

Using Big Books To Teach Data Handling in the Foundational and Preparatory Stages

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‘Big Books’ and shared reading experiences

‘Big Books’ are oversized story books, often containing large pictures and fewer words in large print. This allows for multiple readers to access it and read together comfortably. In the past few decades, the use of big books has gained prominence for ‘shared reading’ experiences with young children in the classroom (Karges-Bone, 1992) (3).



Figure 1: A shared reading experience.

Keywords: *Foundational Literacy and Numeracy, Foundational Stage, Preparatory Stage, early childhood education, data handling, big books, shared reading, integration of disciplines*

Classroom Vignette 1

Picture a group of class 2 children huddled around their teacher, looking over at a large story book gently resting on the teacher's knee. The cover page says 'Dear Zoo'. The teacher, Rini, draws children's attention to the cover page, where you see a partially hidden lion in a crate. After talking about the title and picture for some time, Rini flips to the first page and reads, "I wrote to the zoo to send me a pet." Most of the page is occupied by a large crate that says 'VERY HEAVY!'. Children try to guess which heavy animal can be kept as a pet. A few say elephant, while others say hippo! Rini lifts the flap - it is an elephant! She reads further, "They sent me an... elephant! He was too big! I sent him back." Rini asks questions that make children wonder - *Where would we keep an elephant? What would it eat?* And the story continues... The subsequent pictures partially reveal more animals - a giraffe, a lion, a camel, a snake, a monkey, a frog, and finally a puppy! Each time, Rini lifts the flap by herself or asks someone to lift it for her. A few children disagree about having a puppy as a pet - *A monkey is much more FUN!*

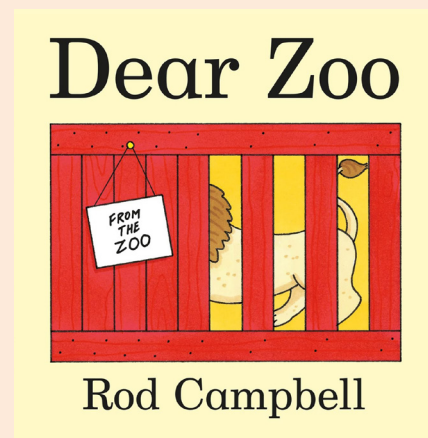


Figure 2: 'Dear Zoo' by Rod Campbell, a 'lift-the-flap' interactive story book, which is also available in the form of a big book.

The big book is then used by Rini for a number of post-reading activities such as - talking about which pet children would like to keep for themselves, telling them more animal stories, making masks and role-playing different animals, and writing a letter to the zoo and requesting for a pet of their own.

Rini frequently uses big books for creating shared reading experiences in her classroom to develop children's literacy skills as illustrated above. But these days, she is also on the lookout for story resources that can enrich her teaching in other subjects. One day, she comes across another storybook - *What Would You Like To Drink?* by Anand Janardhan (illustrated by Ayesha Punjabi) (Janardhan, 2021) (2). The story is about a young girl, Tara, who helps her Dada (grandfather) remember the beverage requests of 15+ people who visit their home for a birthday party. The story embeds the concept of collection and organization of data in an everyday problem context. Rini reads the story and gets a brilliant idea for her mathematics classroom!

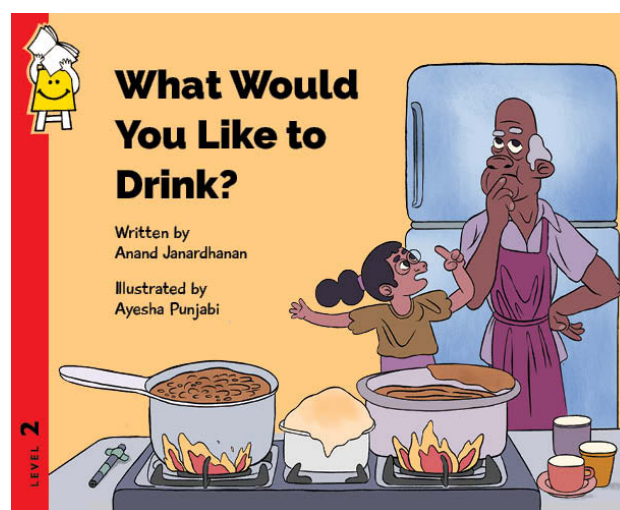


Figure 3: 'What Would You Like To Drink?' by Anand Janardhan (illustrated by Ayesha Punjabi) (Janardhan, 2021) (2), a story embedding the grouping and counting of data in an everyday context.

