

Multisensory Experiential Learning for Kids

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Multisensory Experiential Learning

Visual ✓
Kinesthetic ✓
Spatial ✓

Context of the student

Through real life experience

Should start from the basis
of the school curriculum and
end with it.

Inspiration from the
curriculum

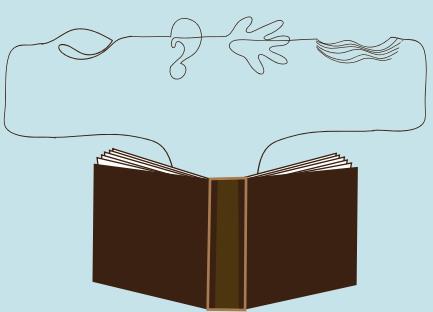
Visual depiction of the
given examples from the
textbook

Through real life experience

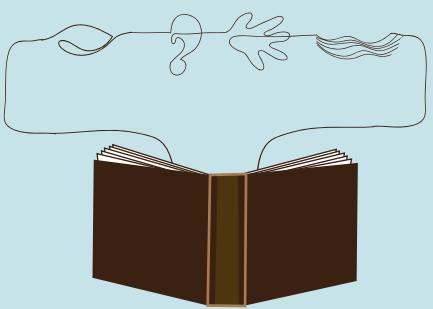
Maths

Visual
Audio
Kinesthetic
Spatial

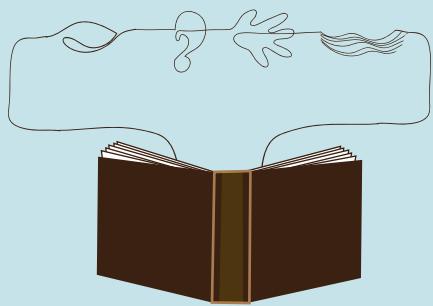
Should start from
the basis of the
school curriculum
and end with it



I HEAR AND I FORGET
I SEE AND I REMEMBER
I DO AND I UNDERSTAND



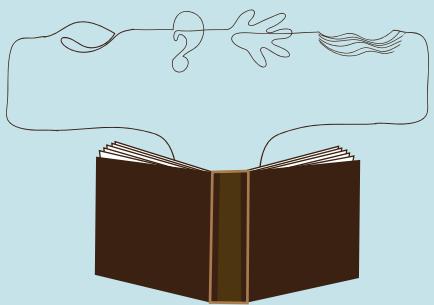
Maths



~~rural kids~~
kids

Maths

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kids

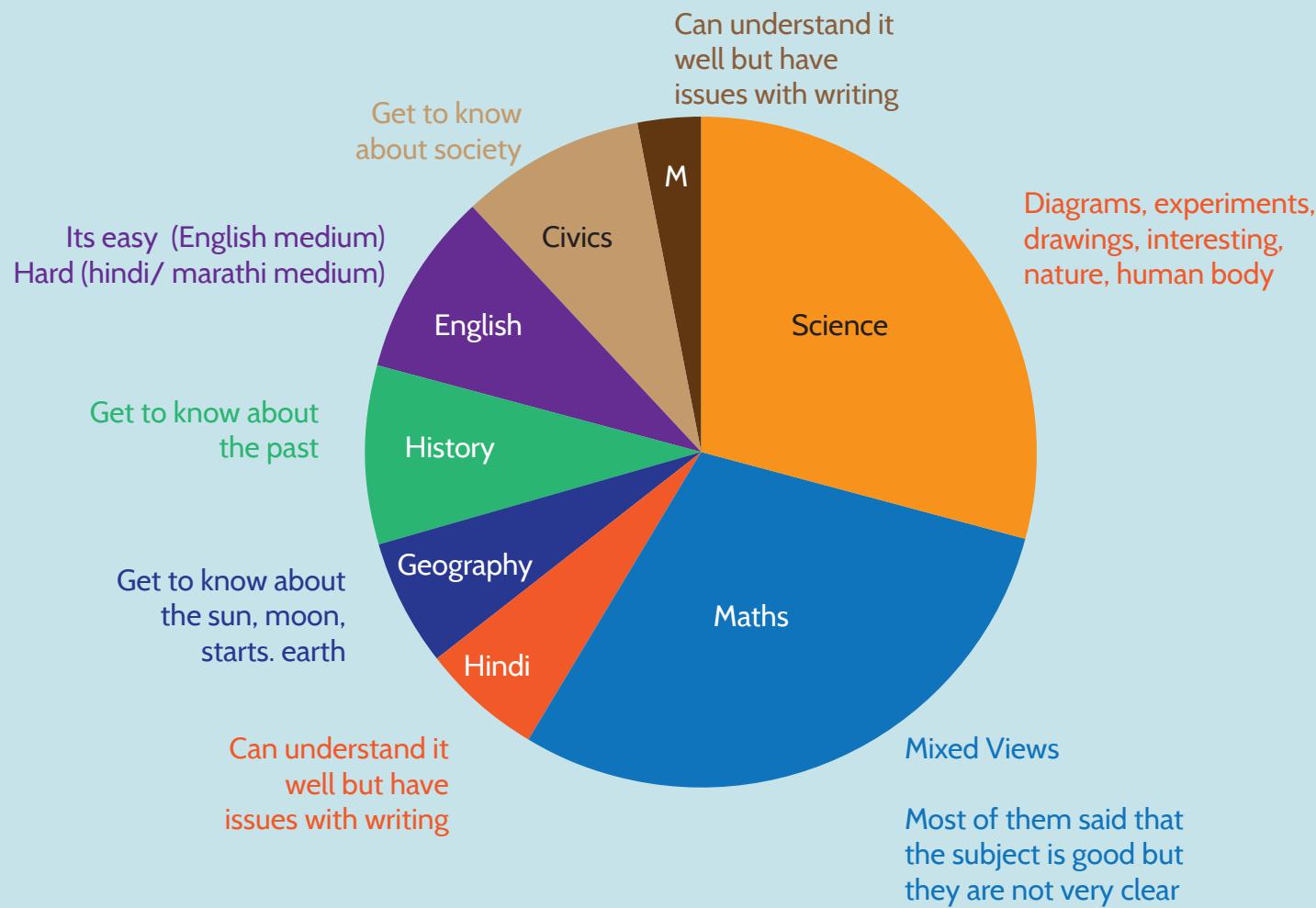
11 to 12 yr olds
Class 6

Mumbai

What is their **favourite subject**? Why?

How do they feel about maths? What are the topics **they understand and they don't**?

What is their favourite subject? Why?



* M stands for Marathi

How do they feel about maths?

I like Maths because there are addition, subtraction etc in Maths there is geometry and I can understand geometry very well but I did not understand some lessons in Maths

My hard subject is Maths because I do not understand what my sis teaches my teacher teach 100 time but I do not understand and we want to solve big-big questions very hard topic is find Area.

I did not ~~like~~^{like math} because I did I find it hard. algebra, equation, etc. the ~~is~~ ^{an} teacher which teach me ~~the~~ ^{he} way to teach me I did not understand.

What are the topics **they understand** and **they don't**?

Don't

Profit and Loss
Fraction,
3D Geometry
Bar Graph
Rational Number
Integer
Ratio and Proportion
Decimal

Do

Geometry has the **highest** number of **positive** as well as **negative responses**.

Children are more **comfortable with** the concept of **2D geometry** rather than 3D geometry because 2D Geometry is practised more and is accurate as compared to creating a 3D structure.

What are the Problems in Maths?

Children understand maths as **formulae** but not on the fundamental level.

They **do not understand** the concept of '**How and Why**'

The children understand **only one basic way** of solving a mathematical problem

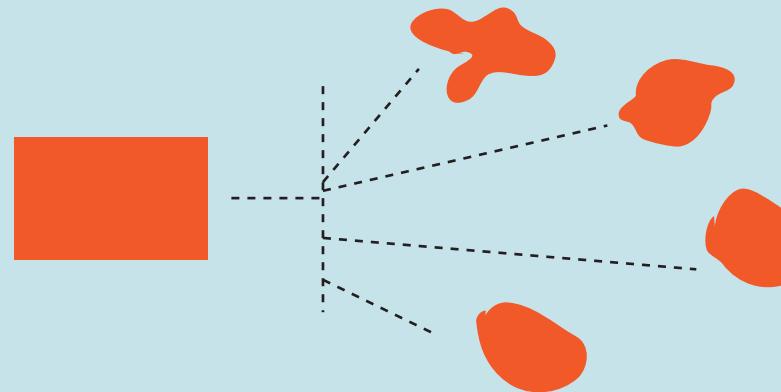
The **teacher** does not cater to the **individual child**.

