Why do Students Struggle with Word Problems?

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Teachers often observe that many children can perform addition, subtraction, multiplication, and division, but when they read word problems, they cannot determine which operation to use. In this article, we examine why children struggle with word problems.

Is mathematics just about operations and correct answers?

Consider this: A man goes to a shop and makes a purchase of ₹62. He gives a ₹100 note to the shopkeeper. Now, how much money should the shopkeeper return, a child is asked. The child answers this question correctly. Yet why does the same question become difficult for the student when it is asked in the classroom?

The girl students with whom I was working on in maths had left school after class V or VI. After a gap of three to four years, these children had started their education again. For the initial three months, they were being taught maths at the level of class III. These students easily solved the word problems when asked orally, but they had difficulty solving the operations by writing them, and they had an even greater difficulty solving the written word problems by reading them. For example, Rama had some money. Mother gave her ₹38 more. Now Ramaa has ₹59. How much money did Rama have in the beginning?

The question is, why is teaching maths using word problems necessary in the first place? When students are able to solve the operations correctly, what is the need for questions as word problems? The answer to this lies in the question: 'What are we willing to teach and why?' An article published in *Pathshala Bheetar aur Bahar,* Volume No. 11, titled 'Mathematics: Why and How?' discusses all these questions.

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Mathematics is not mere calculation. Mathematics is thinking about the relationships between different quantities, generalising them to form rules and principles, and then applying them to different situations. Word problems provide students with familiar contexts and help them understand the relationships between mathematical quantities. If the context is familiar, students are able to solve the word problems orally. However, not understanding written word problems has been observed on a large scale.

Often, even the students who read well expect the teacher to tell them what to do. For example, during my visit to a school, a class V student read out the question smoothly: 'Revati distributed toffees in the classroom on

Figure 1: Students engrossed in solving maths problems from the textbook.

her birthday. She had brought 55 toffees with her and gave one each to 42 students. How many toffees is she left with?' After having read the word problem, the child looked at me as if to ask what to do. When I did not help, she reopened the book and began looking at it again. I thought she was reading the word problem again, but she was not. I asked her, 'If you are not reading the word problem again, what are you looking for in the book?' She said that she was looking for the page on which this question was. In the book, all the addition problems were on one page, and all the subtraction problems were on the next page. It was clear that the student was not making an effort to read and understand the question. She was trying to find out whether the question was from the addition or the subtraction chapter to arrive at the correct answer.

Mechanical method of solving problems

Often, students memorise some steps of an operation learnt mechanically in the classroom and keep repeating these steps without thinking. In doing this, they make more mistakes. For example, in *Figure 2*, the child has correctly attempted three questions on division, but in dividing 535 by 5, the answer is written as 17. Children do not make such mistakes in everyday life. In fact, such mistakes are the result of using mechanical methods to solve problems. Children are unable to establish any relationship between numbers when they solve problems using mechanical methods. Further, because of this, they fail to see the connection between maths in school and maths outside the school.

This also develops among students an attitude of just finding out the correct answer and knowing from the teacher whether it is right or wrong. Children begin to feel happy in finding out how many correct answers they have and how many wrong answers others have. You must have often heard children saying, 'Ma'am, I was the first to answer, wasn't I?' or 'Ma'am, my answer is correct, isn't it, and theirs is wrong?' etc. The whole exercise is about who will be the first to answer. Students do not get a chance to solve the question in their own way, so there is no question as to what the students' method of solving the question is. Neither do they get an opportunity to frame new questions and solve