Classroom Vignette 2

Rini prints this story on A3 paper with a large font and decides to use it as a big book. She uses the whiteboard stand to prop the big book and uses a wooden ruler for pointing. She conducts a shared reading session using the big book and asks questions to spark children’s mathematical thinking. When Dada is puzzled about the quantity (number of glasses) of each beverage he needs to prepare, Tara offers to help. Rini asks, “*How do you think Tara will help Dada?*” A few children respond, “*Tara will call out the name of each beverage one by one and ask the guests to raise their hands. She will count the number of raised hands and tell Dada about it.*” One child says, “*Tara will ask the guests to stand in different corners based on their beverage choice.*” A rather unique response from another child, “*Tara can take down beverage orders from each guest, just like a server does in a restaurant.*” Rini is thrilled to hear such a variety of responses! This shows her that many children in her class have a readiness to formal introduction to data handling techniques. Rini goes ahead and flips to the next two pages. Before reading the story, she asks children to look at the pictures and describe Tara’s solution. With Rini’s help, the children infer that Tara first lists the different drinks - tea, coffee, juice, and milk in one column of the table. She then asks each guest what they want and marks their choice one by one in the next column of the table. Rini then completes the story and asks, “*What do you think of Tara’s solution? How is it different from what you were suggesting? What are the similarities? Do you think this is a useful idea for other problems we face in our lives?*” Afterwards, Rini also encourages children to look at the table and share their observations about the guests’ beverage preferences. For example, which was the most liked beverage, which one was ordered the least, predicting/estimating which ingredient Dada would need the most, etc.

Here are the follow-up activities that Rini does in her classroom:

- Rini asks, “*What kind of beverages would you like to have if we have a get together in our classroom?*”. From children’s responses, preferences such as *chaas*, *bel sherbet*, tea, and *nimbu pani* emerge, which are also popularly consumed locally.
- To decide the quantity (number of glasses) of each beverage, Rini asks if they would like to create a table like Tara did to help Dada. Rini first lists the four beverages. She invites one child, Kaushal, to come forward and populate the rest of the table. Just like Tara did in the storybook, Kaushal asks each child what they want and marks their choice one by one in the table. This leads to the creation of Chart 1:

<i>Chaas</i>	<i>Bel sherbet</i>	Tea	Nimbu pani
✓✓	✓✓	✓✓	✓✓
✓✓	✓✓	✓	✓✓
✓✓	✓✓		✓✓
✓✓			✓✓
			✓✓
			✓
8	6	3	11






Chart 1: Table recording the beverage preferences of children in Rini’s class

- Rini and the children then decide to make a big book of their own. They substitute the birthday party with a classroom party and add their preferred beverages. The story begins, 'Once upon a time in Posaliya town of Sirohi district in Rajasthan, 27 children of class 4 decided to have a party...' Rini keeps the big book in the reading corner and notices children reaching out to it and reading it in small groups.
- After this experience, Rini promises that they will have a classroom party coming Saturday where everyone's preferred beverages will be prepared together and served!

In the days that follow, Rini uses contexts given in the textbook (NCERT Mathematics textbook, Class 2, Chapter 11: Data Handling) (NCERT, 2023) (9) to further develop their data handling skills as per the curricular expectations for this grade level. She first guides the children to understand the contexts by observing and describing the given pictures. This is followed by children counting and collecting data for given categories e.g., favourite colour, type of fruit/vehicle, etc., recording their findings in the form of tables, representing their data in the form of simple pictographs, and talking about the findings by looking at the pictographs.

Discuss the picture and fill the table.



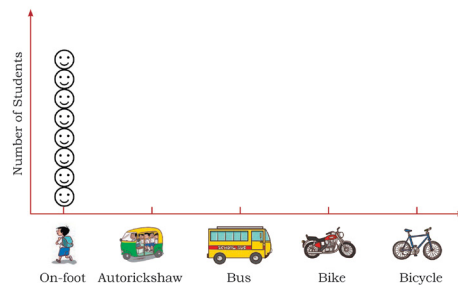
Mode of coming to school	Number of students
	8
	
	
	
	

Reprint 2024-25



Read the table and draw faces (☺) in the chart given below to show the number of students coming to school by different modes. (☺ = 1 student)

Look at the chart and fill in the blanks.