Manipulatives are not **abundant everywhere**.

The content structure is **dispersed**.

Can it be solved by taking the curriculum into consideration?

Connecting Maths (rigid) with an existing non- rigid curriculum



For egs: Sports, Games, Craft, Art, Language etc

Focus to one topic: Ratio and Proportion

Study the underlining fundamental problems in context to the age group

Develop strategic supportive solutions that will incorporate the multisensory experiential approach of learning

Ratio and Proportion

Chapter 12

12.1 Introduction

In our daily life, many a times we compare two quantities of the same type. For example, Avnee and Shari collected flowers for scrap notebook. Avnee collected 30 flowers and Shari collected 45 flowers. So, we may say that Shari collected $45 - 30 = 15$ flowers more than Avnee.

Also, if height of Rahim is 150 cm and that of Avnee is 140 cm then, we may say that the height of Rahim is $150\text{ cm} - 140\text{ cm} = 10\text{ cm}$ more than Avnee. This is one way of comparison by taking difference.

If we wish to compare the lengths of an ant and a grasshopper, taking the difference does not express the comparison. The grasshopper's length, typically 4 cm to 5 cm is too long as compared to the ant's length which is a few mm. Comparison will be better if we try to find that how many ants can be placed one behind the other to match the length of grasshopper. So, we can say that 20 to 30 ants have the same length as a grasshopper.

Consider another example.

Cost of a car is ₹ 2,50,000 and that of a motorbike is ₹ 50,000. If we calculate the difference between the costs, it is ₹ 2,00,000 and if we compare by division;

$$\text{i.e. } \frac{2,50,000}{50,000} = \frac{5}{1}$$



These

In a class, there are 20 boys and 40 girls. What is the ratio of the number of boys to the number of girls?

Ravi walks 6 km in an hour while Roshan walks 4 km in an hour. What is the ratio of the distance covered by Ravi to the distance covered by Roshan?

"I am 5 times bigger than you", says the lizard. As we can see this



12.2 Ratio

Consider the following:

Isha's weight is 25 kg and her father's weight is 75 kg. How many times father's weight is of Isha's weight? It is three times. Cost of a pen is ₹ 10 and cost of a pencil is ₹ 2. How many times the cost of a pen is that of a pencil? Obviously it is five times.

In the above examples, we compared the two quantities in terms of 'how many times'. This comparison is known as the Ratio. We denote

Consider the earlier examples again. We can say,

The ratio of father's weight to Isha's weight = $\frac{75}{25} = \frac{3}{1} = 3:1$

The ratio of the cost of a pen to the cost of a pencil = $\frac{10}{2} = \frac{5}{1} = 5:1$

Let us look at this problem.

In a class, there are 20 boys and 40 girls. What is the ratio of

(a) Number of girls to the total number of students.

(b) Number of boys to the total number of students.

First we need to find the total number of students, which is,

Number of girls + Number of boys = $20 + 40 = 60$.

Then, the ratio of number of girls to the total number of students is $\frac{40}{60} = \frac{2}{3}$

Find the answer of part (b) in the similar manner.

Now consider the following example. Length of a house lizard is 20 cm and the length of a crocodile is 4 m.

"I am 5 times bigger than you", says the lizard. As we can see this

RATIO AND PROPORTION

We can say that the cost of the car is five times the cost of the motorbike. Thus, in certain situations, comparison by division makes better sense than comparison by taking the difference. The comparison by division is the Ratio. In the next section, we shall learn more about 'Ratios'.

Ex. (1) Divide: 1,2509 + 3.5

$$\frac{1,2509}{3.5} = \frac{1,2509 \times 10}{3.5 \times 10} = \frac{12,509}{35}$$

$$\begin{array}{r} \text{Method} \\ \hline 0.3574 \\ 35 \overline{)12.509} \\ - 105 \\ \hline 205 \\ - 140 \\ \hline 65 \\ - 65 \\ \hline 0 \end{array}$$

Explanation
Let us prepare the 35 times table.
 $35 \times 1 = 35$ $35 \times 2 = 70$
 $35 \times 3 = 105$ $35 \times 4 = 140$
 $35 \times 5 = 175$ $35 \times 6 = 210$
 $35 \times 7 = 245$ $35 \times 8 = 280$
 $35 \times 9 = 315$

Even after we have completed the division up to the last digit in the dividend, we still have a remainder of 14. Hence, we assume that there is a zero after the last place in the dividend and place that zero after the remainder 14, and carry on the division.

$$\text{Now, } \frac{12,509}{35} = 0.3574 \quad \therefore \frac{12,509}{35} = 0.3574$$

Exercise 30

1. Carry out the following divisions:

| | | |
|---------------------|---------------------|---------------------|
| (1) $10.35 + 1.5$ | (2) $31.05 + 0.5$ | (3) $759.0 + 1.1$ |
| (4) $957.44 + 2.2$ | (5) $139.3 + 0.7$ | (6) $1393 + 0.7$ |
| (7) $82.175 + 1.9$ | (8) $324 + 1.8$ | (9) $784.8 + 0.4$ |
| (10) $499.95 + 7.5$ | (11) $1846.8 + 7.2$ | (12) $1894.1 + 6.2$ |

In a cricket match, Mahesh scored 60 and Sagar scored 20 runs. We can compare their scores in two ways:

1. By subtraction

$$\text{Mahesh's score} - \text{Sagar's score} = 60 - 20 = 40$$

Thus, we see that Mahesh has scored 40 runs more than Sagar.

2. By division

Let us see how many times Mahesh's score is that of Sagar's. To do this, we shall divide Mahesh's score by Sagar's.

$$\frac{\text{Mahesh's score}}{\text{Sagar's score}} = \frac{60}{20} = \frac{3}{1}$$

Thus, we see, that Mahesh's score is 3 times Sagar's score. When two quantities are compared by division, then the quotient of that division is called a 'ratio'. The ratio $\frac{a}{b}$ is used to express a ratio.

The ratio of 5 to 9 is written as $\frac{5}{9}$ or '5:9' and is read as '5 is to 9'.

The ratio $\frac{a}{b}$ is written as 'a:b' and is read as 'a is to b'.

Comparing two numbers by division means finding the ratio of the two numbers.

Let us consider one more example to understand this better.

Ex. (1) There are 30 boys and 24 girls in a class. Find the ratio of the number of boys to the number of girls.

Definition in the book:

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Ratio: We compare the two quantities in terms of 'how many times'

Proportion: If two ratios are equal, we say that they are in proportion

Ratio = Number of quantity/ Total number of quantity

Important points:

Two quantities can be compared only if they are in the same unit

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Ratio: When two quantities are compared by division, then the quotient of that division is called a ratio.

The ratio reduced in its lowest terms (simplest form)

When finding the ratio of two quantities of the same kind, we have to first express them in the same units. However, the ratio does not have a unit.

Proportion: When two ratios are equal, then the numbers in those ratios are said to be in proportion.

Ratio = Number of quantity/ Total number of quantity

Prior Knowledge expected

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Tables
Divisibility
The use of letters in place of numbers
Decimal Fractions
Number line

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Whole numbers
Integers
Fractions
Decimals
Algebra

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Problems in Ratio and Proportion:

They get confused between fractions, units, ratios and the concept of proportion.

They learn it as a formulae and lack in connection to the real life context.

They have difficulty in solving problems with variables and multiple components.

They do not like word problems which is not related with their context.

How to cater to the assessment?

Learning objective: After the activity they should be able to perform in the curriculum rather than just engaging into the fun part.

How to bring them back to the textbook?

