

My Experiences with Mathematics Education

Abstract

Most adults when asked about their experience with mathematics would say that they are scared of it. This article tries to look at some of the reasons why this is the case. It is based on some of the experiences I have had while working with children, teachers and teacher-students.

A few days ago, a very enthusiastic math educator asked me about my views about 'fear of mathematics'. She wanted to study a classroom and understand the factors that create this 'fear of mathematics'. While talking to her, I remembered all those instances I have seen this fear of mathematics and started wondering if studying one particular teacher or one particular classroom can actually help us.

In this article I would like to recall some of these instances that I have seen and try to look at the question, "Is fear of mathematics a local issue?"

A few years ago, I got a chance to visit a DIET in Rajasthan. When the DIET faculty introduced me to the student-teachers, the student-teachers seemed enthusiastic. But as soon they were told that I would be doing some mathematics activities with them I could see their enthusiasm reduce. I started talking to them about my session and asked how many of them liked mathematics and only one hand was raised. Most of them said that they were scared of mathematics. These student-teachers were soon going to be primary school teachers and were expected to teach mathematics to children so I wondered, how do we expect a teacher who is scared of mathematics to teach children to enjoy mathematics? I also thought about the possible reason for this, As Deborah Ball writes in one of her articles in the context on teachers in the U.S. which is applicable in the Indian context too,

[1] *"That the quality of mathematics teaching depends on teachers' knowledge of the subject should not be a surprise.Equally unsurprising is that many U.S. teachers lack sound mathematical understanding and skill. This is unsurprising because teachers — like all other adults in this country — are graduates of the system we seek to improve. Their own opportunities to learn mathematics have been uneven, and often inadequate, just like those of their non-teaching peers."* While introducing my session, I told them that I would be talking to them about fractions and I saw fear on their faces. Their keenness to know about what I am going to do was further reduced. We started talking about fractions and I saw that their understanding of fractions was very minimal. Most of them thought that $1/3$ was greater than $1/2$.

We started our session. The idea was to introduce the equal share meaning of fractions and work through some examples based on the research. After a series of examples of equal sharing with unit fractions (where the number of rotis to be divided is 1), we moved on to compare some fractions. Now $1/3$ was not anymore greater than $1/2$ because it was clear that if a roti is divided equally between 3 children and another is divide equally between 2, the share of children in the latter would always be greater than the one where there are 3 children. Suddenly fractions like $19/17$ and $17/15$ started making sense and most students-teachers

could verbally compare these two fractions. “If a child gets $19/17$, she will get 1 roti and $2/17$ th part of another. In the case of $17/15$, each child will get 1 roti and $1/15$ th part of another roti. 1 roti divided between 17 children, the share would be lesser than that of 1 roti divided between 15 children.” This method was not only easier but also faster than actually multiplying 17 and 17 and comparing it with 19 and 15. After this some students actually went on to compare $103/101$ and $5/3$. They did not find fractions scary anymore. These fractions were only shares of each child when rotis were divided between children.

This session was only for four hours but I could see that more such sessions would definitely help the student-teachers be less scared of mathematics. Though I would like to believe that my session helped the students understand fractions, the truth is that it was the context which helped the students deal with the topic of fractions better. Fractions were no longer rectangles with parts that were coloured, but were things/numbers they would deal with, play with and understand. The context of equal division of rotis was familiar unlike the rectangles and their equal parts.

When I talked to the student-teachers later, some of them said that they understood the fractions they did that day, but how do they do fractions in mathematics? This question baffled me and I was unable to understand the question at all.

I understood the question much later during an interview. There was a candidate who was asked to divide 4040 by 8. Without even batting an eyelid he said 55 and showed us how he got it. When asked if Rs. 4040 were divided between 8 people, how much would each get, he said that it would

be more than 500. And added that “but in maths the answer is 55.”

Why was it that this person trusted his flawed mathematical algorithm more than his own common sense? Why did he accept the difference in the answer between the answer he got using his basic understanding and the answer he got using mathematical algorithm without question? Is it because the way mathematics is taught in our schools is extremely disconnected from real life? Is it because there is no attempt to connect it to our lives or to even see if the answer is meaningful and sensible?

For example, I remember a constant debate some of us had during designing a state curriculum. While writing the part on measurement, some of the group members wanted to use the word **वस्तुमान** (mass) instead of **वजन** (weight). Long arguments followed about using familiar words with students especially while dealing with young children and **वस्तुमान** (mass) won over **वजन** (weight). Moreover some of my sensitive physicist friends also supported this argument of using mass instead of weight as this can lead to misconceptions while doing higher physics.

A lot of this people who supported using the ‘**वस्तुमान**’ (mass) instead of **वजन** (weight) ignored the fact that this was meant for 7 year old children who might not have ever heard the word ‘**वस्तुमान**’.

Due to our obsession with preparing students for higher studies are we risking reducing their interest in their current studies?

