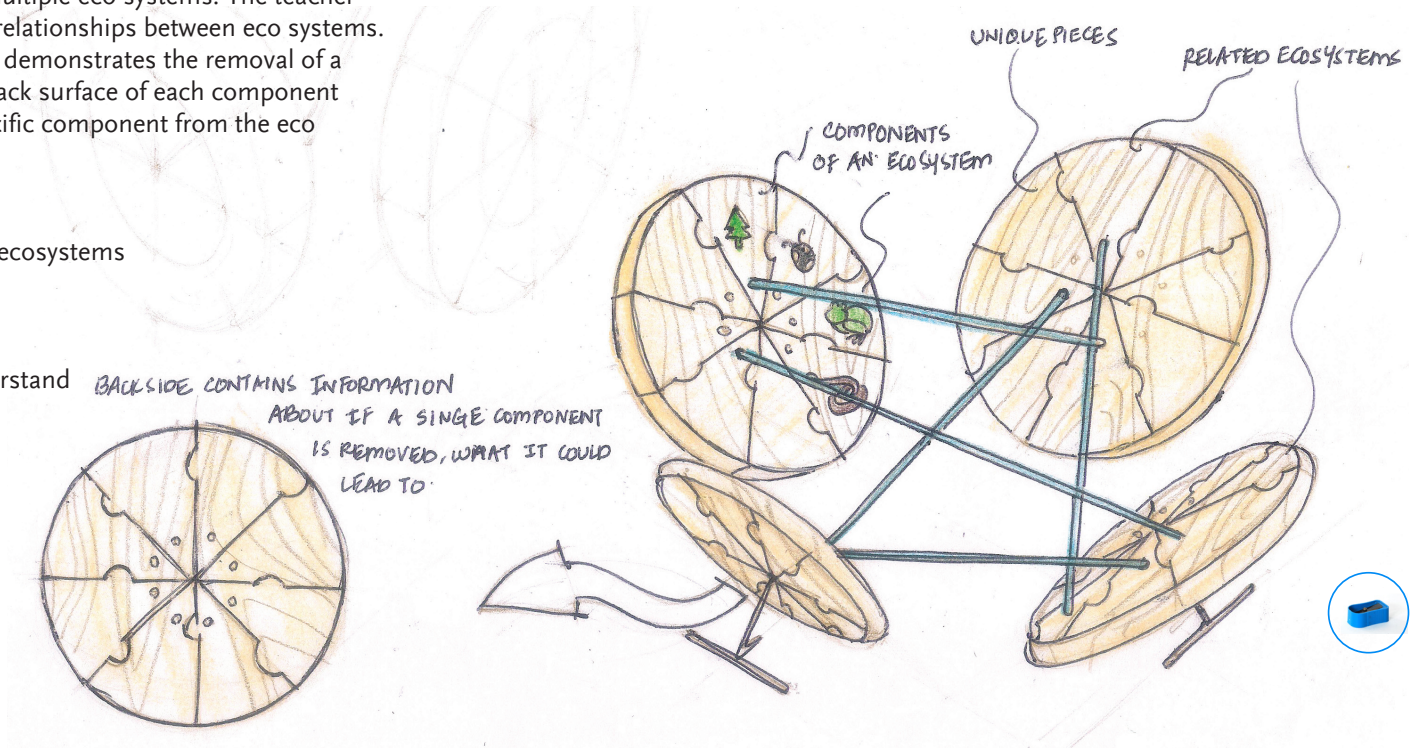
Certain ideas were combined based on chosen desirable attributes of each of them.

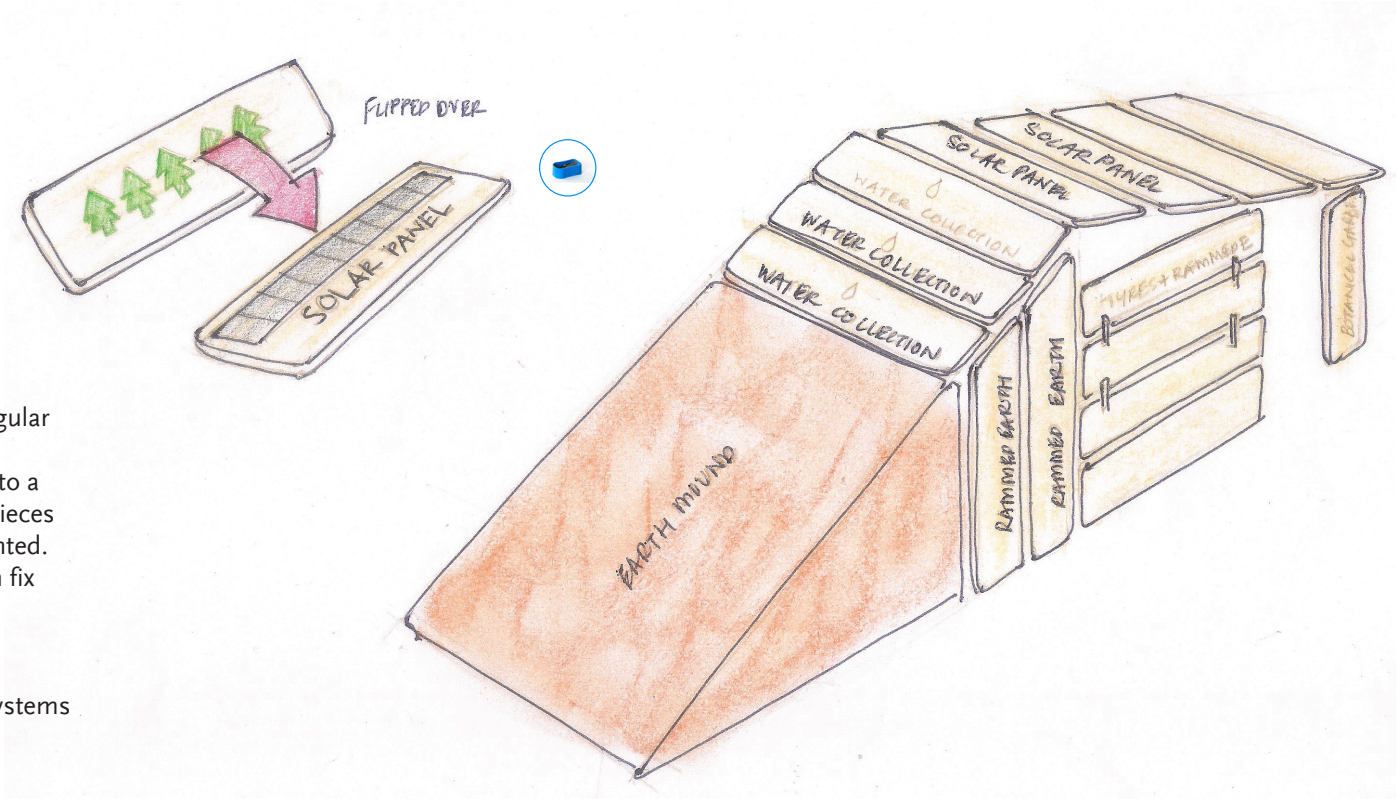
Idea 6

This idea was developed by combining ideas from group 1. There could be multiple puzzles in the shape of a wheel. Each of them containing pieces that are unique. The children have to put the pieces together to make multiple eco systems. The teacher uses these pieces to teach the children about interrelationships between eco systems. she links the related components using sticks. She demonstrates the removal of a component which leads to breaking of links. The back surface of each component tells the children the effects on removal of the specific component from the eco system.

Advantages
- Shows interdependencies and complex nature of ecosystems

Disadvantages
- Level of engagement for children is low
- Components are abstract for the children to understand