The activity could be designed taking the examples from the book.

This will enable them to visualize the problems in the book without thinking them as rigid formulae.

This was observed that all the examples were drawn from the student's environment.

Examples available in the textbook:

Height
Cost
Length
Time
Holidays
Distance
Students

Possibilities:

Context and Interest

TV
Music
Games
Role playing
Puzzles
Drawing
Toys
Animals
Environment
Personal (Body, Name, Parents, Pets)

Can it be combined with?

Games

Indoor/Outdoor games

Crafts

Cooking

Bhel, sandwiches (existing)

Design education

Grids

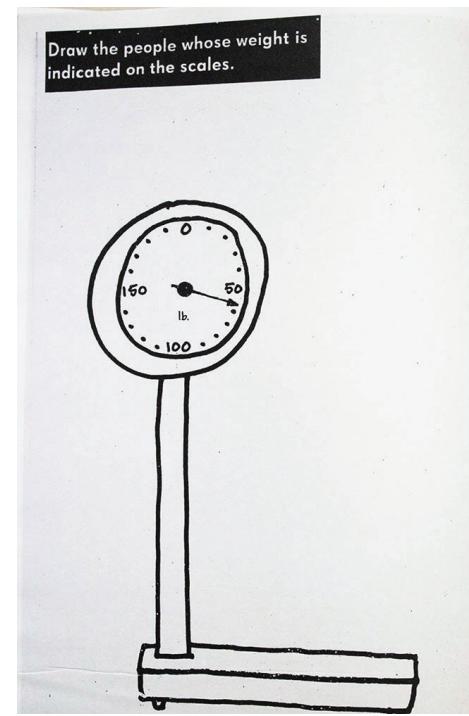
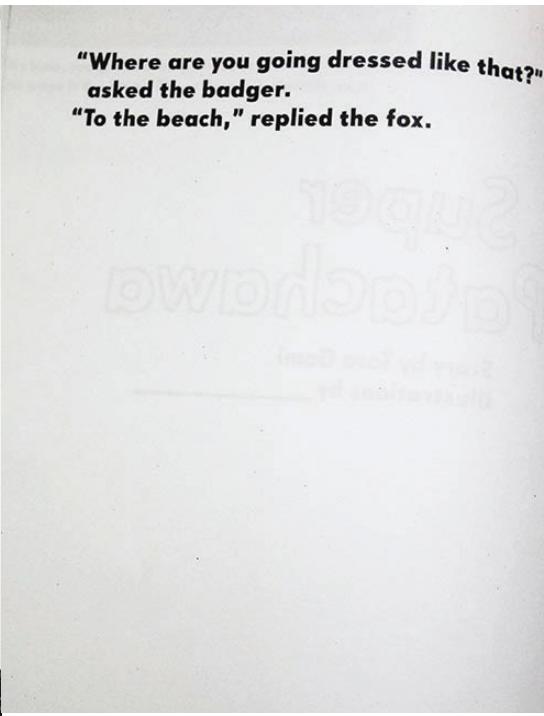
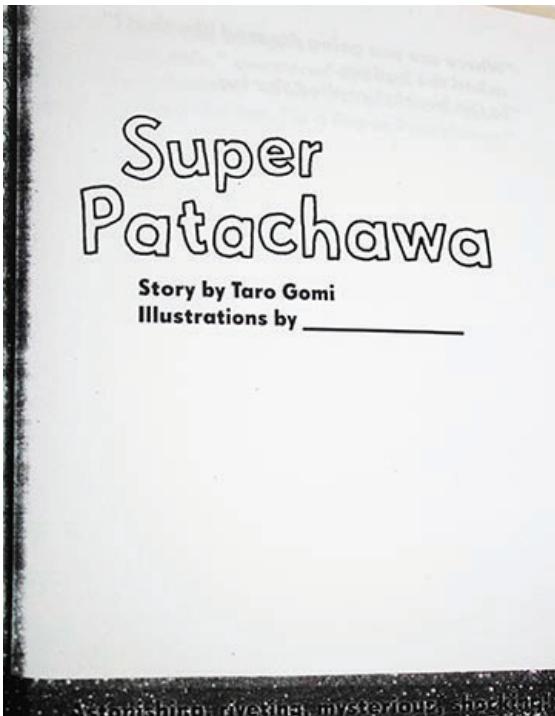
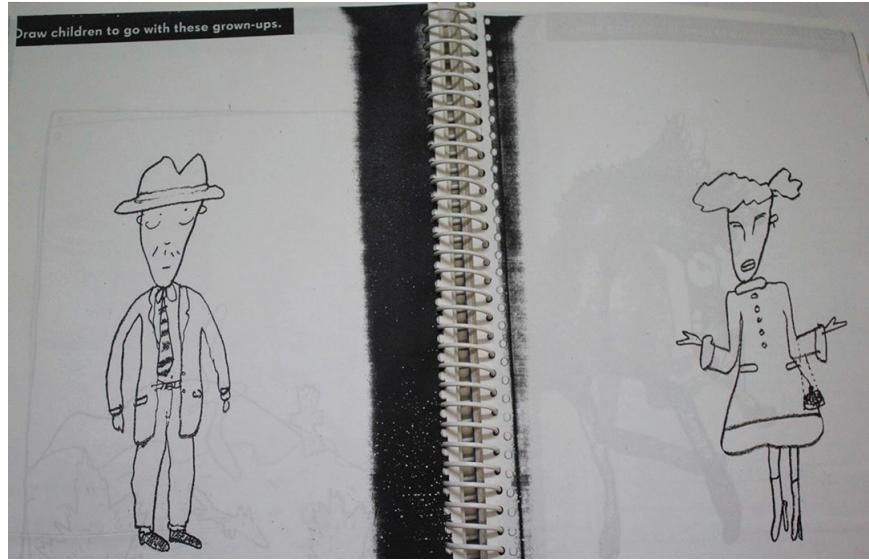
Proportional drawing exercises

Stakeholders:

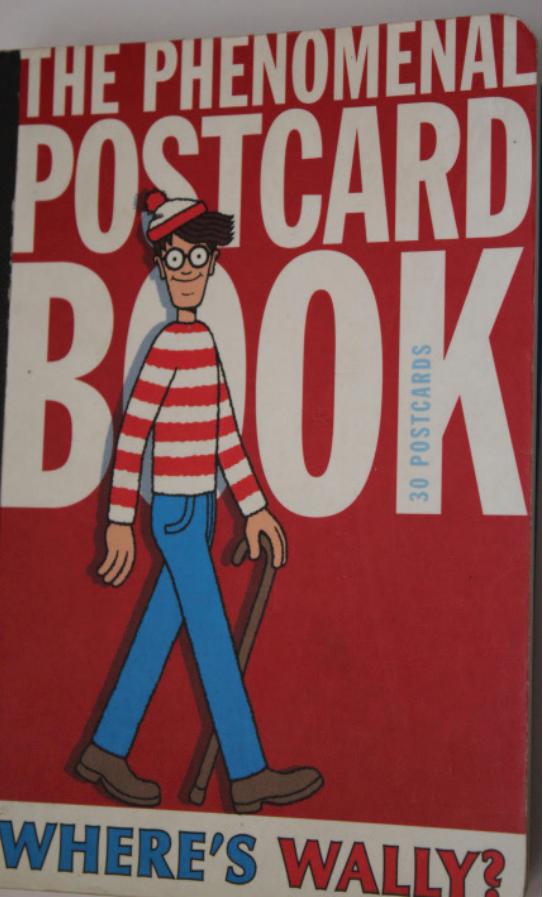
Students: To be able to relate in their own context with multiple levels of interesting clues to relate.

Teachers: It will act as a model that could be easily replicated and which will be supportive of the existing curriculum

Inspiration from the existing examples



Tarogami



Finding Wally

**Zone
5**

It's rush hour on
Planet Monster.

