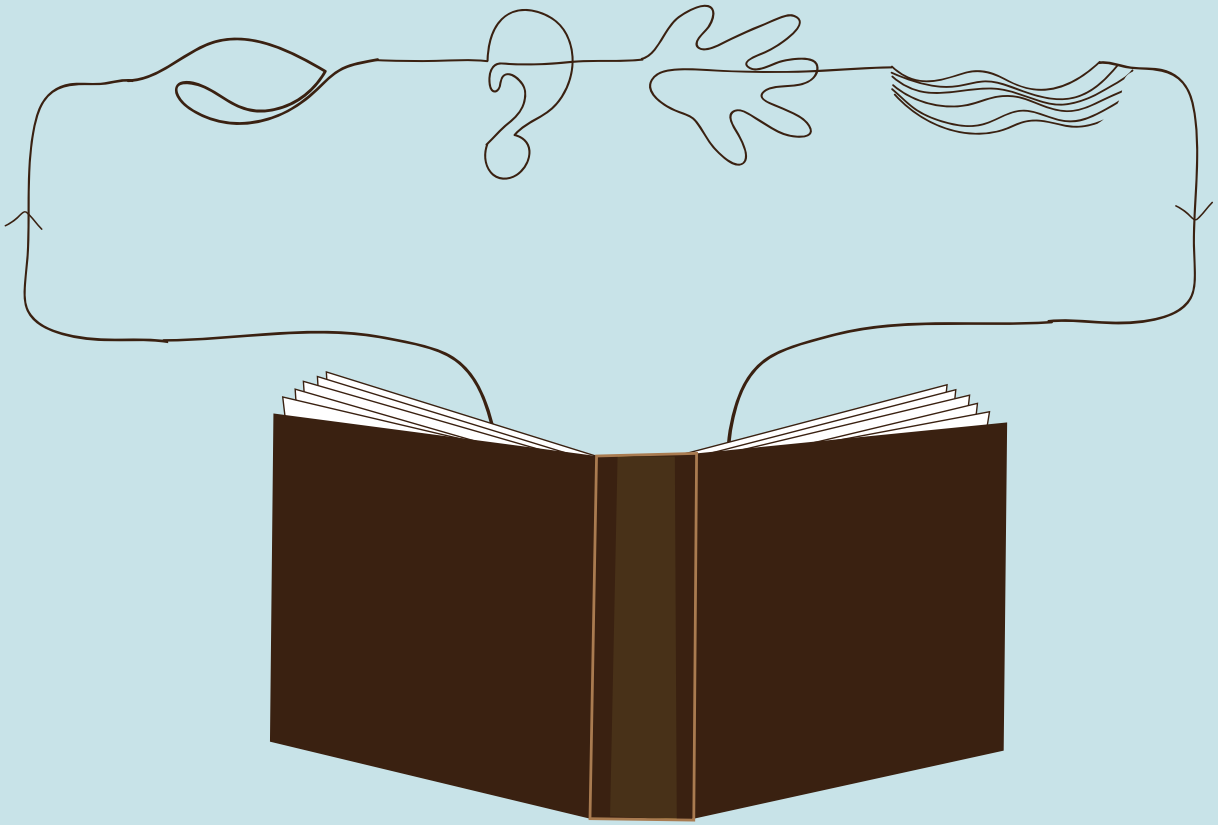


Multisensory Experiential Learning for Rural Kids

Kavita Brahma | 136250012 | Visual Communication | Project 2 Report | IDC, IIT Bombay

Guide : Prof G V Sreekumar | Co- Guide: Prof A G Rao

Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included. I have adequately provided cited and referenced the sources of information that I have included in the study. I also declare that I have adhered to all the principles of academic honesty and integrity and have not misinterpreted or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will cause for disciplinary action by the Institute.

Kavita Brahma
136250012
14th November 2011

Approval Sheet

The Industrial Design project 2 entitled *" Multisensory Experiential learning for Rural Kids "* by Kavita Brahma, Roll No. 136250012 is approved, in partial fulfillment of the requirements for Master of Design Degree in Visual Communication at the Industrial Design Centre, Indian Institute of Technology Bombay.

Guide:

Co Guide:

Chairperson:

Internal Examiner:

External Examiner:

Acknowledgement

I would like to thank the Principal and Teachers of KV IIT Powai and Campus School IIT Powai, Kripa Gopalan, Karuna Barai and Vikas Kolugude of Asha Foundation Powai, Anurag Maloo of Teach For India for helping me during my study.

I would like to thank IDC for giving me an oppurtunity to work on a project which helped me to understand the various aspects of designing for real life. I would also like to thank Prof. A G Rao and Prof. G V Sreekumar for providing me constant guidance and support in expanding the horizon of my knowledge.

I would also like to thank my family and friends for providing me constant support and motivation throughout the project.

Abstract

Mathematics is a subject which is very closely related or rather derived from the real life. Everybody practices maths in each and every step with or without realizing it. For egs: A vegetable vendor who might not have had any formal education uses it for selling the goods. In such cases maths is a functional concept that is being developed from a form of repeated practice.

The formal education also understands its importance and provides it in a very textual form collaborated in a book to the young minds. The textual form might fail sometimes in relating a child to visualize how the same given problem relates in the environment. Since the text and the language also define in understanding the concept to the core, this can be an issue in understanding in a multilingual classroom wherein the language used in the book is difficult to encode.

Therefore the project aims to break the barriers of the book language and help them with a supportive medium in the real life scenarios. The approach is using elements from the child's environment and creating it into deliverables such that it is interesting, surprising and practical at the same time

Table of Contents

Introduction

There are many ways to organize curricula. The challenge, now rarely met, is to avoid those that distort mathematics and turn off students.

Steen,2007

Maths has always been a subject which is not fully understood by children. They either like, hate or majorly fear when they have to struggle with it. My childhood too was affected by the fear of maths and it is still instilled in somewhere with the others as well. So, through this project I would like to cater to all the children that share my fear and want them to overcome by exploring the possibilities of creating and exploring the alternate methods of the rigidly perceived maths with a Multisensory (mostly which will caters to these senses: visual, audio, kinesthetic and tactile) and Experiential (learning from experience) approach which can be become a healthy way to remove the stigma that is associated over time in the young minds. And also provide them a positive outlook that will enable them to explore the alternate solutions and apply that in the context of their existing curriculum as well as provide them a deeper understanding in the real life.

The common misconception about maths:

People regard mathematics as a concept that does not have any direct, day-to-day applications. Nothing could be further from the truth. Adding, subtraction, multiplication, etc. have direct uses in our lives. We also use more abstract mathematical concepts in our day-to-day lives unknowingly.

Why did I choose this topic?

The topic inspiration came from the fear of Maths that honed during my childhood days. I was scared of maths and would keep on sketching and doodling in the homework period. Therefore I was thinking about the topic in the lines of making maths interesting. I was thinking about solutions as replicable, easily transferable and moreover if it can be manipulated according to their context. I was aiming at the solutions which a teacher and a student both will be able to recreate using available materials. This was also the ideal solution that I was expecting in terms of a full day workshop. The workshop will include physical games and activities. With a lot of thinking and analyzing I thought of developing a multisensory experiential approach of learning maths which is non-digital in nature. I say non-digital because I feel that digital technologies are unable to reach each and every classroom in the country. Though creating a audio visual approach might add to the effectiveness who can avail the digital medium. So creating another level of learning will enhance the understanding of the concept. So why not think of a solution which practically works for all. I started with working with the following keywords in mind: Replicable, Interesting, Surprise, and Playful. So the topic finally selected was: Multisensory experiential learning for rural kids

The challenging part in this project was to combine and think in terms of these levels:

1) Possibility within the course curriculum of schools (combining maths with crafts)
2) Combining design education with the existing school curriculum
3) How do I create a non-digital activity book which is multisensory and experiential in nature
4) Further enhancing the non-digital material into a digital medium who can avail it which is supportive in nature rather than mandatory with the latter.

Again I refined the project to "all the kids" than rural kids with the approach that why distinguish the children on the basis of their economic backgrounds. So, if the solution can work for the rural kids per say, it should be equally helpful for the children in the upper strata. So the focus deepened to any kid or child.

The project aims to develop a series of activities which will include tasks that will enhance the understanding of a concept of maths through multisensory and experiential means.

The activities will form a compilation in the form of a activity book which could be used by teachers to easily replicate and distribute among the class or the students can perfoem the activities and learn.

The focus of this project will be a concept of Maths and the target group will be 11 to 12 year old children (Class 6 -7) living in Mumbai.

With this project I will try to cater to the problems faced by children to understand the concept of Maths by providing them alternative techniques which is multisensory and experiential in nature.

The underlying approach of the solution will be explored in terms of cognivitism and constructivism theories of learning.

Design Methodology

1) Secondary Research:

This involved reading articles, case studies, theories which formed the first basis of understanding the topic.

2) Primary Research:

Maths Curriculum across all boards: Comparisions across all the boards (ICSE, CBSE, Maharashtra State Board). Eventually the focus shifted to CBSE and State Board since these board is widespread in Mumbai.