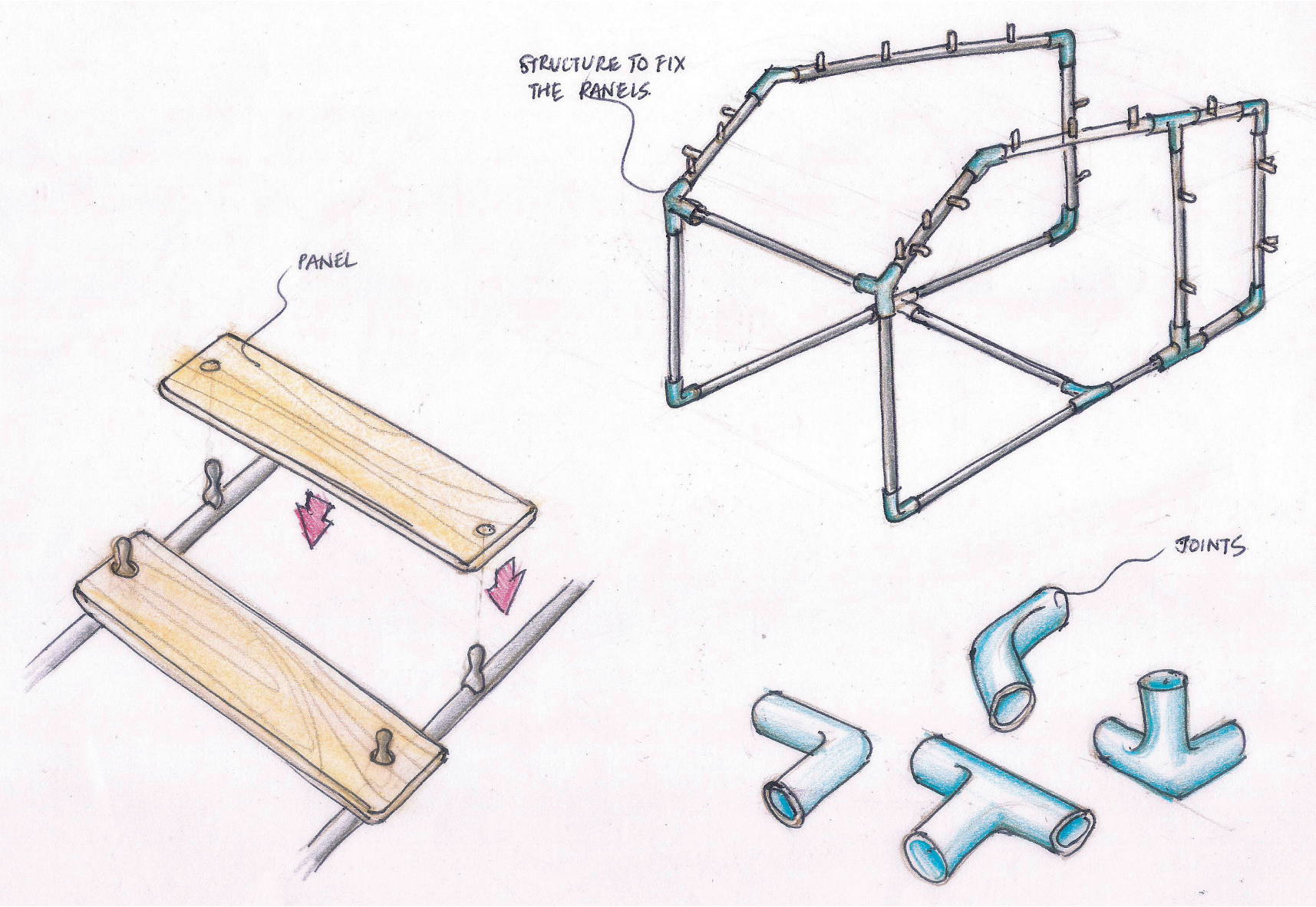


Idea 7

This idea is a development of idea 3.2. the rectangular panels are flipped over and represent parts of a sustainable house. These are the building blocks to a sustainable house. The kit will be provided with pieces of an armature on which these parts can be mounted. The children will first build the armature and then fix the panels on them.

Advantages
- Teaches multiple aspects of sustainability. ecosystems and sustainable housing
- Ensures childs engagement

Disadvantages
- It offers an abstraction of the house
- Does not ensure engagement of a large group of children


STRUCTURE TO FIX
THE PANELS
PANEL
JOINTS

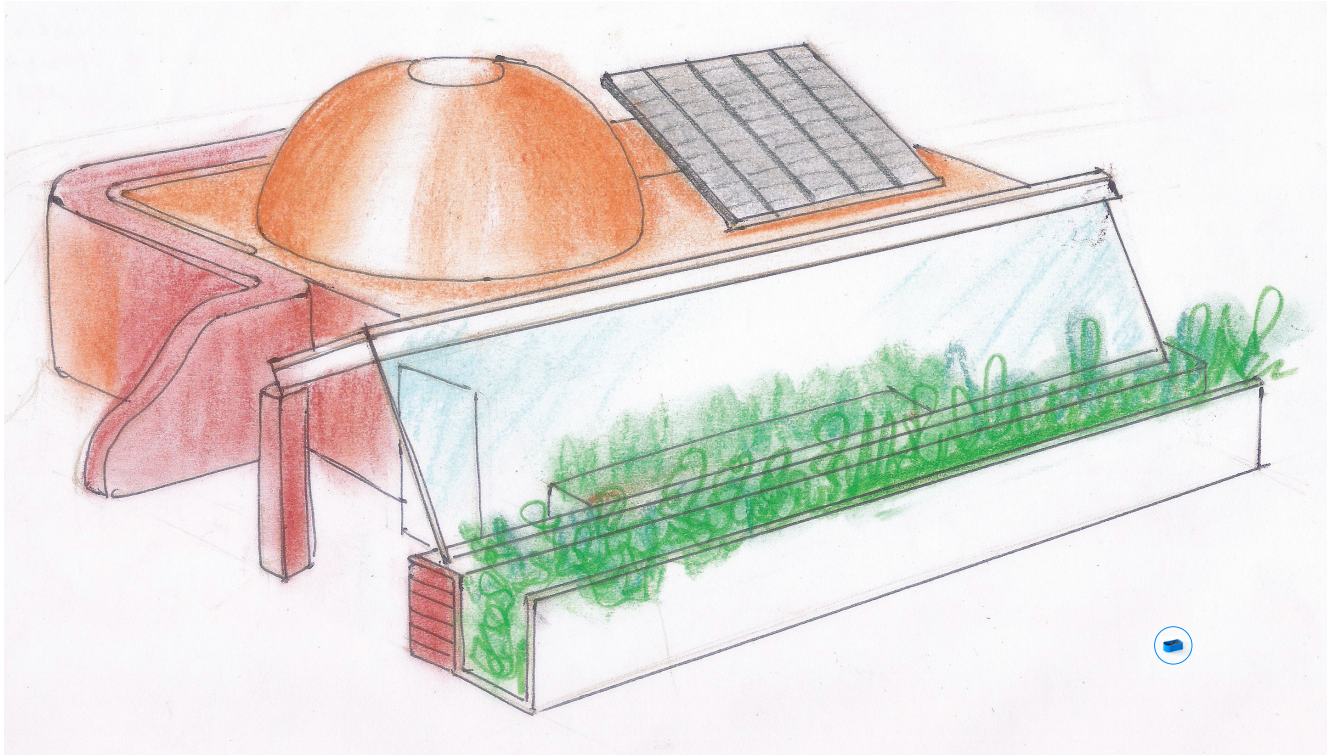
Idea 8

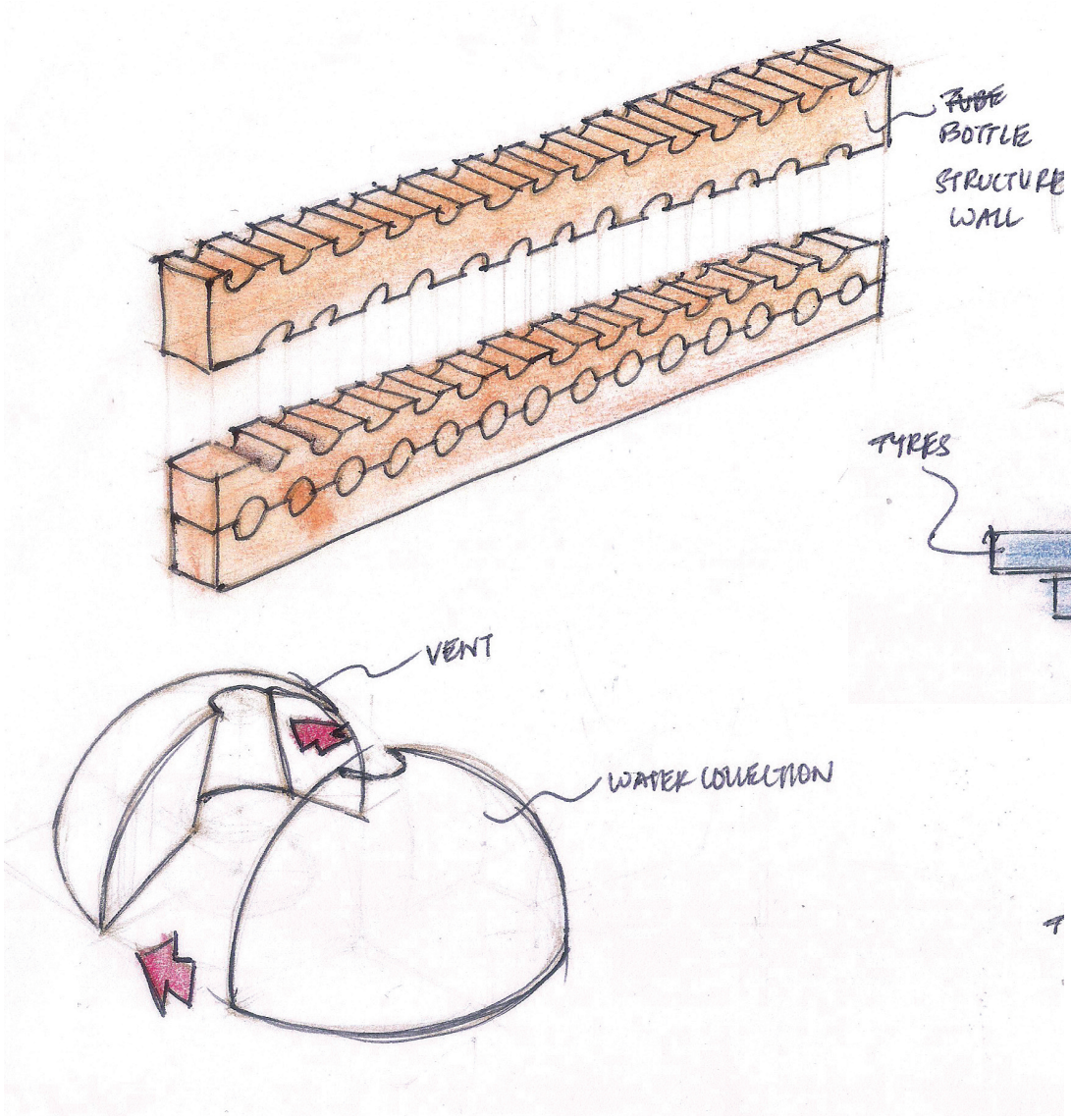
This idea came from studies I did about sustainable housing. I studied a completely sustainable house called the earth ship whose walls are constructed from tires, tin cans and rammed earth. Rain water is harvested, sewage is recycled and water is reused. energy is generated by solar panels. House is constructed to keep it warm during winters and cool during summers. Food is grown in the house.

