15 Dialogue in Math Teaching: Realities and Challenges

Ekta Sharma

Understanding the Problem

"It is more useful to know how to Mathematise than to know a lot of Mathematics" said David Wheeler. Perhaps this sums up the entire problem of Mathematics teaching-learning succinctly. Knowing a lot of Mathematics implies being able to do a variety of computations according to a set procedure that is learnt. Mathematization on the other hand involves the ability to apply Mathematics according to the need of the situation- to be able to think mathematically. Descriptive problems in Mathematics could offer this kind of opportunity to mathematize. Let us attempt to unfold this issue by looking at the scope that Mathematics provides for interaction and dialogue and the extent to which this opportunity is used in teaching learning.

Word Problem- "Seema went to the market with some money. She spent Rupees 150 in buying fruits. She now has Rupees 100 left. How much money did she have when she went to the market?"

Very often when this kind of a word problem is given to children, they get confused about which operation to use. Hence if we try and understand why children might be getting confused, we would be in a position to acknowledge the challenges children might be facing in solving descriptive problems.

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Sometimes we find that children use some phrases like "how many/much in all" or "how many/much left" as cues to decide on the operation they will use – such as addition, subtraction etc. Now the problem given above clearly uses a phrase that could lead the children towards subtraction.

Besides the phrasing, the context and setting of the problem is the next big challenge for children. Sometimes if the context is irrelevant to the child, it takes away all the fun of solving descriptive problems and makes the whole exercise mechanical.

Here is another example: "There are 86 pages in the Math textbook of class 3 and 75 pages in Hindi textbook of class 3. How many pages are there in both textbooks put together?"

Why would any reasonable person want to know how many pages are there in both textbooks put together. Instead if a more realistic context is given, it might attract the attention of the child who would then attempt to solve the problem meaningfully. Here's another example-"Deepa has a habit of recording her daily expenses. Today she spent Rupees 86 on fruits and Rupees 75 on vegetables. Help Deepa by calculating how much money she spent today."

In the above example, with very little increase in the 'language' content, the whole idea of the problem situation gets transformed into a more meaningful exercise. Clearly worded, such language problems would go a long way in changing the way Math is viewed, taught and learnt at the primary level.

The medium of language and the context in which the problem is set is perhaps the primary challenge children face in solving word problems. However there are other issues too. Many a times, children who are fairly conversant with the language also struggle to solve such problems. This clearly indicates that the 'problem' is more deep-rooted than the difficulty with of the medium of instruction. Let us take some examples of simple algorithm based questions to illustrate this point.

24 + 32 ------- -------	24 + 32 = ...	24 and 32 add up to..
(CASE 1)	(CASE2)	(CASE 3)

While the first two questions purely comprise mathematical symbols or are pure mathematical expressions, the third one is a verbal expression of CASE 1 and 2.

CASE 1 depicts the most usual format in which addition problems are presented to learners all over the country. CASE 2 is a minor alteration in the format with the inclusion of a new sign i.e. “equal to”, but when one reads verbally, states the problem more precisely (than CASE 1) in mathematical terms- “ twenty four plus thirty two equals ....). It has been observed that children fairly conversant in addition as given in case 1 and with limited or no exposure to case 2 are either unable to understand how to solve CASE 2 or mix-up the procedure, i.e adding units to tens etc.

This shows that the problem is not entirely with the medium in which a question is asked. Even in the case of a pure mathematical expression children face difficulties in understanding if they are presented in a modified manner.

CASE 3 is a different kind of situation. Here too the language used is not the language that we typically use in our day to day lives. It also involves some abstraction like in case 1 and 2 but at the same time also spells out the operation to be used to solve the problem. It involves a mathematical expression that is written using terms that are mathematical for instance 'add up to' or sometimes '2 and 2 make 4' This kind of terminology does not form a part of the language that is used as a medium which, in this case is English. These are mathematical terms but many a times we tend to overlook this important fact. These terms are a sort of verbal expression of mathematical language. In the absence of introducing children to these terms and phrases as a way of conversing mathematically, problems that involve their use are more confusing for children.