3) User Study:

It involved conversing with the children of different schools of the target group, understanding their interests in terms of their demographics, psychographics. A questionnaire was developed to assess their views about different subjects in the school curriculum and further assessment was done in terms of their most and least favourite topics in maths. One of the topic among the difficult or confusing topic was chosen and taken as the main focus point of the project.

4) Study and analysis of the existing solutions available

5) Setting up the learning objective

6) Developing of concepts:

Concepts that would help them relate in the real life context.

Secondary Research

The secondary research included looking at case studies, reading theories about child cognition, child psychology, teaching methodologies across the world, learning guidelines of the age group, government policies, understanding the context of the children, the problems children has to face in everyday life. Therefore I have provided the references of the articles and studies that has helped me enormously in understanding the base of project.

Teaching Maths to Pupils with Different Learning Styles
Tandi Clausen-May

The book provides insight about teaching mathematics to pupils who have learning differences, not learning difficulties. Pupils with visual and kinaesthetic learning styles often struggle with a school curriculum that is largely based on print. The development of 'pictures in the mind' can help all pupils to understand key mathematical concepts.

A study of role of recreational activities in developing mathematics learning
Minati Paul Dev

Experience shows that the basic principles of learning mathematics can be made easier through mathematical fun, activities and games. If mathematics can be turned into a game it can become child's play. Class room experience indicate clearly that mathematical puzzles, riddles etc encourage an open minded attitude in youngsters and help them to develop their clear thinking.

Sarva Shiksha Abhiyaan

Sarva Shiksha Abhiyan (SSA) is Government of India's flagship programme for achievement of Universalization of Elementary Education (UEE) in a time bound manner, as mandated by 86th amendment to the Constitution of India making free and compulsory Education to the Children of 6-14 years age group, a Fundamental Right.

Key understanding in mathematics learning Paper 7: Modelling, problem-solving and integrating concepts
By Anne Watson, University of Oxford

In 2007, the Nuffield Foundation commissioned a team from the University of Oxford to review the available research literature on how children learn mathematics. This paper is a review is a compilation of eight papers

NCERT Class 6 Ratio and Proportion

This provided me an insight as to what are the examples that are being used in the educational curriculum and can I develop a supporting material which will further enhance the understanding of the children.

Common Core State Standards for Mathematics

Mathematics Grade 6
Grade 6, instructional time

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

Prospects of School Psychology of India
Ramalingam, P.

This paper analytically discusses certain basic issues related to school psychology and its future prospects in India. The major objectives are (i) To explore the international perspectives of school psychology so as to apply it in India, (ii) To examine current research trends in school psychology in India, and (iii) To describe the role of professional organisations in school psychology. To achieve these objectives, the researcher used psychological literatures and the documents on current practices. The analytical discussion encourages that there is a scope for developing school psychology related research in India as a potential major discipline so as to cater to the needs of the children. It also encourages the policy makers, psychologists, parents and teachers to show concern on school psychology.

TEXT TALK, BODY TALK, TABLE TALK: A DESIGN OF RATIO AND PROPORTION AS CLASSROOM PARALLEL EVENTS

The paper describes the rationale and 10-day implementation in a 5th-grade classroom of an experimental ratio-and-proportion instructional design. In this constructivist-phenomenological design, coming from our theoretical perspective, design research, and domain analysis, students: (1) link 'real-world' and 'mathematical' objects reciprocally through classroom enactment of word-problem situations vis-à-vis guided reading/ writing of spatial-numeric inscriptions; (2) interpret and invent rate, ratio, and proportion texts as patterned cells in and from the multiplication table; (3) revisit and consolidate addition and multiplication as conceptual domain foundations.

Design a Board Game
Shell Centre for Mathematical Education
Joint Matriculation Board

Eachmodule package provides comprehensive materialsfor both teaching and assessment, related to a practical context which has proved interest- ing and enjoyable to the students who havetaken part in its development. It is accessible to those who normally find mathematics difficult, while at the same time it provides a challenge for the most able.

A Story of Ratios: A Curriculum Overview for Grades 6-8

This document provides an overview of the academic year for Grades 6 through 8, beginning with a curriculum map and followed by detailed grade level descriptions.The curriculum map is a chart that shows, at a glance, the sequence of modules comprising each grade of the Grades 6 through 8 curriculums. The map also indicates the approximate number of instructional days designated for each module of each grade. The date approximations are based on an academic calendar beginning on 9/6/12 and ending on 6/26/13 with a testing date approximately mid-late April. Details that elaborate on the curriculum map are found in the grade-level descriptions.

Developing Ratio and Proportion Schemes: A Story of a Fifth Grader

-Jane-Jane Lo, Cornell University Tad Watanabe, TowsonS tate University

There is a growing theoretical consensus that the concepts of ratio and proportion do not develop in isolation. Rather, they are part of the individual's multiplicative conceptual field, which includes other concepts such as multiplication, division, and rational numbers.

Theories of Learning Jean Piaget

Behaviouristic Learning
Cognitivism Learning
Constructivism Learning

What is Experiential Learning? James W. Gentry

It has a quality of personal involvement-the whole-person in both his feeling and cognitive aspects being in the learning event.

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

Learning: creative approaches that raise standards

This survey evaluates and illustrates how 44 schools used creative approaches to learning. These schools had aspirations for their pupils to ask questions independently, make connections between ideas, think creatively, challenge and participate effectively, and reflect on their learning. The report also evaluates the impact on pupils' achievement and personal development. All the schools selected for the survey had been judged good or outstanding in their most recent inspection in terms of their pupils' enjoyment of learning, their preparation for future economic well-being and the curriculum.

How do children learn Maths?

Pamela Liebeck

When we teach only for calculating competence, we get demands for understanding. When we teach only for understanding, we get demands for calculating competence. The real need is for both of these. It is through both of them that we are equipped to solve real problems. To solve real problems, we need to understand mathematics. Paradoxically, to understand mathematics, we need to explore real problems. When children learn mathematics, they need to play with and explore real objects that interest them.

Why and how of learning mathematics?

1. Why teach mathematics?

Mathematics is useful for everyday life, for science, for commerce and for industry, because it provides a powerful, concise and unambiguous means of communication and because it provides means to explain and predict. It attains its power through its symbols, which have their own 'grammar' and syntax. It develops logical thinking, and it has aesthetic appeal.

2. Why do people enjoy mathematics?

Some people may enjoy mathematics because it is useful. But it is far more likely that its appeal for us lies in the intellectual or aesthetic satisfaction that we derive from it. This is particularly true of children. So teachers must be constantly aware that, although the justification for spending so much school time on mathematics is that it is useful, its appeal for children is based on their intellectual or "aesthetic response, in much the same way as the appeal of music or art.

3. How can maths appeal to one aesthetically, in a way similar to music or art?

We must first recognize that personal differences influence our response to music or art. We do not all like the same sort of music and we certainly cannot expect everyone to like the same sort of mathematics. However, a basis to our enjoyment of music or art is our response to pattern, and the following little excursion appeals to that response in mathematics.

4. Mathematics is often called an 'abstract' subject

Mathematics involves a hierarchy of abstractions, and we cannot understand any mathematical concept without also understanding the concepts on which it depends lower in the hierarchy. Of course, language itself is abstract, and we communicate mathematics through language. But language in general does not involve this hierarchical structure to the degree that mathematics does. The teacher's task is to lead children through this hierarchy without losing the chain of connections with the real world.

5. How does the brain cope with this hierarchy?

Symbols are an essential ingredient of mathematics. They condense a hierarchy of concepts into 'manageable' form. Such notation enforces a much more complex thought process than does our decimal notation. Symbols are a very important part of mathematics.

6. How does a child develop abstract thought?

The process happens in these following steps:

E - Experience with physical objects,
L - Spoken language that describes that experience,
P - Pictures that represent the experience,
S - Written symbols that generalize the experience

The mathematical experience, like all his experience, must progress through this sequence of abstraction.

Organisations working under the same interest

The organisations are working for developing curriculums for maths which targets kids of all social strata. They curriculum enhances:

Different Learning Styles in the Classroom
Visual, Auditory, Kinaesthetic
Pictures in the Mind
Using Symbols and Understanding Diagrams
Identifying Different Learning Styles
Assessment for Learning

Some of the organisations who are developing materials are:

Jodo Gyan

Jodo Gyan approaches maths teaching as a get away from thinking of mathematics just as a collection of rules for addition, subtraction and other operations and an array of formulae to start seeing it as a way of thinking, modeling and reasoning about the reality. They do it by catering to the tactile sense of teaching by using manipulatives.

Drawbacks: They cater only at the primary level and fails to explain the next level of complexities once the children progress in the higher level.

Navnirmiti

Navnirmiti is 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.

Drawbacks: the drawbacks are quite similar to what Jodo Gyan features. They cater only at the primary level and fail to explain the next level of complexities once the children progress in the higher level.