The kit would contain modular elements which would simulate building of an earth ship.

Advantages
- Exposes the child to new ways of living.
- Ensures the childs engagement by interesting ways of building

Disadvantages
- One time learning.




~~TUBE~~
BOTTLE
STRUCTURE
WALL
TYRES
VENT
WATER COLLECTION

9.2 Assessment of ideas

The evaluation of ideas was done qualitatively and not quantitatively. The criteria for evaluation were:

Fun and Playful learning
Simplified information
Group learning
Progressive learning
Doing and learning
Sustainable methods of making the product
Low cost

Initially two ideas seemed promising. One being idea group 2. (Making things and using them for teaching) and idea 8 (earth ship sustainable housing). Group 2 was eventually chosen because it offered the flexibility to teach multiple concepts through multiple stories. This ensured that even older kids (5th and 6th std) Could learn through the same medium just by increasing the level of complexity. Idea 8 couldn't be applied until the child had a basic understanding of sustainability principles hence it proved void. Some other reasons were group 2 had better engagement by children and it was easily expandable for a large group of students and ensure their participation.

10. Idea development

The first step to the development of the idea was to develop a strong teaching model.

Class room scenario

↓

20 students

↓

kit provided to the teacher

↓

kit contains- instructions for the teacher, story to be told, materials and intructions to make the entities of the story, board for teaching

↓

students are divided into smaller groups representing various entities of the story

↓

each group indulges in a craft activity to make the entities

↓

the child becomes a part of the story as an entity as these entities are then used to teach through multiple stories

10.1 Design thoughts

The story had to have a plot. A strong story line was required to make it interesting for children. Based on design discussions with my guide.I followed the following structure while writing the story.

Sahridaya

(Means harmony)

Samasya

(Introduction to the problem)

Sangharsh

(Struggle to solve the problem)

Samadhan

(Rewards of solving the problem, harmony again)

10.2 Story writing

The next step was to write a story. Some of the factors I had to consider were the simplicity of the story, role of the students in the story, relating the learnings to daily life. I also had to revisit the principles of reuse, reduce and recycle before I wrote the stories.

I had to spend sufficient amount of time to relate these values to their immediate environment. Since I'm not much of a story teller I had to write multiple stories to refine them step by step.

Story 1.

Endangered species and Global warming

We live on planet earth. Earth is made up of land and water. There is fresh water and salty water (instruct water group to place the water elements). Oceans are very important to us. There are lots of living things in the ocean (instruct the ocean life group to place their elements). These are sea plants and corals. They are a home to the fish in the ocean. The fish eat the sea weeds. The bigger fish eat the smaller fish. We (points to the humans to put the humans on the board) live in the cities. The builders make houses for us (instructs builders to put a few buildings on the board, some close to the river too). We all need food to eat, cars and vehicles to move around, electricity to light our homes and keep our homes cool during summers. Lots of people eat fish. The fishermen get our fish to us. They go fishing in the ocean using ships (put the ship in the ocean, reduce a couple of fish). We also move around in cars and other vehicles (put the cars and vehicles on the board). The fuel for the cars comes from oil from the oceans (reduce some oil from the bottom layer). We also use tube lights and appliances which need electricity (put appliances and tube lights on the board). Electricity is provided by Electricity companies. They make electricity from coal (reduce coal from bottom layer). This coal and oil when consumed by us, our cars give out poisonous gases and also CO_2. This gas is not seen by us (put some CO_2).

Our earth is covered with the atmosphere which has oxygen which we breathe. There is also a layer called the ozone layer which protects our earth from harmful ultraviolet light of the sun (point to the ozone layer). The CO_2 which is given out by our cars and appliances slowly rises up to the atmosphere. And makes holes in the ozone layer (move the CO_2 to the top layer and remove parts of the ozone layer). The ultraviolet rays from the sun start heating up the earth. And the ice on the earth starts melting. This process is called global warming. The melting glaciers feed the rivers with fresh water. The ice from the north and the south pole starts melting.

As we know our cities are becoming more crowded. Builders are building more buildings. Electricity is needed to make these buildings and live in these buildings. People need more food (add ships, reduce the fish, put a red ring around it calling it endangered). People are buying more cars. (Add buildings, add appliances, add cars reduce coal and oil, add CO_2, remove a few parts of ozone layer, remove few parts of glacier, increase river, remove ice from poles, increase sea level).

If this continues to happen (repeat the entire activity) fish will become very expensive and soon disappear from the ocean. The other fish that eat the smaller fish wont have anything to eat so they will become extinct too (remove the other fish).

The coal used to give us electricity will get over and the oil that is used to fuel our cars will get over (remove left over coal and oil from the ocean). The CO_2 that is given out by our cars and appliances will eat the ozone layer so much that the ultraviolet rays from the sun will start melting the ice on the earth (add more CO_2, reduce ozone). If all this ice melts into the rivers which lead it into the ocean, soon the rivers will dry up. Millions of people live on river banks and they will have no fresh water to use or drink (remove glacier parts, once glacier is removed, remove river). If the ice from the poles continues to melt the sea levels will rise drastically. Mumbai is a coastal city. Mumbai and other cities like us will face floods (remove ice from poles, increase sea levels).
How can we prevent this from happening?

Use public transport and share a car to save fuel
Switch off the lights and fans when we don't need them.
Turn off the tap while brushing your teeth or washing your face
Switch off the charging points when not in use
Use an AC only when you need one
Walk short distances
Have a bucket bath and not a shower
Get a bicycle

Story 2.

Mumbai floods

Mumbai is a coastal city. It has a sea shore. It also has estuaries that lead the sea water inland during high tide. The estuaries are lines with mangroves that act as a barrier for sea water. It also has a couple of rivers that carries rain water and excess water from the lakes into the sea.

As we know Mumbai is the financial capital of our country. People from all over the world come to Mumbai in the search of livelihood. In order to accommodate so many people, builders started building more and more houses. Builders slowly started building into the sea, mangroves and the rivers as the people increase, we want more and more things to use. We want more clothes, furniture, appliances, and cars. Factories make these things for us. They are made from things in nature. Machines dig our earth and get coal and metals for us. Waste from this digging is thrown into the lakes. Hence there is insufficient space to collect the water. Slowly these natural resources won't be there for us anymore. When these things we use are made in factories, lots of harmful waste is produced. This solid, liquid and gaseous waste is put into our rivers, estuaries and oceans. Lot of people throw away plastic bags outside their homes. This garbage then enters our drains and blocks them.

Mumbai has been receiving heavy rainfall because of the mountain ranges close by. Now since our mangroves are destroyed, estuaries have become smaller, lakes are filled up; river banks are occupied with people and waste (e.g. Mithi). Drains are choked with plastic. Mumbai faced serious floods in July 2006. Hundreds of people died, lost homes, transportation was disabled and thousands of people were stuck and stranded. Our city cannot take the pressure of so many people and their needs. What can we do?

The waste should be recycled or reused
Do not throw garbage on the road
Avoid using plastic bags and plastic products
Use and reuse things
Share your toys and clothes
Buy things only if you need them
Use public transport instead of cars
Protect the mangroves
Tell more people about it
Encourage your parents to do the same

Story 3.

Mangroves

This is the city of Mumbai. As we all know Mumbai is a coastal city. There are some rivers which lead the water out into the ocean. But there are also some estuaries (like passages) which let the sea water into the city. These estuaries prevent the sea water from entering the land areas where we live. If the sea water enters where we live, it will cause floods.

These estuaries have mangroves around them. Mangroves are small shrubs which can grow in salty water. These are extensions of forest into the sea. Like any forest they have animals, birds, reptiles and insects. These unique forests help us in lots of ways. They make us feel not too hot during summers and not too cold during winters. They protect us from floods and strong wind. They prevent the soil from getting washed away by the water. These plants give firewood. Their wood can be used to make boats, roofs. In these estuaries and mangroves fish find their home. Local fishermen go fishing in these estuaries.

