Play kit in Bamboo based on Optics

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Project **II**, M.Des., IDC, IITB

AIM

- To design an **aid to explore** important concepts of optics through their expressive activities i.e., **through play** and comprehend the principles of optics in a **tacit way**, most broadly to help them become better learners.

- The design challenge is to **develop features** that are specific enough so that kids can **quickly understand** how to use them but general enough so that kids can continue to **find new ways** to use them.

- **Exploring the bamboo** as material and developing product to utilize the advantageous properties of the material.

SCOPE

- To design a play kit with mirrors, convex, concave lenses, convex and concave mirrors which can be handled by **10 years** and above age group.
- Using user friendly, warm to touch **properties** of bamboo.
- Use of innovative joints to make the kit easy and **convenient to play** without having the fear of handling precise elements like mirror and lenses.

PROJECT STATEMENT

- An aid to understand the abstract theories and relate them with every day experiences.

? ? Bamboo

- Natural Material, Eco-friendly, fast growing biomass
- Grass family
- High value in the market
- Product Elegance
- Curved cylindrical body
- Bamboo Strips - Multiple uses - Good substitute of Wood
- Bamboo is solid and easily blocks light.
- It does not get heated up by bulb light.
- Assembly is very simple and can be easily done
- By children. Provides flexibility in sizes to accommodate different sizes of material
- Electrical insulator
- Consists no toxic constituents
- From market aspect:
  - ? No such toys or play kit in market
  - ? Easily available
  - ? Gives freedom to creativity
  - ? Can be placed easily in Museums, Crafts shops, Science centers, etc.

- Light source gives feel of other world
- Many possibilities to explore
- New area for the play kits
- They rarely experience optical devices as a play
- More excitement and fun is involved
- Relating with real life experiences is less emphasised
- Basics for higher studies

Methodololgy

Stage 1

Study of child psychology
NCERT syllabus and lab equipment

Stage 2

Understanding the Material

Stage 3

Market Study

Stage 4

Ideation

Stage 5

Exploratory models and arriving to final concept

Stage 6

Testing and Optimizing

Theories in Learning

Piaget’s theory of learning :

“Action rather than observation”

Vygotsky’s theory of the zone of proximal development (ZPD)

Independent problem solving ⟷ Problem solving under guidance

Skemp’s theory of learning

Learning by Hierarchy, towards a goal

Jerome Bruner’s ‘Theory of Instruction’ and ‘Constructive theory’

Children learn more when assigned a task which motivates them to use the acquired knowledge

Dienes’s theory of learning

Increasingly intricate play
Primary Play : Open task
Secondary Play : Aim to particular task

Characteristics of this age group

Age group : **10** years and above

Social Skills

– Excellent eye-hand coordination
– Growing importance of friendships
– May become more emotional

Intellectual and Cognitive development

– Can work no longer and more projects
– Learning more about the world, including myths and biographies
– Can think and solve problems
– Able to read newspapers and magazines

Study of School Cirriculum

Practical experiments on light or optics are conducted only for the classes 10th and 12th standards only.

Class	Age (In years)	Topics on Optics
VI	10-11	No topics
VII	11-12	Convex and Concave mirrors (Theory only)
VIII	12-13	Laws of Reflection, Spectrum (Theory only)
IX	13-14	No Topics
X	14-15	Study of images formed by Convex and concave lenses, Convergence and divergence using lenses, reflection of light through prism
XII	15-16	Focal lengths of convex and concave mirrors and lenses respectively, Nature and size of images formed using all the lenses and mirrors

Aims

– Emphasis on basic conceptual understanding of content

– Promoting process skills, problem solving abilities and applications

– Concepts and contents should be useful in real life situations

So How do they Learning ?

Formal : Schools and colleges

Informal : Home sciences, parks, museums, workshops

Learning kits, toys, games and puzzles

*** Best learning process occur when they are actively engaged in designing and creating things

Children :

Age group : 10 to 15 years

No.s : 10

Questionnaire :

* **Topics** taught in Optics
* Topics **difficult** to understand
* Which topics are **enjoyable**
* Comparison of the experiments with any other things around
* Any products belongs optics

Teacher:

No. Of Teachers: 2

Questionnaire :

* Which topics are **difficult to teach** in optics
* How many **experiments** students have to do in optics
* Are theory and practical taught on the same day/week?
* About apparatus
* What kind of other experiments in optics are done

Parents

Feed back

- Kits can be used by single **or** a group
- Child could relate knowledge in the device with academics
- Activity should be **initiative** and interactive
- **Peer group** will influence the type of game they choose
- Cost **may not** be a factor if the product will have some
- Teachers and academics play a **major role**
- Parents learn and teach to the child
- Parents knows what their kids like and dislikes

Why do they lack interest?

