

Play and Learn Kit for School Going Children

Guide:

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Children ...



Children love to play...

Playing is

fun and joy

natural intuition

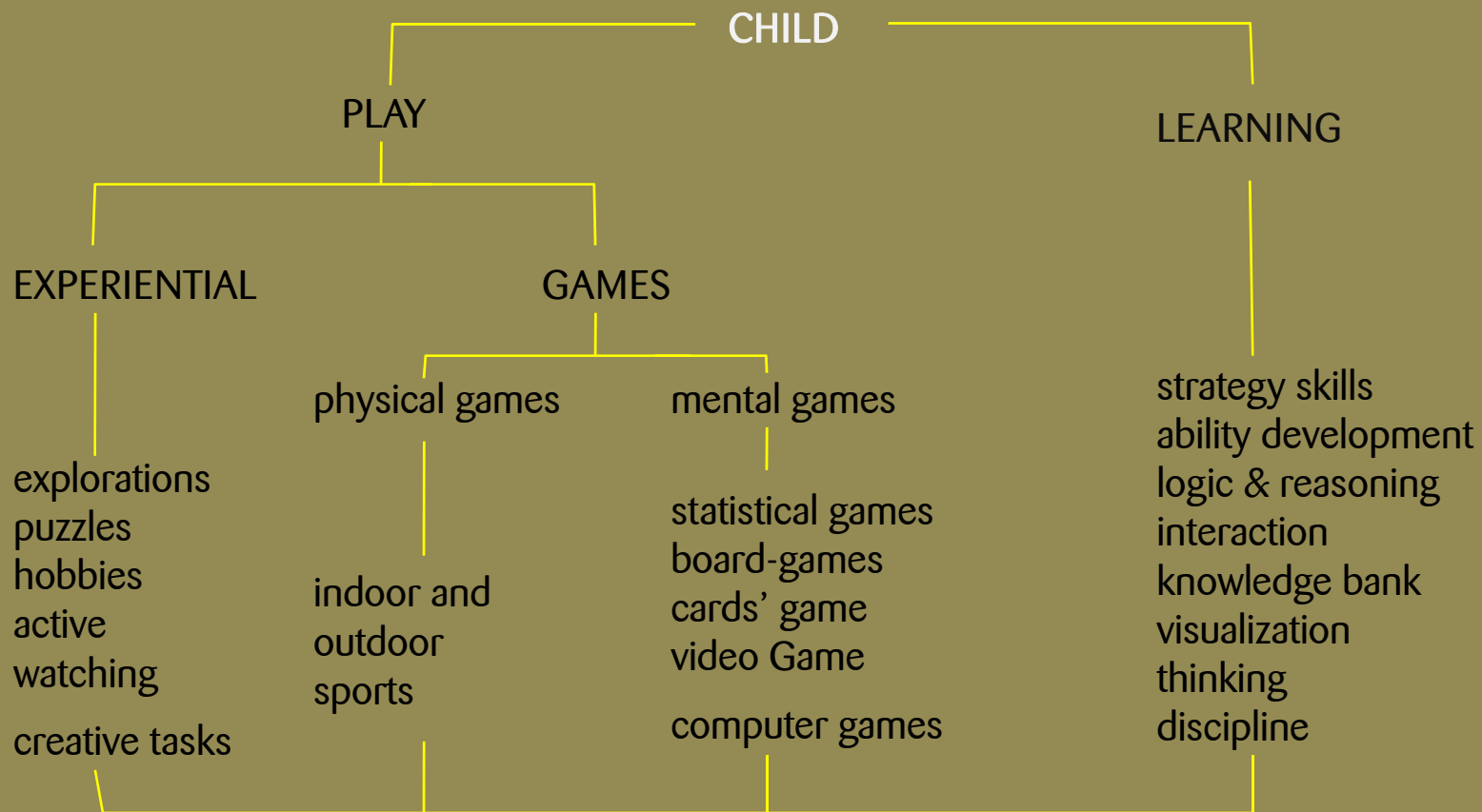
exploration

experimentation

natural educational technology

powerful learning environment.

Children love to play...



Importance of Playing...

School going children ...



Primary School Children Grade I to V

Learning program is arranged on the
playful platform

Playing and learning takes place
together

School going children....



Secondary School Children Grade VI to X

The relation between play and learn becomes weak

The playing involves only sports and indoor games

Students are forced to study rather than play

Playing becomes secondary activity

School going children....

Who?

Secondary school children

from standard VI, VII & VIII;

the age 11 years, 12 years and 13 years respectively

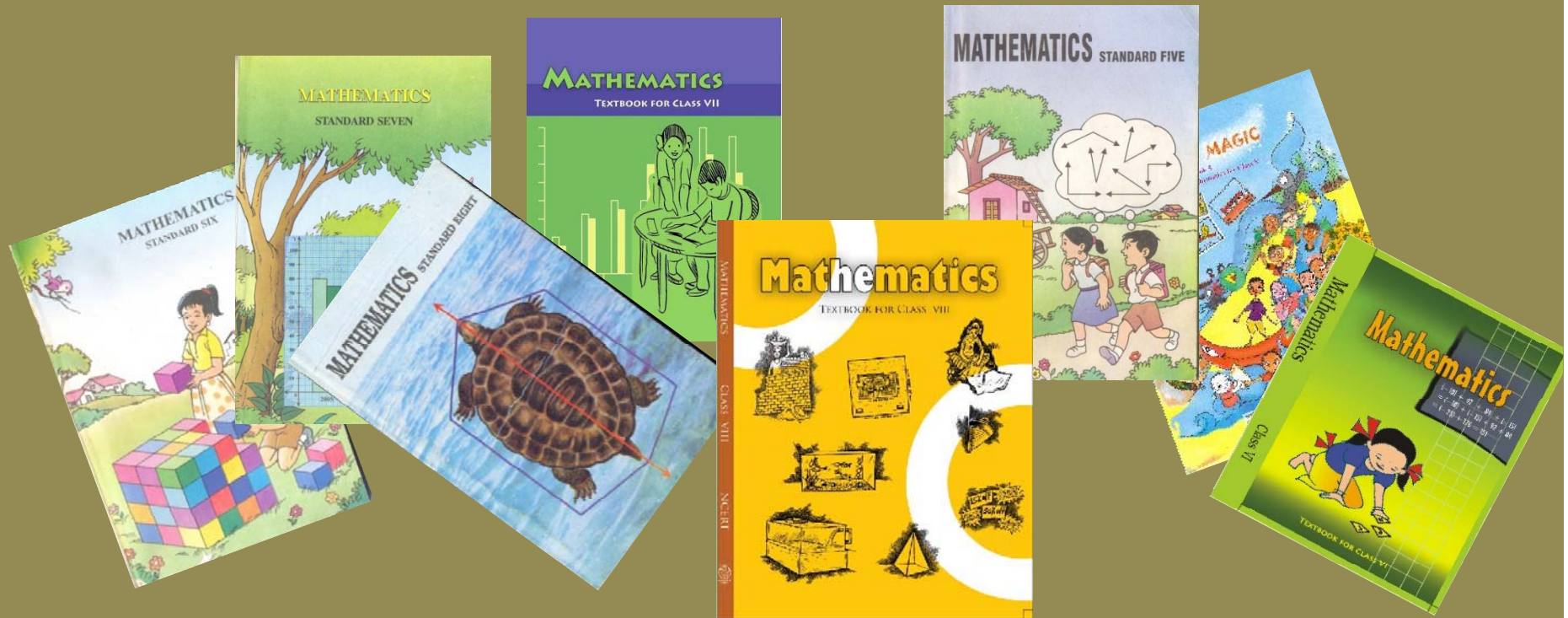
Why?

There is a design opportunity to establish and strengthen the connection between playing and learning.

How?

Children should be encouraged to learn by introducing a playful media.

Defining user....



Studying the course structure...

Analyzing the course contents

The possible problem area

Geometry in course structure

Volume : as a problem area

Studying the course structure...

students are interviewed in their learning environment
The interviews are in formal and informal mode

To understand ...

- Their perceptions

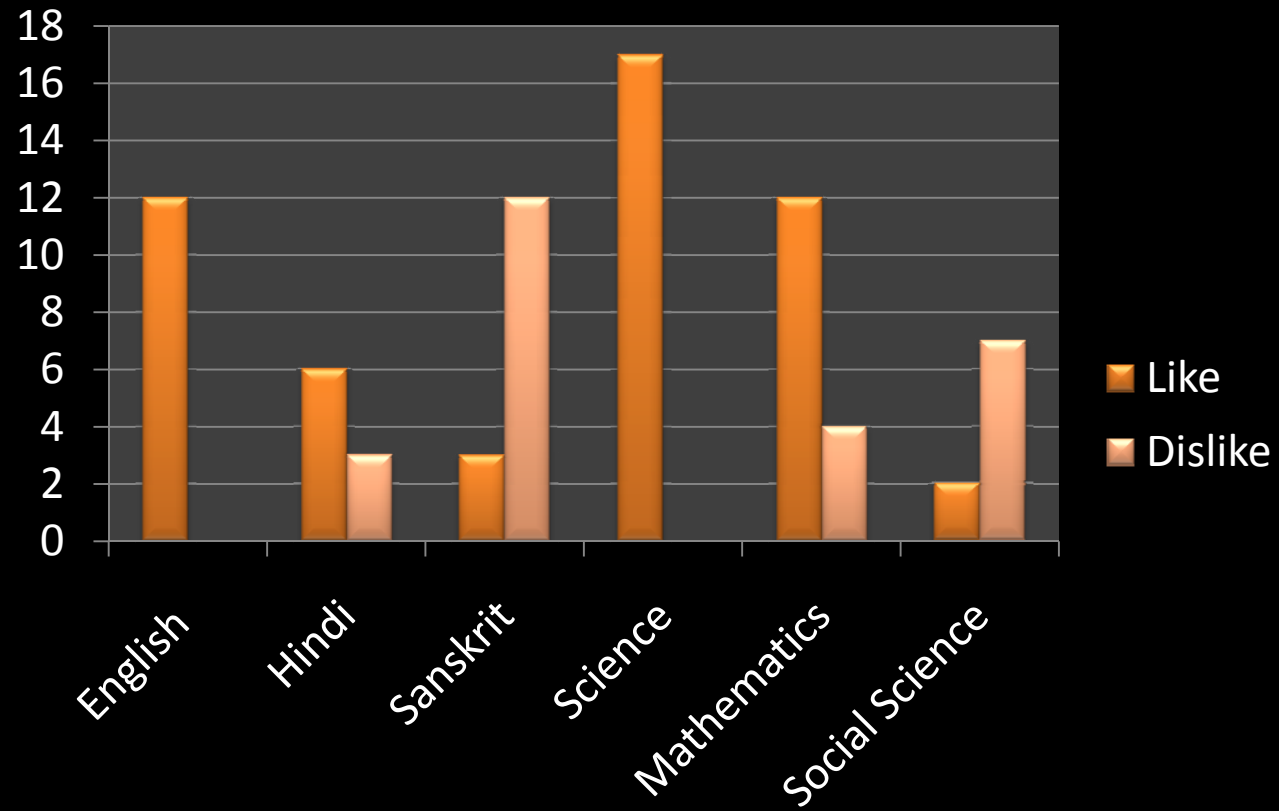
- How they think and respond

- to understand various facets of their personality and behaviour

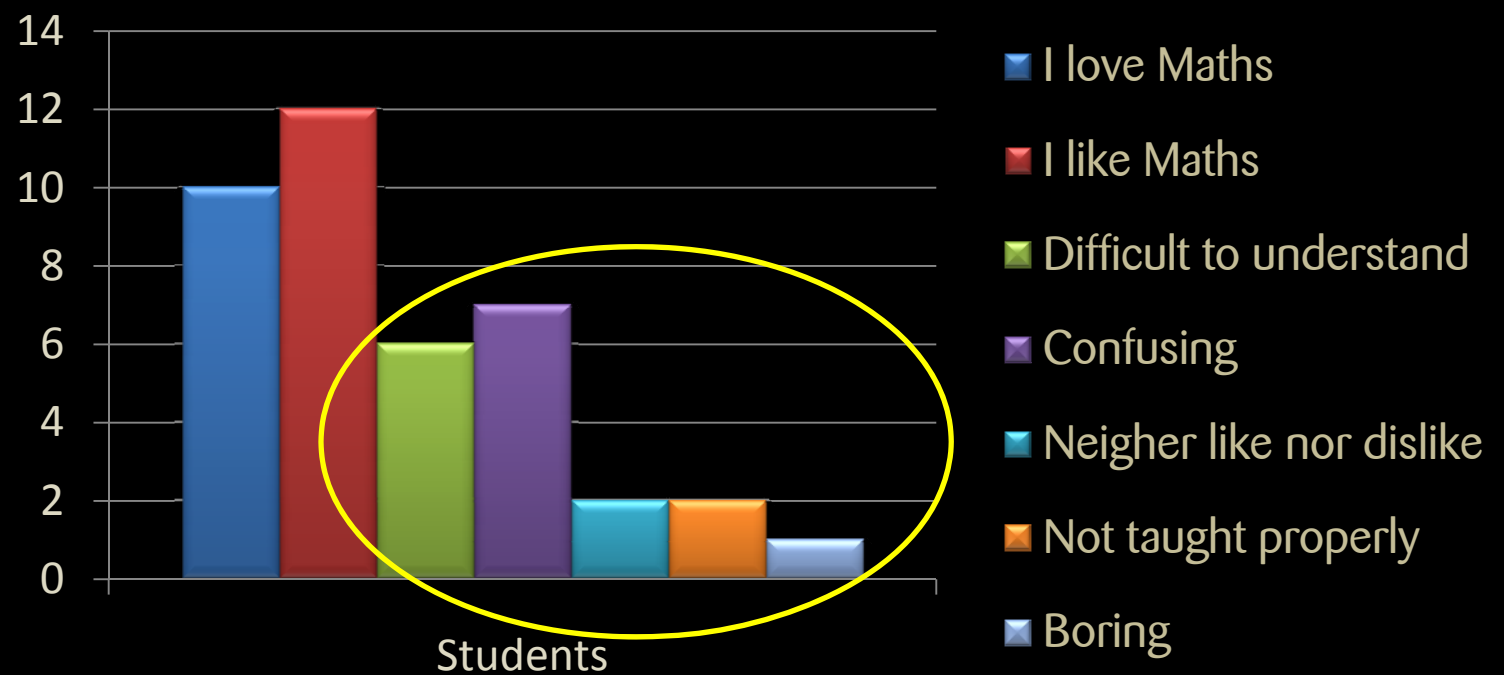
Understanding the situation....