Key Findings: Jodo Gyan and Navnirmiti follows a collaborative approach of creative manipulatives which they divide and cater to topics. Their products are highly effective in rural areas and are being used extensively.

Asha

Asha is a Non Profit organization that deals with teaching kids in a multi-level schooling system wherein all the children sits in different groups stated according to the standard of their intellectual level and are taught different concepts in the same room. One observation that I have found out is that the children there are not scared by the teacher and is given freedom in terms of attending the lecture. So, in this way the teacher welcomes the students from of learning point of view and keeps the insights in improving and adapting into the learning method for the next time. Asha also uses Jodo gyan and Navnirmiti approaches extensively in their teaching.

Observations
Asha students are quite welcoming in terms of learning. They are confident in subjects like maths and science. They are exploratory in terms of finding out alternative methods derived from the underlining concepts Anyone in Asha can sit for any of the classes at any point of given time.The Learning environment does not restrict any time frame or standard.

Asha for Education
Bringing hope through education

Primary Research

The Primary research included understanding the curriculum, analysing it, comparing it across the complexity of language used, issues faced by children and identifying the topics where there are isssues with the subject.

1. Overview of the curriculum:

The curriculum is compared across the major existing boards that dominate across Mumbai.

Central Board of Secondary Education (CBSE)
Indian Certificate of Secondary Education (ICSE)
Maharashtra State Board of Secondary & Higher Secondary Education

1.1 Analysis

ICSE	CBSE
More Topics and Concepts Included	Proper descriptions and briefing
All major school's use different books	Illustrations and examples provided
Cost is Expensive for a text book	
Confusion in standardizing syllabus	Lacks some topics when compared with ICSE
Proper briefed	Proper redundancy in division of topics and sub topics
Adequate amount of examples	

Maharashtra State Board

Short descriptions
Lacks examples and proper briefing
Available in cheap price
Lacks some topics when compared to ICSE and CBSE

1.2 To analyze the conventional teaching methods. My primary research was focused on the following schools:

KV, IIT Powai
KV Bhandup
IITB Campus School

1.3 The study was also done with children from different schools. Namely:

Teerandaaj Municipal School
KV Bhandup
Bombay Public School
Powai Hindi/Marathi Medium School

1.4 Questionnaire and Findings

I studied the children to understand what they feel about maths as a subject taking the class 6 standard book as a sample. To understand their opinions I considered taking a more broad class of students from Standard 4,5, 6, 7, 8. (10 to 13 yrs) Though CBSE and Maharashtra State Board are dominant in most of the government schools, therefore the conclusions are limited and subjected towards these two curriculums. Here I provided them the contents page of the available book. The study is based on a group of 20 children.

I asked children to write down what are their favorite subject and Why.
I also asked them to write down what do they think about Maths as a subject and what are the topics they like and they don't.

Findings:

Geometry: There were 20 positive responses and 11 negative responses

Equation of a variable: There were 4 positive responses and 2 negative responses

Fraction: There were 1 positive response and 3 negative responses

Profit and Loss: There were 5 positive response and 4 negative responses

Simple Interest: There were 6 positive response and 1 negative responses

Volume/Area: There were 7 positive response and 4 negative responses

Algebra: There were 4 positive response and 1 negative responses

Indices: There were 5 positive response and 0 negative
responses

3D Geometry: There were 0 positive response and 4 negative responses

Bar Graphs: There were 1 positive response and 2 negative responses

Average: There were 4 positive response and 0 negative responses

Power and Square Roots: There were 5 positive response and 2 negative responses

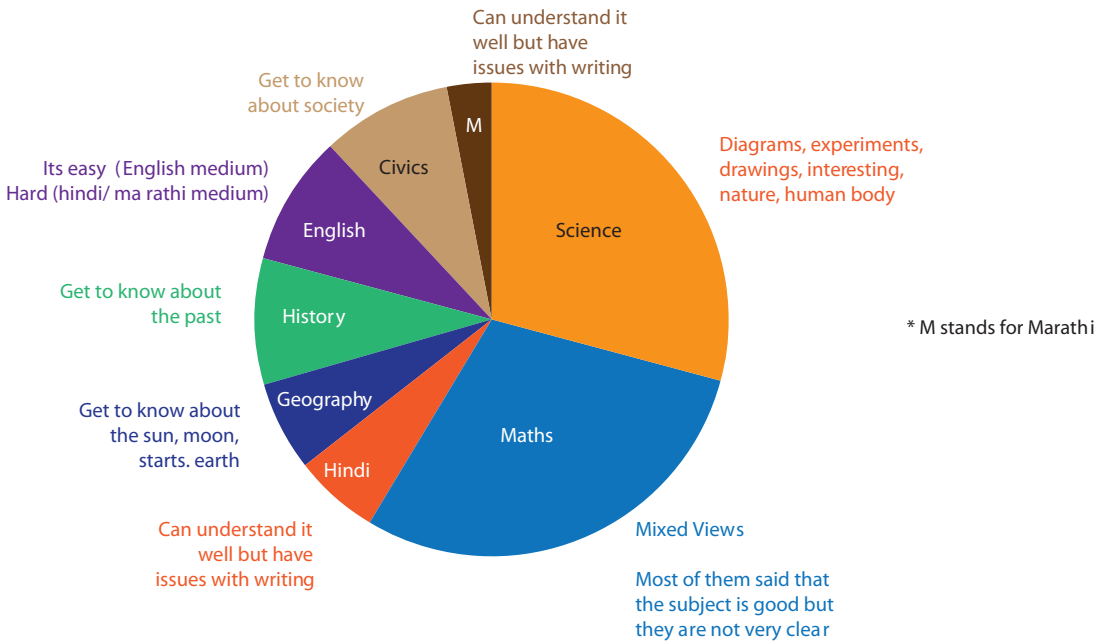
Addition, division, subtraction, multiplication: There were 3 positive response and 1 negative response

Rational Numbers: There were 0 positive response and 2 negative responses

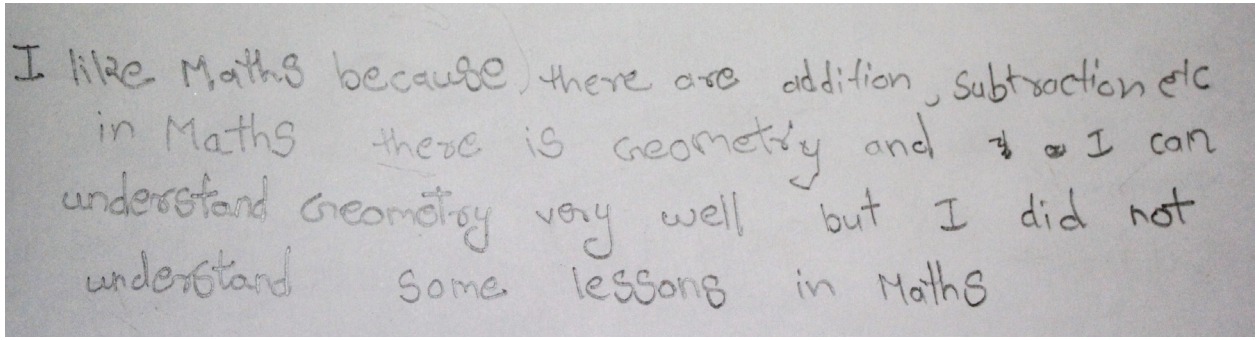
Integers: There were 0 positive response and 1 negative response

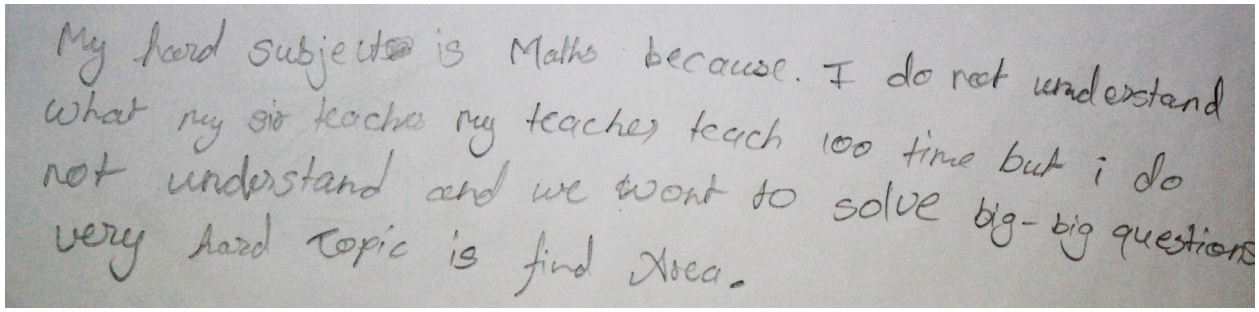
Ratio and Proportion: There were 0 positive response and 5 negative responses