Routine and bookish knowledge only

Depends on how teacher teaches

Rigid curriculum

Teachers and scared about accidents with the glass equipments

Learning process is more restricted to classroom

Not much exploratory kits are available

Laboratory Equipment

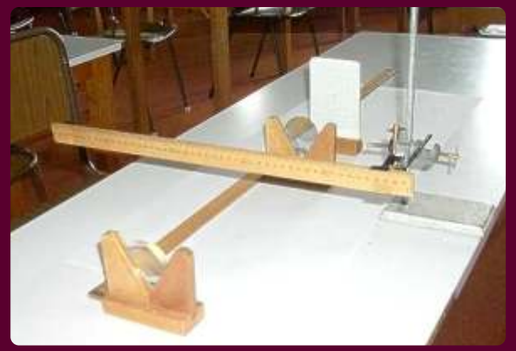
Focal length with with both convex

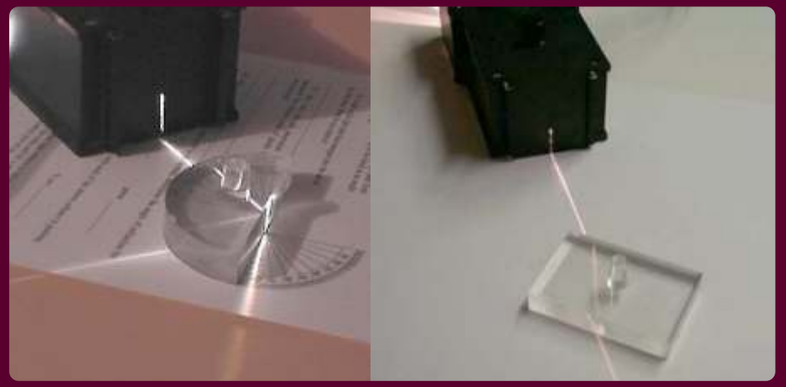
Image formation in Concave

Focal length of convex lense

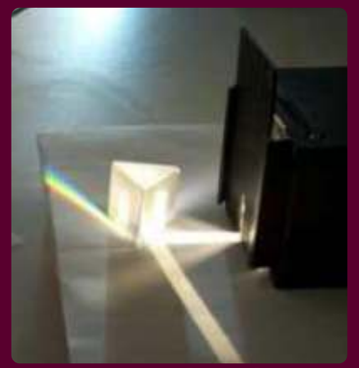
Focal length of infinite object

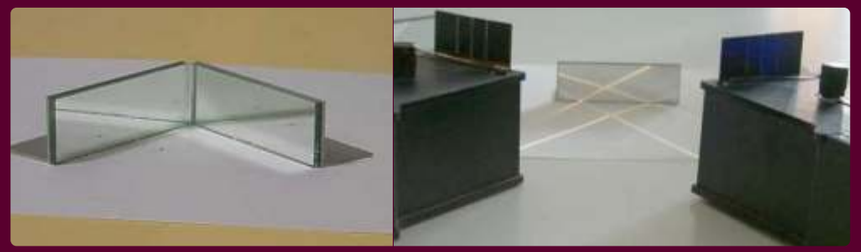
Laboratory Equipment





Principle of Microscope





Spectrum of colors with

- Laboratory equipment **looks very serious** and meant for only certain applications.
- **No protection** is provided to the equipment
- Children are scared of **damaging** of the equipment
- Mostly the equipments are made of natural Material or metal.

Laboratory Equipment

Kits made with optical devices are **hardly playful**

All products are made with plastics but **not explored** with bamboo or any other natural material

Only **one or two devices** is provided with the kit.

Items with mirrors are **not** given to handle. They are used as display boards and are bigger in size