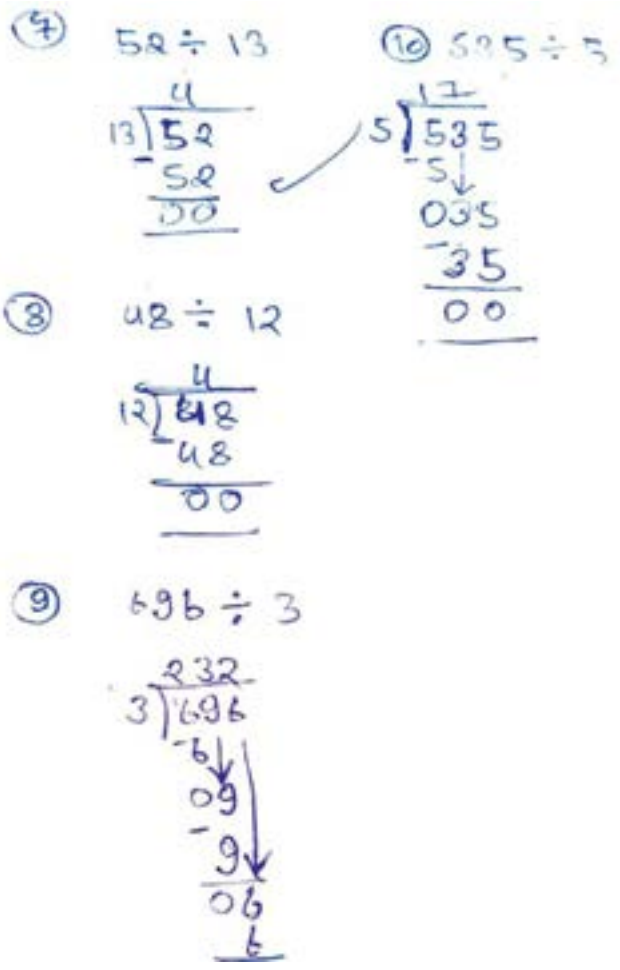

Figure 2: The student solved three sums correctly but got confused in the fourth one.

them. Tackling one question type at a time does not allow enough scope for careful reading before solving. 'What a nice question has been asked!' is rarely heard in a classroom. When I was pursuing my graduation, I had once heard a teacher telling a girl, 'You ask very good questions.' Since then, I have believed that asking questions is a more important ability than answering a question because, if there is no question, how can the attempt to find the answer begin!

I have given the following questions/responses an important place in my class:

1. How did you solve this problem?
2. Do you think this is the correct answer? Why?
3. Can you explain this problem to your friends?
4. Your question is excellent.

Working with these in the classroom requires a lot of time, but I wonder if it is not necessary to spend so much time on what we are trying to teach them? Sometimes, we do feel that there is a time constraint, but if we do not discuss like this, children will never

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learn to think logically. Answering mechanically not only limits children's ability to think but also affects their ability to make new connections, such as between their own experiences and the textbook or to make different connections between two operations. Slowly and gradually, children's distance from maths and mathematical thinking increases.

Some more experiences

I sat down with the students of class IV with a worksheet with word problems. The children knew they were learning multiplication. They simply had to find out two numbers which they could multiply. Keeping that in mind, I tried to put more than two numbers in the questions. For example, the question went like, 'A cow gives milk two times a day. If she gives 4 litres at one time, how much milk would she give in 5 days?' As an answer to this problem, children gave the answer as 20 by multiplying 5 by 4, whereas it should have been 2x4x5. You can see more such examples in *Figure 3*.

In *Figure 3* the child has answered many questions correctly. I also discussed some questions with the child. This helped in understanding which two numbers were to be multiplied, but at one place, the child also multiplied 121 by 1. Had the child understood the meaning of multiplication or the question properly, they would not have multiplied 121 by 1. This problem seems to me to be the result of not asking questions through word problems. The word problem here was: 'There are 121 children in a school. 1 plate, 4 bowls and 2 spoons will be required for each child. Calculate how many bowls, spoons, and plates will be needed in all.' Despite this, the child multiplied 121 by 1. In yet another question, the child has multiplied by 1. One reason for this is that the child is mechanically repeating the multiplication steps learned by rote in class. Another reason could be to solve the question as quickly as possible and show it to the teacher.

There are many more mistakes on this page (*Figure 3*). Like, while multiplying 128 by 8, writing 6 in the units' place and adding 4 tens to the tens place as the result. However, the child has not made this mistake everywhere. In other questions, like when multiplying 122 by 6, the child has not made the same mistake and has arrived at the right answer through multiplication. This shows that while working on different hypotheses, children solve a variety of questions and learn gradually. Apart from this, it is important to understand the problem in mathematics, how to write it, and what to keep in mind when solving it.