It needs to be recognized that Mathematics is a language in itself with its own set of symbols, and like any other language, it must be made meaningful rather than just decoded. Just knowing symbols and procedures will certainly facilitate computation but it does not help children think mathematically until opportunities for understanding the meaning are provided.

Key issues

Why do children find it so difficult to solve word problems? The NCF, 2005 strongly articulates the centrality of meaning in learning. It argues, in no uncertain terms that meaning-making is a necessary pre-condition for learning which is relatively permanent in nature.

Having said that, let us examine whether the way Mathematics is being introduced and taught to children meets this condition. Taking some examples from textbooks used in government primary schools we notice that :

1. The pre-mathematical concepts of big/small, identifying patterns, recognizing similarities and the likes do not get adequate space
2. Even where they do, they are not really made use of in understanding numbers.
3. The numbers and their verbal equivalent for eg. '3' and 'three' are both introduced simultaneously.
4. Connections with day to day life are not very strong and apt
5. The scope for practice has been significantly reduced in textbooks as more space is given to concept introduction. While this is a good thing as it attempts to focus on conceptual understanding, in the absence of alternative practice material like workbooks etc., it adversely impacts children's learning. (Here I suggest that practice also has a place in learning Mathematics). Practice in solving problems with conceptual clarity is indeed essential for learning the subject as Mathematics is all about developing a certain way of thinking and reasoning – this definitely requires practice.

Considering the reality that textbooks almost entirely guide teaching-learning, it would be reasonable to say that the teaching of Mathematics is also characterized by the above mentioned points.

Added to this, the fact that children fare better in algorithm based problems like CASE 1 (shown in previous page) when compared not just to descriptive problems but even slight alterations in form (CASE 2), it is easy to see that the difficulty is rooted in lack of understanding of the nature of Mathematics as a subject. The key issue appears to be the misplaced emphasis on following a set procedure to arrive at the correct answer. There is no emphasis on allowing the children to engage with the problem, to identify different ways of solving a problem, be it a simple algorithm based one, to articulate the procedure used and the reasons/logic behind it.

Looking ahead

Simply put, just as for learning any language needs to be contextualized, likewise Mathematics, when introduced at the primary level, needs to be put in a context. Teaching-learning should be organized so as to provide realistic problem situations. Children must be encouraged to find multiple solutions in place of just asking them to arrive at the correct answer. In order to do this, the descriptive problems presented should be in a manner that allows dialogue to take place. For example, instead of asking children to do a simple addition, ask them to find out 3 different ways of adding the given numbers; or even give them answers to which they are required to create questions.

There is need to bring this kind of dialogue and interactivity into Mathematics in order to make it a more meaningful learning experience for children.

This is a big challenge as Mathematics has always been used as a discriminatory tool in learning situations. It has evoked fear and anxiety and even led many young learners to take extreme steps. Even teachers feel that some children are just not upto the challenge that Mathematics offers. That girls are not as mathematically oriented as boys is also a common myth.

These beliefs are unfounded and it is important for all of us to recognize that **"Every child can learn Mathematics and all children need to learn Mathematics".**

All that is needed is to teach the subject in a manner that it evokes interest and allows for deriving meaning rather than just confusing the learners. It is time to remember what Bruner said with regard to the suitability of subject matter for learning; **"Any subject can be taught effectively in some intellectually honest form to any child at any stage of development".**

Mathematics, I believe, is no exception!

Ekta Sharma is currently working as Academics and Pedagogy Coordinator with team Uttarakhand of Azim Premji Foundation. She joined the foundation in June, 2005 from Central Institute of Education, Delhi University, after completing her Masters in Education. She can be contacted at ekta@azimpremjifoundation.org

Logico-Math Brain Teasers

There are three containers on the table, one is of 800 ml and is full of Apple juice, The others are 500 ml and of 300 ml size respectively. Rajdeep wants to measure exactly 400 ml Apple juice for a recipe. How can you help Rajdeep solve this problem?

Use this space for calculation