Not much exploratory optical **kits** are available in Indian market

The area in optics is still wide open

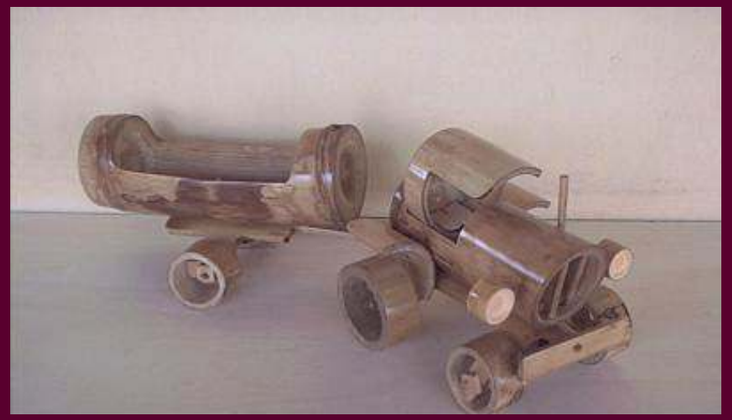
Similar Products

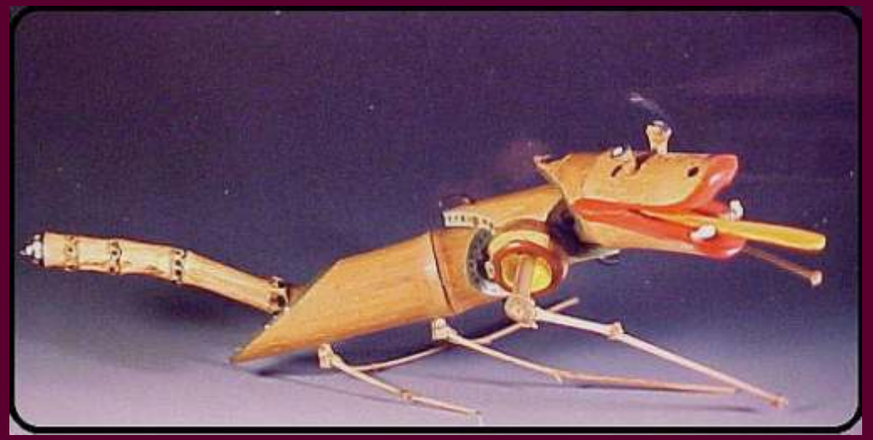
Similar Products (Kaleidoscope)

Similar Products







Similar Products

Products made with bamboo are **not explored** much, especially in optics area

Detailing of the bamboo products is very crude

It is good to see application of **colors** on bamboo material

Play kits made with bamboo are **mostly puzzles**

Stage 3: Analysis of Play kits and Games

Single

Skill | Strategy | Chance | Mixed

Double

Hop scotch

Chess

crap

Monopoly

Shooting

Tic-tac-toe

Snake and Ladder
Ludo

Football
Cricket
Baseball

- **Physical** Skill
- Oldest games

- Not Surprising
- Mathematics
- **Manipulation** Symbols

- They have levels
- Based on **luck**

- Strategy
- Chance
- Skill

Play kit and Age Group

Ready for sophisticated problem solving

Can handle complex puzzles

Enjoy realistic three - dimensional modeling projects

Inferences

- ? Laboratory apparatus are **not** designed to play with
- ? **Less safety** precautions have been taken
- ? Each apparatus is designed for **specific purpose** no combinations are available
- ? Interaction with devices is **very less**
- ? No variation in the level of fun
- ? No product or game has used different principles or apparatus for a given task
- ? LASER should **not** be used
- ? Start collecting things and collections are very precious to them

Inferences

- ? Bamboo has certain **constraints** like bending, storing conditions, nailing, joining, Shrinkage etc.
- ? New technology is also being involved with bamboo
- ? Children of this age group enjoy creative kits more.
- ? They **need** change and things to **explore**
- ? Surprise element attract a lot
- ? Develop hobby and like to spend time for it.
- ? Start collecting things and collections are very precious to them

Target Users : School Children of the age group of 10+ years or VI th standard onwards (Concrete operational stage)

Objectives :

With the kit children **may not learn** the principles of optics immediately but it can become an aid to compare and understand for in their higher education, i.e., help children to learn in a tacit way.

Aimed to **enhance creativity** and provide possibility to create new things

It should have entertainment as well as educational value

Scope for exploring more in optics in a **tacit way**

Kit should make children **more sensitive** towards manipulating the light and images with different optical devices

Product is to be put forward to the **higher class or schools or science museums**, etc.

Should be more interactive with involving one or more persons

Features :

Properties of bamboo are to be used properly

Product should have features, which permit children to play, modify and learn.

Care to be taken to design components to **avoid accidental injury** with proper surface finishes to Avoid bamboo fibers to hurt fingers

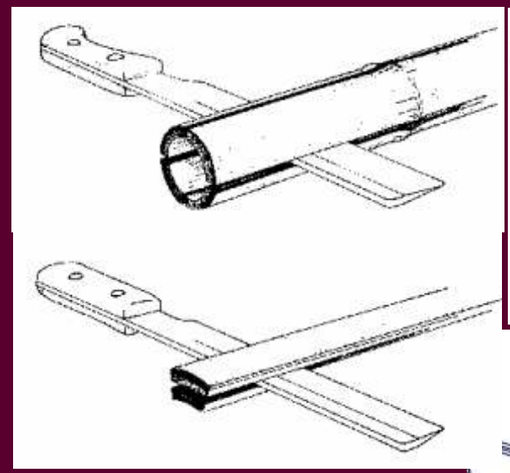
Safe joints and rounded edges

Should satisfy children's developmental needs

Playfulness as important element and some semantic clues of the scientific optical equipments Should remain which will help them in future to recognize and recall the activities played