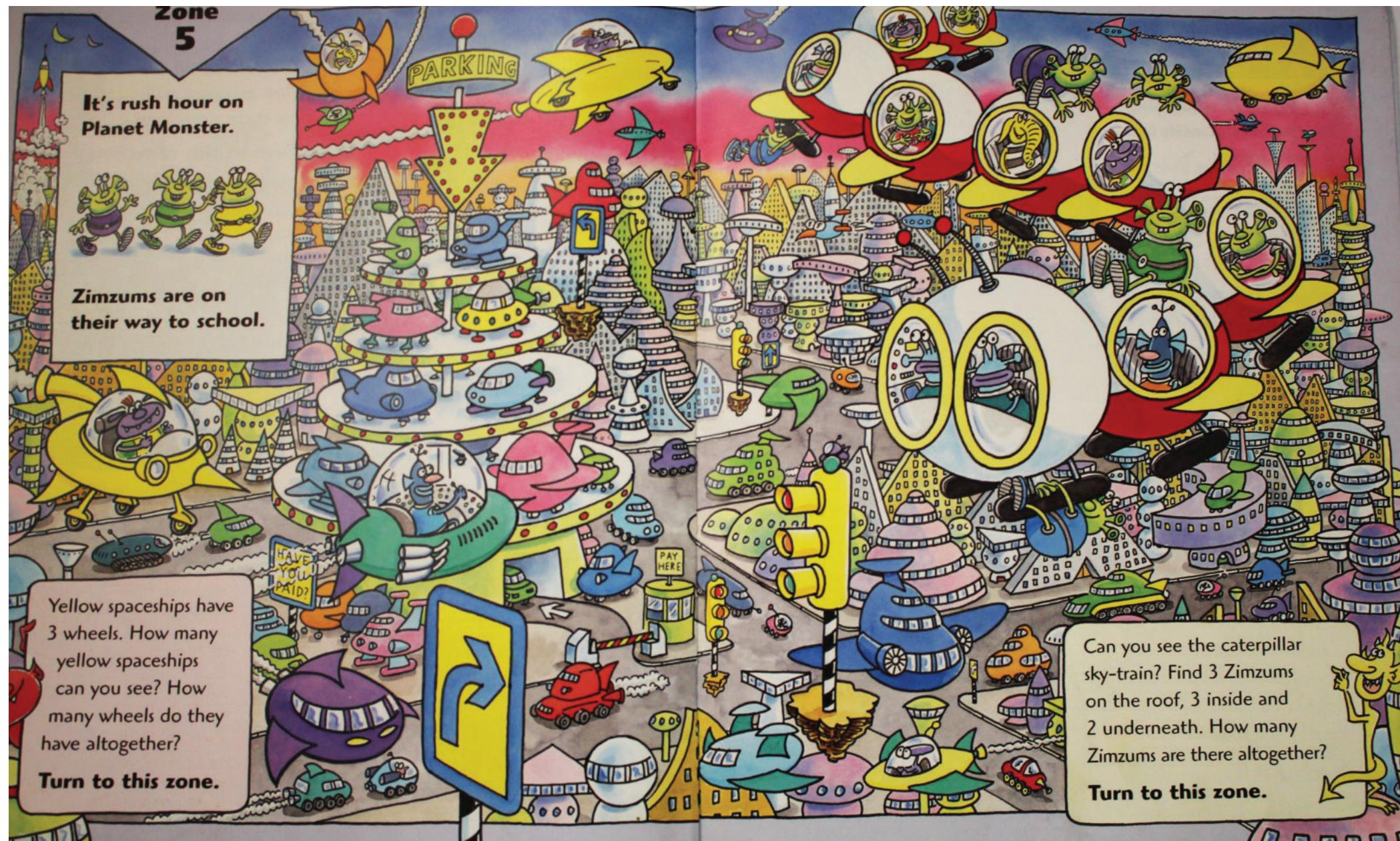


Zimzums are on
their way to school.

Yellow spaceships have
3 wheels. How many
yellow spaceships
can you see? How
many wheels do they
have altogether?

Turn to this zone.

PARKING



Planet Monster



1. What is the ratio of circle to stars?



2. What is the ratio of stars to all shapes?



3. What is the ratio of lines to circles?



4. A television screen is 25 cm long and 15 cm wide. What is the ratio of length to width?

5. A television screen is 25 cm long and 15 cm wide. What is the ratio of width to length?

6. A class has 25 students. Fifteen are boys. What is the ratio of girls to boys?

7. A class has 25 students. Fifteen are boys. What is the ratio of boys to all students?

8. $\frac{14}{n} = \frac{7}{4}$

What does n equal?

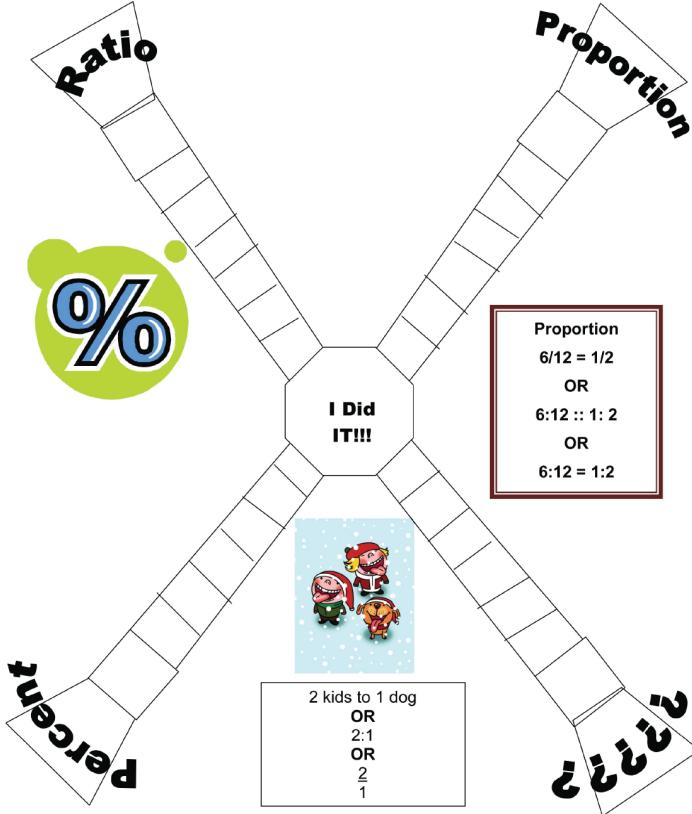
9. A cookie recipe for 60 cookies calls for 4 cups of flour. How much flour is needed to make 90 cookies?

Write the proportion that shows this.

BONUS: Solve the problem

10. A school has 240 boys in it. The ratio of boys to girls is 6 to 5. How many girls are in the school?

Write the proportion that solves this.

BONUS: Solve the problem**Ratio, Proportion and Percent Board Game****Answers to Ratio, Proportion and Percent Question Set**

1. $4/2 = 2/1$
2. $2/9$
3. $3/4$
4. $25/15 = 5/3$
5. $15/25 = 3/5$
6. $10/15 = 2/3$
7. $15/25 = 3/5$
8. $n = 8$
9. $60/4 = 90/n$. Answer is $n = 6$ cups of flour (Proportion set up could vary)
10. $6/5 = 240/n$. Answer is $n = 200$ (Proportion set up could vary)
11. a. 1
12. c. 20/1
13. c. 45/1
14. $78/780 = 1/10$
15. $6/2 = 18/x$. Answer is $x = 6$ people (Proportion set up could vary)
16. $12/x = 9/6$. Answer is $x = 8$ (Proportion set up could vary)
17. $15/20 = x/12$. Answer is $x = 9$ (Proportion set up could vary)
18. a. 1%
19. c. 75%
20. b. 55%

Ratio, Proportion and Percent Board Game

Solution

An activity book

A compilation of a series of activities that can be applied across various context