- Most number of students come to school by _____.
- Least number of students come to school by _____.
- The number of students who come to school using bus is _____ (less/more) than the number of students who come using autorickshaw.
- The number of students who come to school using bike is _____ (more/less) than the number of students who come using bicycle.
- The number of students who come to school using _____ is less than the number of students who come using _____.
- The number of students who come to school using _____ is more than the number of students who come using _____.

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Figure 4: Source: NCERT Mathematics textbook, Class 2, Chapter 11: Data Handling, pp. 125-126 (NCERT, 2023) (9)

Rini then culminates the topic of data handling in her class by setting a task where children have to create a pictograph for the beverage table they had created earlier. Children create the following pictograph and attach it to their big book:

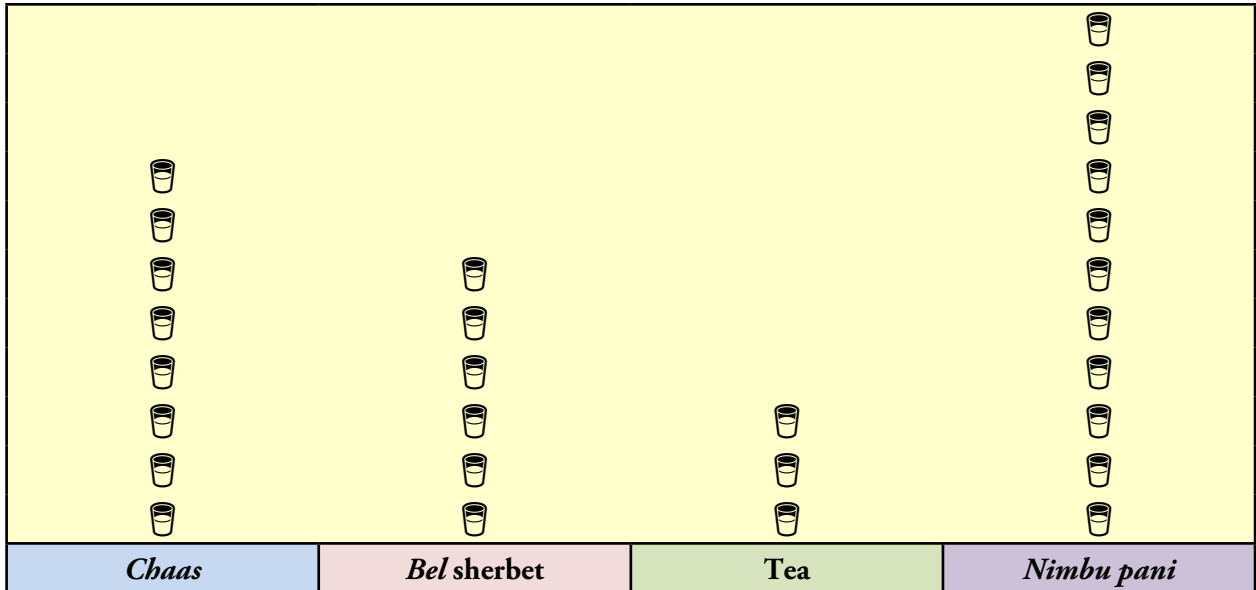


Chart 2: Pictograph representing the beverage preferences of children in Rini's class, based on Chart 1

Using big books in teaching mathematics

Rini's experience is an example of an intimate and participatory reading experience for introducing a mathematical concept. Though such experiences are generally recommended for language and literacy development¹, there is a growing acceptance and practice of embedding mathematical concepts within narratives such as stories and rhymes for young children (NCF-FS 2022, p. 141) (7). Such integrative approaches support and extend the conceptual understanding of complex mathematical development. This is because familiar contexts allow children to draw on their prior knowledge to bring meaning to mathematics. Integrating mathematics and literature creates opportunities to introduce new vocabulary, to make connections among abstract concepts, and showcase ways that mathematics applies across the curriculum. (Koellner et al, 2009) (4). We saw that Rini's children offered a variety of solutions for Tara's Dada. This was because they had become immersed in solving a problem in a familiar context. Young children are known to choose a variety of ways for representing their data when given the opportunity, such as by making templates/drawings, simple pictographs and bar graphs, making block charts using sticky notes, etc. (English, 2013) (5). Here the use of a simple story provided such an opportunity to children.