Bamboo and its Properites

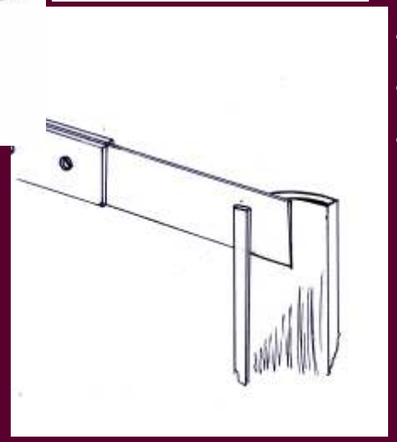
– Around 100 species are available in India
– Excellent Tensile strength
– Durability depends on species, climatic conditions
– Bio degradable
– Split bamboos are used more



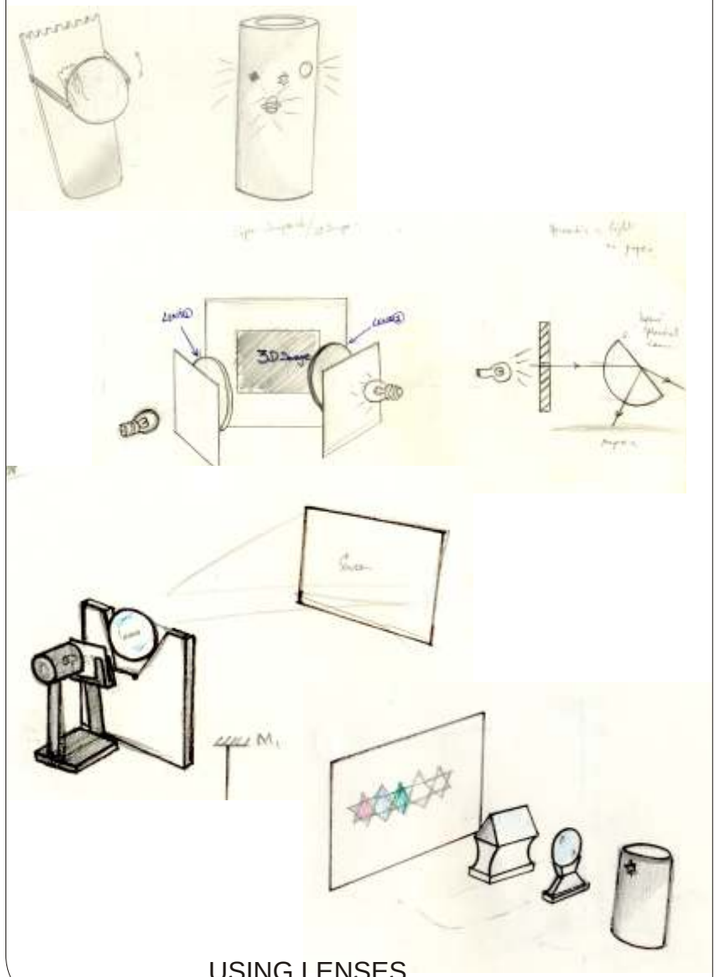
Selection

– Use only pronounced brown colored
– Select the longest large diameter culms
– Don't use whole culms of green or unseasoned bamboo

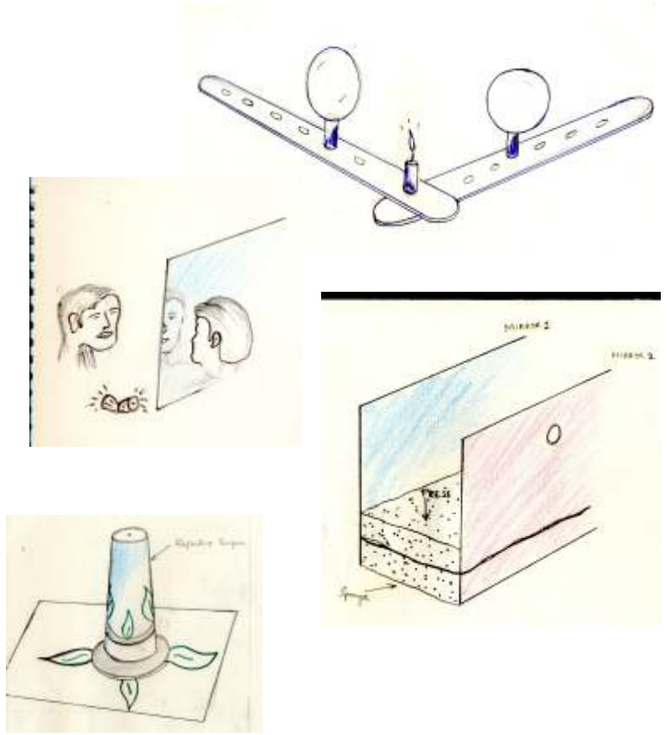
– Splitting
– Drilling
– Dyeing
– Joining