Low cost

Interesting and descriptive

Replicable

Easily adaptable

Surprising and exciting

Works across the school curriculum

Acts as a supportive medium

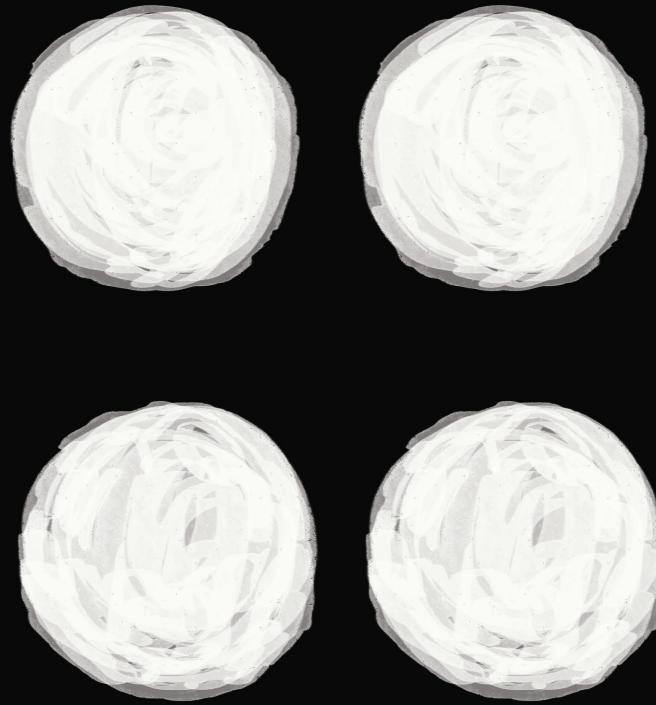
Look and feel

Should be xeroxable

Should look equally clear in black and white

The activity could be easily replicated by both teachers and students

Non generic, minimalistic, descriptive and simple illustrations (Black Ink and line drawings)



Ratio and Proportion

An activity book for all of you



I am the..
Scary maths ghost

You all fall for me .. I scare you with difficult maths questions.. I make you confused. I make you believe that maths is hard.

There is no one who can save you from me..

hoooh hoooo haaa haaaaaaaa

**Scary Maths
Ghost**

Character derived from the fear of maths



Fight sequence

Throw the maths fear out

Ratio

Ratio is a relationship comparision between two things

Ratio symbol :



Lets take two shapes. A star and a hexagon

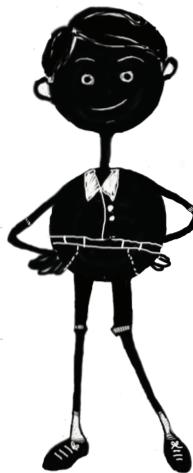
Now the ratio of to is $\star : \hexagon$

This can be written as,

Ratio of star to hexagon = $\star : \hexagon$

If we count and write it in numbers, it will be written as

Ratio of star to hexagon = 1 : 1



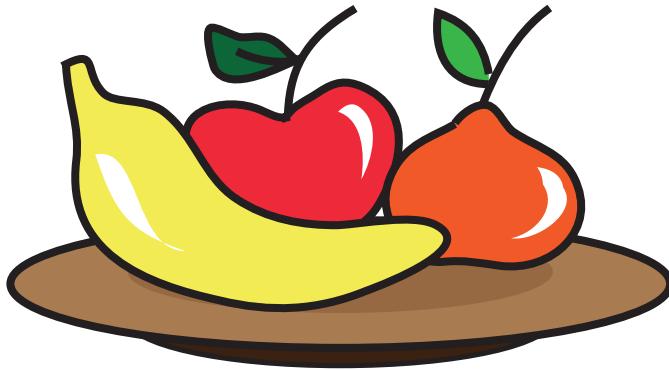
Ratio of star to the total number of shapes = $\star : \hexagon + \star$

Therefore, the ratio of star to the total number of shapes is = $1 : 1 + 1$
= $1 : 2$

Similarly, Ratio of hexagon to the total number of shapes = $\star : \hexagon + \star$

Therefore, the ratio of star to the total number of shapes is = $1 : 1 + 1$
= $1 : 2$

Lets take the easiest way to understand this..



In the plate we can count and see that there is

1 Banana 

1 Apple 

1 Orange 

1 Plate 

Lets see how to find out the Ratio

$$\begin{aligned}\text{Ratio of Orange to Banana} &= \text{Orange icon} : \text{Banana icon} \\ &= 1 : 1\end{aligned}$$

$$\begin{aligned}\text{Ratio of Banana to Apple} &= \text{Banana icon} : \text{Apple icon} \\ &= 1 : 1\end{aligned}$$

$$\begin{aligned}\text{Ratio of Apple to Orange} &= \text{Apple icon} : \text{Orange icon} \\ &= 1 : 1\end{aligned}$$

$$\begin{aligned}\text{Ratio of Plate to Banana} &= \text{Plate icon} : \text{Banana icon} \\ &= 1 : 1\end{aligned}$$

$$\begin{aligned}\text{Ratio of Plate to Total number of fruits} &= \text{Plate icon} : \text{Banana icon} + \text{Apple icon} + \text{Orange icon} \\ &= 1 : 1 + 1 + 1 \\ &= 1 : 3\end{aligned}$$



Ratios and body



Activity



What is the ratio of nose to ears in your face?



Can you guess the weight of this two person?



Weight _____ kg



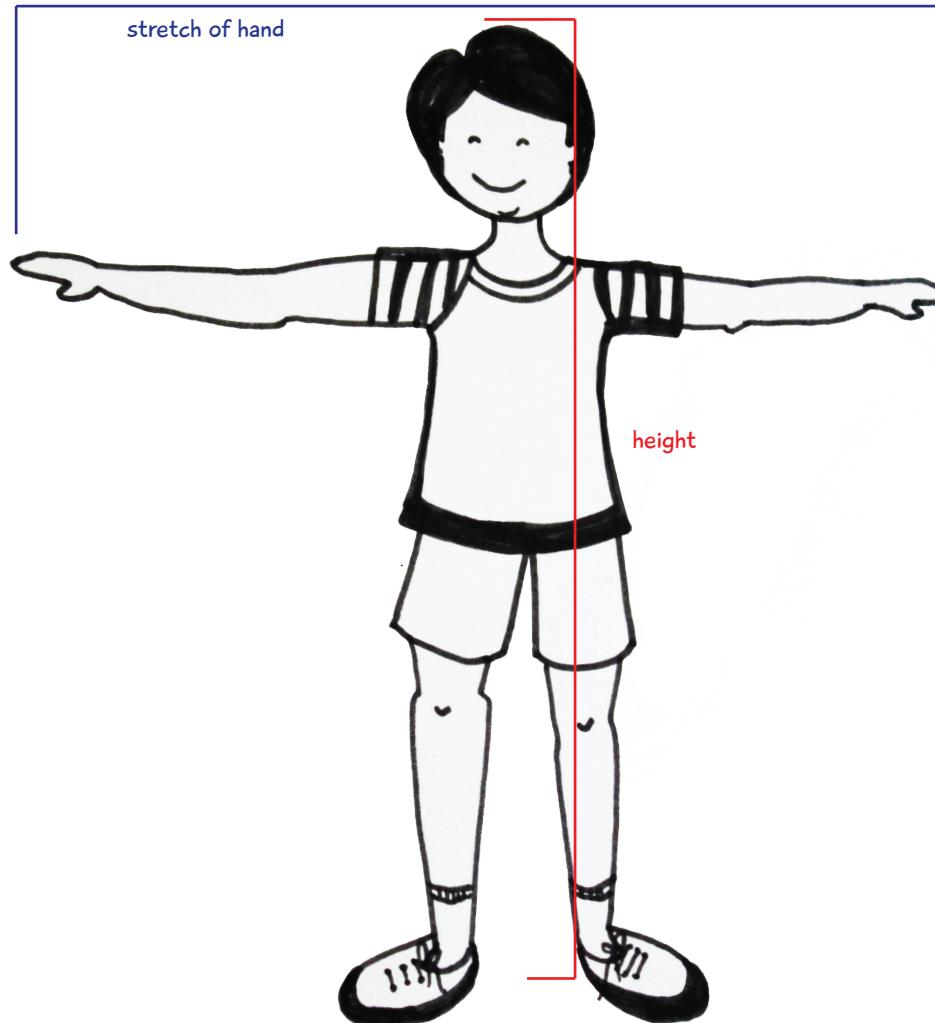
Weight _____ kg

Ok. Then, find the ratio of their weights

“ The ratio of the stretch of the hand to the height of a person is said to be 1 : 1 ”

Find out if the statement is True or false

Use a measuring tape to measure the stretch of hand and height and take out the ratio.