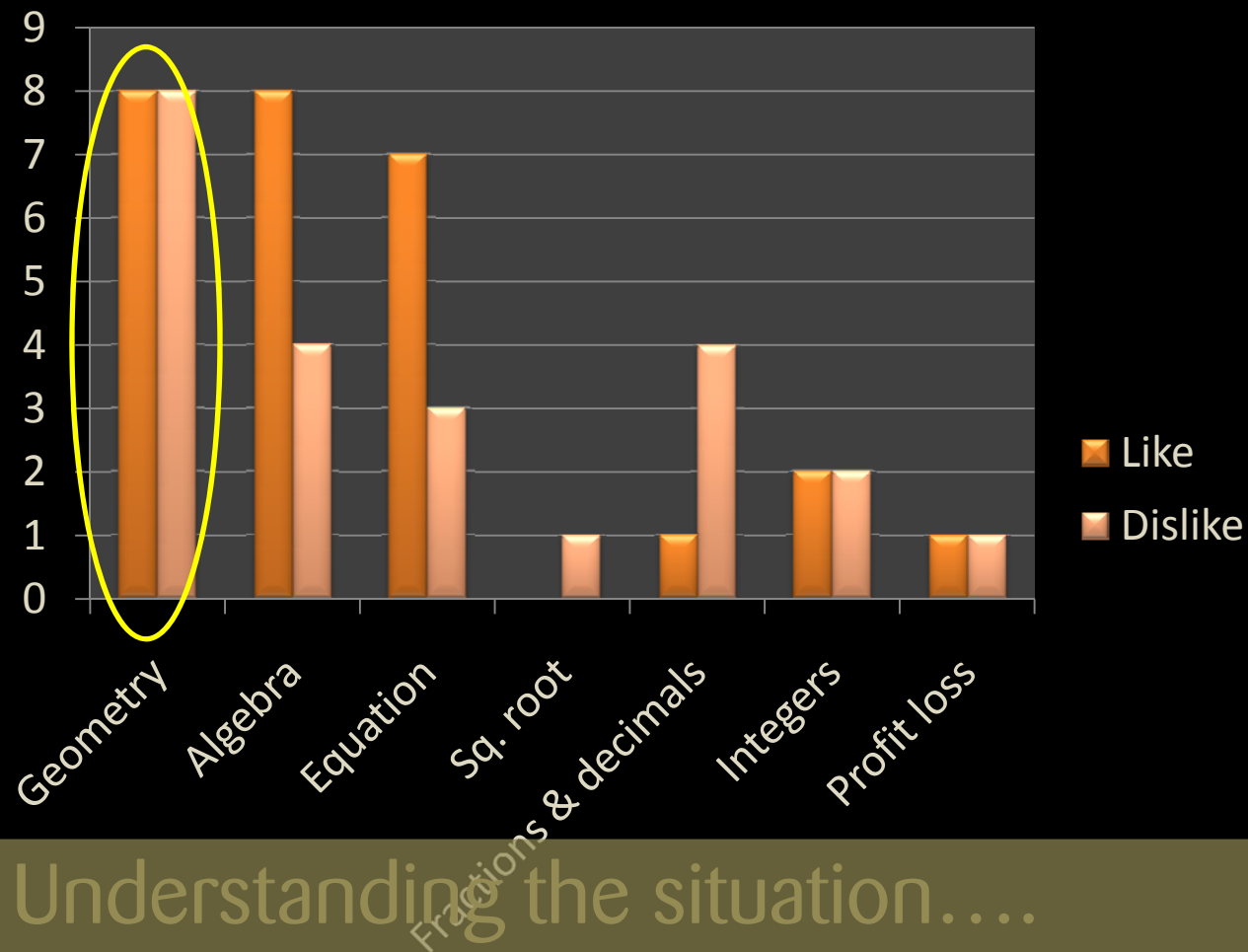
Understanding the situation....



Understanding the situation....



Understanding the situation....



Understanding the situation....



Leisure time activities...

crafts, origami, paper-craft, sketching and painting..
collection of things. This collection touches variety of topics viz. postal stamps, coins -notes, stones, shells-conch, leaves-flowers and images-articles from newspaper & magazines, toy cars etc
reading fantasies, stories, cartoons, adventure and detective books
watching TV & movie
videogames & computer games.
eating junk food and roaming around.
listening music and making poems.
dancing and playing musical instruments.
swimming and gymnastics
indoor & outdoor games

Leisure time activities...



Playing...

Crossword

Puzzles

Keywords

Carrom

Ludo

Snake-n-ladders

Chess

Monopoly

Lifestyle

Card-Games



Hide-n-seek

Confusion

Chain-chain

Langdi

Hoping-n-cursing

Chocolate box

Lagori

Volleyball

Football

Throw-ball

Basketball

Badminton

Table tennis

Cricket

Squash

Kabbadi

Kho-Kho



Mobile games

Computer games

Video games



Playing...

The classroom teaching – becomes monotonous

The limited time span

Attention paid by the students is not sufficient

Teacher to student ratio is high

Limited use of teaching aid and new media

Teachers' opinion...

There are problems with the basic understanding of concepts

Students get confused with the geometric formulae

They can't remember formula

Lack of visualization

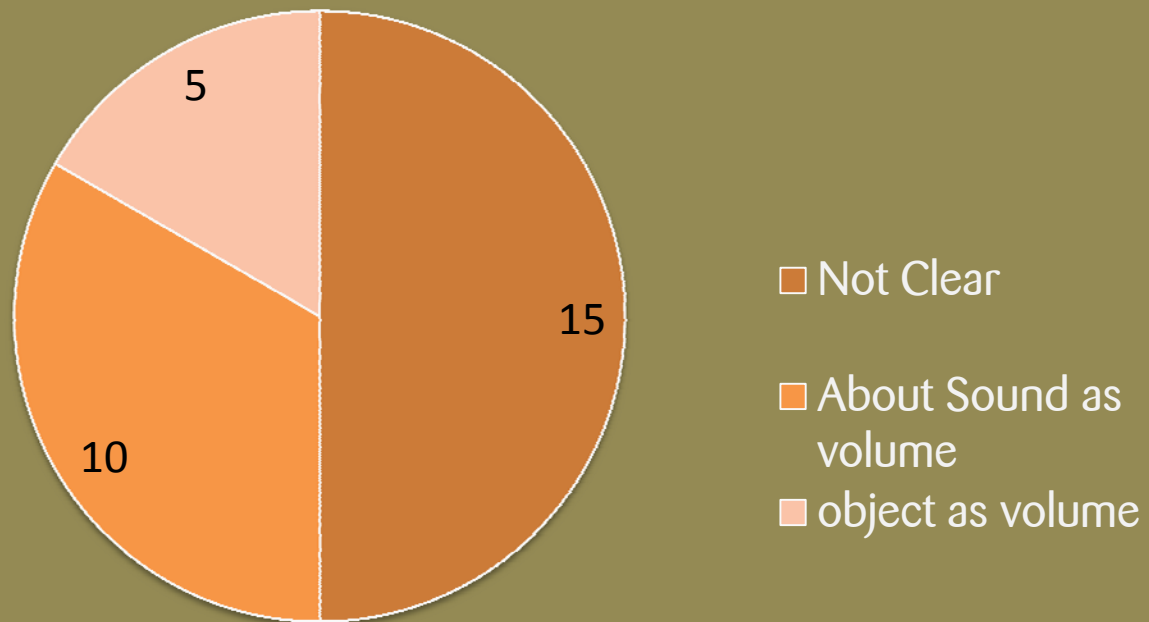
They get confused between the perimeter and area as well as volume and surface area..

They are not able to connect the abstract form of Mathematics with the real-life.

Teachers' opinion...

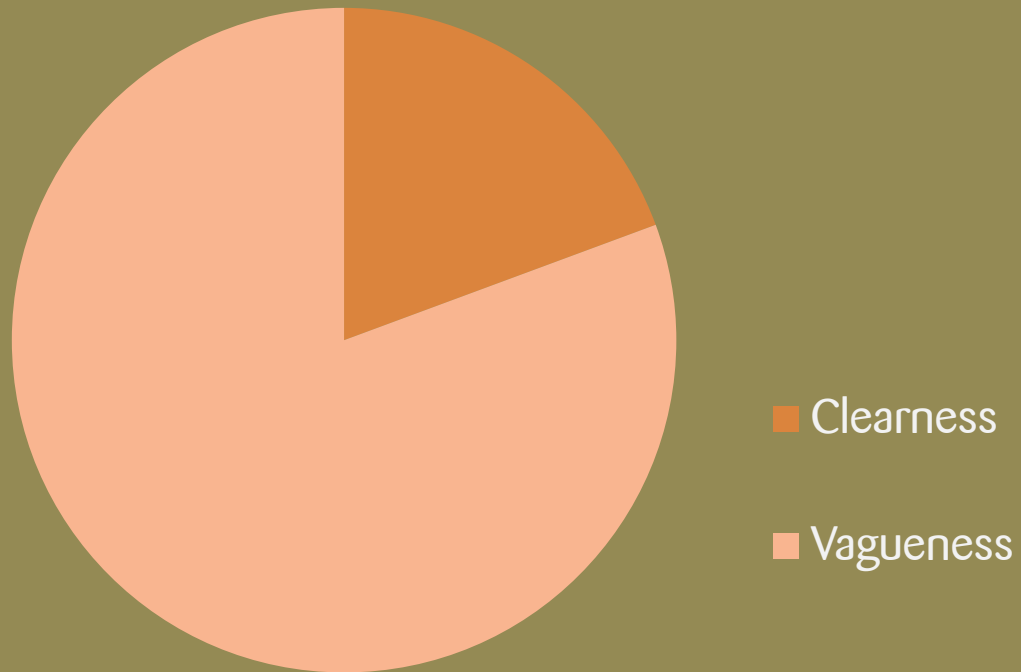
Perceptions of children about volume...

Children and concept of volume



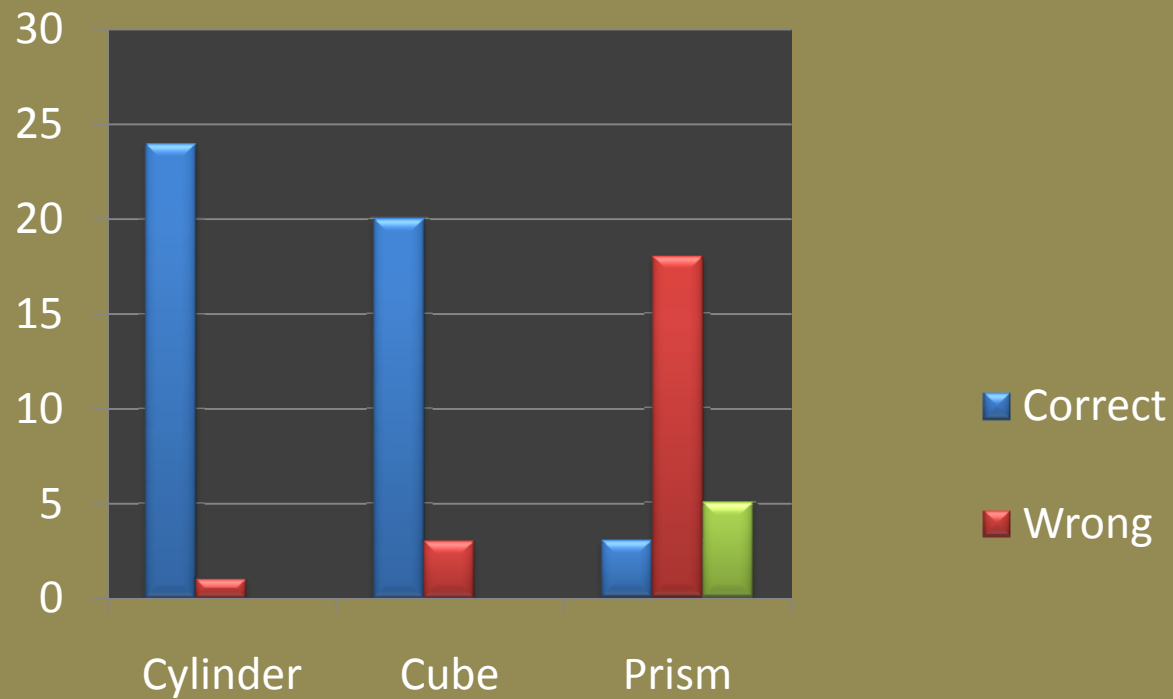
Perceptions of children about volume...

Perceiving the volume in
real life.

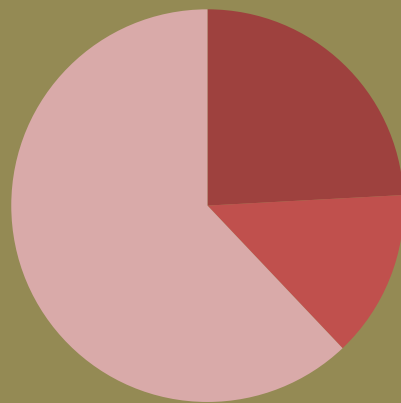


Perceptions of children about volume...

Identification of shapes



Perceptions of children about volume...



■ correct

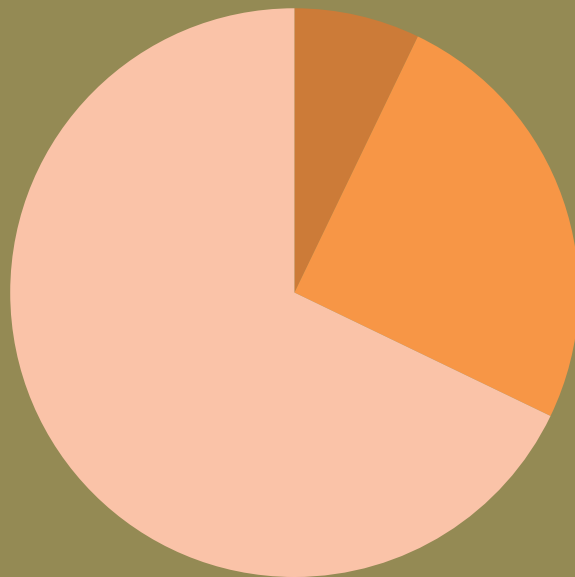
■ wrong

■ not attempted

Given a cylindrical tank, in which situation you will find surface area and in which situation volume?

- a) To find how much it can hold
- b) Number of cement bags required to plaster it
- c) To find the number of smaller tanks that can be filled with water from it.

Perceptions of children about volume...



correct

wrong

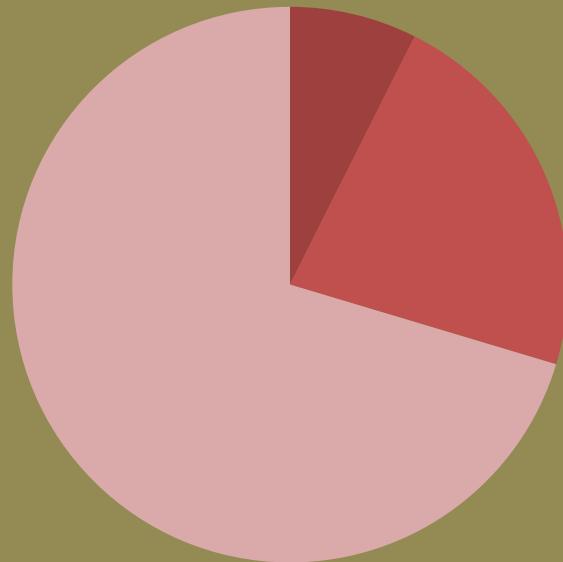
not
attempted

Cylinder A,
diameter= 7cm, height = 14

Cylinder B,
diameter= 14cm, height = 7cm

Whose volume is more?

Perceptions of children about volume...