In our city these mangroves were quite abundant earlier. Now as the population of the city is increasing, lots of these mangroves are being cut and building s are being build in this area. Lots of harmful waste from our homes and factories gets dumped into these estuaries and mangroves. These mangrove plants are getting poisoned and they will die slowly.

The government realized the importance of mangroves and it imposed some laws which do not allow builders to build in this area. But often these laws are violated. Bandra kurla complex is an example of this violation. Destruction of mangroves in this area is one of the reasons the Mumbai floods happened in 2005. The mangroves weren't there to block the water. If the mangroves disappear we might experience extreme climate change. The fish and the other animals that live in these forests will have nowhere to go. We won't have any fish to eat. We won't be able to protect our city from floods

What can you do to protect the mangroves?
Tell the local authorities if you see any violation.
Tell more people about the mangroves and their importance
Participate in scientific plantation of mangroves
Use cloth bags instead of plastic bags

10.3 Making the entities

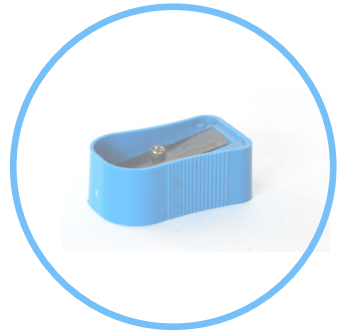
The next step was making the entities such that the children enjoy doing the activity and its simple enough for them to make. I explored materials like corrugated waste from cartons, paper mache, clay, wire and old clothes.

Design thoughts

Thought process while designing these entities involved the following
- Interesting enough for the child to get them engaged
- The activity should not be beyond the child's ability
- Using some kind of waste as a starting point, the child hence learns to respect waste and indulges in a sustainable activity.
- Applying elements of design to make these elements
- Consider the child's point of view, child semantics
- The entities cant be too abstract such that the child is unable to imagine the actual component

Wire stencils to produce the entities in clay. Advantage it offers it the re use of clay for making different things. These clay objects could also be baked and the children could take these home. this introduces them to the material Terracotta and its sustainable nature.

Cut outs in corrugated sheets will be provided which the children have to assemble according to the manual provided to them. I also explored some surface treatment like stitching.



I explored in the paper mache medium. The basic structure is made of wire and then paper mache activity is done. They are then painted to get the desired effect. This is a long process which may require multiple sessions to make these entities. the child was introduced to the activity of recycling paper to make toys or other useful objects.

River

River

ship

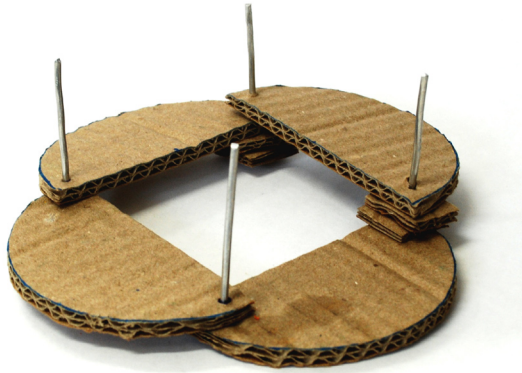
Car

Fish

Buildings

sea weeds

The basic structure was made in wire and then cloth was wrapped around it. This process requires some skill. the intention was that child indulges in collecting waste clothes from home and using them for a purpose.



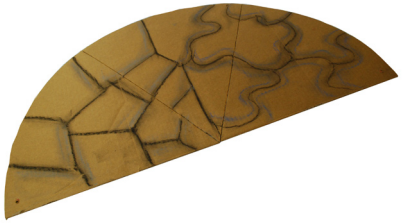
coal

ozone layer

land

10.4 Making the board

If we are looking at a class strength of 20 students the size of the board would also be quite large considering visibility and interaction for all. Hence I looked at how I can make the board compact for packaging. Also as the story demands, there might be a requirement of using multiple layers for teaching for example. The land, coal, water table, atmosphere etc. The number of layers of the board can be increased or decreased as per need.

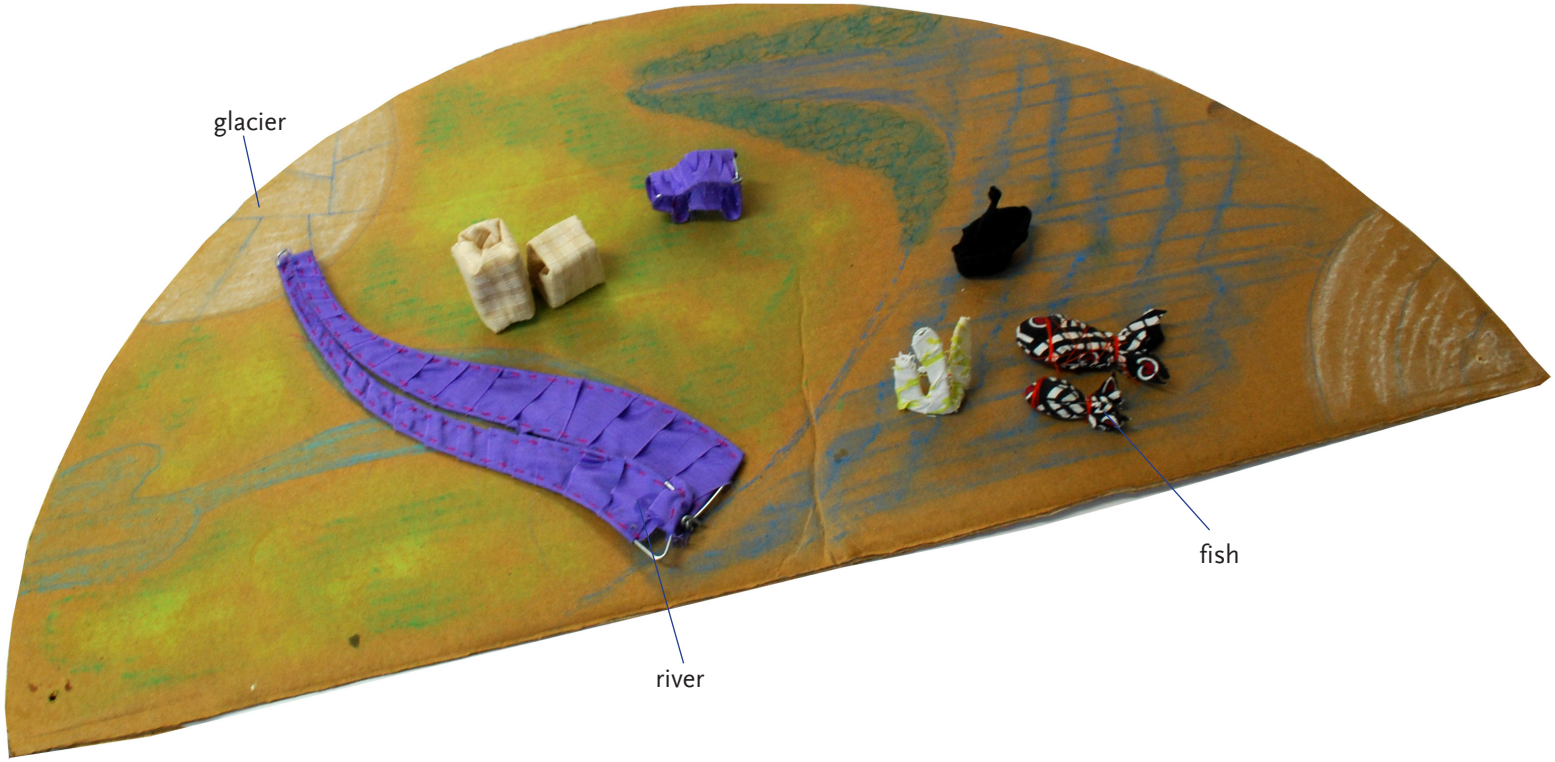


Assembling the board. The pieces fit like a puzzle

The middle piece has sliding channels on either sides.
Into which the respective adjacent pieces are slid in.

10.5 Using the board to teach

The groups of children assemble with their respective entities that they made e.g. Tree group, builders, fisherman, industrialists group. The teacher will narrate the story and give instructions to the respective groups to put and remove the entities with the course of the story.eg. As the glacier melts, the glacier will melt and slowly the river will dry up as all the fresh water from the glacier disappears.



11. Improvement after feedback- version 2

Based on the feedback received from the stage 2 presentation, I refined my concept. The story was too long and there were too many messages so I re wrote a story which was focussed on a smaller problem with a clear moral. One interesting feedback was also relating the activity of using a certain material to the story. I worked on making the story more interesting for the children. I also redesigned the teaching model to improve participation from children. Time frame was also a constraint since the activity has to fit into a class duration. I developed all the entities required. One more feedback was that I need to closely interact with children. Hence I tested the kit with children to get their feedback and insights.