Shapes and Ratios



Ratio of this circle to number of pieces = $1 : 1 + 1 + 1 + 1$
 $= 1 : 4$



Ratio of 2 pieces with the total number of pieces = $2 : 4$
 $= 1 : 2$



Ratio of 3 pieces with the total number of pieces = $3 : 4$



Ratio of 4 pieces with 1 piece
 $= 4 : 1$



Ratio of this box to number of pieces = $1 : 1 + 1 + 1 + 1$
 $= 1 : 4$



Ratio of 2 pieces with the total number of pieces = $2 : 4$
 $= 1 : 2$



Ratio of 3 pieces with the total number of pieces = $3 : 4$



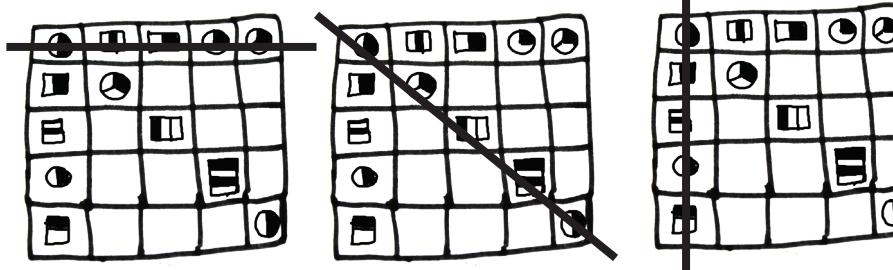
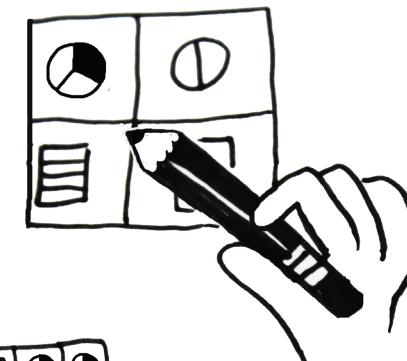
Ratio of total number of pieces to 1 piece = $4 : 1$

Ratio Housie



The person who will pick will put their hand in the bag and draw a card and shout aloud the number written on it. Lets take it as $1 : 3$

The players will have to shade the ratios in the shape box



The person picking cards will continue picking and shouting aloud. The players will keep on shading the respective ratios. The play will go on until the player who will finish shading the horizontal or vertical or diagonal set of shapes gets points. The one to finish all (horizontal, vertical and diagonal) wins.

Finding Proportion



Find if 3:4 is proportion to 42:56

3:4 means for every 3 items there are some other 4 items.

Now, lets take 3 as  and 4 as 

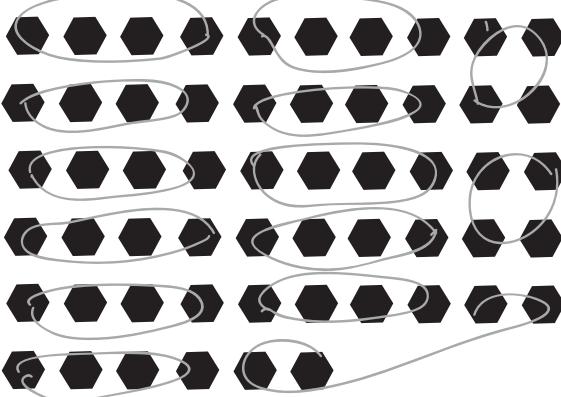
Therefore 3:4 can be written as

 : 

Lets check by repeating the shapes whether 3:4 is proportion to 42:56 or not.

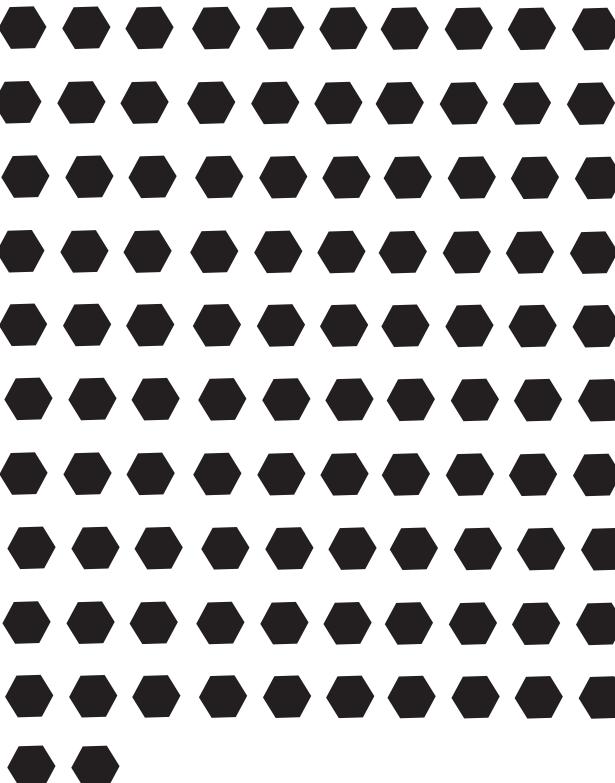
Here I will circle every 3 star and cut 4 star to see whether they all match as a set or not

Lets try it out. For every 3 stars lets circle 4 hexagons..

| 42 stars | 56 hexagons |
|---|--|
|  |  |

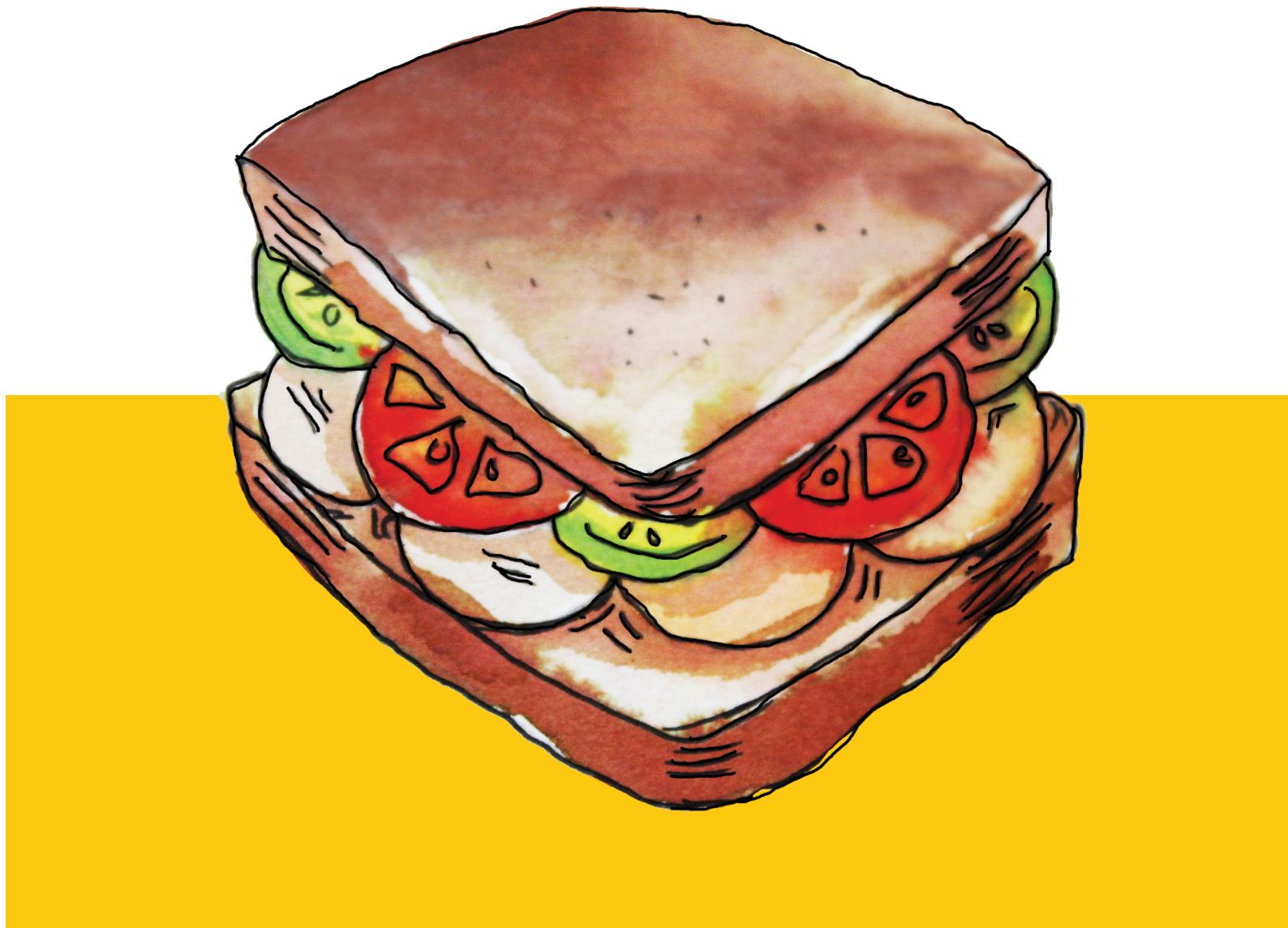
Since I am done, There are no extra stars or hexagons left which do not match the 3:4 ratio.
Therefore 3:4 is proportion to 42: 56