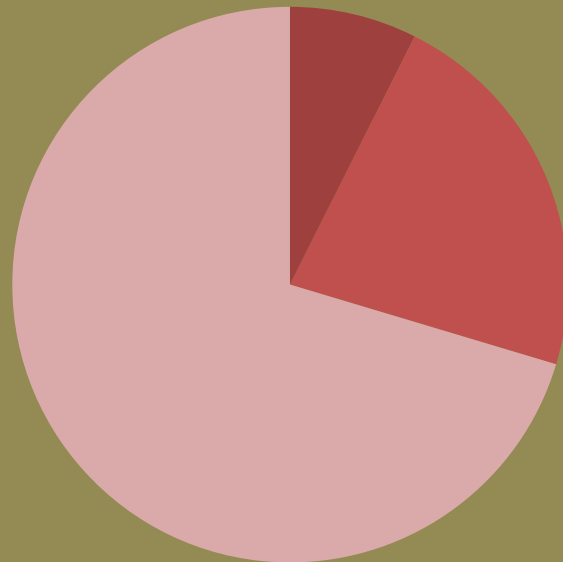
■ correct

■ wrong

■ not
attempted

If each edge of a cube is doubled,
How many times will surface area
increase?
How many times its volume
increase?

Perceptions of children about volume...



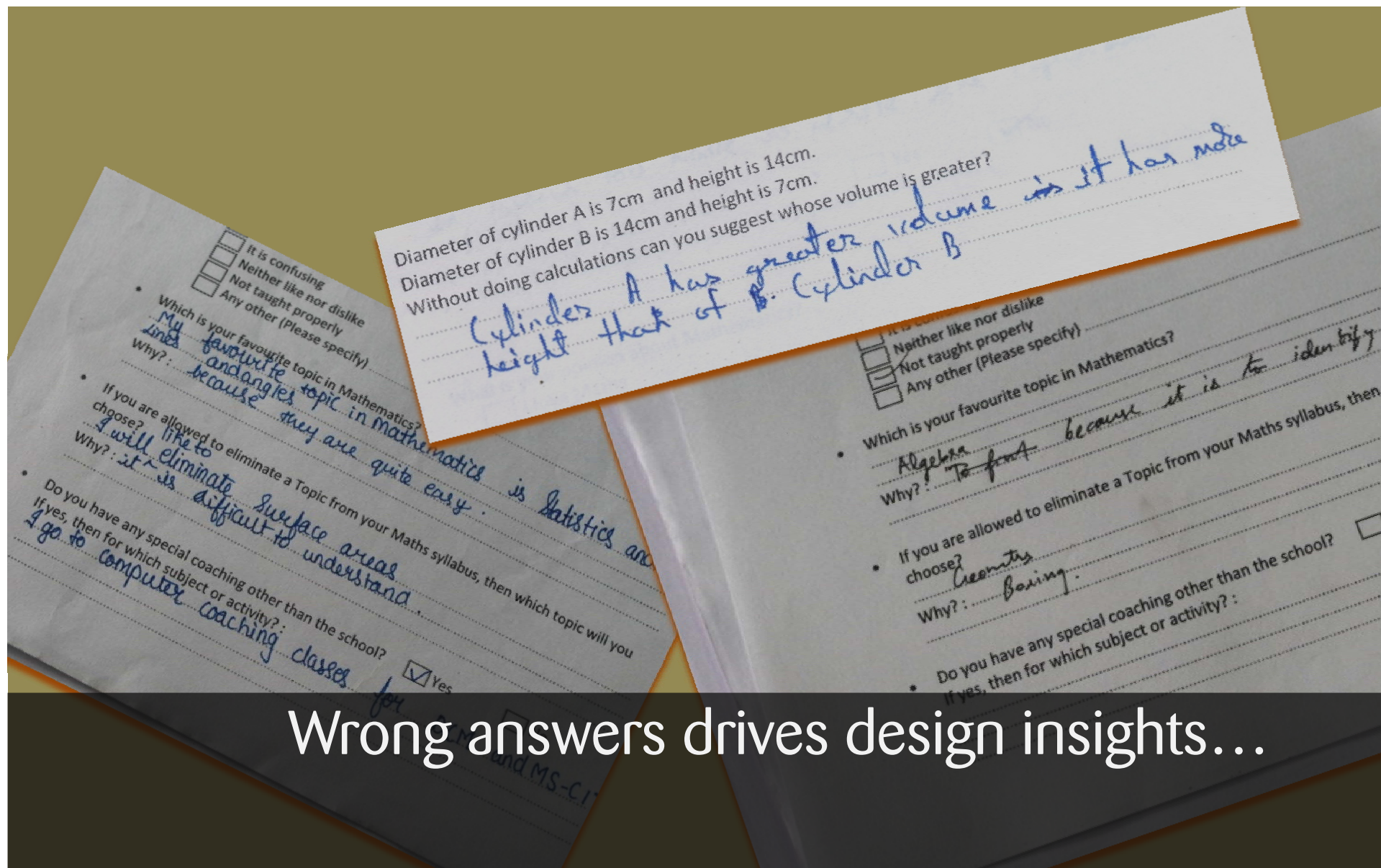
■ correct

■ wrong

■ not attempted

If each edge of a cube is doubled,
How many times will surface area
increase?
How many times its volume
increase?

Perceptions of children about volume...



Wrong answers drives design insights...

The concept of volume is introduced in a very abstract form.

The connection between practical & conceptual volume is very weak.

Due to the absence of experiential learning, visualization of children is limited, which results in poor learning and also the concepts become confusing for them.

Some students who don't know the basics concepts very well, lags behind and even loose interest in studies.

design insights...

need to boost their interest in the learning the concept of volume in more practical way.

It should have a fun Factor

strategy based games and sports,
some challenges to achieve
competitiveness in design.

The perception of volume should be connected
with the logical measurement techniques.

Thus there is an opportunity to develop their visual mensuration sense.

design insights...

TO DESIGN AND DEVELOP
A PLAY AND LEARN KIT
FOR SCHOOL GOING CHILDREN
FOR STANDARD VIITH & VIIITH
WHICH WILL TEACH THEM
THE ABSTRACT CONCEPT OF VOLUME
IN A PLAYFUL MANNER
BY BRIDGING THE GAP BETWEEN PLAYING & LEARNING

Project brief...

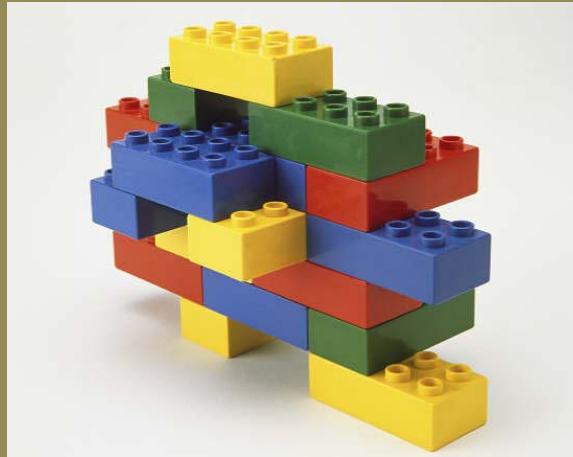
An overlook to the contemporary market
Understanding the current taste and potential of the market

toys
puzzles
educational aid kits and
games

Analyzing contemporary products...



Magnetic
Construction toy



Lego Blocks



Children's factory –
Big Block Set

Toys...

amusement and fun
open for the imagination of the player
fantasy
Experiences



Soma Cube



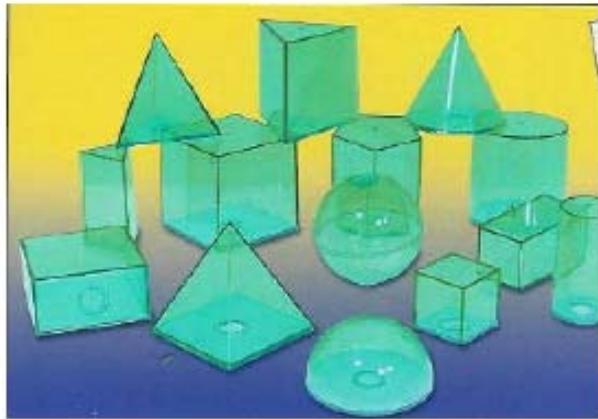
Rubik's Cube



Solid Pentaminoes

Puzzles...

challenge for its user
logical thinking
different experience



View Through-
Geometric Solids



Getting in to solids



Folding geometric shapes

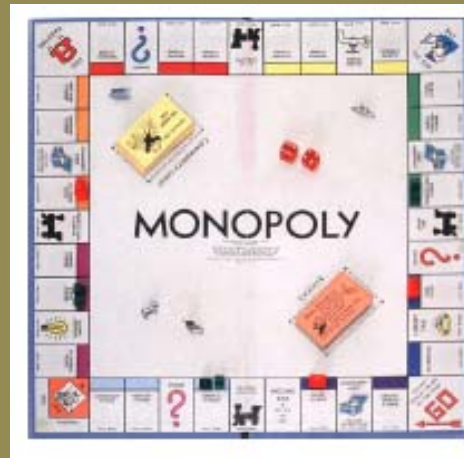
Educational Kits...

Learn
Skill

Focus is on education
need of an instructor.



Snakes and Ladders



Monopoly



Chess

Games...

The play and learn kit would ...

encourage the children to develop the skills required
for the perception of the volume

for that it will use the platform of the strategy games

The learning will build their tacit knowledge and the perception

The competitive spirit of the game will boost the understanding of the concept

There would be some chance factor which will add drama and surprises.

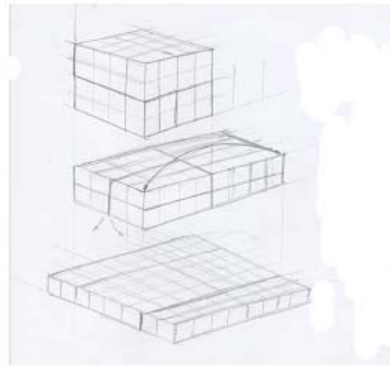
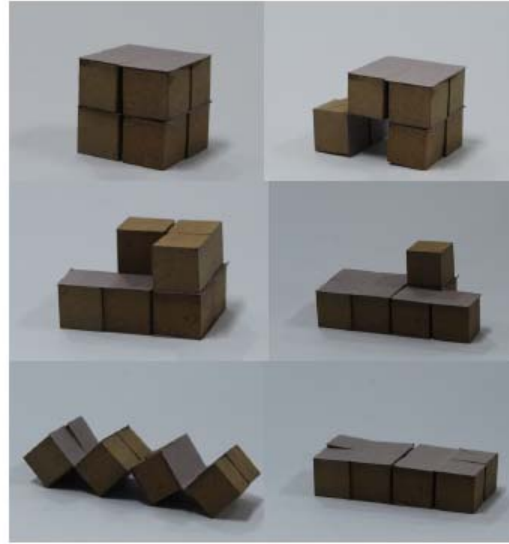
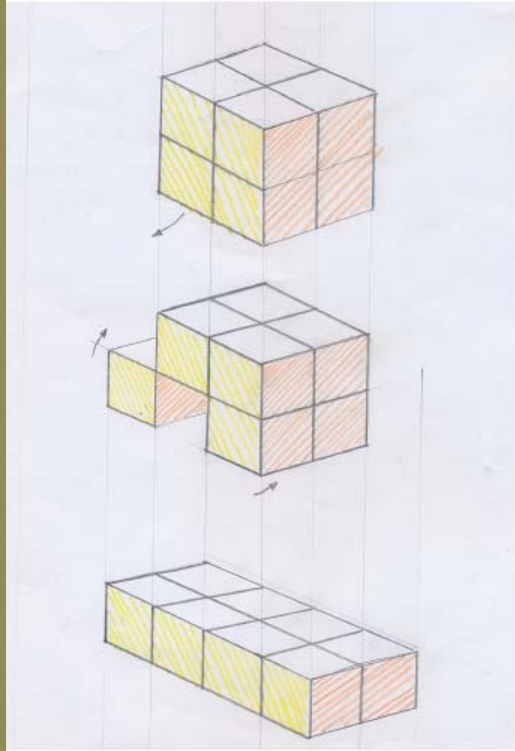
Thus the child would like to play this game again and again.

Product positioning...

Keywords for explorations:

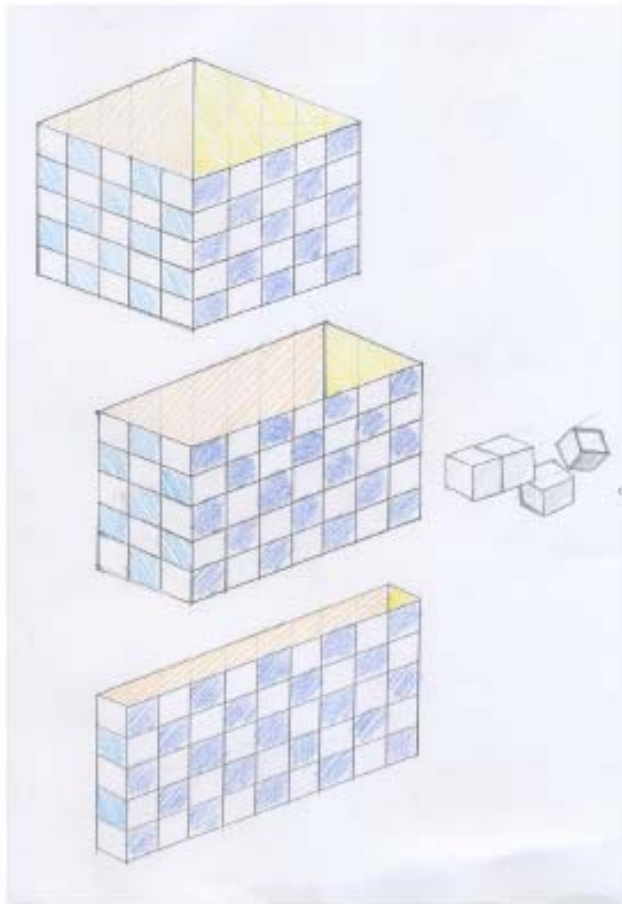
- a) Perception of the volume and actual measure
- b) The manipulation of volume
- c) Change in the form, with constant volume
- d) Real life problems
- e) Experiencing volume
- f) Transfer and comparison of quantity

Explorations



Idea: A
Hinged elements of
cube

Explorations



Idea: B
elements of cube

Explorations



Idea: C
Development

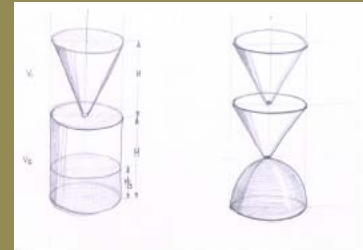


Fig.:



Fig.:



Idea: D
Volume transfer

Explorations

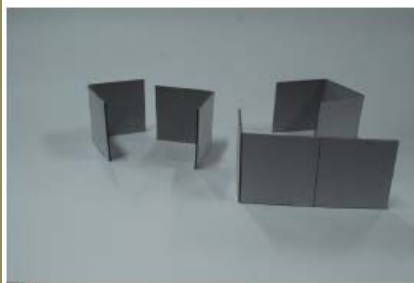


Fig:



Fig:

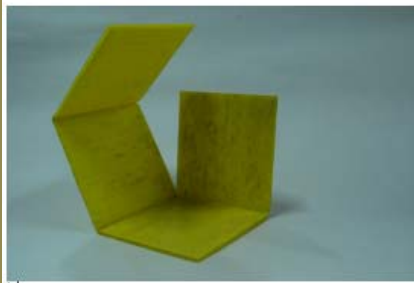


Fig:

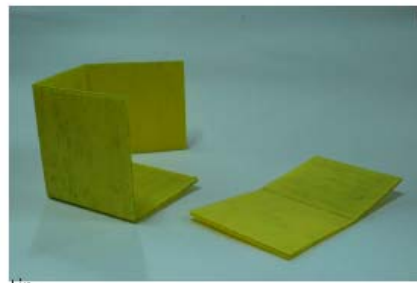
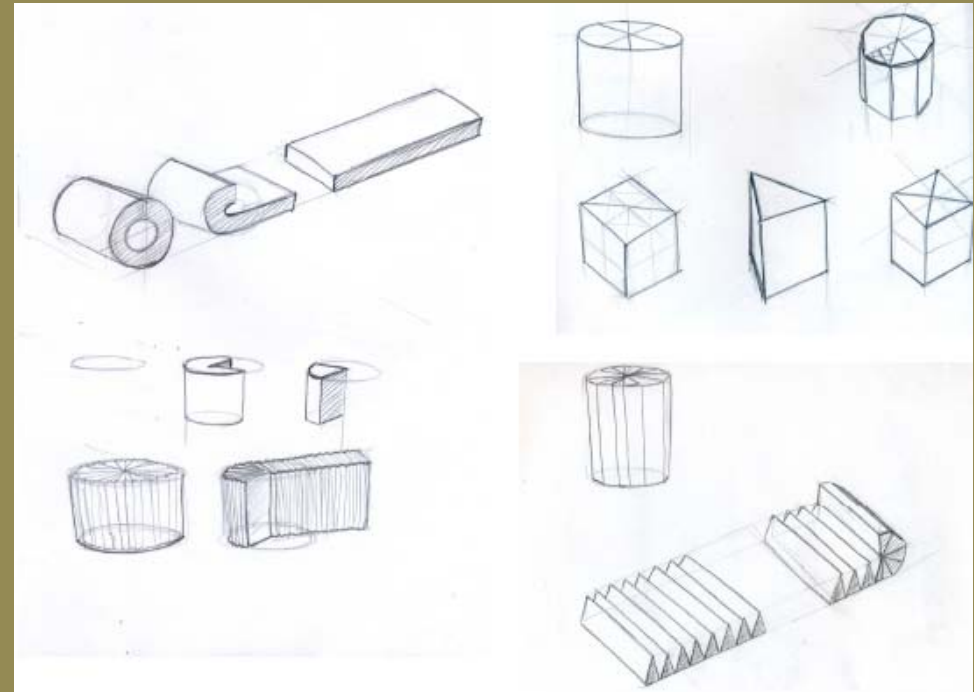
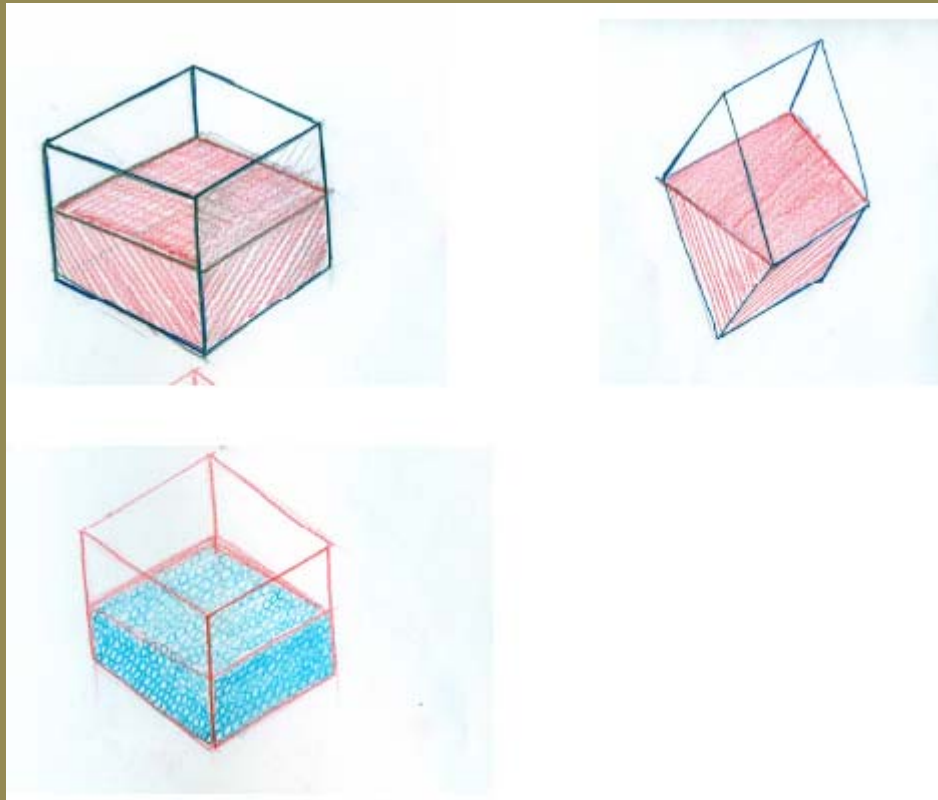


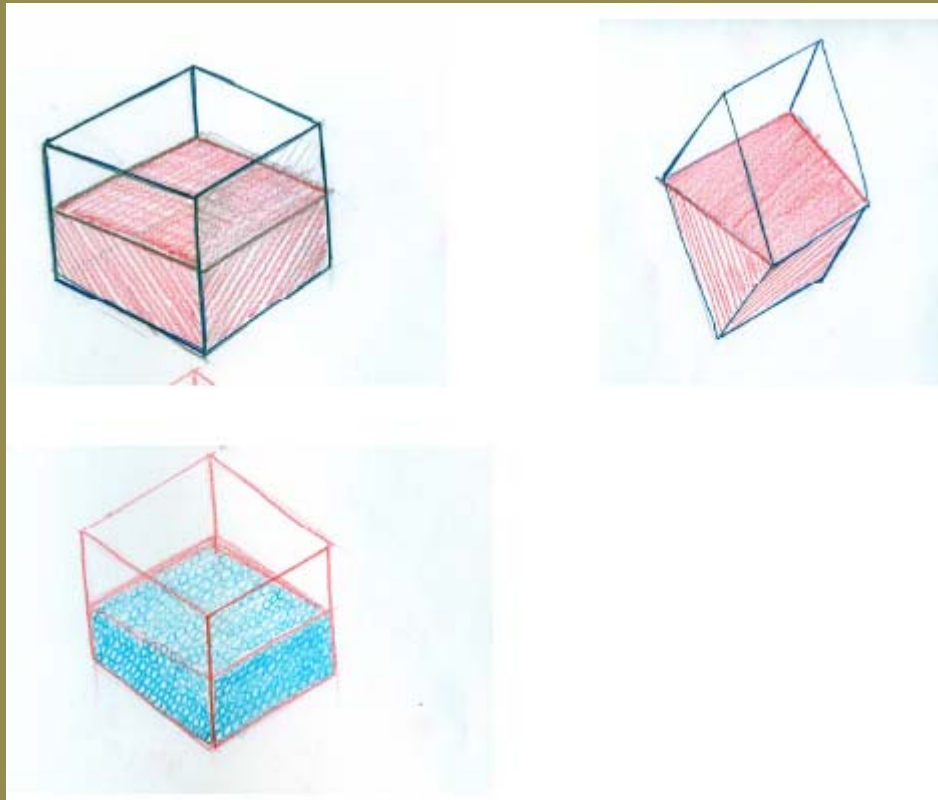
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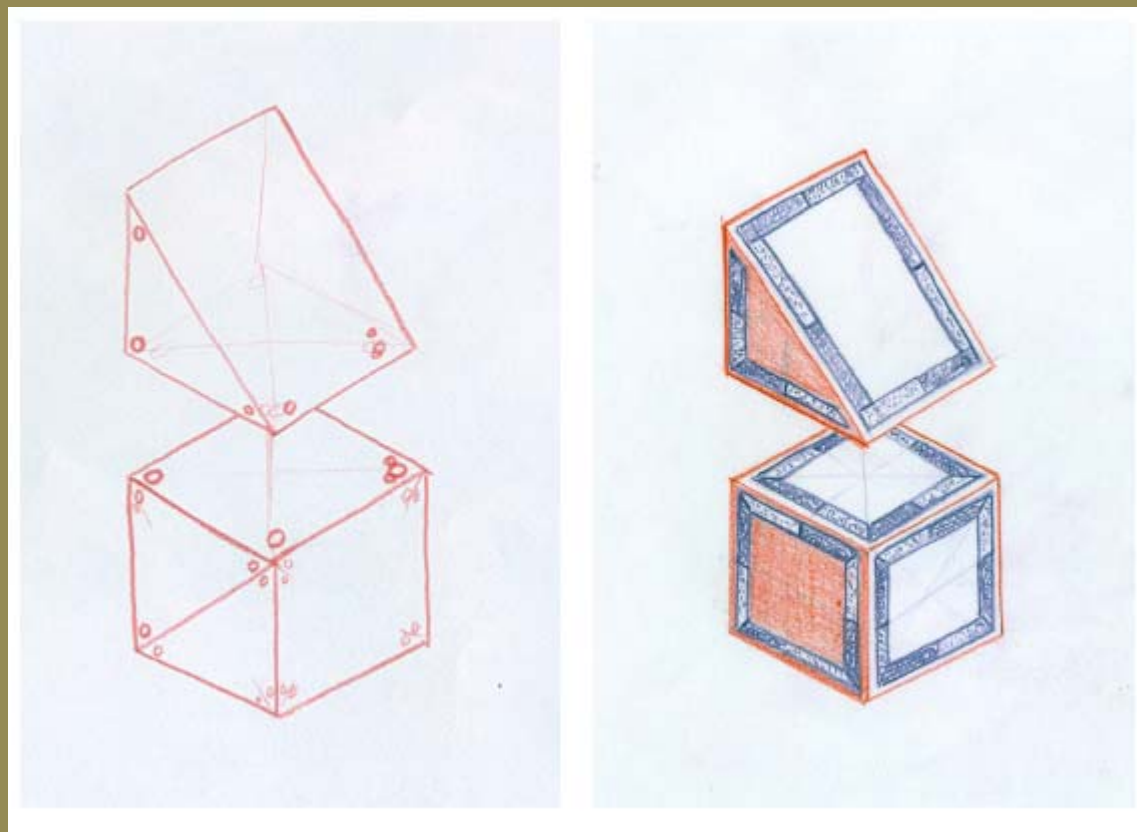
Explorations