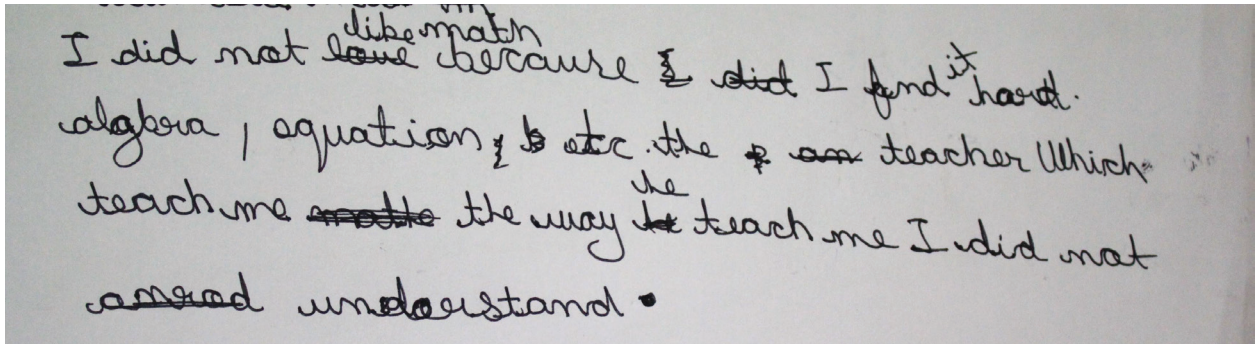
Decimal: There were 0 positive response and 1 negative responses

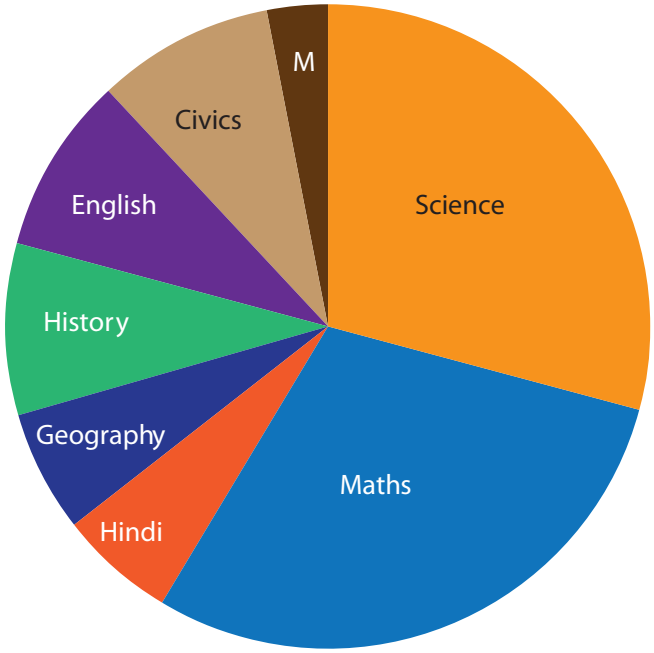


Some responses on: How do they feel about maths?


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 sir teaches my teacher teach 100 time but i do not understand and we wont to solve big-big questions very hard topic is find Area.


I did not ~~love~~ like math because ~~did~~ I ~~find~~ it hard. algebra, equation etc. the ~~can~~ teacher Which teach me ~~middle~~ the way the teach me I did not ~~read~~ understand.



* M stands for Marathi

Important responses:

Science: There were 10 responses as the favorite subject. (They liked it because it gave them to do Diagrams, experiments, drawings, interesting, nature, human body)

Maths: There were 10 responses as the favorite subject. (Mixed responses in terms of liking the subject. Most of them said that the subject is good but they do have issues with some concepts about which they are not very clear)

History: There were 3 responses as the favorite subject. (They can learn about the past)

English: There were 3 responses as the favorite subject. (Easy to read and write. Want to learn to speak fluently)

Geography: There were 2 responses as the favorite subject. (They can see the sun, moon, stars)

Civics: There were 3 responses as the favorite subject. (It teaches them about society)

Hindi: There were 2 responses as the favorite subject. (Again Hindi is promoted throughout the mass media. Since they can understand it well, it

Marathi: There was 1 response as the favorite subject. (Since, it is the majority's mother tongue, it is easy for children

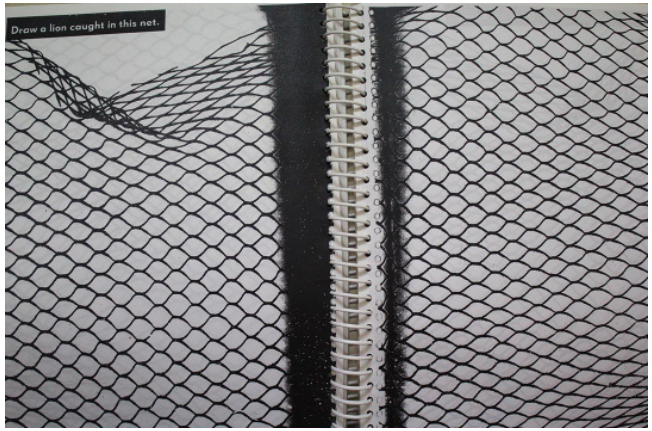
Conclusion

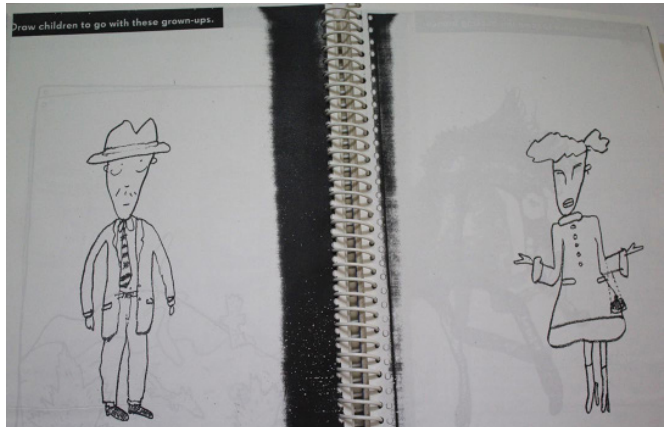
Profit and Loss, Fraction, 3D Geometry, Bar Graph, Rational Number, Integer, Ratio and Proportion, Decimal are the least favored subjects.

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

Therefore I would like to carry forward taking Ratio and Proportion as the topic of my study.

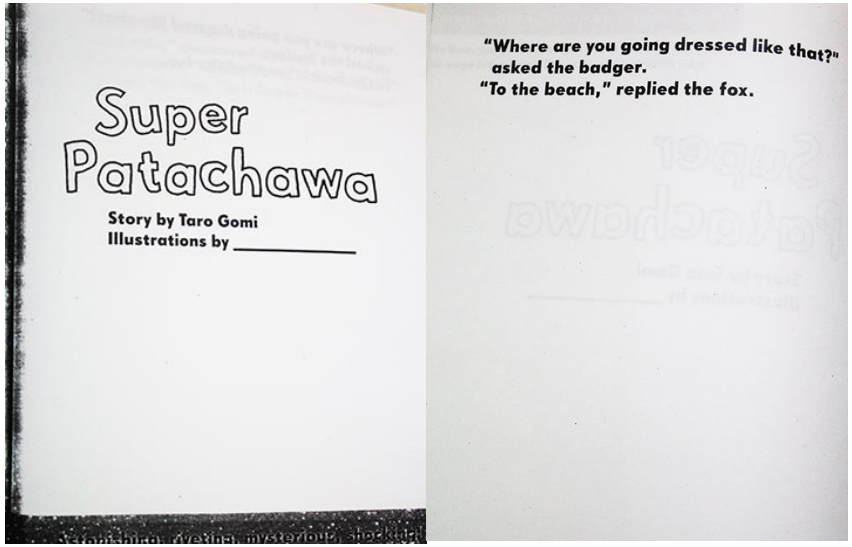
Inspiration from the existing examples

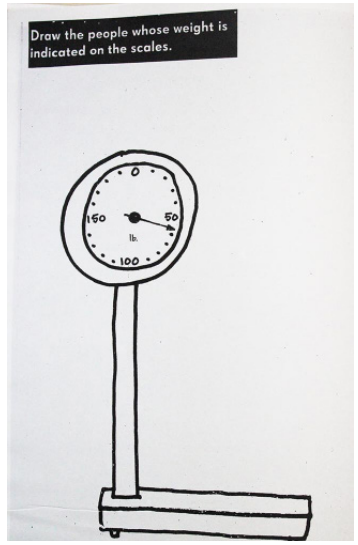




1) Tarogami

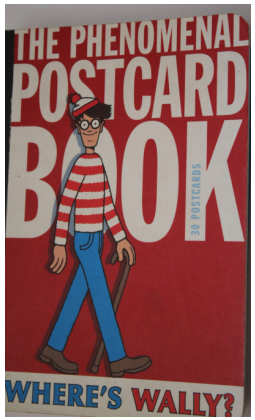
It is an activity book that subtly enhances the boundaries of a child's imagination by enagaing them with playful and enormous creative freedom.