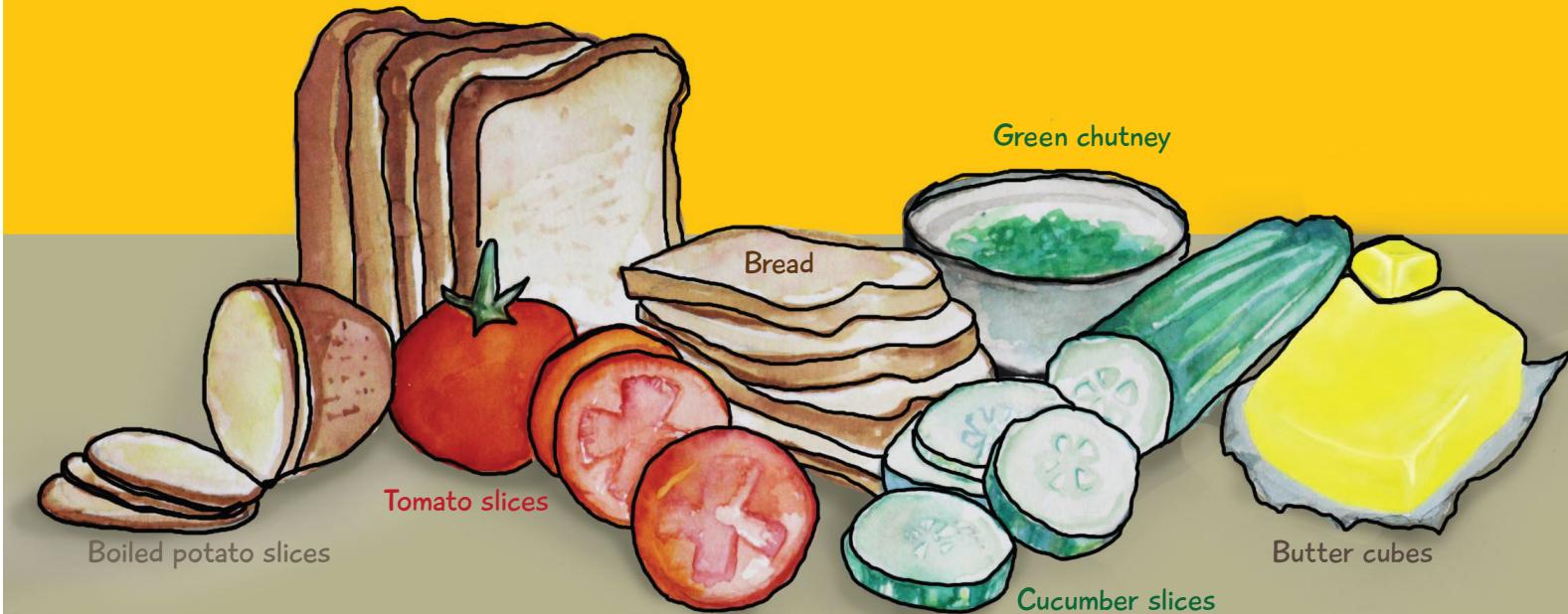
Find if $2:6$ is proportion to $34:102$ or not ?

| 34 stars | 102 hexagons |
|--|--|
|  |  |

Food and Proportion

Sandwich Activity





Ingredients required to make sandwiches is given below

If 1 sandwich requires

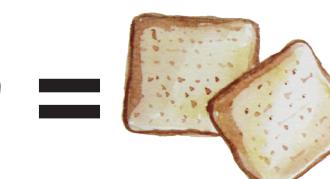
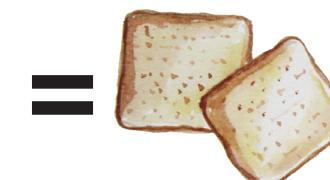
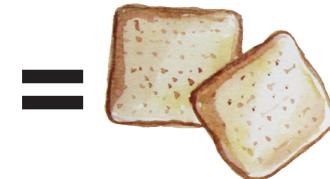
- 2 bread slices
- 2 slices of tomato
- 3 slices of cucumber
- 4 slices of boiled potato
- 1 cube of butter
- 1 spoon of chutney

Lets try to think about how many pieces each we would need if we increase the number of sandwiches.

Feel free to sketch and doodle in the next sheet.

Ratio of sandwich to the ingredients are

| | | | | | | | | | | | | |
|---|---|---|---|---|---|----|---|---|---|---|---|---|
| 3 | : | 6 | : | X | : | 12 | : | 6 | : | 3 | : | 3 |
|---|---|---|---|---|---|----|---|---|---|---|---|---|



X



| | | | | | | | |
|------------|---|---------|--|------------------|-----------------|------------------|--------------------|
| 3 Sandwich | = | 6 bread | | 12 potato slices | 6 tomato slices | 3 cube of butter | 3 spoonful chutney |
|------------|---|---------|--|------------------|-----------------|------------------|--------------------|

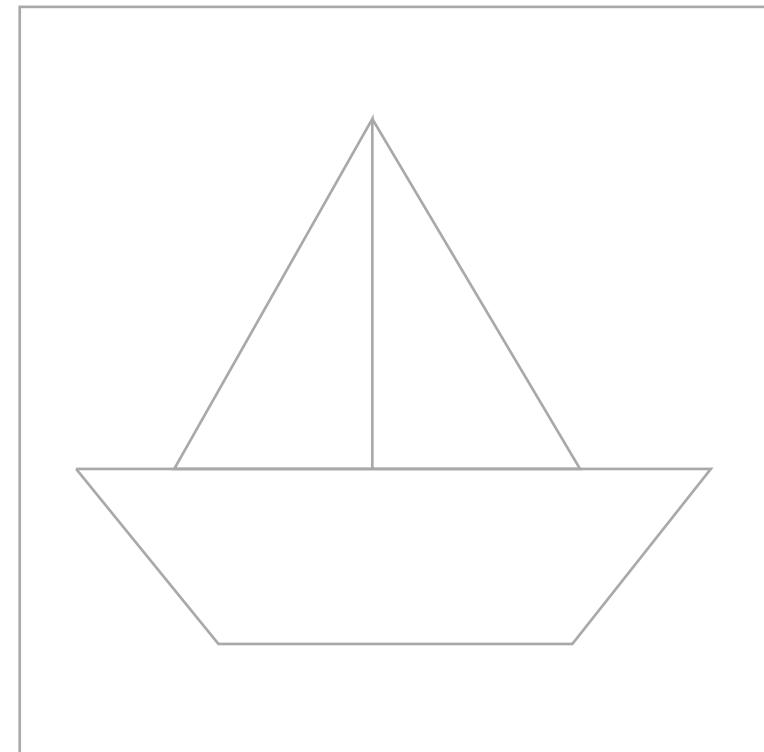
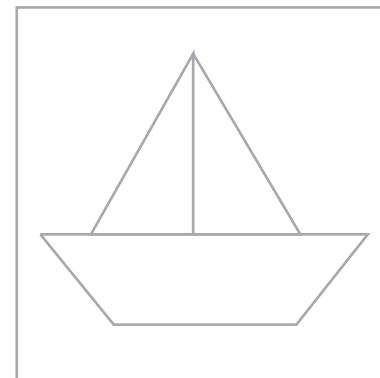
Craft
and
Proportion

Take two paper squares of 12 cm and 6 cm. Make paper boats out of both. Stick them on the other sheet.