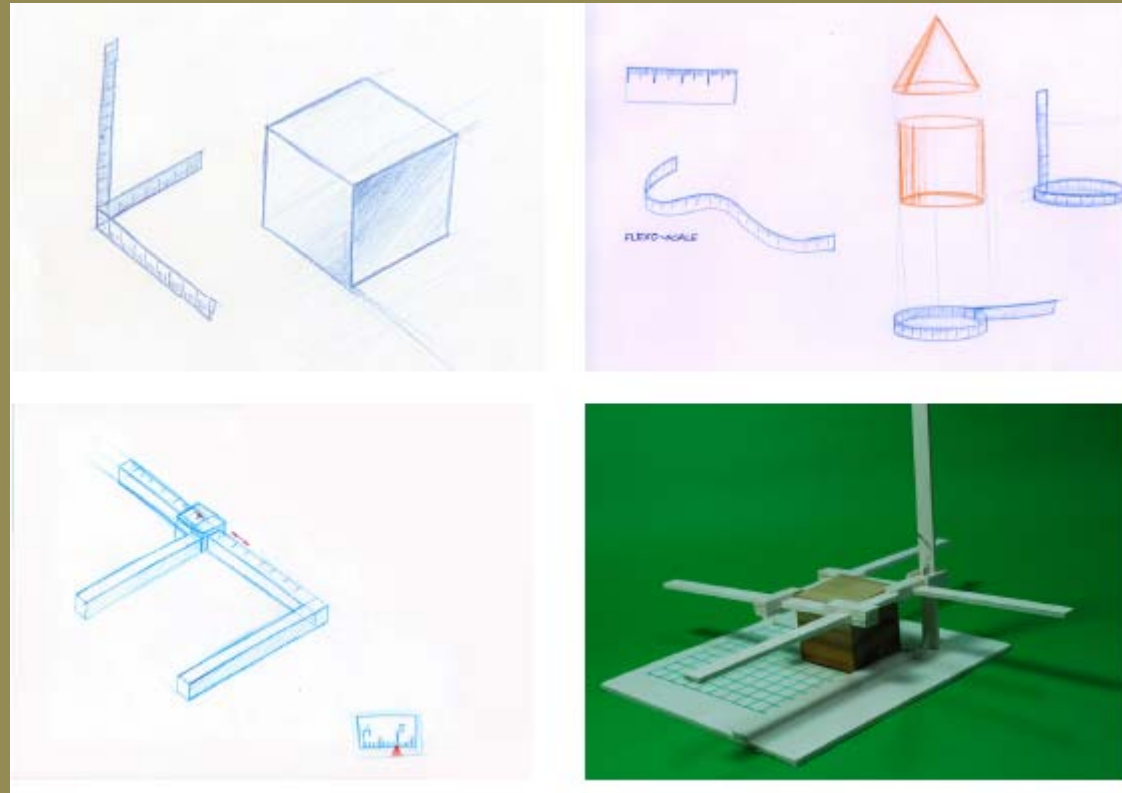
Explorations



Explorations



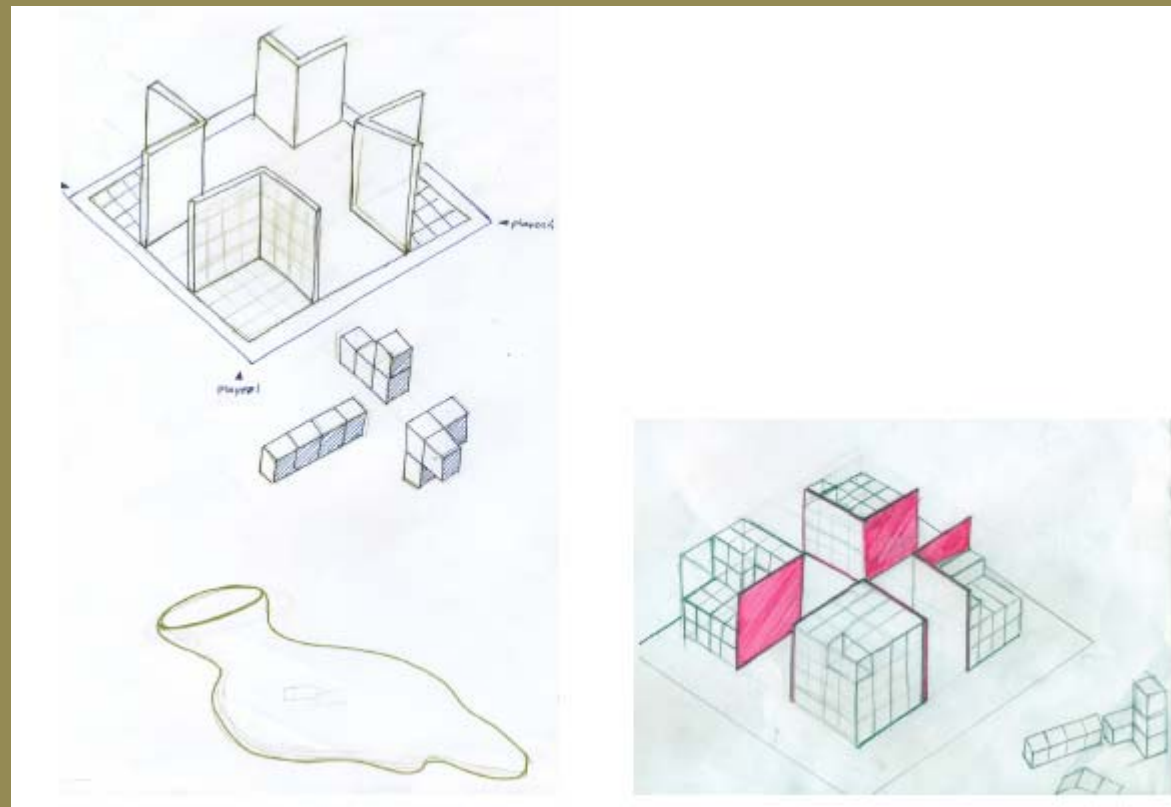
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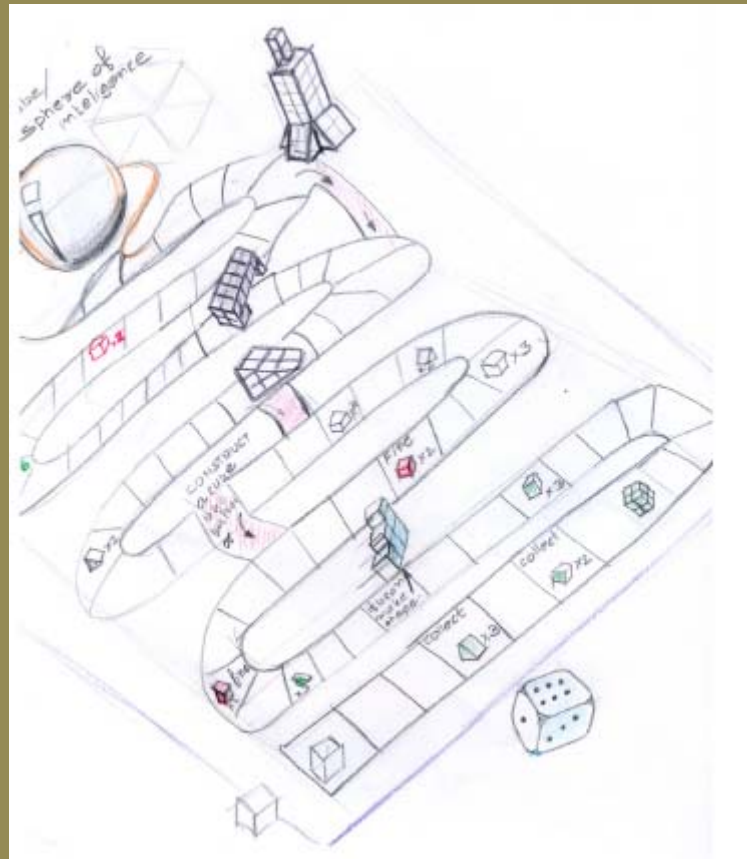
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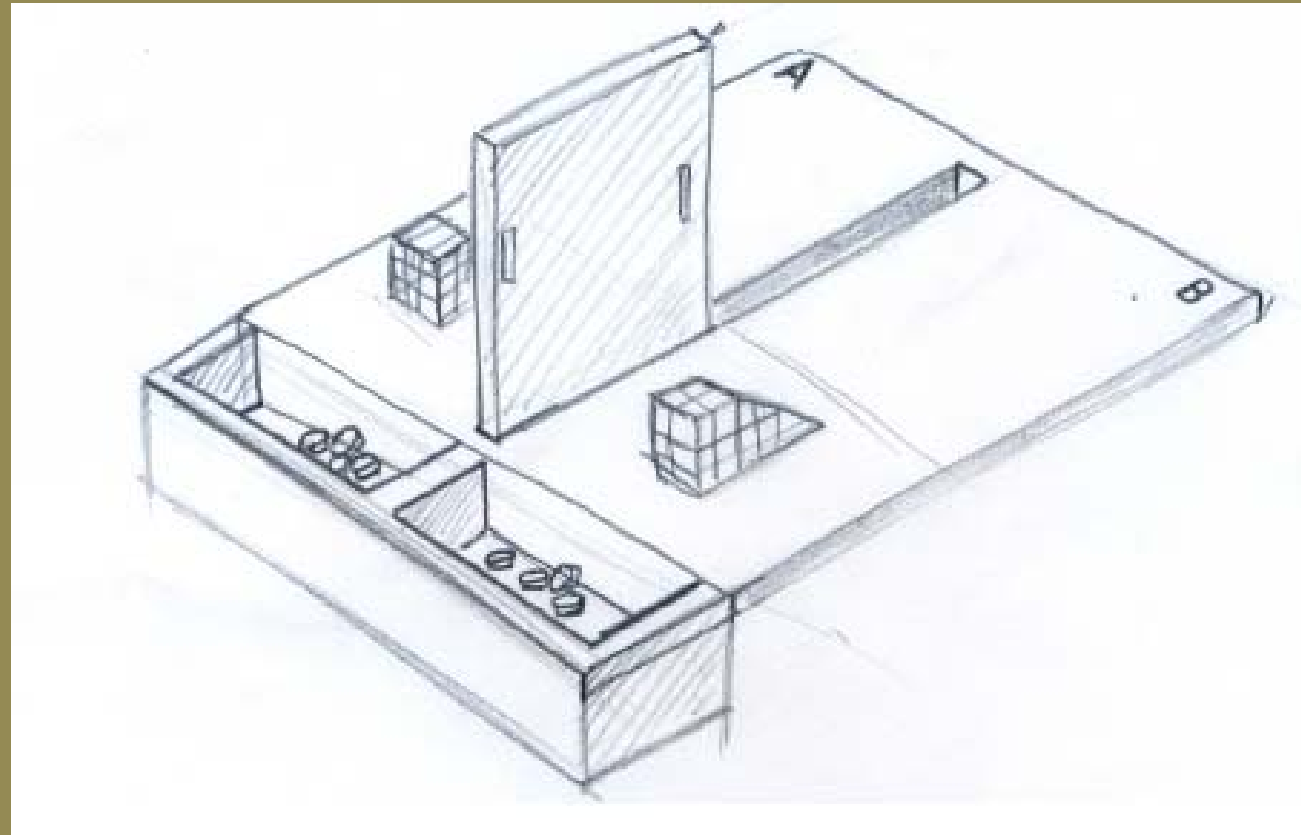
Explorations:
Stories and games



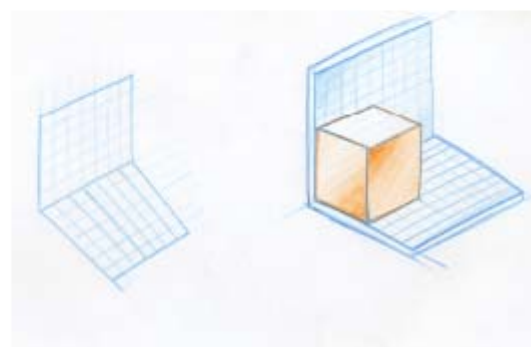
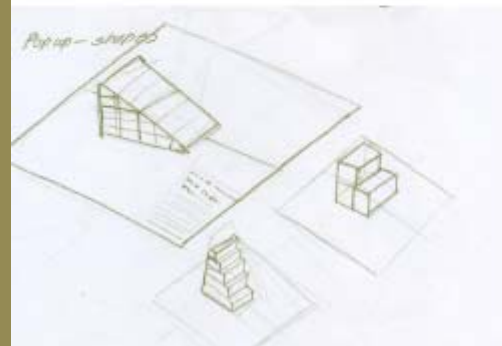
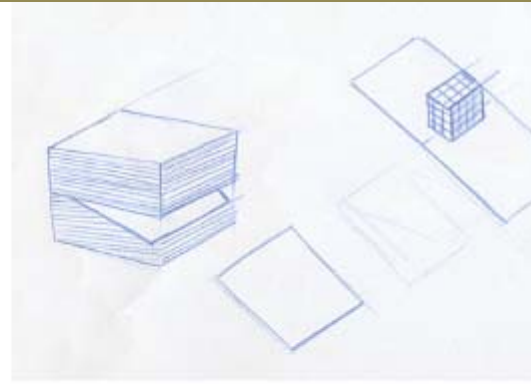
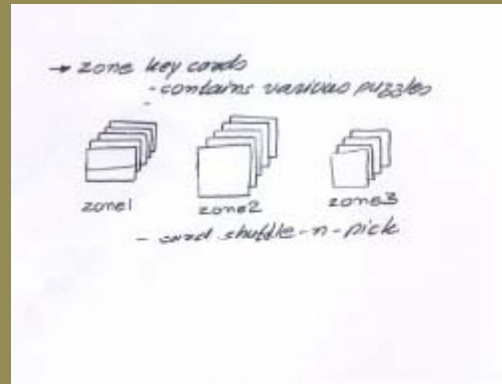
Explorations



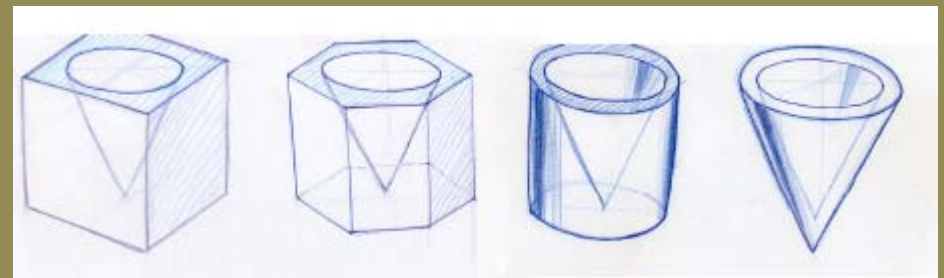
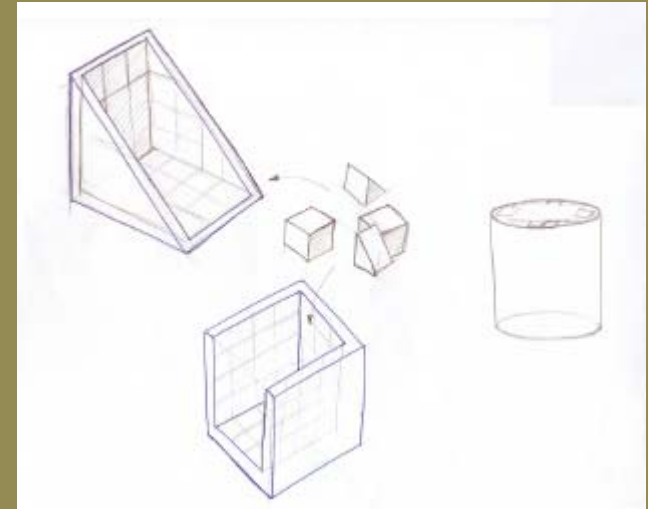
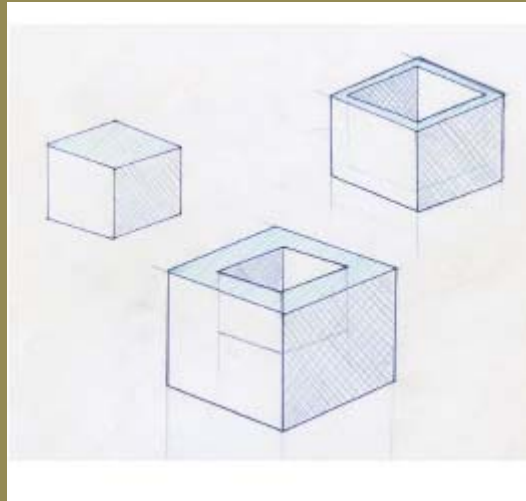
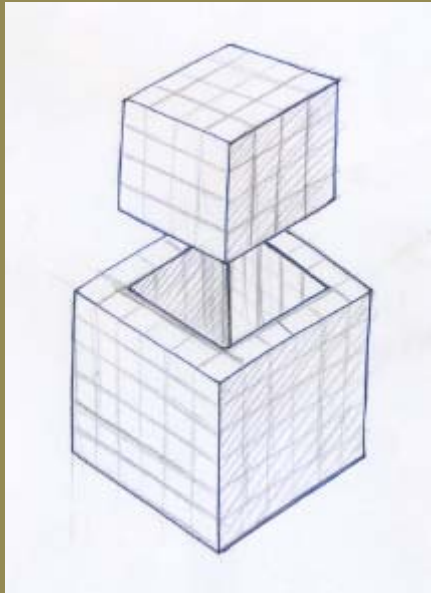
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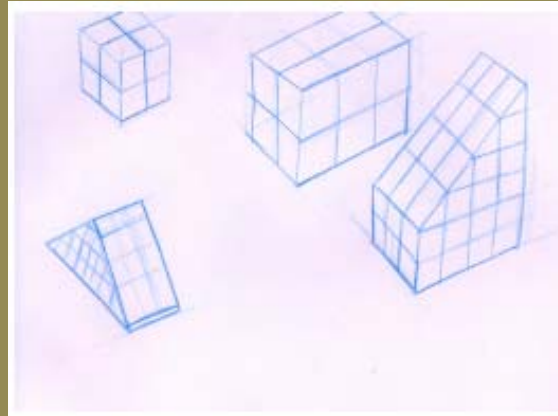
Explorations



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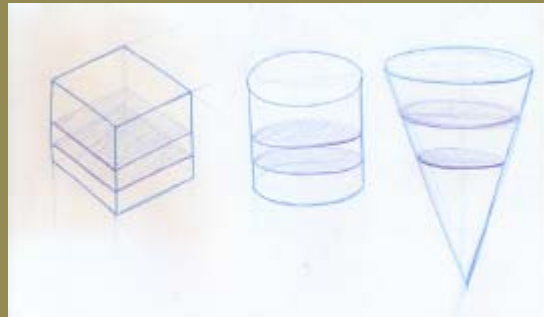
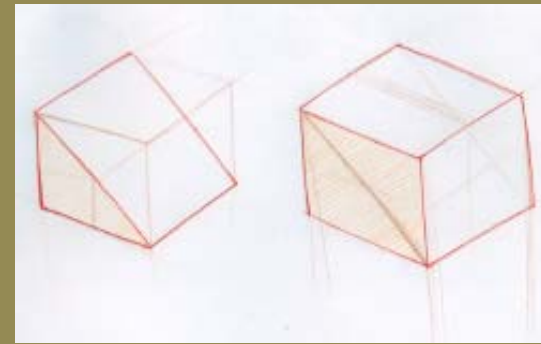
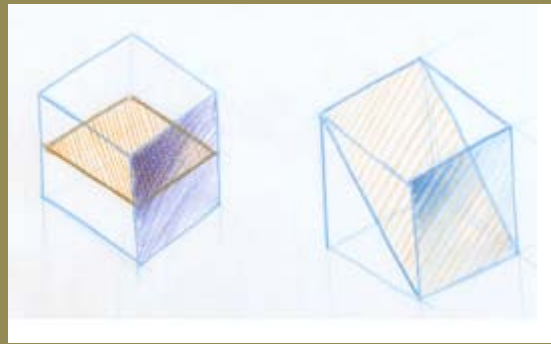
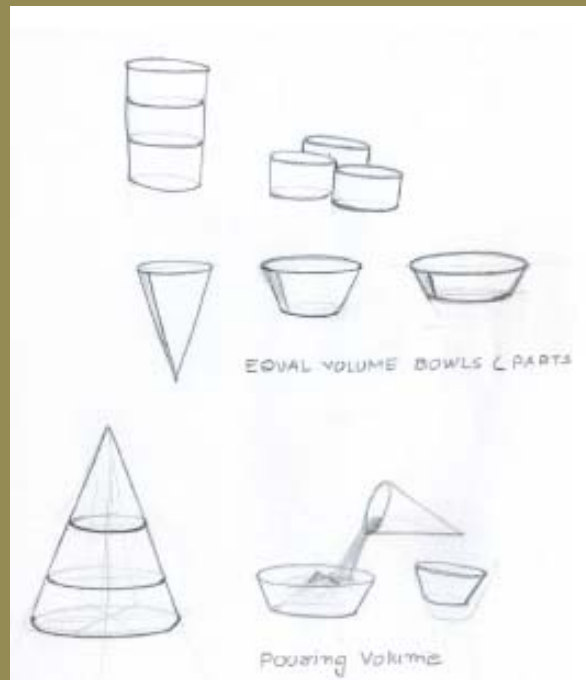