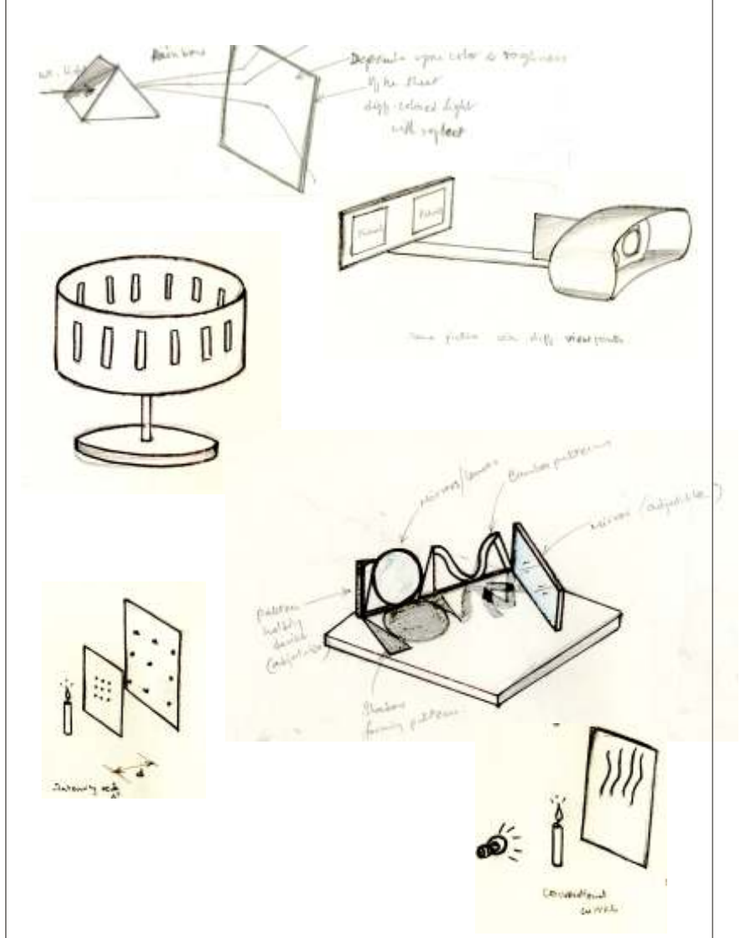
Stage 5: Intial Ideations



USING LENSES

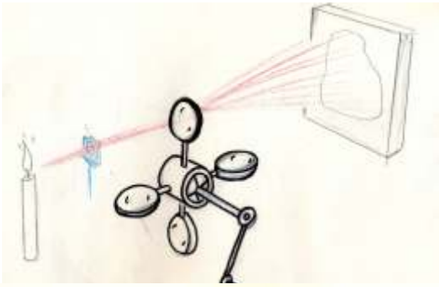


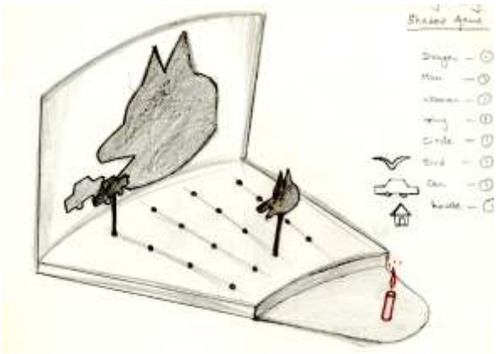
USING MIRRORS

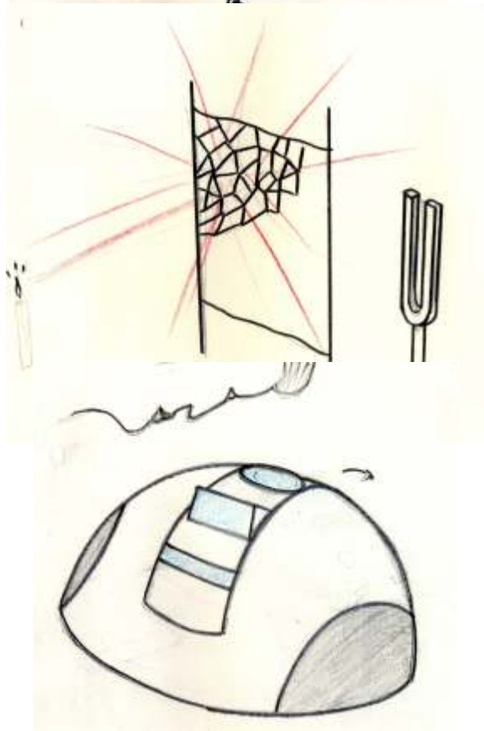


USING LIGHT AND SHADOWS SHADOWS

Ideation and Explorations