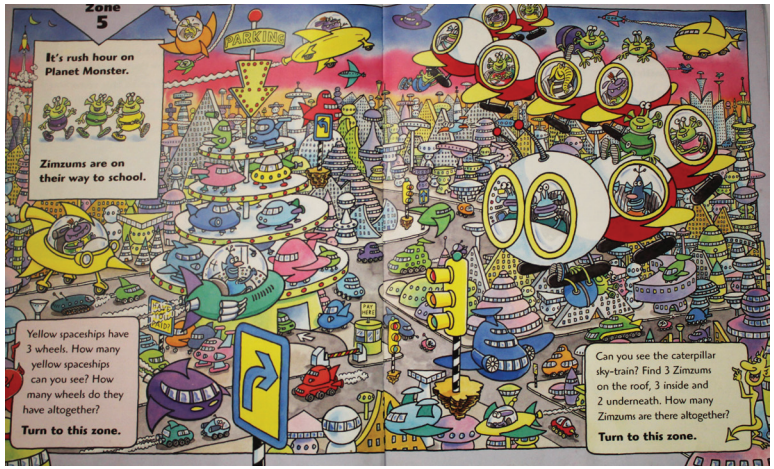
2) Finding Wally

It is a fun book that lets you search and find Wally the main charachter among a huge crowd of people.



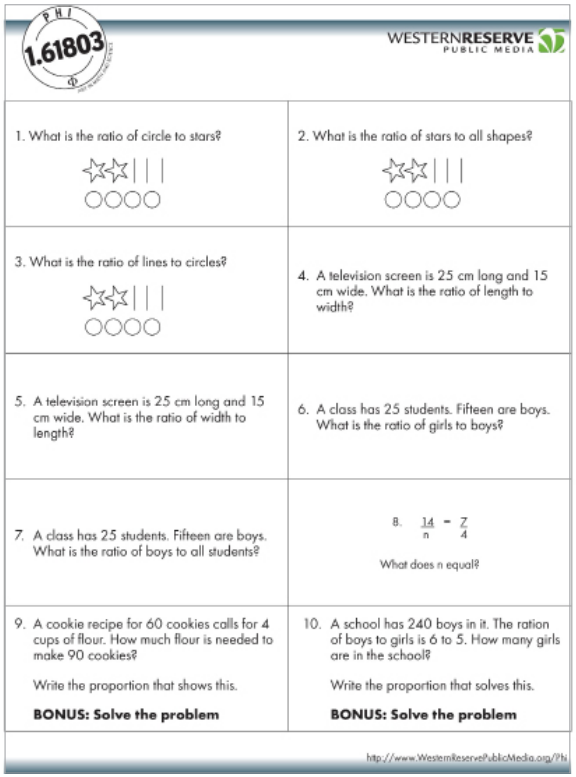
3) Planet Monster

It is a fun book that lets you search the different items in a very interesting way. This one uses the find and count approach with complexity levels merged through the pages.



4) Ratio, Proportion and Percent Board Game

Western Reserve Public Media



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.

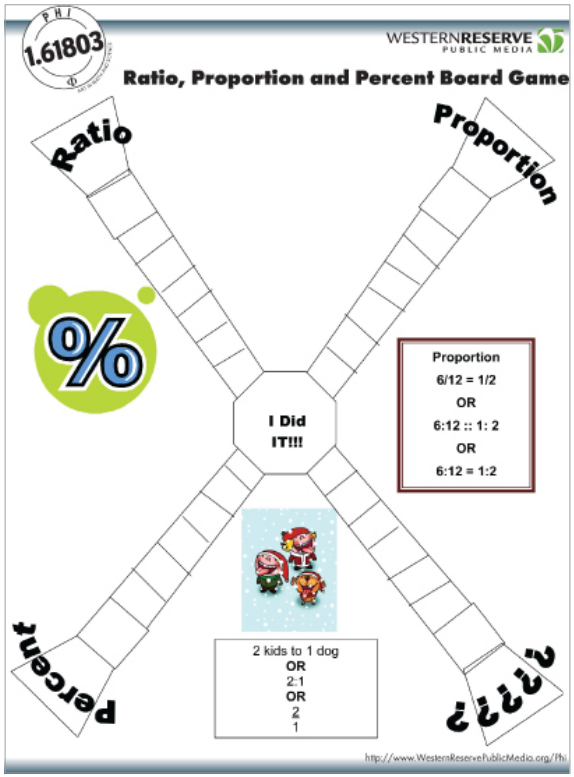
BONUS: Solve the problem

10. A school has 240 boys in it. The ration 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

http://www.WesternReservePublicMedia.org/Phi



Ratio, Proportion and Percent Board Game

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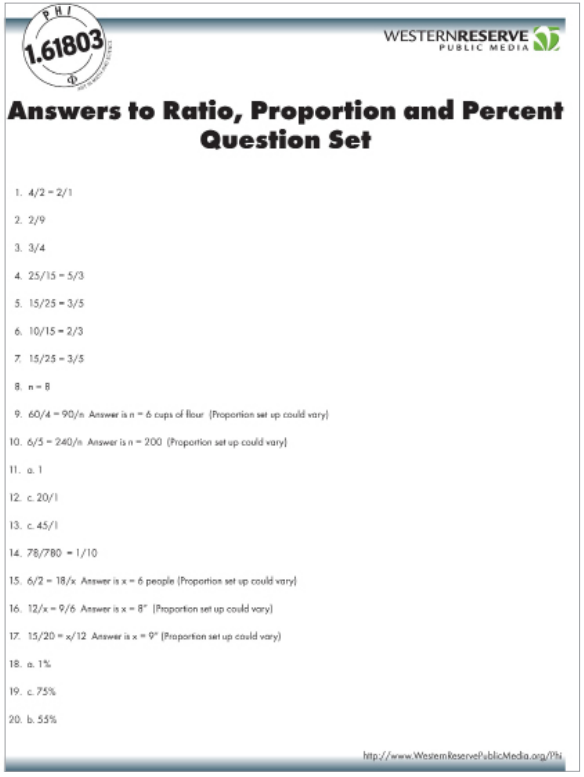

Answers to Ratio, Proportion and Percent Question Set

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%

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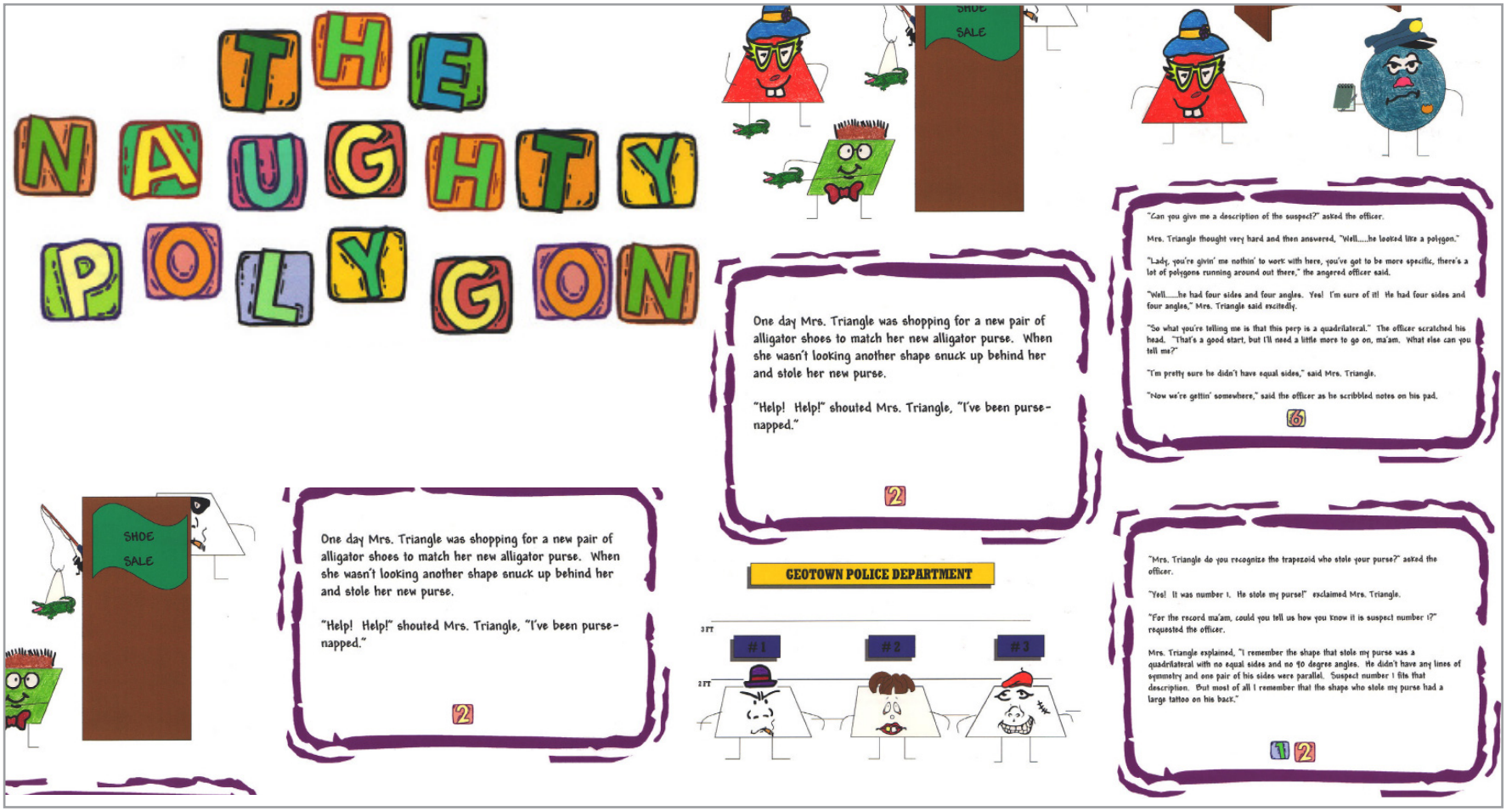
5) The naughty polygon