Story theme- hazards of plastic, story of mumbai floods

Values- Reuse of things

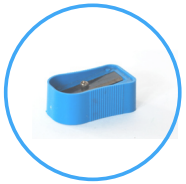
Medium of making the entities- corrugated sheets, packaging waste

Narrator- Teacher

Story structure
- Example of a family in mumbai
- Every member of the family has a certain lifestyle
- The family goes through a traumatic experience of a flood
- Realization about how they affect things around them
- Changed their ways of living

Moral of the story
- Avoid using plastic bags and plastic products
- Avoid throwing garbage on the road
- Sharing things
- Buying things only if you need them
- Reusing older things for newer functions eg.plastic bottles for pots, old clothes to make cloth bags.

11.1 Making the entities



Trees

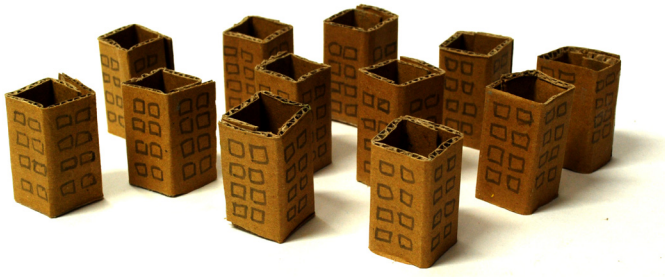
flooding water

Fish

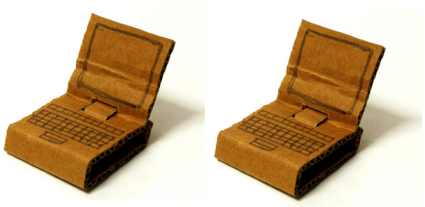
Turtle

Medicine and apples

Cars



Buildings



Laptop

plastic PET bottles

Cell phones

Plastic bags

Drains

Chargers

12. Testing 1.

No of students- 9
Grade- 7 students from 4th std and 2 students from the 6th std.

Medium of documentation- Photography, external observer

Step II. Telling the story through the entities






Step III. Validating what they have learnt

Validation was done through mostly asking them questions what they learnt from the session.

12.1 Results of the testing

Feedback
- Activity of learning was an enjoyable experience
- Some things that were taught were repetitive
- Teacher generally reads out things, there is no other activity alongside

Observations
- Its difficult to keep the interest of children at regular intervals
- The way of making the elements was too simple, they wanted more challenge
- The story was too simple, children were losing interest.
- Large group of children are difficult to control
- Long intervals of the story had less or no action on the board.

Analysis
- The activity of making things should be more interesting
- There is a need to develop interest at regular intervals
- Story needs to be more interesting and impact full.
- Role playing needs to be enhanced

Design thoughts

- The values that are taught should be concurrent with the current teaching
- It became important to evaluate which activity should be demonstrated and spoken
- The entities have an emotional nature
- The entities and the kit should have certain aesthetics, such that they look finished and part of one family, elements of design should be used for this purpose.

13. Improvement after feedback- Version 3

I went through a couple of iterations of the story and ways of communicating the message. The message had to be clear. After a struggle a simplified story evolved where I tried to get enhanced role playing.

Story theme- Role of mangroves and Mumbai floods

Values- conservation of nature, reuse and reduce and recycle, rain water harvesting

Medium of making the entities- corrugated sheets, packaging waste

Narrator- Teacher + students

Story structure
-Mumbai, mangrove, estuary, Arabian sea, environmentalists are characters. There are also some governing bodies
-The characters tell their respective stories. They explaining their roles in Mumbai and how they have changed over a period of time because of human intervention
-Building of the problem and their consequences
-Mumbai floods
-Environmentalists and their intervention

Moral of the story
- Protection and conservation of mangroves
- Rain water harvesting
- Reusing, reducing the things they use like toys and clothes
- Separation of waste

13.1 Role playing

In this teaching model. Each student and the teacher plays a certain role in the activity. The teacher is the primary narrator. The children are divided into groups and one person from each group becomes the narrator for that group. In the story each of the groups become a character in the story.

Narrators	Groups	Things they make
Teacher		
Mumbai city		
Arabian sea	Arabian sea	Waves
The Estuary	Estuary	Fish, turtles
Mr. Mangrove	Mangrove	Mangrove trees, butterflies, crab, flamingo,
Environmentalist	Environmentalists	Badges
	Builders	Buildings, offices
	Industrialists	Factories, laptop, cell phones, cars, TV, waste
	Common man	Plastic bags, waste
	Fisherman	Boat
	Rain group	Rain water

13.2 Story

The text in blue tell the respective group the activity they are supposed to do on the board at that point in the story. They will be instructed by the teacher about the specific activity.

Mangroves

Mumbai says “Hello everyone. I am the city of Mumbai (teacher points to the board). I am a home to millions of people. I used to be a happy place once, where I and my friends Mangrove, Estuary, sea (teacher gesturing to the respective children to put their entities on board) lived in harmony. My citizens were healthy and happy. I have become the financial capital of India and people from all over come to stay here. I’m a growing city with people and their growing needs. People of my city are careless and want lots of things all the time. Builders build buildings in which they live. (Builders put buildings) They buy furniture, appliances, cars etc from malls which are produced in factories by industrialists. (Industrialists put furniture, appliances, cars). These factories give out waste and dump it into my friends. (Industrialist and common man put waste) This was my short story. Well here come my friends who will tell you their story.”

Arabian sea says “Hello I am the Arabian Sea, me and Mumbai have lived together for many many years. I have seen Mumbai growing up over so many years. I have helped it in lots of ways all these years. I have given it beautiful scenic sea shores. As beautiful and friendly that I can be, if troubled too much I can become angry. My anger can hurt a lot of people.”

Estuary says “Hello I am an estuary. I am the Arabian seas brother. I flow into Mumbai city but I’m Mumbai’s friend. I look like a river but I have salty water. Lots of fish, turtles etc live in my water (gesturing the fish, turtle to put into the estuary). The fisher men of Mumbai come to get this fish. (fisher men group put boats) My brother the Arabian sea has quite a temper so when its high tide, (sea water will enter the estuary) I prevent the sea water from flooding Mumbai. During low tide I also help Mumbai to drain its excess water into the sea. My friend Mr. Mangrove helps me I’m my job. Here he comes now”

Mangrove says “Howdy! I’m Mr. Mangrove. I’m very unique. I’m a forest which can grow in salty water. (Mangrove group put mangroves next to the estuary) I live next to my friend estuary. No other plants grow in salty water. I am also very strong. I can stop the might waves of the Arabian Sea from entering the land and flooding it. (Arabian sea group show high tide) I also have the ability to make you feel not too hot during summers and not too cold during winters. My forest has lots of unique birds, animals and insects like the flamingos, turtles, snakes, tigers and butterflies.

put animals birds and insects). My unique roots hold the soil together and prevent the waves from washing it away. As my friend Mumbai has been growing older its people keep coming to me for wood from my forest." (Mangrove group remove a 2trees of mangroves)

A few years passed by and Mr. Mangrove came crying to his friend estuary.
The estuary asked "what happened Mr. Mangrove?"

He looked at her sadly and told her about what happened. A few months back, Mr. Mangrove had spoken to a governmental organization about how some hungry builders are cutting his forest and the animals and birds have nowhere to go. People continue to throw garbage and toxic substances into him. He told them about his other problems of how he's dying because of the pollution. The fish which live in the estuary are also dying because of the pollution. The Government took pity on him and passed some laws preventing the hungry builders from building over his forest land. He was relieved after that agreement. One night as Mr. Mangrove was asleep. He heard some noises. As he woke up he saw the builders had come and cut more than half of his forest. His animals and birds were dying. (Mangrove group remove mangrove except some, animals and birds) (Builder group put buildings)

Mr. Mangrove said looking worried that "I have noticed that Arabian Sea levels are rising and I don't have enough plants to stop the water from entering the land. I can also see that I don't have enough plants to prevent the land from being washed away by the powerful Arabian sea"

All of them sat together and wondered what they could do to solve this problem. And then it happened. Because of the pollution the fish and other animals were dying and disappearing. (estuary group and mangrove group remove all animals and fish) The fishermen came and could hardly find any fish. A common man couldn't afford to eat fish any more. They had become a rare thing to find. The rainy season came along. Mr. Mangrove was dying. Very few of his trees were left now. It was raining heavily for a long period and the high tide had come.(rain group flood the roads) The Arabian Sea current was very strong. (Arabian sea group show high tide)
"I cant stop the water anymore" cried Mr. Mangrove.
The worst had happened. The water from the sea and the rain had flooded the entire city.

Mumbai cried “hundreds have died, thousands have lost their homes, and thousands are injured. The sea has washed off my land as there were not enough mangroves to hold the soil” (Mumbai group remove land)

Mumbai and his friends were very upset. They tried to help but their efforts were futile.
Then came the environmentalists who understood the agony of Mumbai and his friends. They decided it was high time.

Environmentalists said “we understand why the floods happened and what effects the people’s lifestyle has on our Environment. We understand the importance of mangroves now. We will try to change things.”