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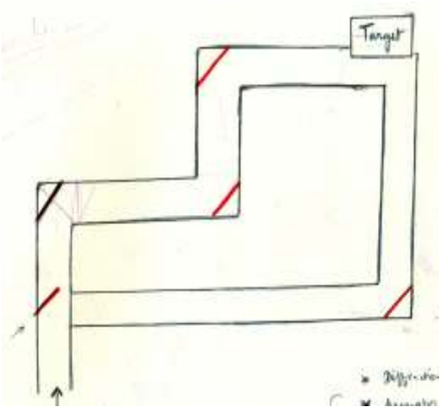
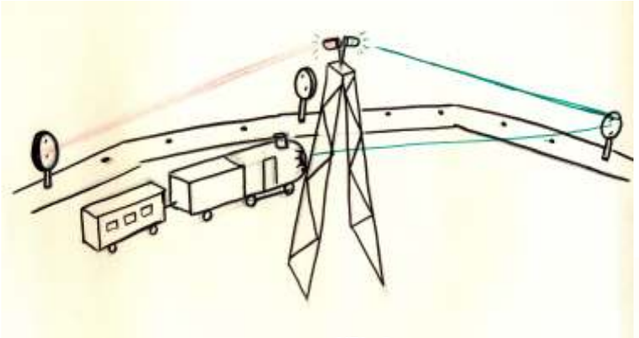
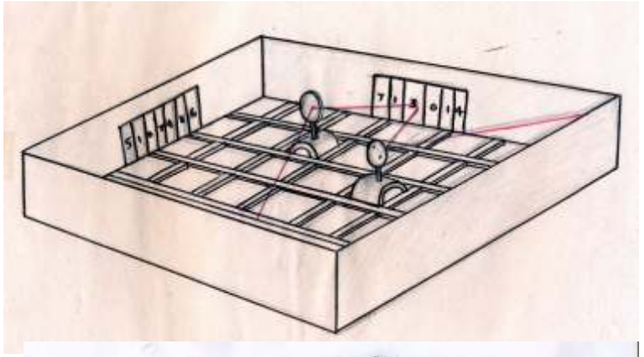
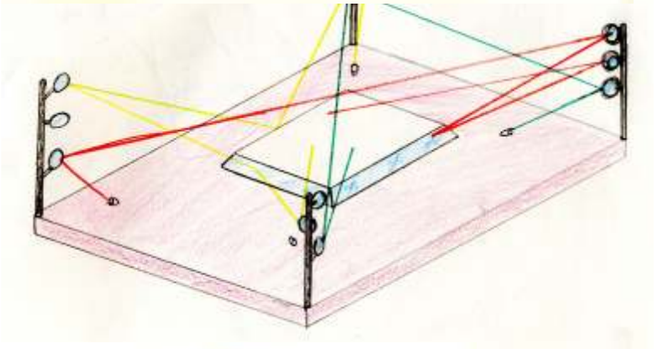
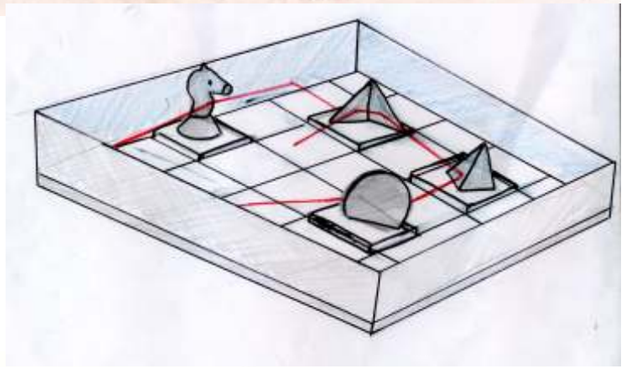
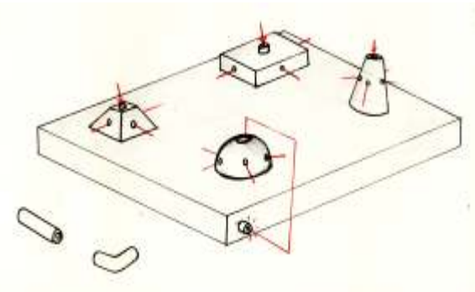