Kelly Orta



Redefining the Topic :

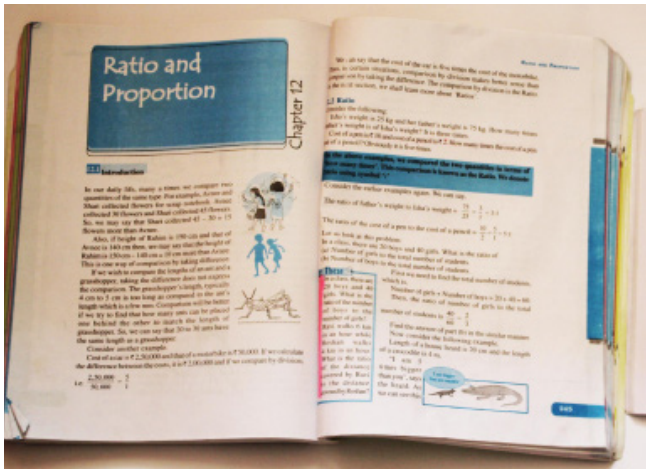
Mutisensory Experiential Learning with Ratio and Proportion as the concept of maths

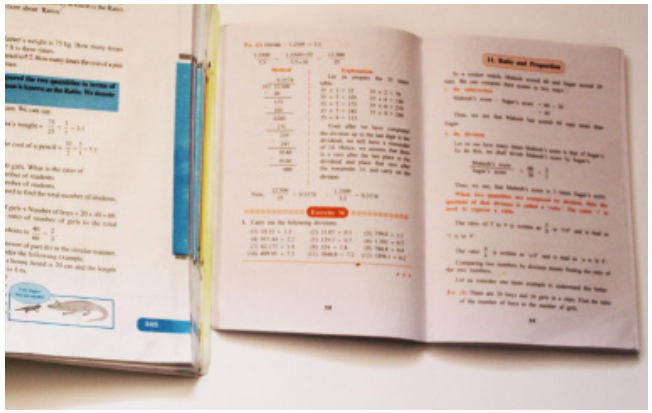
Learning Objective:

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.





CBSE

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

Maharashtra State Board

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 from the children before Ratio and Proportion is introduced across dominant curriculums

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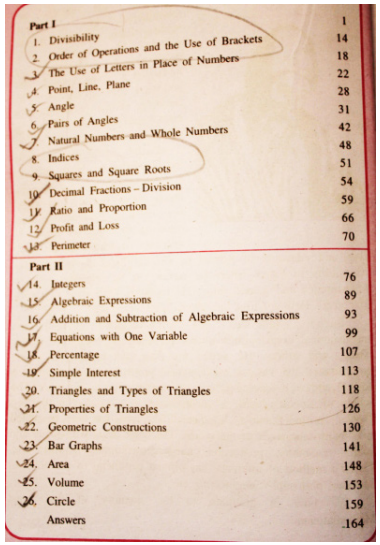
Tables
Divisibility
The use of letters in place of numbers
Decimal Fractions
Number line
Natural numbers and whole numbers

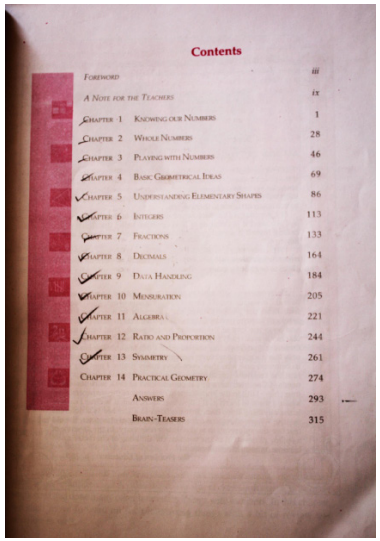


Part I

Part II

CBSE

Whole numbers
Integers
Fractions
Decimals
Algebra



Contents

Problems in Ratio and Proportion:

Problems statement:

Lack of "multiplicative conceptual field" to refer to "all situations that can be analyzed as simple or multiple proportion problems." Mathematical concepts that are tied to those situations include, multiplication, division, fraction, ratio, proportion, and linear function.Students develop these concepts not in isolation but in concert with each other over long periods of time through experience with a large number of situations.Therefore, research studies on children's ratio and proportion concepts also need to consider the other concepts that are a part of children's developing multiplicative conceptual field.

The issues with ratio and proportion are:

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. For egs: Money share, height and weight after 10 years etc.

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. So in order to give them more clarity to the problems they can have more access in the real life context. This will provide them a horizon to relate the concept with everyday situations.

Inspiration: Examples from textbook initially and then gradually shifting to a wider concept

For example: Combing the concept of numbers with squares, grids, pixels and then image. This will help them to understand the concept of meta pattern. This concept could be combined with their craft curriculum.

Examples available in the textbook:

Height
Cost
Length
Time
Holidays
Distance
Students

Stakeholders:

Students
Teachers
Parents

Students: to be able to relate in their own context

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

Can it be combined with?	Possibilities: Context and Interest:	Solutions
Games: Indoor/Outdoor games Game of life (money exchange) Crafts: Puppet, toys, gifts, dyeing, pop up, mask Cooking: Bhel, sandwiches (existing) Design education: Elements of design Tessellation Grids Proportional drawing exercises	TV Music Games Role playing Puzzles Drawing Toys Animals Environment Personal (Body, Name, Parents, Pets)	Games Puzzles Finding games Creating and narrating a story Masks and puppets

Context of the student

Through real life experience

Multisensory Experiential Learning

Visual
Audio
Kinesthetic
Spatial

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

Explorations of the activities

Drawing inside a grid sheet
Finding Ratios in the environment
Calculation of score in ratios
Ratio Housie
Craft and Ratios

Activity 1

What is Ratio ?

This activity will enable them to understand that ratio refers to comparision of units. When happens when there is proportion. The units increase in a recurring multiple. They will understand both by doing this exercise.

The ratio refers to a comparision between two quantities. Ratio doesnot have any units.

Ratio is denoted by : symbol

$$\text{Ratio} = \frac{\text{Number of units}}{\text{Total number of units}}$$

Why cannot we break the use of language and show it in a symbolic form

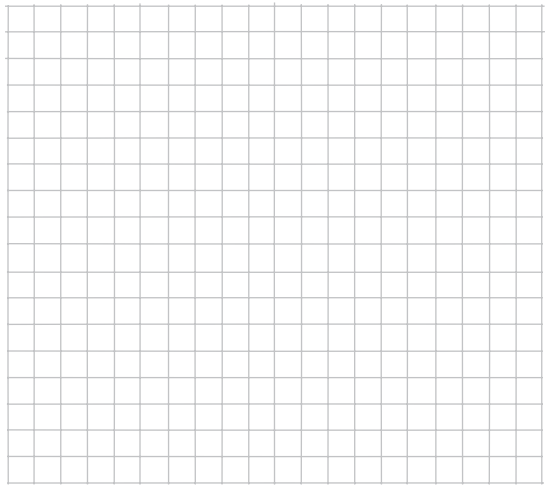
$$\text{Ratio} = \frac{2}{10}$$

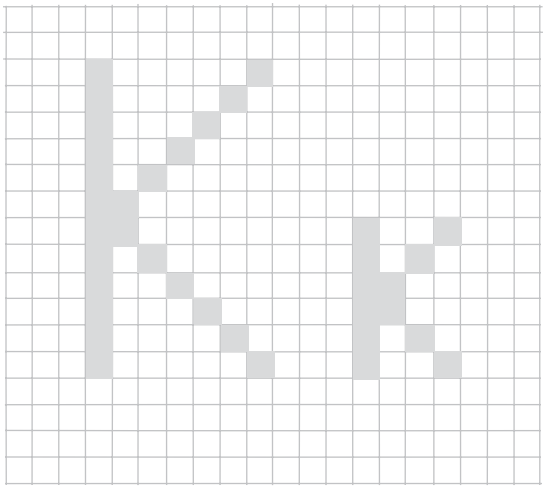
Ratio of the 2 boxes : total number of boxes = 2 : 10

$$\text{Ratio} = \frac{\square\ \square}{\begin{matrix}\square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square\end{matrix}}$$

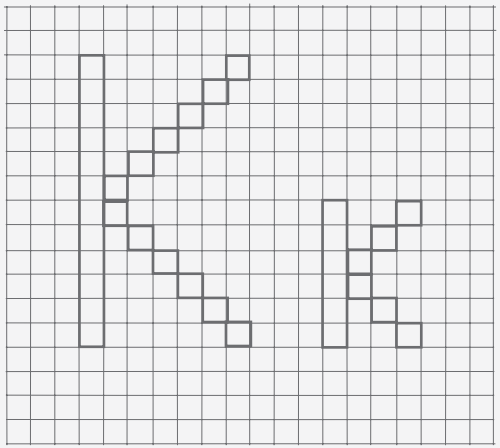
Before the activity they will be shown a sample how write the alphabet.