When a group of Class 5 students were given this problem the teacher wasn’t sure how the students were going to solve. “*2 pencils and 1 eraser cost Rs. 13 and 1 pencil and 2 erasers cost Rs. 11. What is the cost of 1 pencil? 1 eraser?*”

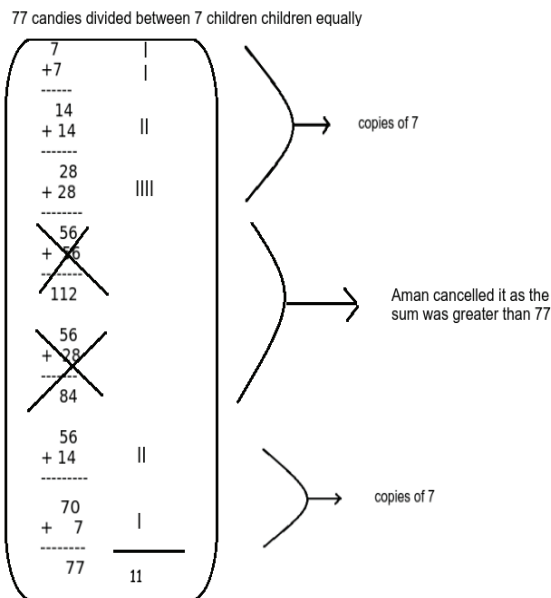
After a couple of minutes, some children said that the cost of the pencil was Rs. 5 and the eraser was Rs 3. The teacher noticed that whatever calculations the children had done were oral. When asked how they got the answer, one girl said, “2 pencils and 1 eraser and 1 pencil and 2 erasers give us the cost of 3 pencils and 3 erasers, that is Rs.24. Then we get the cost of 1 pencil and 1 eraser which is Rs. 8 and from that we get the cost of 1 pencil and 1 eraser.” I was very surprised to hear this. The children were never taught this strategy. They had figured out strategies to ‘find the unknown’ themselves.

Though I said that the children were not taught this strategy, I should mention that in this classroom there was a complete freedom for the children to use their own ideas and solve problems. All methods were welcomed and the only condition was that the children were expected to justify their methods to their classmates. Hence the children weren’t worried of going wrong.

Whenever I think about children’s own methods I think about Aman. One of my colleagues decided to teach mathematics to students who had difficulty in mathematics. The teachers from a school near-by were contacted and some children who the teacher thought were weak in mathematics were asked to come every week. Most of the children lived in a basti close to the school and belonged to the lower socio-economic class of society. Some of them helped their family in earning their livelihood and were very quick and confident of doing oral mathematics.

In these sessions, children were given various problems (mostly contextual) and their methods were discussed in the classroom. During one such session, the children were asked a problem which involved equal division. Aman very quickly solved the problem.

The method he used was something like the way given below.



(The numbers Aman actually used might have been different)

When Aman showed us his method, for a few minutes we were unable to understand the method and its working. When we understood the method, all of us appreciated it and told Aman that we liked the method very much. Aman’s reaction to this was very surprising, he looked at us very confused and said, “You liked this? My teacher didn’t like it at all”

This happened a couple of years ago. Since then I have talked about this method to many teachers and teacher educators. Their reactions have been very varied. But one reaction that remains with me was given by a teacher educator, she refused to believe that this method was ‘mathematically’ correct as, ‘multiplication is repeated addition and division was repeated subtraction’. Her argument was simple, “How is that no mathematics books have realized that division can be done with adding repeatedly when a 10 year old boy could do it?”

It is surprising that while we talk about Gauss’s method of adding first

100 numbers is an effective way when he was in school, we refuse to believe that Aman can think about a new algorithm to divide numbers.

Coming back to the question we started with, 'Is *fear of mathematics* a local issue?' Can we study one teacher, one classroom or one school and decide on the factors which cause this fear of mathematics? My answer to this is No.

This fear of mathematics comes from the curriculum, its disconnect from real life due to the nature of mathematics or the way it is organised. Lack of teacher preparation is a major factor why the students feel the disconnect. Our system expects teachers to teach without giving them the help they need to teach. The NCF 2005 position paper on teaching of mathematics underlines a lot of issues raised in this article and the NCERT textbooks, especially the primary textbooks, do work towards addressing some of the issues stated in

the position paper.

Various individuals and organisations have been working very hard to develop trajectories, curriculum and teaching education material through practice and research to help students and teachers to understand mathematics or to teach it in a more effective way.

When I reached the end of this article I wondered why I was writing it. Am I asking some new questions, offering some solutions? Maybe not. But I feel that there are some questions which have to be asked again and again so that we don't forget the issues involved.

I would also like to add that this article in no way wants to question the efforts done by the mathematics education community in India but wants to say that we need to work even more towards a mathematics education which is more equitable and inclusive.

References

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2. Subramanian, J., Subramaniam, K., Naik, S., & Verma, B. (2008). "Combining share and measure meaning of fractions to facilitate students' reasoning". In Proceedings of the International Conference of Mathematics Education. Monterrey, Mexico. (<http://tsg.icme11.org/>)