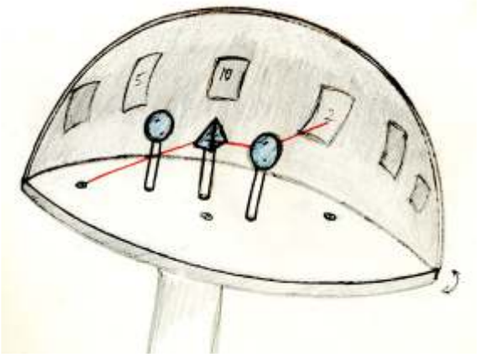


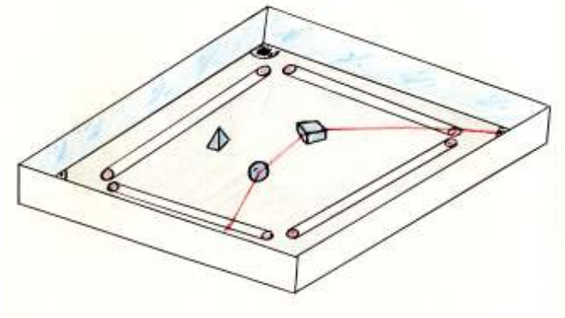




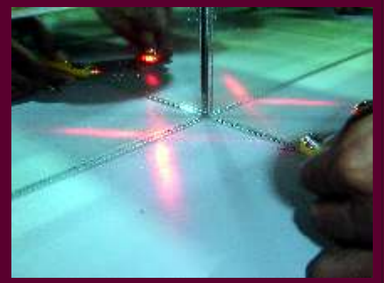








Ideation and Explorations



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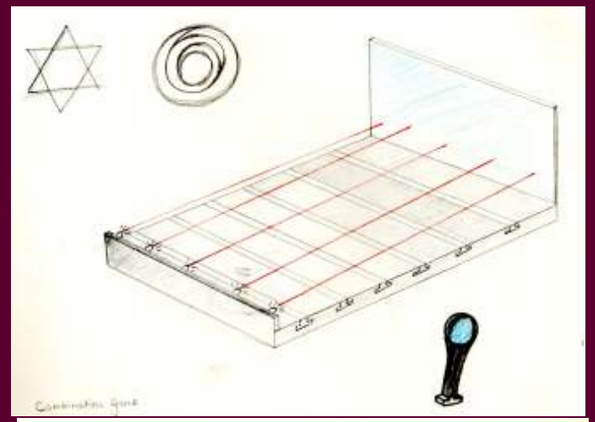
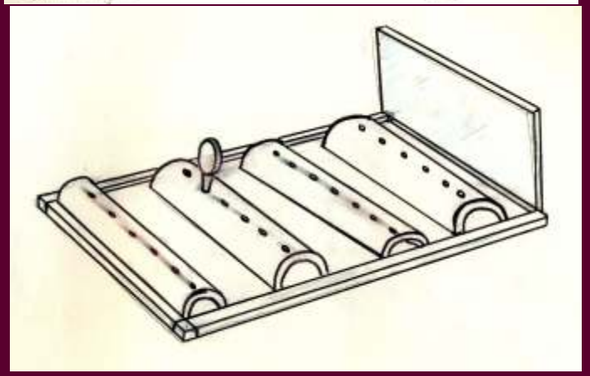
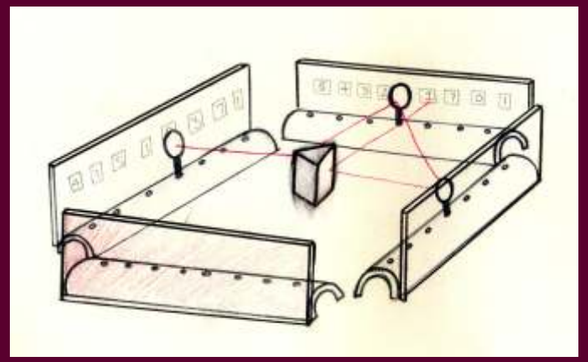
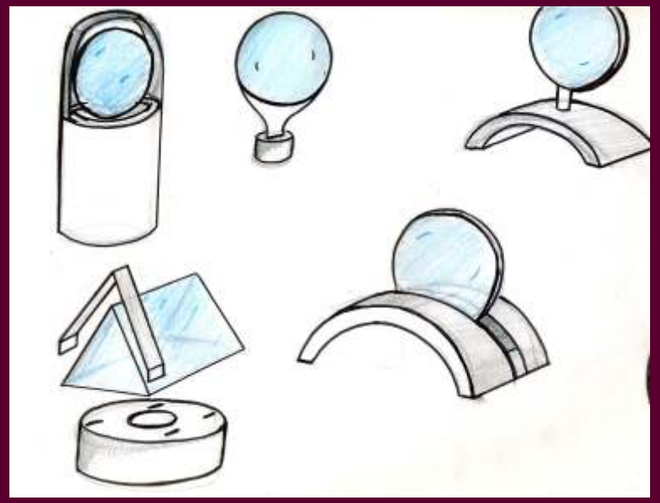