Write the first alphabet of your name in the boxes.





What is the ratio of the height of the two letters. Answer in units.



$$\text{Ratio} = \frac{\text{Height of the tall letter}}{\text{Height of the shorter letter}}$$

$$\text{Ratio} = \frac{12}{6} = \frac{\cancel{12}^{\,2}}{\cancel{6}_{\,1}} = \frac{2}{1}$$

Ratio = 2 : 1

This exercise will enable them to visualise what the formulae actually depicts.

They will also have an understanding that ratio is just a comparision between two similar quantities.

Activity 2

Finding Ratios

The activity will let them search for ratios. There will be more themed exercises of this kind. Here they have to find ratios using visual clues. Like in this picture the unform worn by girls is blue frocks whereas the uniform worn by boys is blue shirt and white pant. They children have to look closely and identify the number of students. All the elements will represent their life context.

For example:

Ratio of boys to girls

Ratio of boys to total students

Ratio of girls to total children

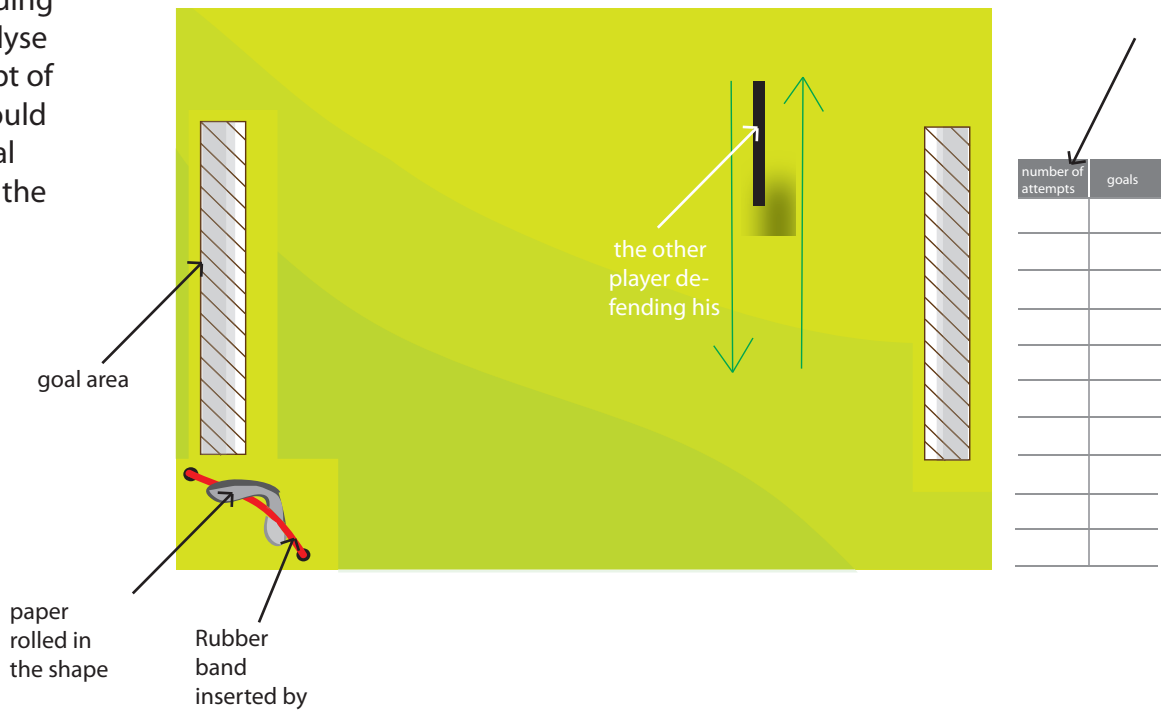
Ratio of trees to benches

Ratio of teacher to total number of students

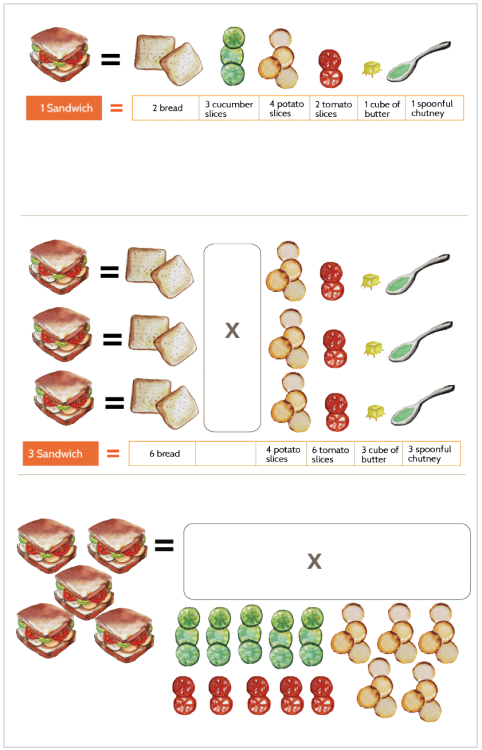
Ratio of number of swings to the total number of children

Activity 3

The board game and understanding of ratios could help them to analyse ratio and understand the concept of runs and cricket. This concept could be applied in any kind of physical game wherein they have to find the number of attempts to total number of scores.

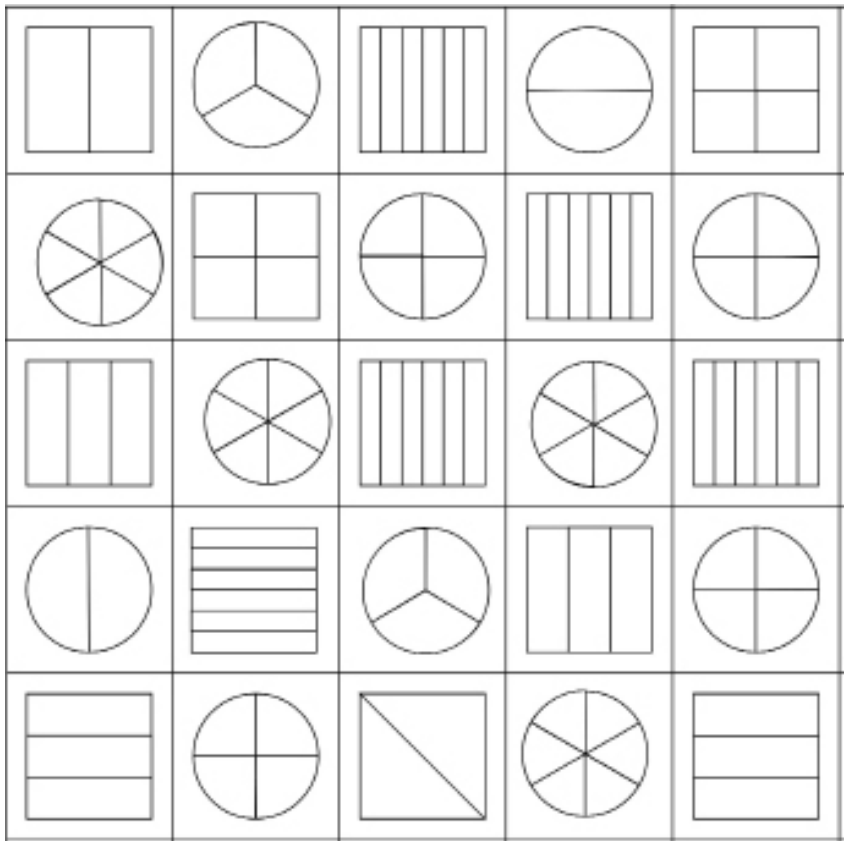


This activity is about finding the variable " x " which is introduced as a fun food activity. They can understand proportion using this activity.



Activity 5

This activity is inspired from housie. One of the child or teacher will draw the cards and announce the ratio. After which the children will shade one of the figures to represent the number. The person who attains a daiagonal, horizontal or vertical combination wins.



Ratios written on cards. This could be in the form of plastic tokens also.