A cursory survey of publishers of children's literature in the market reveals a surge of stories where mathematical concepts are clearly embedded. These are usually referred to as 'STEM' (Science-Technology-Engineering-Mathematics) books. In the early years, they usually embed concepts related to EVS and mathematics such as plants, health and hygiene, birds and animals, mathematical operations, shapes and objects, measurement, time, etc., in their plotlines. Here are a few examples from popular publishers of children's literature in India:

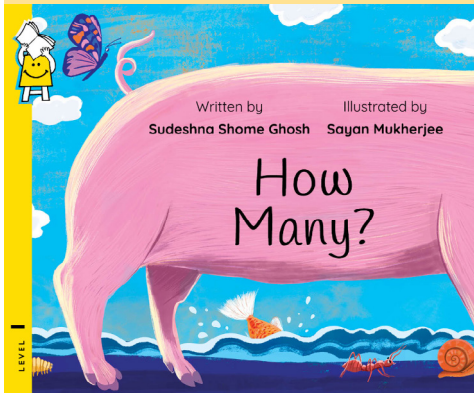
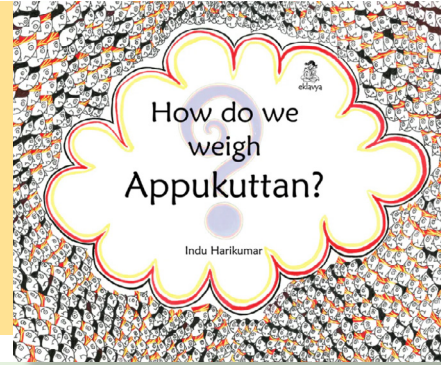
¹ For example, to develop interest in stories, build familiarity with print, demonstrate a variety of reading strategies, expand vocabulary, and develop early reading skills such as recognizing words and developing connections between sounds and letters.

How Do We Weigh Appukuttan?

(Eklavya)

Written by Anjali Alappat and illustrated by Yogee Chandrasekaran

Concept covered: Weight (standard and non-standard units)



How Many?

(Pratham Books)

Written by Sudeshna Shome Ghosh and illustrated by Sayan Mukherjee

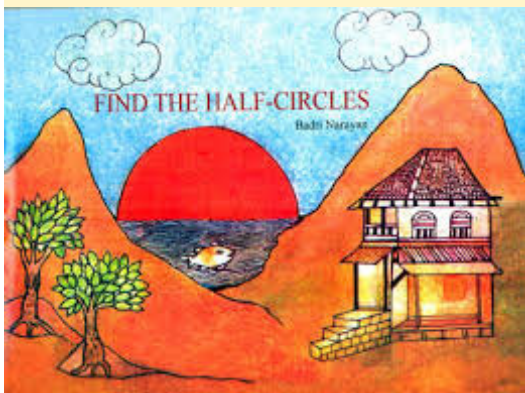
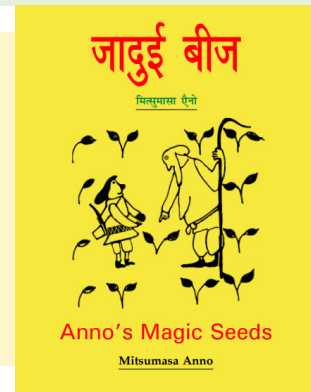
Concept covered: Counting

Anno's Magic Seeds

(Bharat Gyan Vigyan Samiti)

Written by Mitsumasa Anno and Hindi translation by Arvind Gupta

Concepts covered: Addition and multiplication, can be extended to arithmetic and geometric progression too (for higher grades)



Find The Half-Circles

(National Book Trust)

Written by Badri Narayan

Concept covered: Shapes (semi-circles)

Ek Mein Do

(Translation: *Two In One*) (Scholastic)

Written by Gulzar and illustrated by Anjana Guha Thakurta

Concept covered: Counting

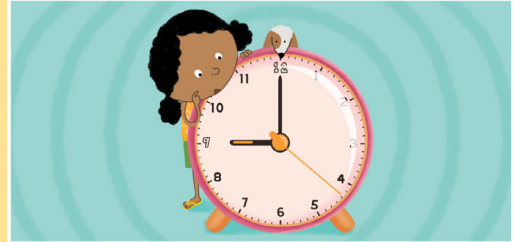


When Will Amma Be Back?