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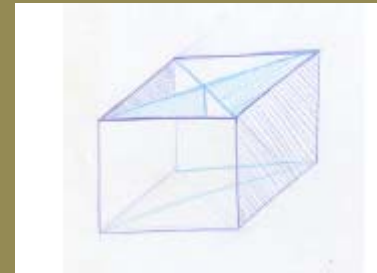
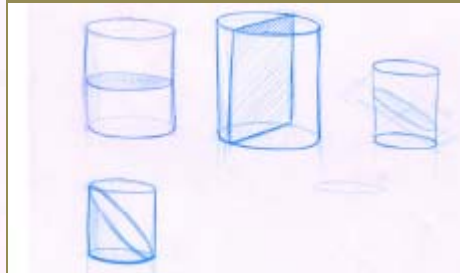
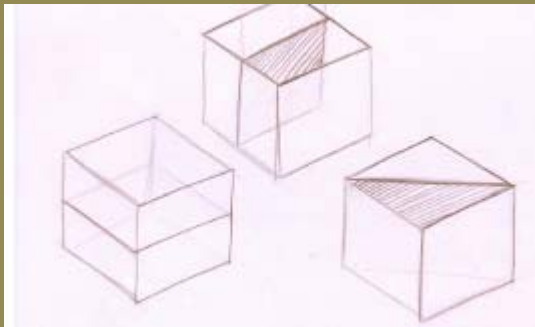
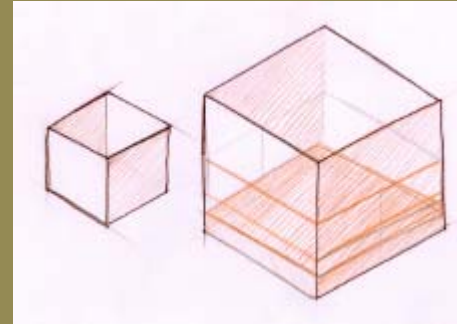
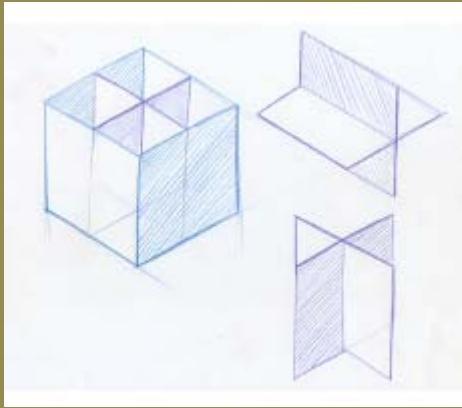


Volume :
Comparison and perception

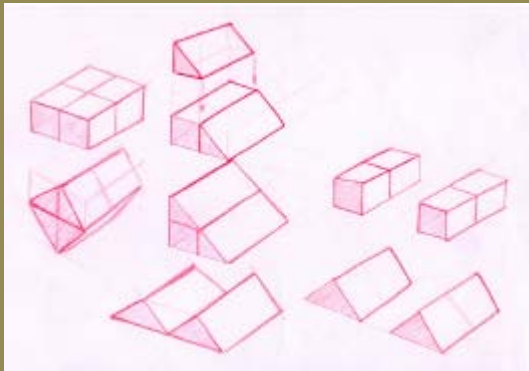
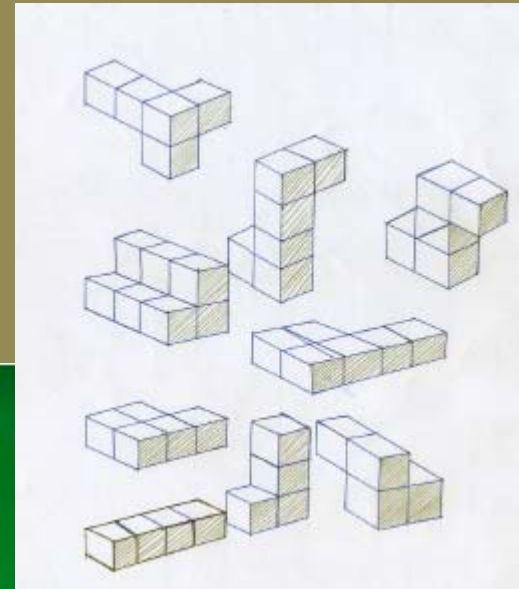
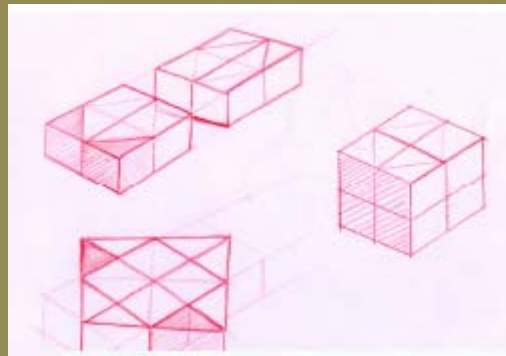
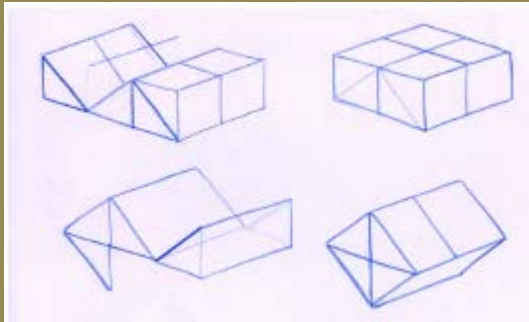
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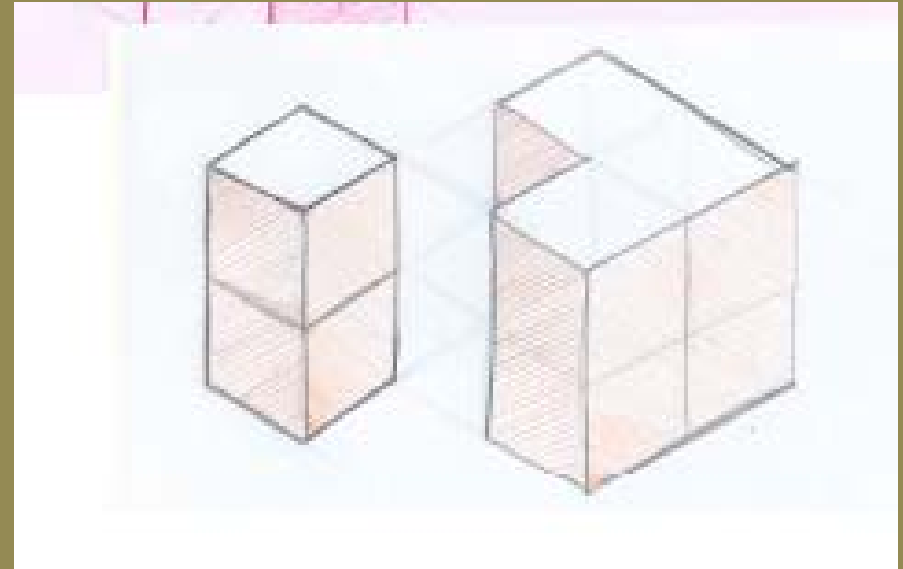
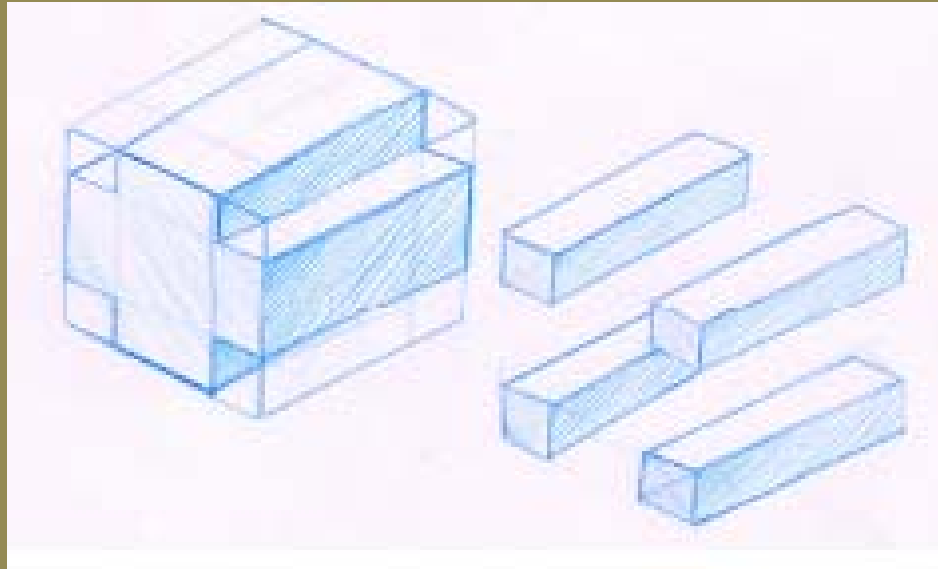
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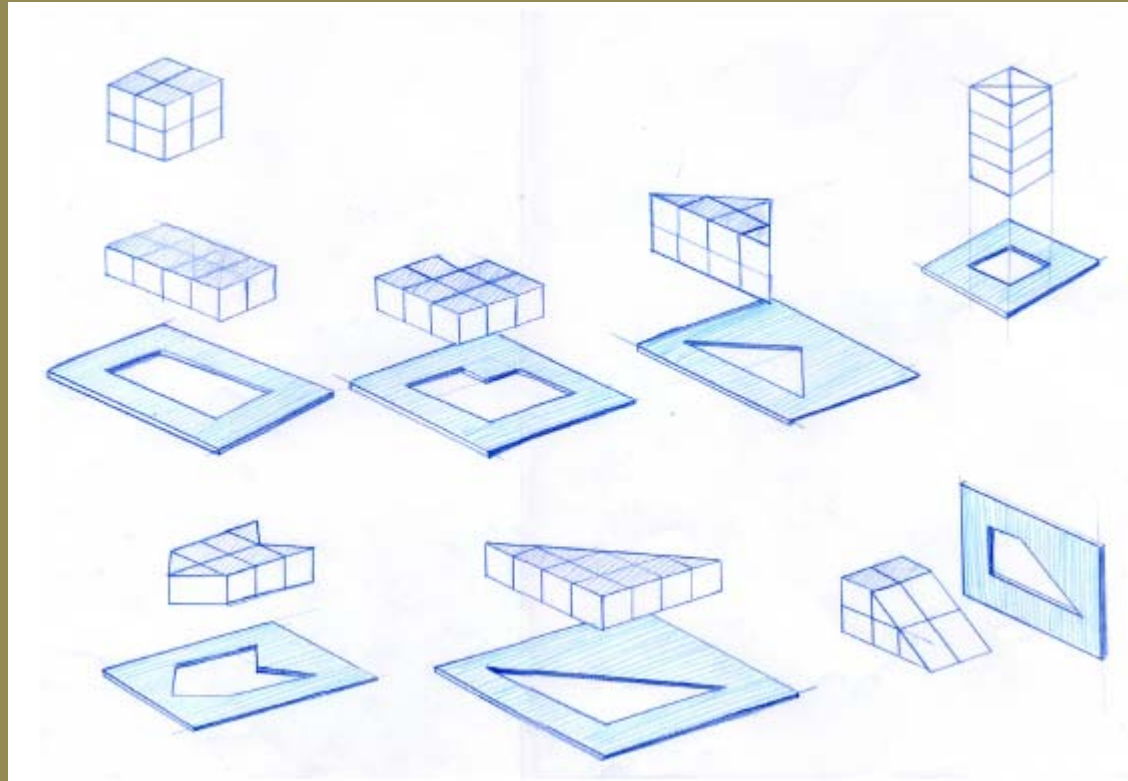
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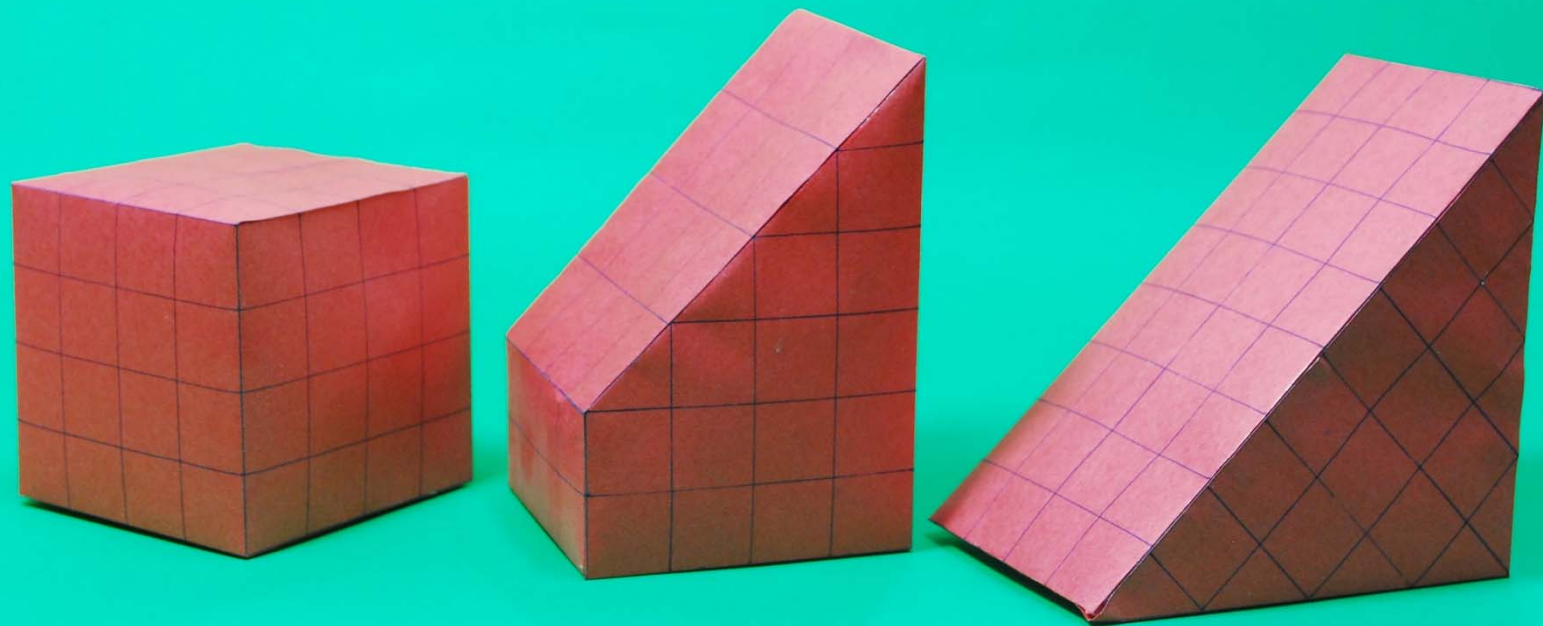