1:2

3:2

1:3

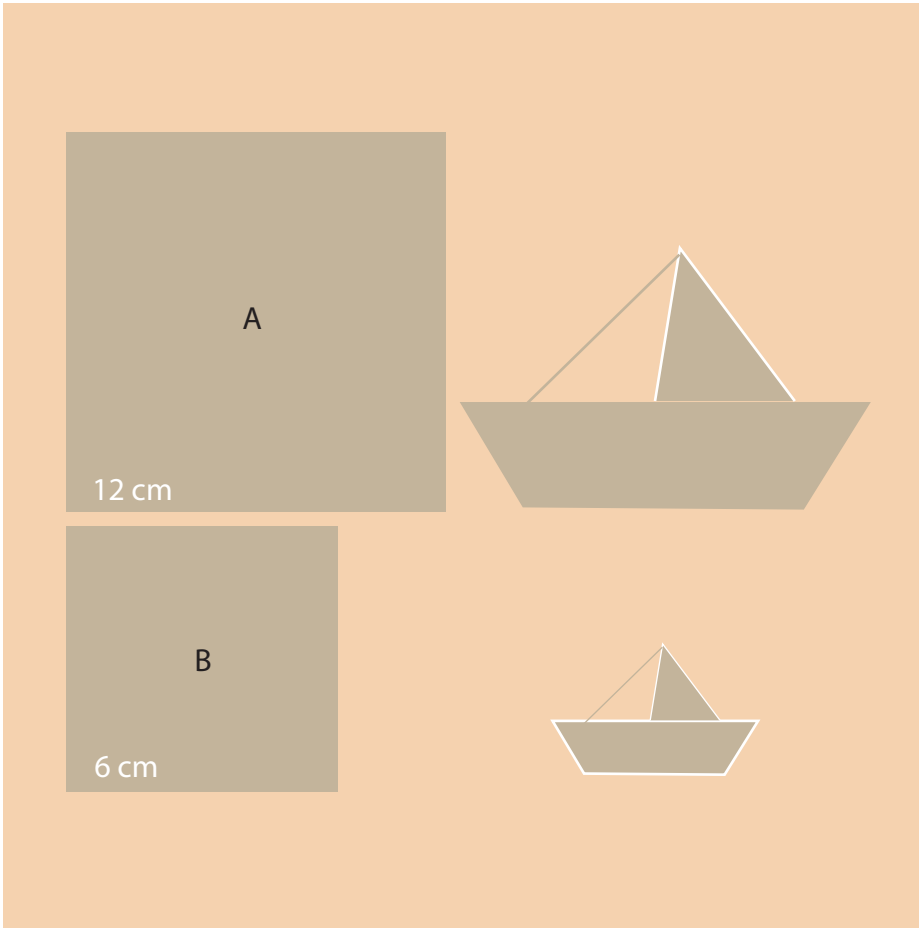
2:4

2:6

2:1

Take two paper squares of 12 cm and 6 cm. Make paper boats out of both. Can you measure the height if boat and find the ratio :

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



This activity will teach them to see how ratios can be used alongwith the craft curriculum.

Activity 7

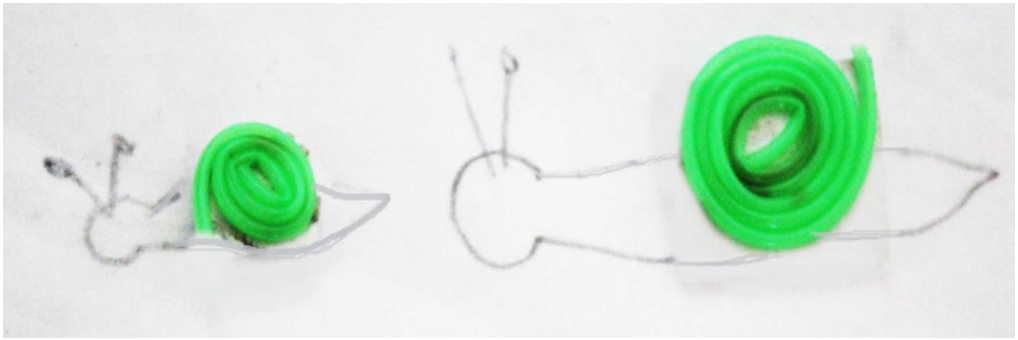
Take a rope/thread and fold it into seven equal parts. Now cut the rope in the ratio of 2 : 5

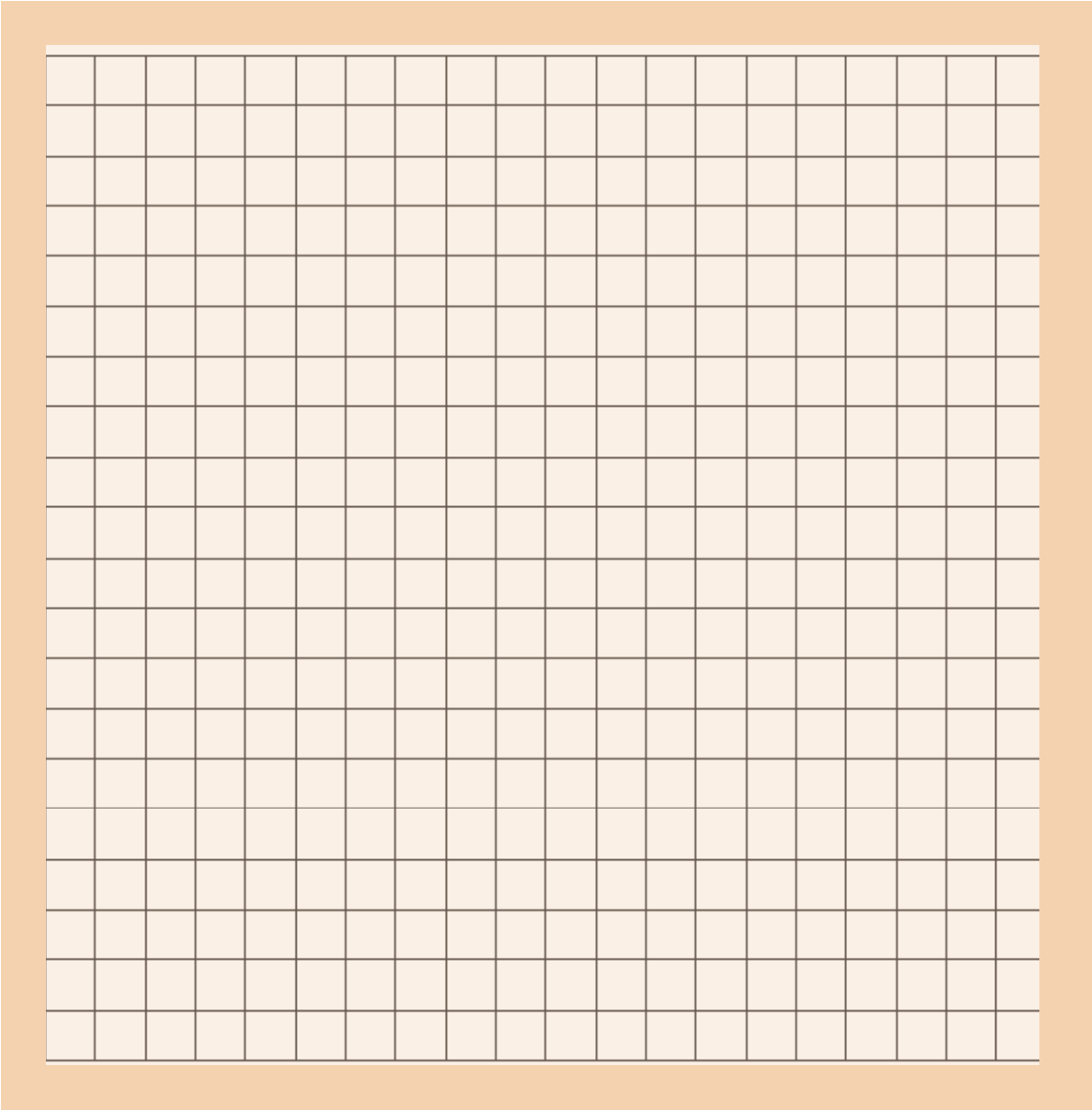
Can you coil and stick it to form a circle.

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

Can you see anything in the circle. I can see two snails. Draw the two snails.

With this activity, they will learn how to think ratios in terms of physical materials. The next level is again an addition to the other level of maths. Then this whole activity sums up in the end by giving them the freedom the visualise and create something new. The clue also adds to their excitement.





This activity is like a board game wherein they have to take a ratio they want. They will work in pairs. Lets take the example that they have taken 1:2. One player forms 1 and the other 2 on either side. But the pairs will have one colour each. Now they roll the dice and get a number (1 to 6). Now they have to find the proportion of the ratio and cover the number of boxes on their own side. The strategy would be to block the path of the other group.

Progress on the solution:

The activities provided are just depiction of the concepts and these will get more enhanced. The book will have activities in a single dominant illustration style.

Scope of the project:

The activity book concept can be applied to all the other topics of maths wherein there are levels of visual clues provided along with supportive text.