(Pratham Books)

Written by Prathiba Swaminathan and illustrated by Alankrita Amaya

Concept covered: Measurement (time)



When Will Amma Be Back?

Author: Prathiba Swaminathan
Illustrator: Alankrita Amaya



Level 2



Keshav's Kolam

(Karadi Tales)

Written by Shobha Viswanath and illustrated by Leeza John

Concept covered: Patterns, symmetry

Mina Makes A Dash

(Pratham Books)

Written by Anjali Alappat and illustrated by Yogee Chandrasekaran

Concept covered: Measurement (length)



Mina Makes a Dash

Author: Anjali Alappat
Illustrator: Yogee Chandrasekaran



Level 3



Gola Gola

(Pratham Books)

Written and illustrated by Aithihya Ashok Kumar

Concept covered: Venn diagrams



Gola Gola

Author: Aithihya Ashok Kumar
Illustrator: Aithihya Ashok Kumar

Level 3

The Animal Plot

(Pratham Books)

Written by Lokesh Khodke and illustrated by Lokesh Khodke

Concept covered: Bar graphs



The Animal Plot

Author: Lokesh Khodke
Illustrator: Lokesh Khodke



Level 3

Figure 5: Samples of children's literature in India.

Such children’s literature can prove to be an excellent resource for teachers to include in their mathematics classroom in a variety of ways. Teachers can also look for the potential to engage with mathematical ideas in non-STEM children’s literature. For example, even classic tales like *Jack and the Beanstalk* or *The Monkey and the Cap Seller* can be adapted and used for teaching various concepts such as counting, addition, subtraction, measurement, comparisons, etc., as per the teacher’s imagination. The new mathematics textbooks by NCERT also have ample contexts for building mathematical stories. The use of stories also provides a seamless opportunity to engage children in developing problem solving skills, which is also an important goal of teaching in a mathematics classroom (NCF-SE 2023, p. 177) (8).

Data handling

Data handling is a major component or area of mathematics learning in the Foundational Stage along with number and its relations, basic mathematical operations, shapes and spatial understanding, patterns, and measurement. In today’s world, with the constant bombardment of huge amounts of data, bar graphs, pie charts, etc., have become routine forms of communication in almost all walks of life. Therefore, a sound understanding of data handling is an important component of children’s mathematics education (Shirali, 2016) (10). The National Curriculum Framework for Foundational Stage (NCF-FS 2022) defines data handling as ‘*understanding the collection of data, collecting and analyzing it*’ (NCF-FS 2022, p. 121) (7). It further states that data handling in the Foundational Stage involves sorting, classifying, and counting objects in groups (NCF-FS 2022, p. 333) (7).

Children naturally group and count items outside school in a variety of real-life contexts such as while playing with their toys, laying the table, and cleaning up after themselves. When children first enter the formal school space, a few ways in which these experiences get extended is during attendance time, during a contest, and while choosing a game/sport to play.

When children develop sorting and classifying skills in early childhood through concrete experiences, they can be supported to represent the data using pictographs and block charts. Such experiences help children notice patterns in their surroundings and develop skills that can be applied for handling data in later stages of schooling. For example, in the Preparatory Stage, collecting, organizing, and representing data takes relatively more abstract forms such as using tally marks, bar graphs, and pie charts along with development of the ability to read and interpret/infer meaning out of these representations (Shirali, 2016) (10).