Can you find the ratio :

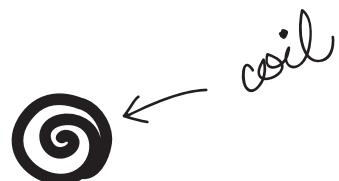
- 1) of the paper square A and B
- 2) of the height of two boats

Is the ratio of the paper squares proportion to the height of the boats?



Take a paper strip and fold it into eight equal parts. Now cut the paper strip in the ratio of 2 : 6

Can you coil and stick both the paper strips to form a circle.



Now, Lets try measuring the diameter of the circle. Can we find the ratios of the two circles?

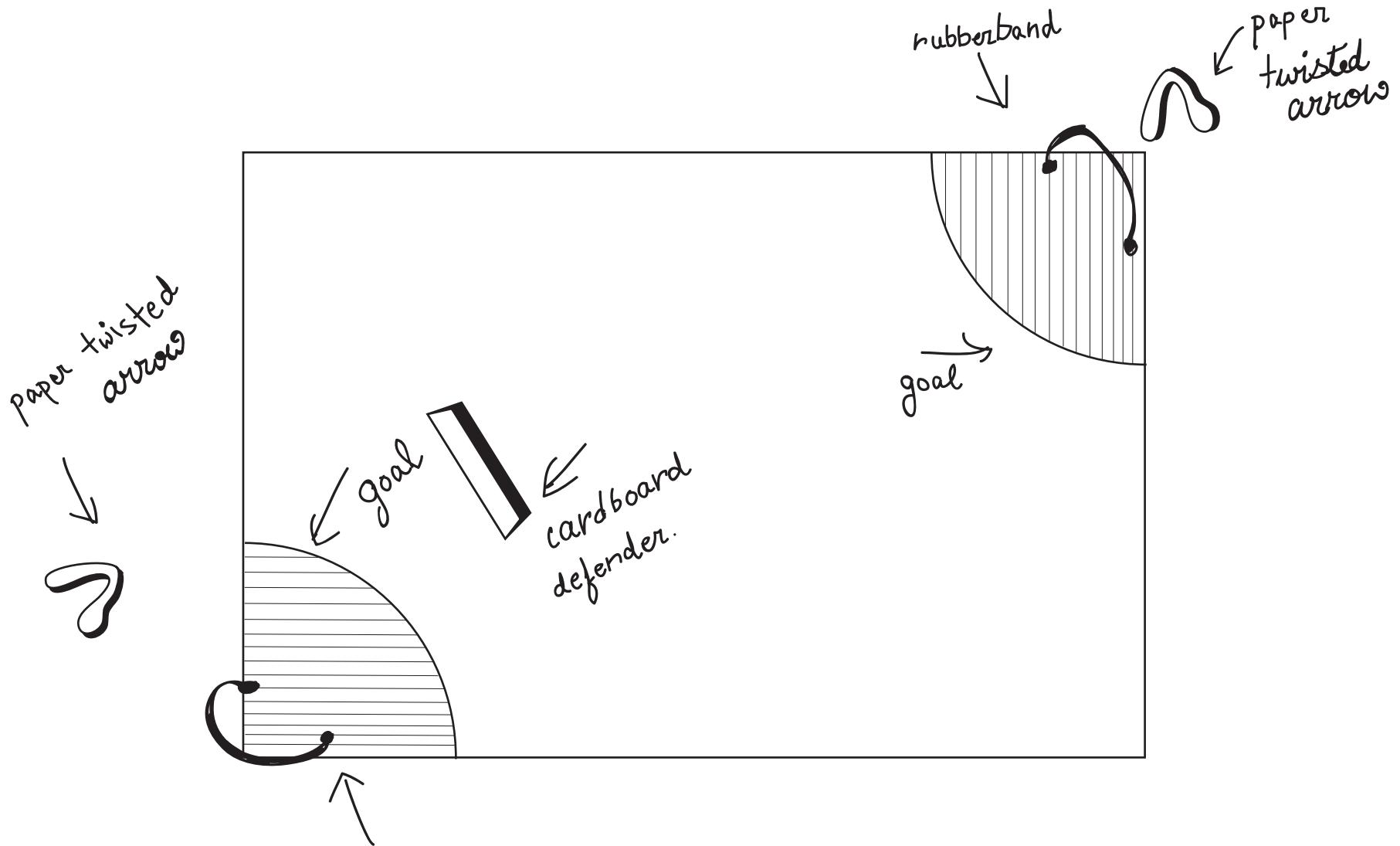
Can you see anything?

I can see two little snail.



Draw what you see in the coil circle then.

Scores and Ratios



User Testing

User 1

Sneha Shivagi Gaikwad

Little Flower English High School

Class 8

Raigarh Slum

User 2

Suman Joshi

Little Flower English High School

Class 6

Raigarh Slum

Observation

They had issues with understanding english.

Initially when asked they said that the topic is easy and they know everything about it. But when I gave them a basic ratio question they got confused and they couldnot even identify the ratio symbol.

After I gave them a copy of the book, they got very excited about the illustrations. And took some time to understand the activities.But once they did, they were able to solve questions of varying complexities.

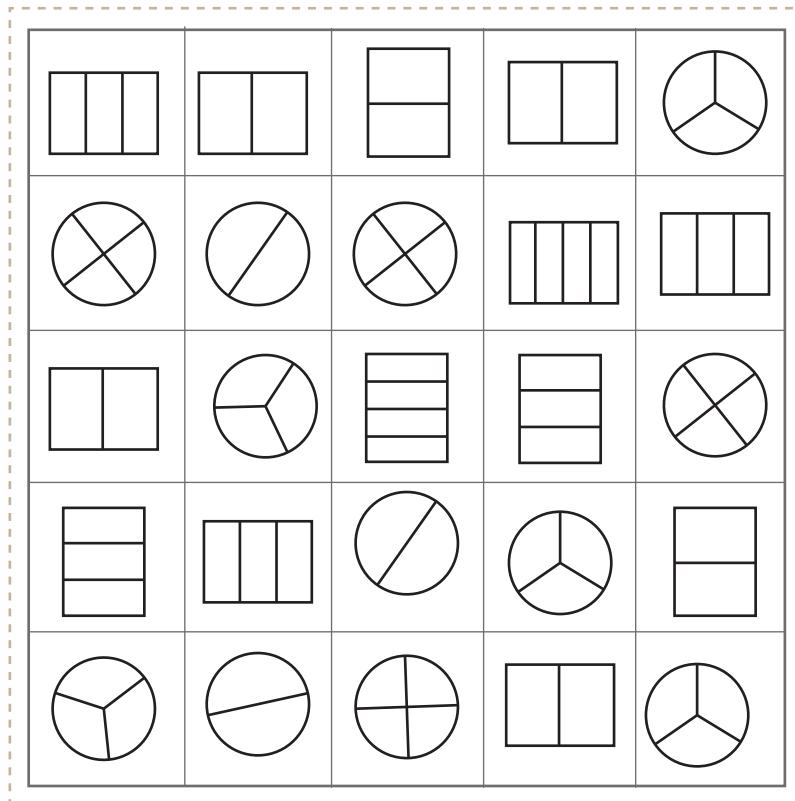
Learnings from this project

**Understanding, analysing and designing
for children is not that easy.**

**It requires a huge amount of research in
the field to get their acceptance.**



Thank You



Activity Cards



Ratio Cards



Mr Ratio

Character inspired
from the ratio symbol