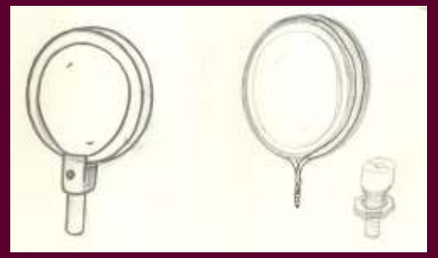




Ideation and Explorations

Lens, handle and stand





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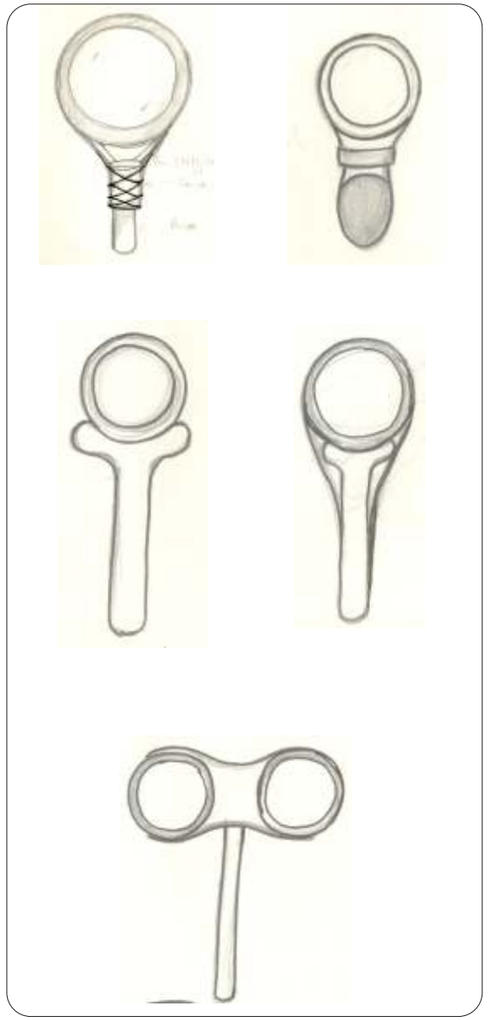
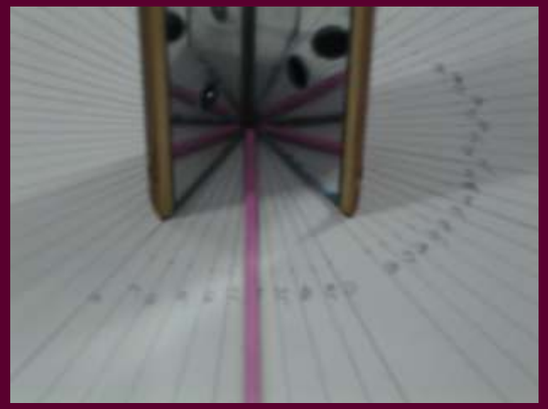
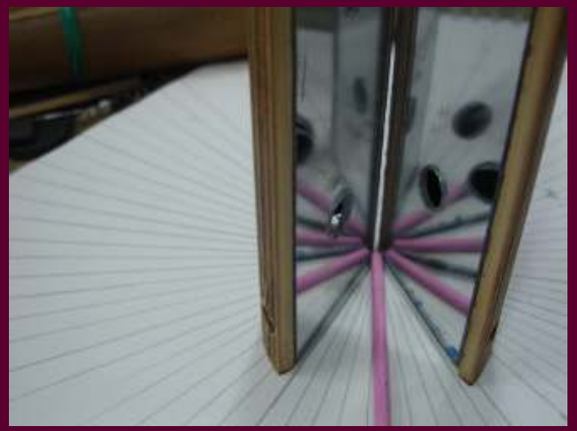


Keleidoscope

Keleidoscope Kit





Concave Mirror

- Reflecting small images
- Enlarging image
- Seeing minute skin surface
- Looking parts of your eye

Convex Mirror

- Seeing nearer distance object into longer distance object
- Short images
- Reflecting bulky image

Convex lens

- Enlarging the images /objects
- Thread counting device for fabrics
- Burning paper
- Looking tiny animals / insects

Concave Lens

- Zooming out
- Cover more area

Paravarthan - Make your own Keleidoscope


Paravartan
A creative educational kit - 2
(Discovery the fun)
Learn principles of optics in a tacit way
User friendly, warm to touch
Use of eco-friendly, natural material
Safe, shock-proof and no toxic constituents


Convex Lens
Concave Lens
Concave Mirror
Convex Mirror
Paravartan
A creative educational kit - 2
(Discovery the fun)
Learn through play and manipulation
Learn principles of optics in a tacit way
User friendly, warm to touch
Value of play education terms and social interaction
Use of eco-friendly, natural material
Safe, shock-proof and no toxic constituents

Paravarthan - Fantasy Mirrors