Gaps in children’s understanding of data handling

As children become older and move from the Foundational Stage to the Preparatory Stage and later, they deal with mathematics in more abstract ways. Unfortunately, data handling is a neglected area in early mathematics. If children have not engaged with sorting and classifying information in concrete ways in the early years, dealing with abstract data in the forms of tables, charts, and graphs becomes even more challenging. For example, a child despite being in class 4 may look at Chart 3 which uses ‘pictographs’, and find it difficult to grasp the following:

- What each part of the chart represents e.g., that each green triangle represents 3 children, the title of the chart, and other data labels.
- That the number of children in each task can be calculated from the chart, along with the total number of children.
- That the ideas of ‘more’, ‘less’, and ‘equal to’ can be explored through the chart e.g., which task is being done by most children.
- That all this information can be represented in the same chart.

- That all this information is related to their daily lives, and that they too can collect and represent similar data from their surroundings.

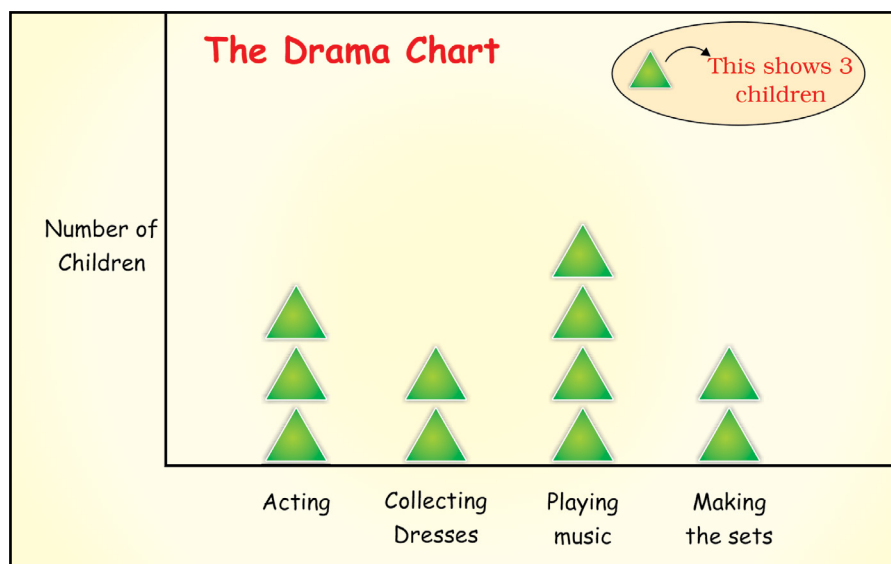


Chart 3: Pictograph representing the different tasks being done by children of a class for a drama

Source: NCERT Mathematics textbook, Class 4, Chapter 14: Smart Charts, p. 163 (NCERT, 2007/2024) (6)

As children move to higher grades, data is represented in more complex ways such as by using tally marks, bar graphs, and pie charts. Children may incorrectly group tally marks in sets of five, misinterpret graphs due to confusion regarding the use of scale, or misinterpret pie charts due to difficulty in understanding fractions.

Summary

As in the case of other mathematical concepts, misconceptions regarding data handling are typically due to how the content is presented and sequenced in the textbooks, along with gaps in the teacher's pedagogy, where children typically do not get a lot of hands-on experience of collecting, sorting, and representing data in authentic, meaningful situations. Use of children's literature can help in providing meaningful contexts for developing and practicing mathematical concepts in the classroom. More specifically, big books emerge as a developmentally appropriate tool for working with young learners as their large, visually engaging pages effectively illustrate data handling concepts and make the learning process interactive and accessible. When teachers adapt existing storybooks to make big books or co-create big books with children based on stories and conversations with them, rich and relevant contexts emerge for teaching not only mathematics but language and other subjects like The World Around Us (EVS) too. Children also love to repeatedly read big books in their own time, further serving the purpose of developing their interest in reading and making them keen readers. (Karges-Bone, 1992) (3).

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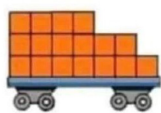
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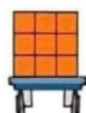
Opening the Question Up!

Here is a question that appeared on our WhatsApp group.

HOW MANY CUBES ARE ON THE TRAILER?



SIDE



BACK



TOP

Is there only one correct answer to this question?

This is a great hands-on exploration even for students who haven't studied the concept of volume. In fact, better answers may come from them. Have fun experimenting with interlocking cubes, model the given information and unleash your creativity!

Send in your solutions to AtRightAngles.editor@apu.edu.in