They made a list of things that we can do to help this situation. So here it goes,
(environmentalist group can read it out and demonstrate)

Protect the mangroves. Inform local authorities if you see any violation.
Tell more people about mangroves and their importance
Use cloth bags instead of plastic bags
Avoid using plastic products as they are poisonous..
Buy lesser things. When u go to buy things, ask yourself a question if you really need that thing. Lesser things means lesser waste, lesser garbage.
Share your toys and clothes
Try to separate waste. Plastic, paper and wet organic waste. Talk to people in your community and make a compost pit that can recycle your organic kitchen waste into manure for plants. Paper and plastic can be given for recycling separately.
Put tanks at home when its raining to collect rain water.

13.3 Making the entities

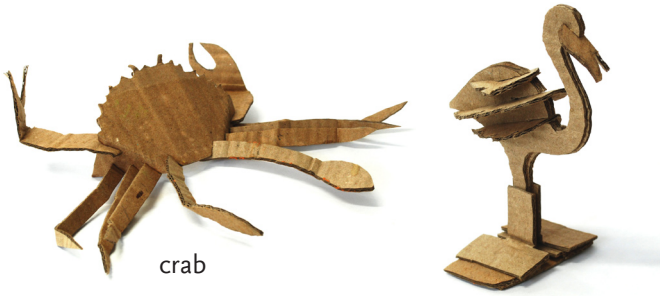
This activity is done by children as the first step in the activity. Each group makes their specific entities. The respective parts are distributed to the children by the teacher. Some of these entities are a part of my experimentation with the material corrugated paper which is essentially packaging waste.

Trees

Turtle

Snail

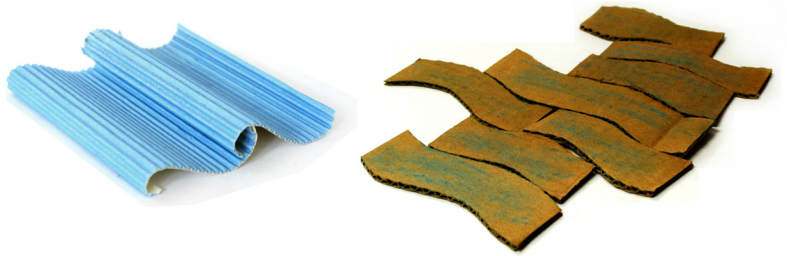
Butterfly



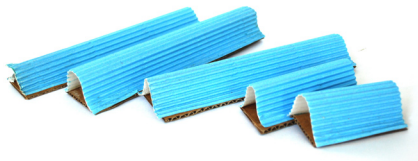
crab

Flamingo

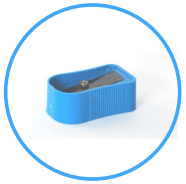
Fish



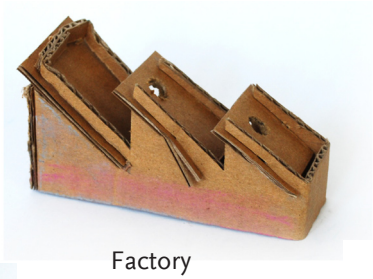
flooding water



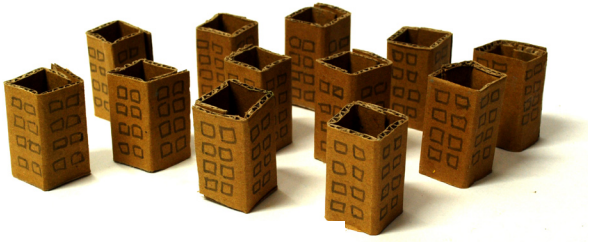
Waves

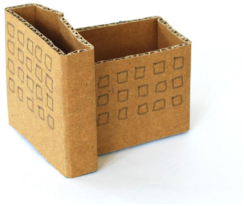


Towers



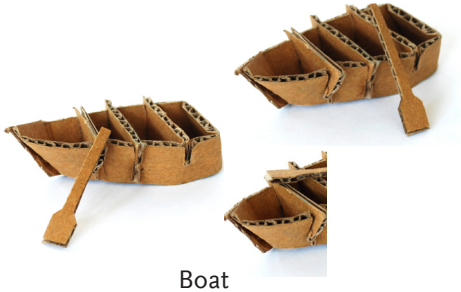
Factory





Buildings

Cars



Boat

Laptops

Television

Fish

cell phones

plastic bags

Charger

14. Testing 2.

No of children tested- 12
3 students from 6th, rest 4th std

Method of documentation- Photography, video and external observer.

Step II. Narrating the story with entities

14.1 Results of the testing 2

Feedback
- Children found the activity enjoyable
- They learnt new things

Observations
- The moral of the story was very bluntly told
- There was problem with accessibility of the board
- Some children had problems while reading
- Some children sat idle while others had a stronger role
- Some entities like the waves take time to build
- Narration by children shows better involvement
- Children laughed at the scale of things on the board
- Large group of children is difficult to manage

Analysis and insights
- The kit and its placement in the class needs to reviewed
- Language needs to be simplified
- Scale of the objects on the board needs to be checked
- The distribution of tasks to children should be equal
- Moral of the story has to be interestingly told. Tell them realistic things they can do and how
- The tasks need to analyzed on the basis of child's ability

15. Improvement after Testing 2- Version 4

The basic structure of the story and the teaching model remains the same except the moral of the story which is told a little differently i.e. With appropriate relevant action on the board.

The entities which are a vital part of the learning experience were explored in order to improve their expression using elements of design. It was ensured that the activity of making the entities doesn't become too complex for the child to handle.

Efforts were taken to have a common language in aesthetics of the kit. Illustration styles, graphic design, material, manufacturing process and form was used to achieve this result.

A guide for teacher and a guide for children where designed.

Packaging was designed to house the board, manuals, entities etc.

re^{act} diary was designed as a part of a system which ensures and encourages children towards a more sustainable lifestyle.

15.1 Exploring the entities

In effort to create certain kit aesthetics, colored corrugated sheets were explored as a medium to make the entities.

Crab

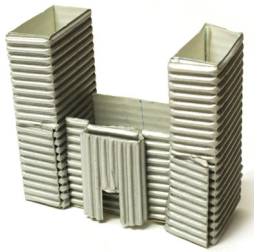
Turtle

Butterfly

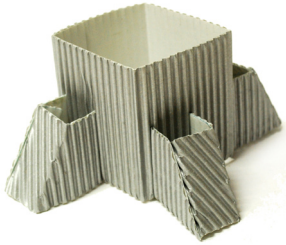
Turtle

Bird

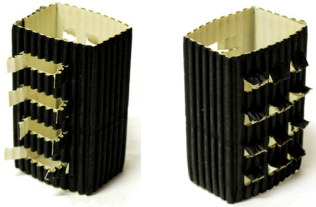
Twin Tower



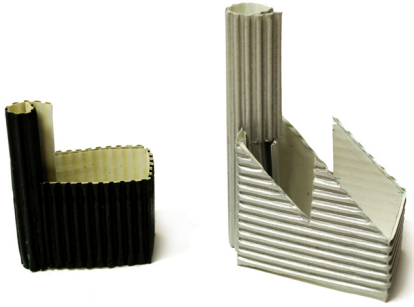
Office 1



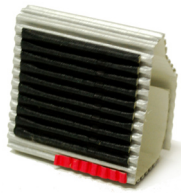
Office 2



Building

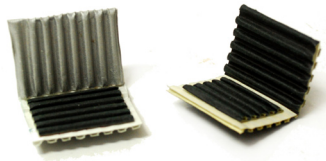


Factory



Television

Car



Laptops

It was observed that some of these entities were still quite difficult for the children to make, hence they were further refined. Colored corrugated sheet were also weak and requires glue to hold them at certain places. I chose the brown corrugated sheets as a final medium. In order to give them a finished look, certain illustration styles were explored.

Certain existing illustration styles were studied.

Image 14a

Image 14b

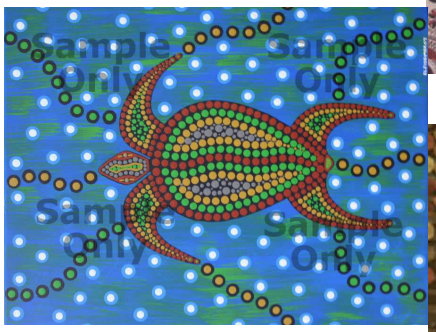


Image 14c

Image 14d

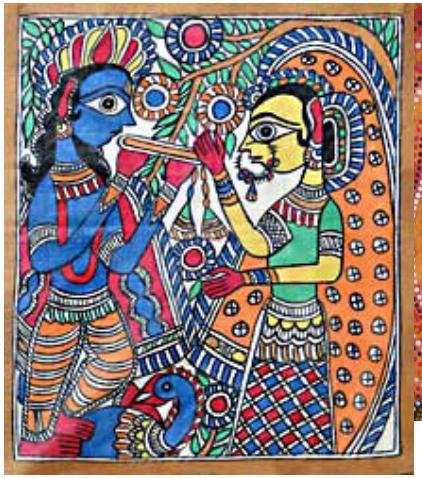


Image 14e

Image 14f

Image 14g

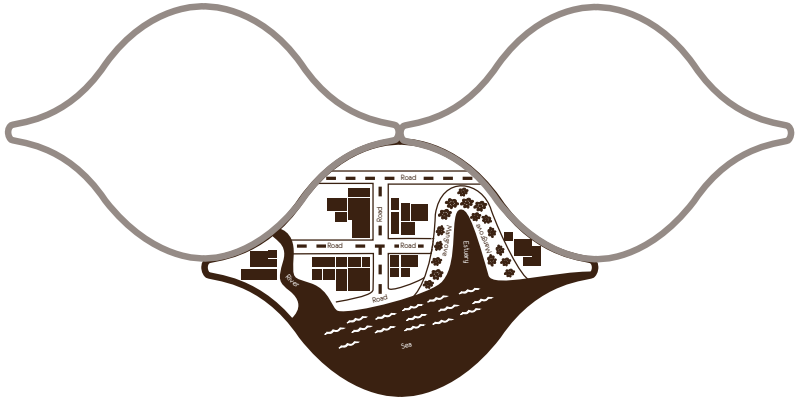
16. Prototyping

Material- corrugated sheets
Printing technique- screen printing
Cutting- die cutting, creasing