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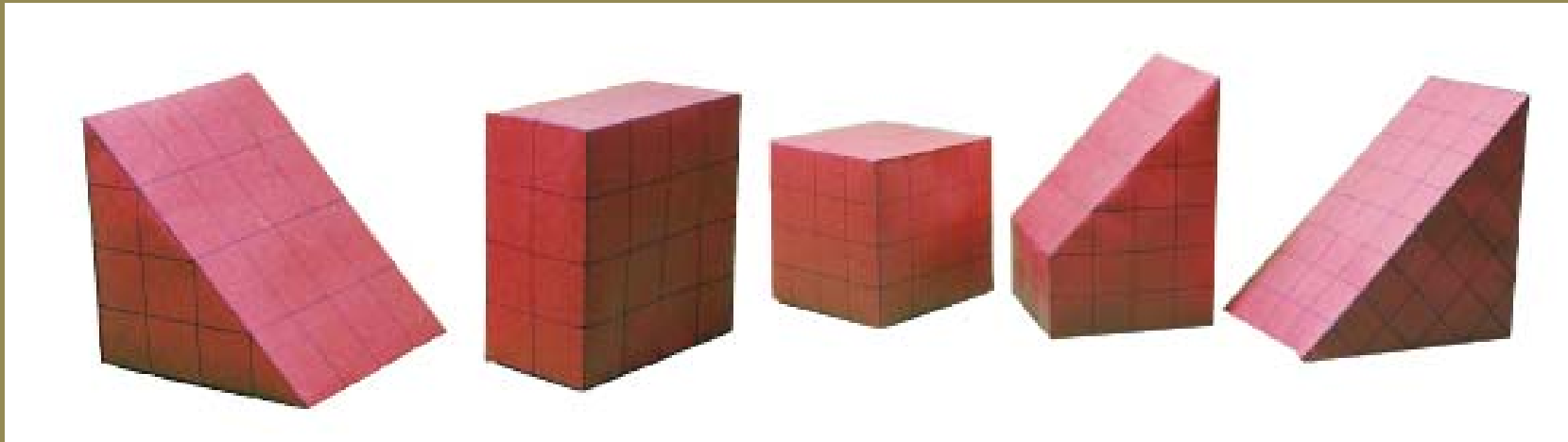
Explorations

The different forms, having volume same



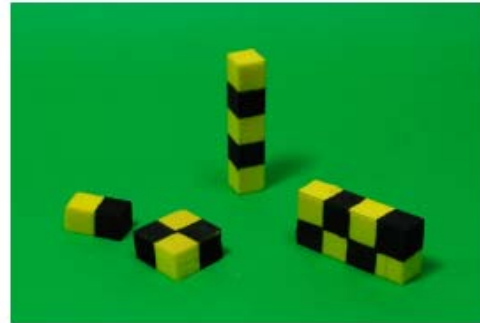
Explorations

Volume and Perception



Explorations

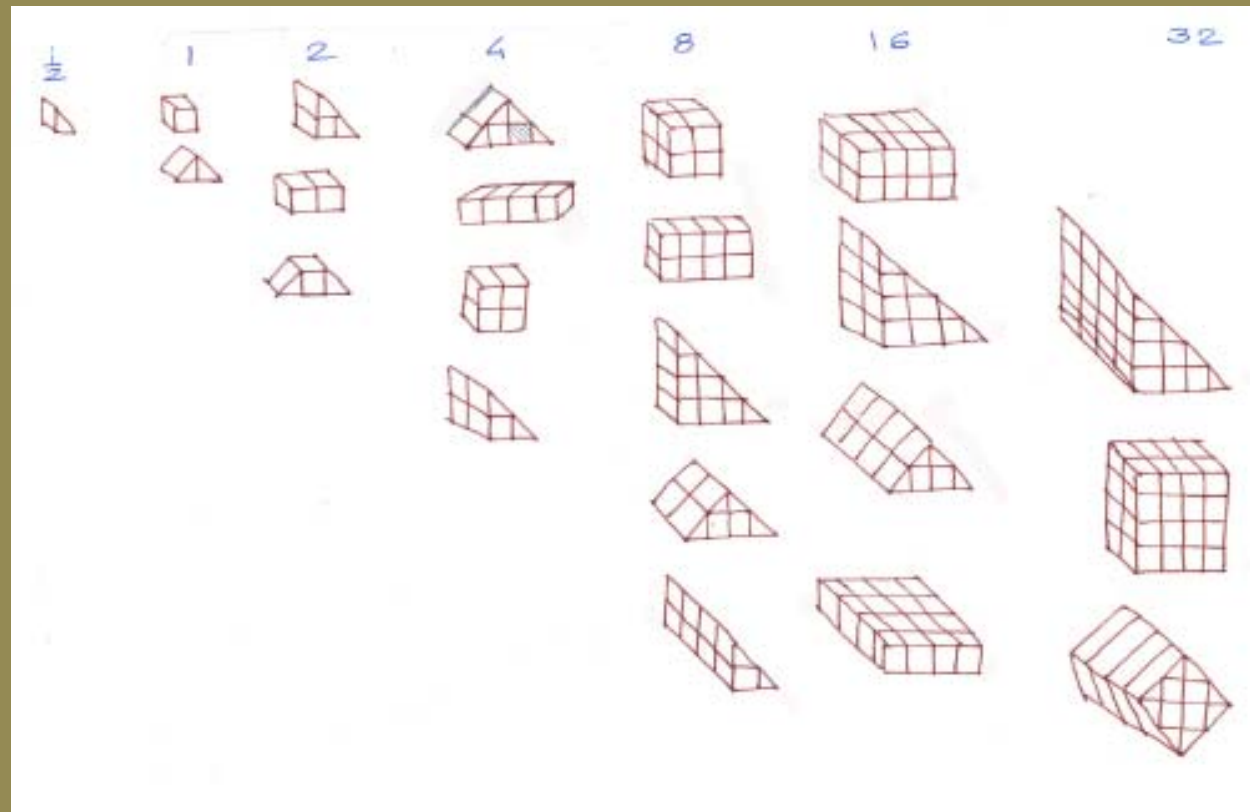
Volume and Perception



Explorations



Explorations



Explorations



Aim:

To win the treasures boxes as many as possible.

To start:

With 2 to 4 player it is recommended to play the game, among the total players 1 player will act as a 'guardian of the treasures'

Place the board on a flat surface.

The guardian of the treasures will arrange all the 'treasure blocks' according to their value and shape.

He/she will also arrange the 'treasure boxes'

Concept A:

Playing the game:

The game is played with two dies viz. 'Value die' and 'Form die' Throw the both dice together. The value (number) comes on the value dice and the 'form' comes on the 'form die' will determine together, which treasure blocks you will get. Place the block on the area provided for you on the board.

Thus by the rotation, each play get a chance to play.

Player have to form a shape of value 64. Once player forms that shape. He/she can demand a treasure box from the guardian of the treasures. The size of the form of treasure blocks should match to that of treasure box. There are only seven containers for all.

Thus a player, who has maximum treasures boxes, will be the winner.

The treasure blocks left with the each player, are counted and noted in a chart as a record. At the end of the game, the sum of points is to be made; the player who score minimum will be the winner

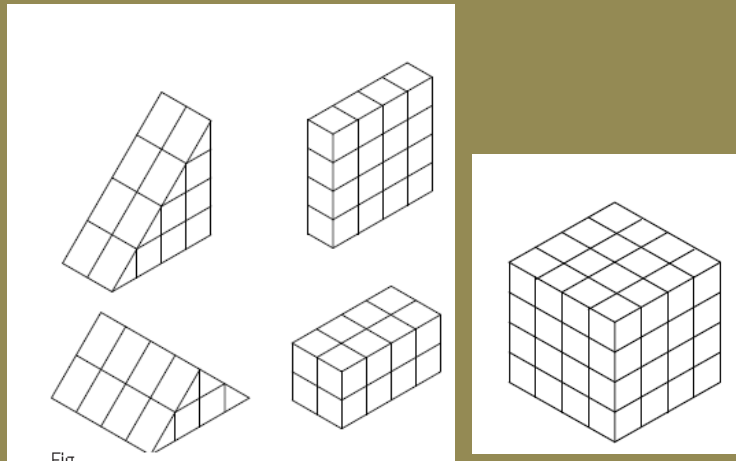


Fig.

Aim:

To acquire maximum volume

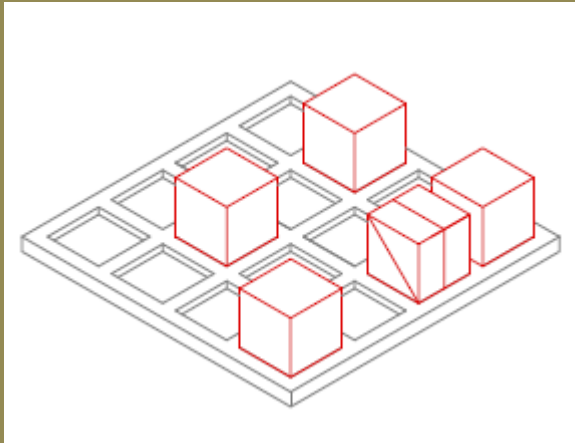
To start:

With 2 players it is recommended to play the game
Place the board on a flat surface.

There are four types of elementary blocks which are
the 4th part of the cube. These blocks are as shown
in fig.

These blocks are distributed to each player such that
each player should get eight numbers of each block.
Thus each player will have 32 blocks with him/her.

Concept B:



Playing the game:

The player should start playing by placing a block in the square area of the board.

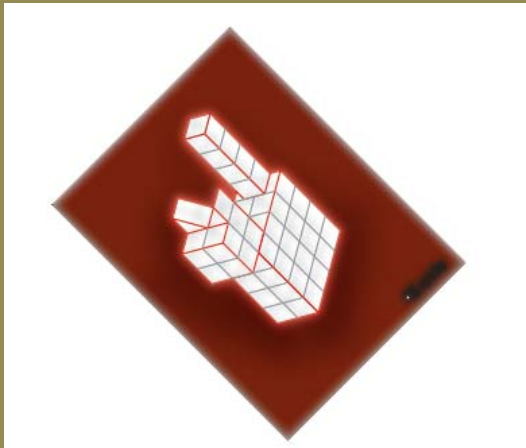
The first move can be anywhere on the board. Now its second player's turn, he can place the block either in same area or any adjacent area.

This way the game continues.

The player should try to complete the cubes, whosoever completes the cube by placing a block in it, will acquire that cube. As a reward he gets an additional chance to place a block.

The player, who has maximum number of cubes, wins the game.

The game can be continued with the number of blocks every player has, winned from the last game.



Aim:

To create the forms of elements referring the images

To start:

Single player or more players

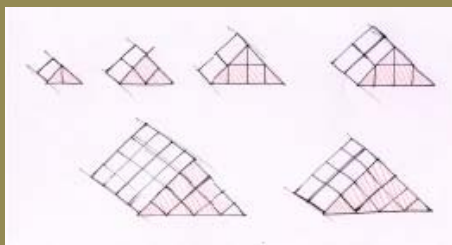
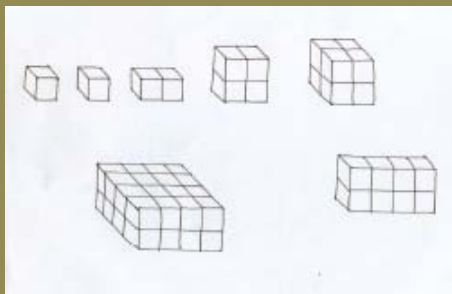
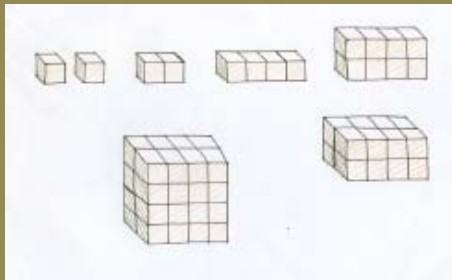
Place the board on a flat surface.

The set of cards should be shuffled and placed in to the centre of the board.

There are 2 sets of elements; each player will get 1 sets of each.

.

Concept C:



Playing the game:

Each player will pick a card from the stack of cards.

Each card contains an image of a particular combination of elements. The image is a representation of a thing. The total volume of the each combination is also provided on card.

Now the player should start arranging those elements to form the desired image on the card. The player's imagination and spatial thinking will increase with this toy.

The player are encouraged further to develop their own shapes fro combinations and they can also make the cards to represent the same. For that the card will contain the grid pattern to guide. So following this grid pattern the child would create his own world of fantasies



The concept B is developed further..

By providing story as a base for the game,
To create more interest in the game.

Concept development...

The stories:

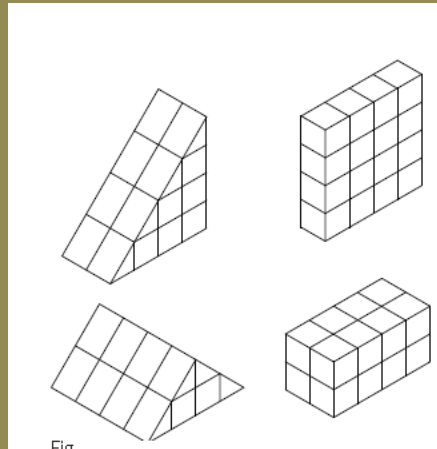
A sorcerer kidnaps eight princess

The property war

The Four element and the space creation

Strategy of oil company

Concept development...



The development of element blocks:

The chosen elements are the fourth part of cube
($4\text{cm} \times 4\text{cm} \times 4\text{cm}$)

All four elements are equal in volume (16cm^3)

The grid pattern marked on the surfaces of each block, helps in counting the volume of that block, in cubes and half cubes.

Concept development...

Manufacturing

These elements are manufactured from

Rubber wood or Pine wood

They are further processed with natural dyeing method to get the different colours.

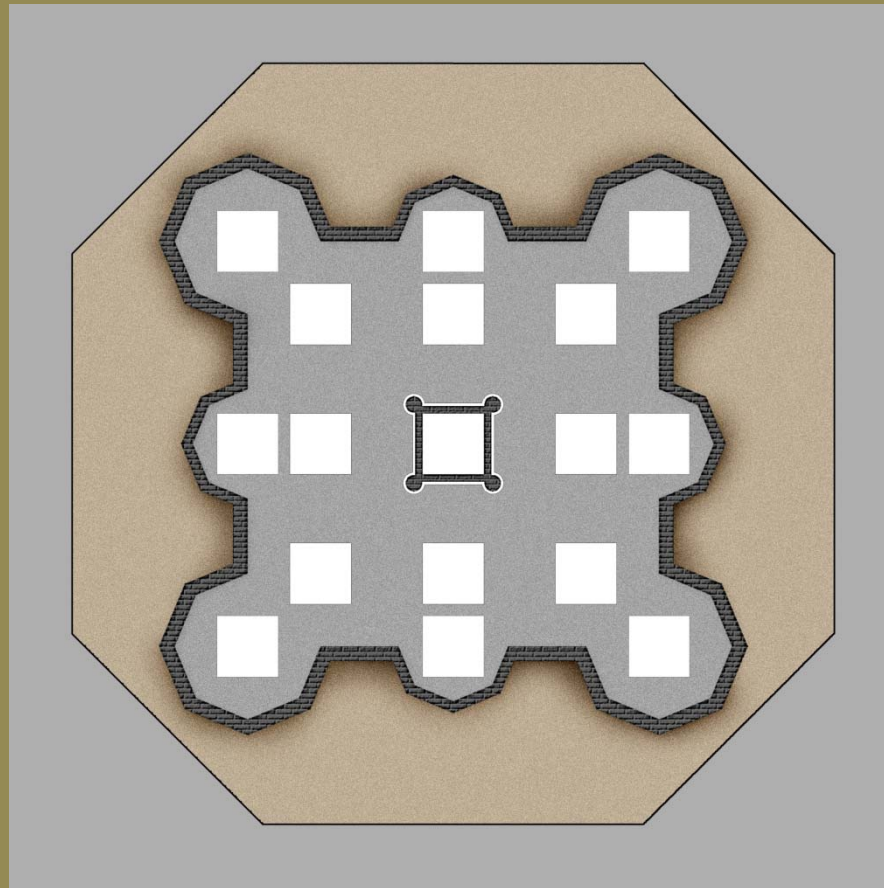
A protective coat of lacquer or melamine is applied for increasing lifespan of elements.