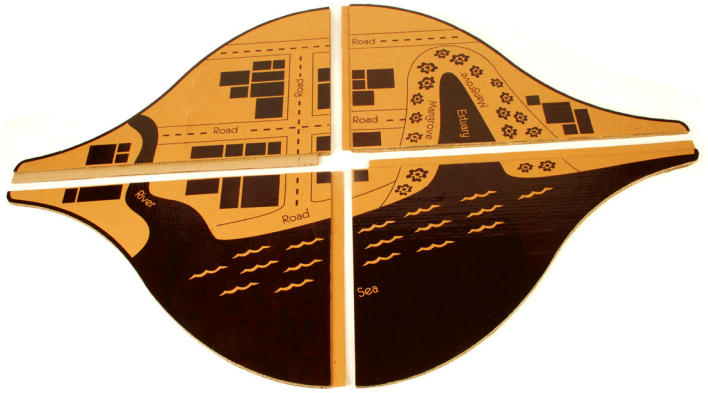
16.1 Board

The previously semicircular shape created orientation and accessibility problem for children. Lots of shapes were explored. The shape was altered in such a way that if this kit has to be used to teach multiple stories and which might require multiple boards. Eg. A certain story might require the earth, ozone layer, earths core etc. So the number of boards can be increased and fit compactly. So that the entire group of children are close together.

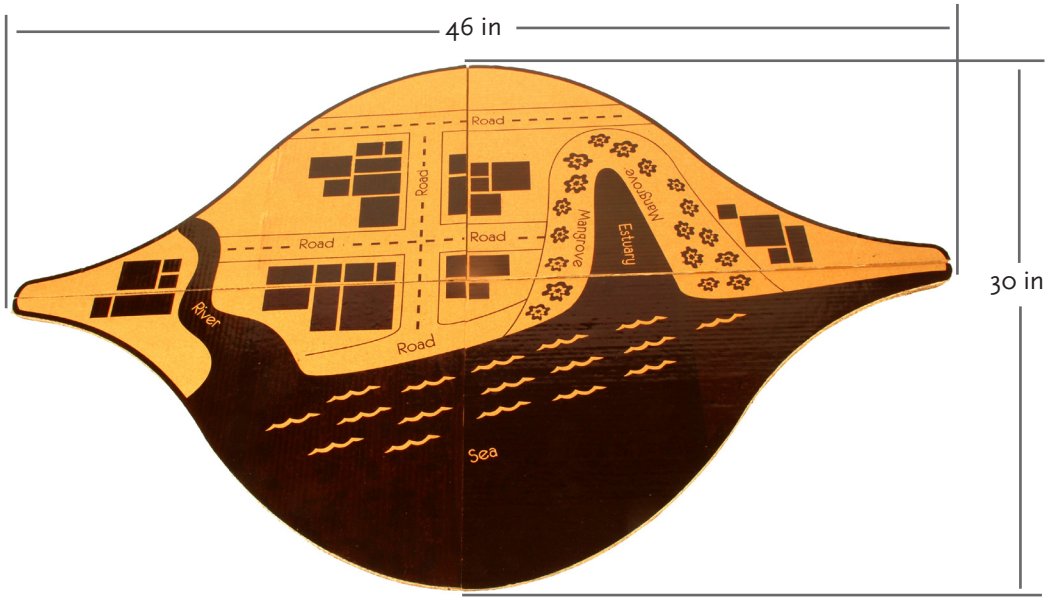
The board was made in 4 parts for the ease of printing and packaging. The four parts fit like a jigsaw puzzle



Multiple boards fit closely



board made in 4 peices

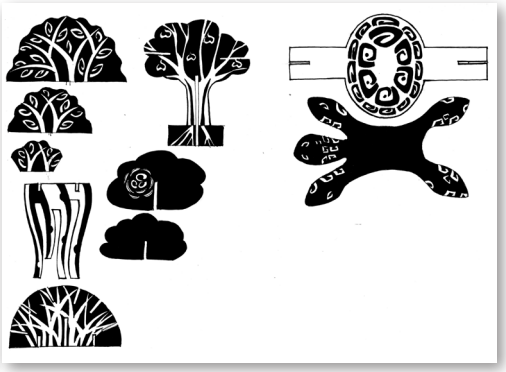


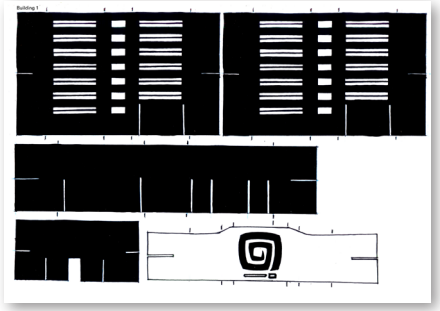
4 board pieces assembled into 1

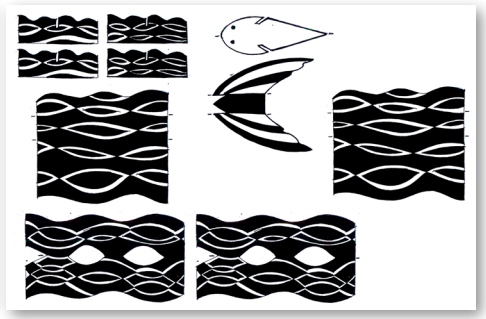
16.2 Entities

The parts of the entities are screen printed on cardboard sheets and partially cut.
The child will have to push them out, fold where necessary and then assemble them.
Most of them do not require any glue to assemble.

The drawings were provided to the screen printer.







Mangrove

Tree

Turtle

Flood water

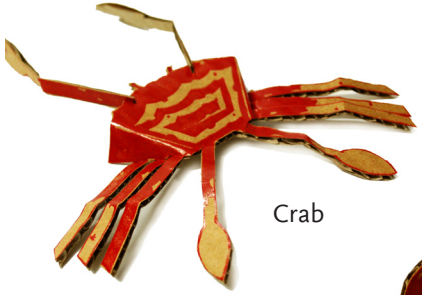
Waves

Bird

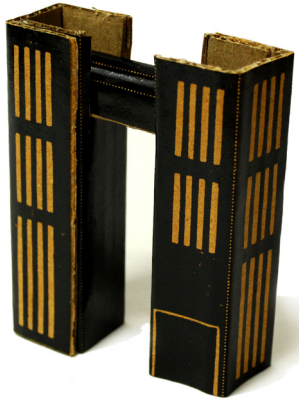
Fish

Butterfly

Snail



Crab



Twin Tower

Office

Car

Factory

Building

Flamingo

Laptops

Television

Plastic bag

Fishermans boat

16. 3 Naming the kit

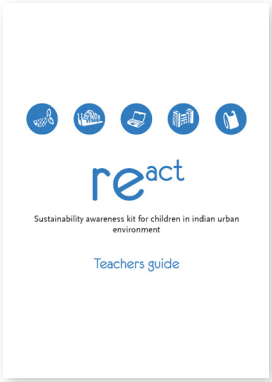
The kit was named as react. 're' stands for following values of Reduce Reuse, Recycle, Realize, Responsibility, Respect, Restore, Revive, Retain, Repair, Recreate, Relive and 'act' stands for acting upon all these values.

16. 4 Packaging

The packaging is a simple box with a provision to house the board, the entities, and the manuals.

16. 5 Guide for Teachers

A guide for teachers is designed for the teacher to understand the step by step process of the exercise. The teacher goes through the entire guide before the exercise takes place.

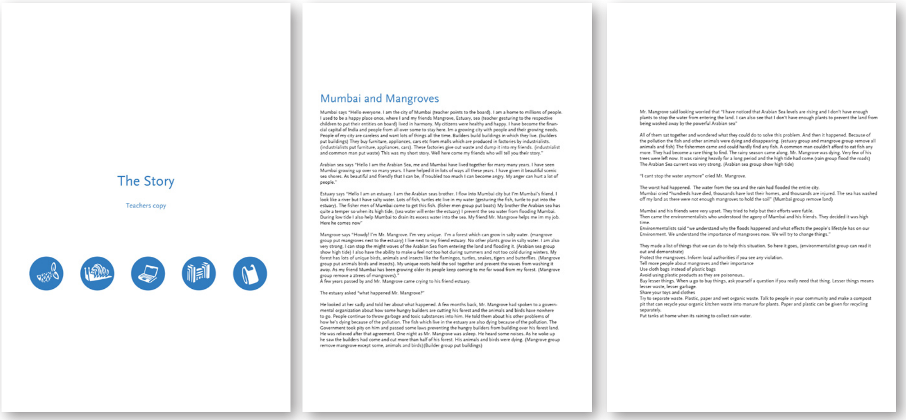


16. 6 Guide for children

A set of cards is provided which gives the children clues about how to assemble the entities.

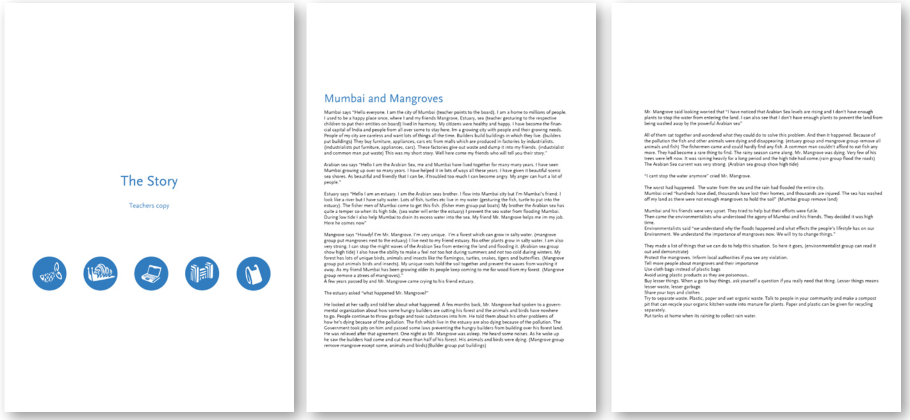
16. 7 The story- Teachers copy

The story is provided to the teacher with details where she is supposed to instruct the child to do the respective activity on the board.



16. 8 The story- students copy

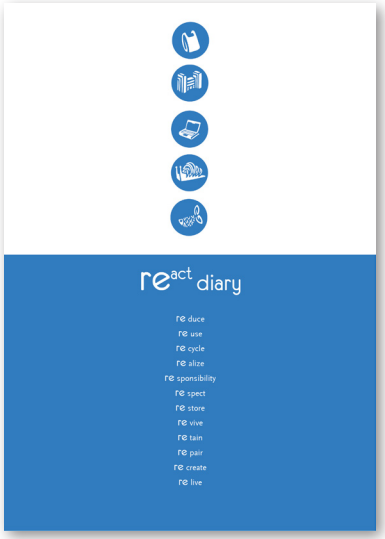
The story is provided to the children where the respective representative from each group can narrate their characters part.

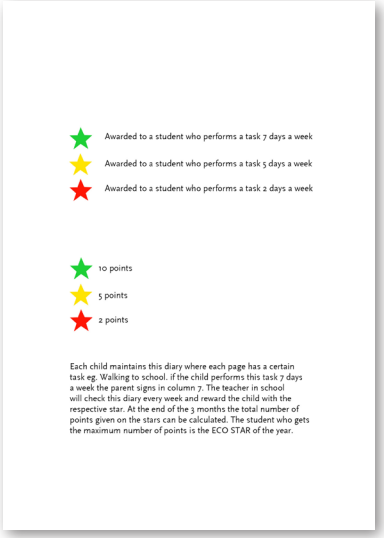


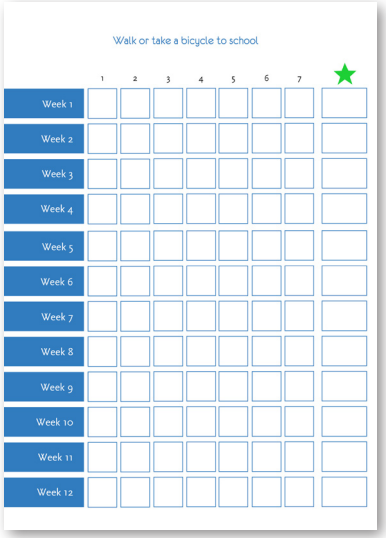
16. 9 re[act]- Diary

Taking the learning at home, sharing it with the family would be essential in imbibing this learning and reflecting on it. It was hence proposed that the child would maintain a diary which has certain tasks enlisted which ensure a sustainable way of living. Depending upon the extent of fulfilment of the task by the child, the parent makes a note in the diary which is then checked by the teacher in the school and the child is rewarded with a star. The star can be red, yellow, or green. Green being rewarded to the child who is most sustainable in his actions and red rewarded to the student who is least sustainable in actions. Green star is equivalent of 10 points while the yellow is equivalent of 5 points and the red of 2 points. At the end of the year each child can calculate their number of points. The child with the maximum number of points is awarded with the ECO STAR award.

This was proposed as children at this age group are often competitive. The intention was also to make the child perform a certain activity until it becomes a habit







17. re^act kit in class

After children assemble their respective entities and the teacher assembles the board. The board is kept at the centre of the class. The children gather around. The teacher is dynamic and doesn't have a fixed place. This ensures better control in class. The children then indulge in active role playing where each group becomes a character in the story and plays a specific role. As the story proceeds, the teacher instructs the children to take some action on the board. The moral of the story is told as things the children can do in their daily life to make a change by showing respective actions on the board.

18. Expandable nature of the teaching model

Currently for the sake of demonstration of the concept, one story was written. A certain number of entities were used in this teaching exercise. These same entities and multiple stories can be used to teach more things to children.

19. Conclusion

Designing for children is always a challenging yet gratifying experience. Through this project I got the opportunity to understand the subject of health and sustainability which are my areas of interest. As a person I am always open to undiscovered areas of work. This project was also one example which helped me look at design in a more holistic manner and not as isolated design domains. Most fun was to make the whole experience both visually and physically playful. I learnt to work with new materials and printing techniques. It was overall a good learning experience.

19. References

Images

Image 3a- http://www.whiteindianhousewife.com/wp-content/uploads/2009/04/img_2410.jpg
Image 3b- http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-21687165-&caller=search
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Image 3g- http://www.indiamike.com/photopost/data/502/1223trafikkaos1.jpg
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Image 3i- http://img1.eyefetch.com/p/05/773925-4f945816-eea1-4d8b-9ac5-e1fc0d14f959l.jpg
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Image 4a-http://www.med.nyu.edu/mindbody/images/hands.JPG
Image 4b-http://www.judydicanio.com/enercov5.jpg
Image 4c-http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-17866688&caller=search
Image 4d-http://img1.eyefetch.com/p/05/773925-4f945816-eea1-4d8b-9ac5-e1fc0d14-f959l.jpg
Image 4e-http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-21865518&caller=search
Image 4f-http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-23047076&caller=search
Image 4g- http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-23063117&caller=search
Image 4h- http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-19402452&caller=search
Image 4i- http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-23063117&caller=search
Image 4j-http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-19637555&caller=search
Image 4k-http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-17866688&caller=search
Image 4l-http://www.med.nyu.edu/mindbody/images/hands.JPG

Image 4m-http://img1.eyefetch.com/p/05/773925-4f945816-eea1-4d8b-9ac5-e1fc0d14-f959l.jpg
Image 4n-http://bellbajao.org/wordpress/wp-content/uploads/2009/10/submission-0021.jpg
Image 4o-http://www.judydicanio.com/enercov5.jpg
Image 4p-http://www.med.nyu.edu/mindbody/images/hands.JPG
Image 4q-- http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-23063117&caller=searchImage 4r-
Image 4s- http://www.indiamike.com/photopost/data/502/1223trafikkaos1.jpg
Image 4t-
Image 4u-http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-17866688&caller=search
Image 4v-- http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-23063117&caller=searchImage 4w-
Image 4x-http://www.corbisimages.com/Enlargement/Enlargement.aspx?id=42-17866688&caller=search
Image 4y-http://www.judydicanio.com/enercov5.jpg

Books

1. Appropriate sustainabilities, new ways in french architecture- Marc Emery
2. Sustainable architecture, low tech houses
3. Environmental pollution and health hazards of india- Dr. R Kumar
4. Domestic environment and health hazards of women- H N B Gopalan and Sumeet Saksena
5. Health for effective living- John.E.B
6. Green design
7. Search of sustainable livelihood systems
8. The total beauty of sustainable products- Edwin Datschenfski
9.Environmental studies- GR Sawnhey
10. Environmental studies, Textbook for class 4
11.General science book 1
12 General science book 2
13. General science book 4
14. looking around- class 3
15.Starting Geography- class 4
16. General science

Links

http://www.ecoliteracy.org/
http://www.learningandteaching.info/learning/piaget.htm
http://www.edge.org/q2008/q08_1.html#gardner
http://www.ecoliteracy.org/about/index.html
http://www.ecoliteracy.org/education/sustainability.html
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