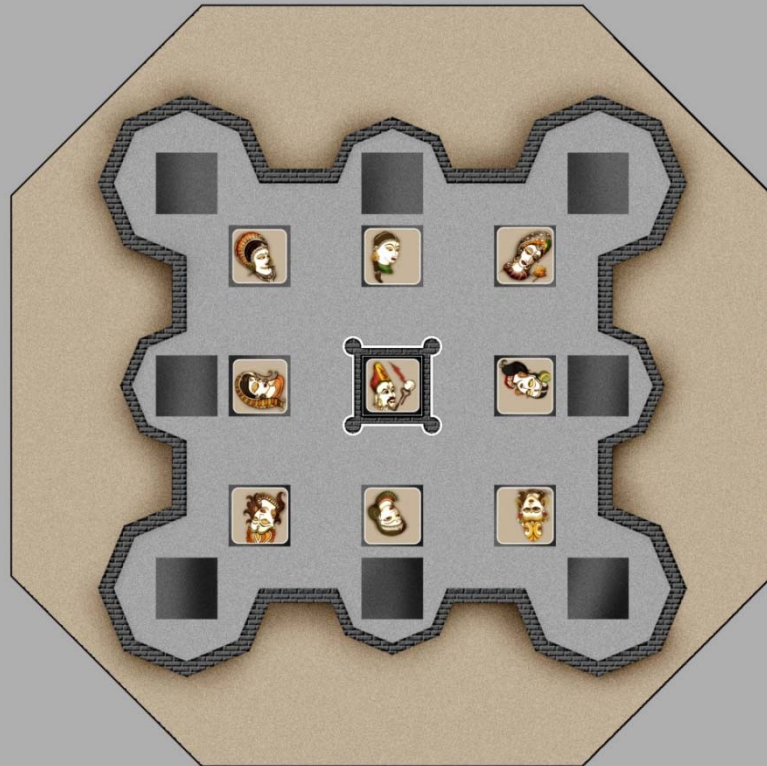
Natural Dyeing

The natural dyeing method is traditional and used for dyeing cloth, wool, cotton and bamboo. The substances like Manjistha, harda, indigo, turmeric, tea leaves, cutch tree, harda, jungle yellow, alta and cow urine are basically used for dyeing purpose.

IDC, IIT Bombay, had carried out research and development in the area of colouring Bamboo strips with natural dyes, this project is headed by Prof A.G. Rao. The same work is referred for natural dyeing process.



Basic layout of game board...



The board game :

Aim:

To rescue all the 8 princess and defeat the sorcerer.

To rescue princess, the player has to complete the cube. Who so ever completes the cube, can set the princess free.

After rescuing all the princess the sorcerer need to be defeated, by forming a cube.

The player will get 1 cube point for princess, and 2 cube points for defeating sorcerer. Who so have max points, will win the game

After playing ...



Evaluation of game:

The game is played and following points are observed;

The story and visuals doesn't go with contemporary life style.

The game becomes logically predictive.
There is need to have some 'chance' which will create fun.

The development continues...

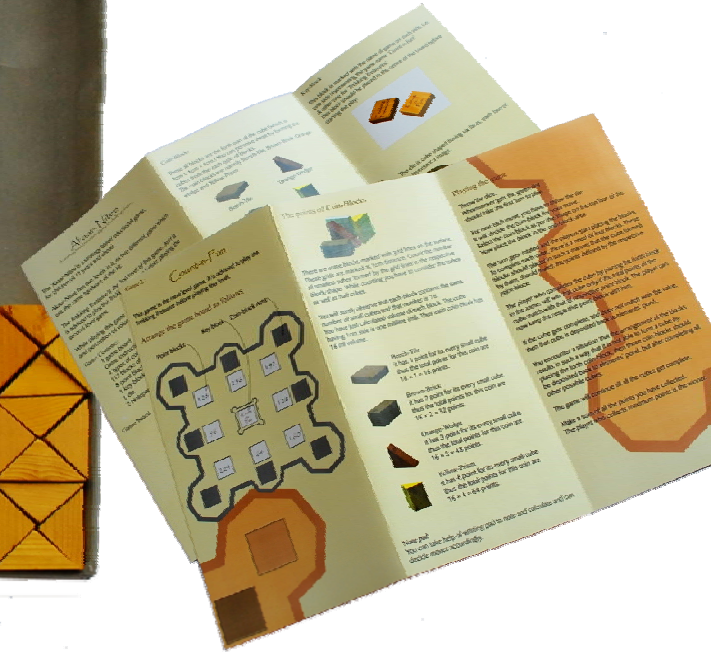
AkaarNitee

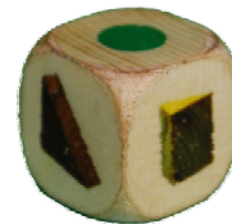
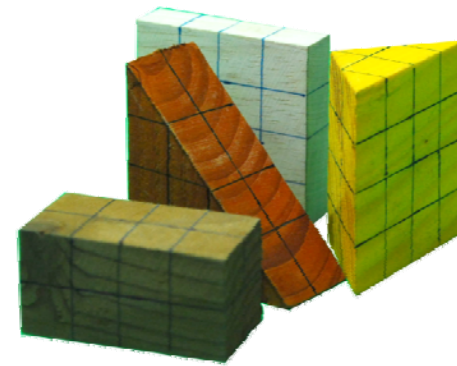
A strategy based educational game

designed for Secondary School Children
age group : 12 & 13 years

playing with this kit the children will develop their
spatial thinking and learn the concept of volume
tacitly







AkaarNitee

a strategy based educational game

Two levels

Trekking Treasure

Count-n-Fun

Chance based strategy

Complex level intellectual strategy

Nitec
Strategy based educational game.
Two levels in it, as two different game which
hardware of the kit.

ing treasure is the first level of this game. And it
to play the tricking treasure before playing the
level game.

re playing this game you will develop your spatial thinking
perception of volume.

Game Contents
1 game board
4 game instructions
4 types of coin-blocks
12 point-blocks
8 key-block
1 die
2 Notepad & 2 pens

Game board



Max-Bag

You can keep anything in this bag from a small needle to 10 feet
ladder and you can still carry that bag on your shoulder, as light
weight as a feather.

Lumino- Torch

It gives a high power beam light, so that you can walk in night with
your lit path like daylight.

SeeThrough-Spectacles

This is enriched with night vision.

Extreme Binoculars:

You can see across the stones and walls as if there are no
obstacles.

Mag-Camera

This camera can fly in air and will take any picture based on your
command.

Ski-Shoes

these shoes are made from magical animals skin. If you wear this,
you can walk easily on any surface having any inclination.

Speedo-Bicycle

If you want to ride on water surface you must get this bicycle.

Tent

Any number of people can stay in this tent and this tent is
equipped with all the facilities with luxurious style.

Trekking Treasures

You have got a special chance to go for an adventure camping
in a green forest of Sahyadri Mountains. This place is full of
variety of flora and fauna.
On the way you face a mysterious fog. The cave is enchanted with
magical mystery. You observe that there are special marking
on the floor of cave. There are some square pits and it's a kind
game.
Now your logic says by playing this game you can release
the frozen objects. These frozen objects are having extreme
magical powers.

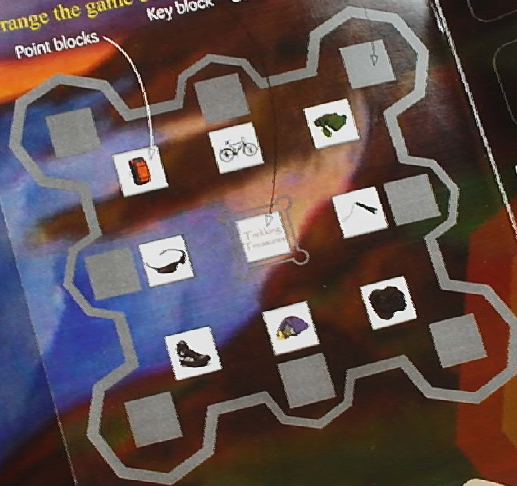
Now get ready to enter in the cave.
Two to four courageous person can play this game.

These magical objects are released by completing respective
cube. The player who completes the cube will get the
respective magical object.

Arrange the game board as follows

Point-blocks

Key block Coin-block Area



Playing the game

Throw the dice.
Whomsoever gets the green dot
should take the first turn to play.

For next each move you have to throw the die.
It will decide the coin-block for your move.
Select the coin-block as per the image on the top face of die.

Six faces of die are:



Four images representing respective coin-block.

The Green dot represents the freedom of
selecting any block



The Cross mark represents you have loose
the chance to select the block.



Now place the block in the coin-block-area, i.e. the peripheral
squares adjacent to point-blocks.

The turn gets rotated and the players start placing the blocks.
To complete each cube there is a need of four blocks.
Use your strategy and knowledge of volume to complete the
cube.

The player who completes the cube by placing the forth block
in the same; will win that cube.
The player has unlocked the missing object and now he/she
can keep the respective object (point-block) with him/her.

If the arrangement of the cubes results in such a way that it is
not able to form a cube by placing the forth coin-block, then
those coin-blocks should be deposited back to elements'
pond, but after completing all other possible cubes.

The game will continue till all the cubes get completed and the
all the respective objects are released from the magical trap.

The player who collects maximum points-block is the winner.

Akaar-Nitee

The 'Akaar-Nitee' is a strategy based educational game for children of 11 years and ahead.

Akaar-Nitee has two levels in it, as two different game which use the same hardware of the kit.

The 'Trekkling' Treasure is the first level of this game. And it is advised to play the 'Trekkling' Treasure before playing the 'Akaar-Nitee'.

Game 2:

While playing this game is advised to play the 'Trekkling' Treasure before playing the 'Akaar-Nitee'.

Game Contents:

- 1 game board
- 4 types of coin blocks (12 blocks of 12 point block)
- 8 point block
- 1 key-block
- 1 die
- 2 Notepad

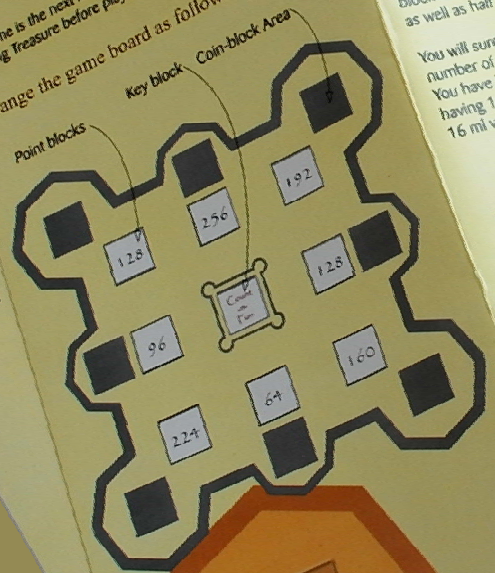
Game board

Count-n-Fun

This game is the next level game. It is advised to play the 'Trekkling' Treasure before playing this level.

Game 2:

Arrange the game board as follows



Coin-Blocks

These all blocks are the forth part of the cube (which is 4cm x 4cm x 4cm). You can perceive these by forming the cubes from the each type of blocks.

The coin blocks are namely Beech-Tile, Brown-Brick, Orange-Wedge and Yellow-Prism



Beech-Tile



Orange-Wedge

The points of Coin-Blocks



There are some blocks marked with grid lines on the surface. These grids are marked at 1cm distance. Count the number of smallest cubes formed by the grid lines in the respective block-shape. While counting you have to consider the cubes as well as half cubes.

You will surely observe that each block contains the same number of small cubes and that number is 16. You have just calculated volume of each block. The cube having 1cm side is one millilire (ml). Thus each coin-block has 16 ml volume.



Beech-Tile
it has 1 point for its every small cube
thus the total points for this coin are
 $16 \times 1 = 16$ points.



Brown-Brick
it has 2 point for its every small cube
thus the total points for this coin are
 $16 \times 2 = 32$ points.



Orange-Wedge
it has 3 point for its every small cube
thus the total points for this coin are
 $16 \times 3 = 48$ points.



Yellow-Prism
it has 4 point for its every small cube
thus the total points for this coin are
 $16 \times 4 = 64$ points.

Note pad
You can take help of writing pad to note and calculate and can decide moves accordingly.

Playing the game

Throw the dice.
Whomsoever gets the green dot should take the first turn to play.

For next each move you have to throw the die. It will decide the coin-block for your move. Select the coin-block as per the image on the top face of die. Now place the block in the coin-block-area.

The turn gets rotated and the players start placing the blocks. To complete each cube, there is a need of four blocks. These blocks should be placed in such a manner that the cube formed by them, should match the points defined by the respective point-block.

The player who completes the cube by placing the forth block in the same, will win that cube only if the total points of the cube match with that of respective point-block. The player can now keep the respective point-block with him.

If the cube gets complete, and does not match with the value, then that cube is deposited back to elements' pond.

You encounter a situation that the arrangement of the blocks results in such a way that it is not able to form a cube by placing the forth coin-block, then those coin-blocks should be deposited back to elements' pond, but after completing all other possible cubes.

The game will continue till all the cubes get complete. Make a sum of all the points you have collected. The player who collects maximum points is the winner.



Playing Trekking Treasure



Playing Count-n-Fun

The desire to win the game, will promote children to know the logic of volume applications.

Thus by playing again and again the experiential learning will boost tacit knowledge, in the volume domain.

AkaarNitee – a strategy based educational game

The development of play and learn kit,
evolved through a creative methodology,

The methodology is differs from
the regular practice of industrial design

...and it touches the area of education, strategy
and instruction design as well.

About the process...

Papert Seymour
Mindstorm: Children, computer and powerful ideas

Michael Polanyi
Personal Knowledge: towards a post critical philosophy

Marvin W. Daehler, Danuta Bukatko
Cognitive Development

Steve Peek
Game Inventor's Handbook

Text books: Standard Vth to IXth
Subject: Science and Mathematics
Published by National Council of Education Research and Training

Text books: Standard Vth to IXth
Subject: Science and Mathematics
Published by Maharashtra State Bureau of Textbook Production and Curriculum Research, Pune

Colouring Bamboo Strips with Natural Dyes
Published by: Industrial Design Centre, IIT Bombay

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A Magazines of the Arts
Volume 58, Number 2, December 2006

References:

Thank you...