That is why, after this, I asked the child to read the question completely and to write the answer in

1. A plant grows 10 centimetres every year. Its height increases for up to 30 years. How many centimetres tall will this plant be at the end of 25 years?
2. There are 19 lanes of houses in Rajiv Nagar. Each lane has 29 houses. How many houses are there in total in the colony?
3. A hotel serves 4 types of *parathas* (potato, cauliflower, peas, and paneer). It sells these *parathas* with 4 types of chutneys (red, green, white, yellow). How many options does a person have in eating these *parathas*?
4. There are 128 children in a school. All the children stood in rows for prayer. There were 8 rows of children. How many children will be in each row?
5. There are 23 rooms in Apna Ghar School. Each room has 3 fans and 4 tube lights. How many total fans and tube lights are there in the school?
6. A buffalo gives milk twice a day. The buffalo gives 5 Liters of milk at a time. How much milk will the buffalo give in 90 days?
7. The price of a book is ₹26. Sharda Mandir School needs 56 copies of it. How much will the school have to pay for 56 copies?
8. There are 121 children in Apna Ghar School. For every child, the school needs 1 plate, 4 bowls, and 2 spoons. How many plates, bowls, and spoons will the school need in total?
9. There are 18 rooms in a school. 3 carpets need to be bought for each room. The price of one carpet is ₹153. How many carpets will the school need, and how much money will have to be spent?
10. A shopkeeper orders 132 biscuit packets for his shop every month. How many biscuit packets will he order in 1 year?

Figure 3: The class IV worksheet with word problems and the student's work.

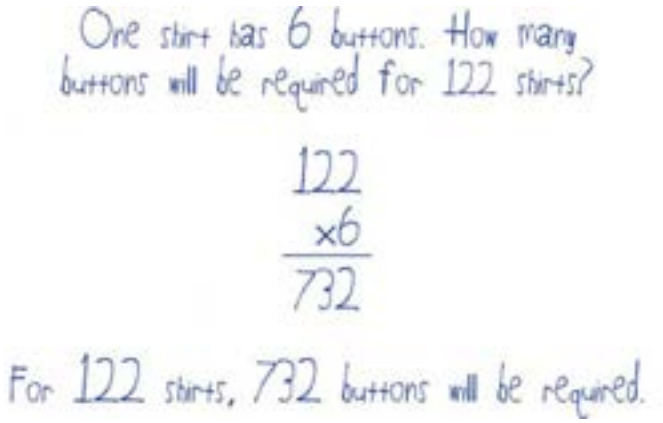

Figure 4: When presented with a complete question, the child has answered correctly with a complete answer.

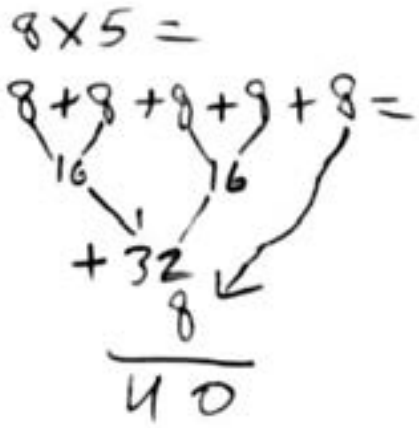

Figure 5: See how a child arrived at the answer to 8x5.

complete sentences. In *Figure 4*, you can see that the same child has written the question correctly and answered in a complete sentence. This helps children think about what is to be done to solve the problem and what has been done, ultimately making mathematics meaningful.

While working in the classroom, I realised that children are sure to make mistakes. Many times, the reasons for these mistakes are not clear at all, and sometimes, even the child cannot tell you how they arrived at the particular answer. No matter how good a method is, if the child is unable to make sense of it or is unable to visualise it, mistakes are inevitable. For example, subtracting large numbers from small numbers.

Understanding or visualising the meaning is possible only when the child is solving the question with a method or algorithm, logically. One thing that we can do for this is to discuss the questions in class each time. Discuss why a given answer is right or wrong, and how they arrived at a particular answer. Give freedom to students to solve a question using different methods and encourage such practices in the classroom. Allow students the space to express their logic of how they arrived at the answers. Allow space for other children to agree or disagree with that logic. If we want to teach children to think, then such practices must find a place in the classroom.

To learn mathematics, children do not just have to perform operations. Mathematics is far beyond merely finding solutions to problems. It is a way of thinking. Children learn to think by asking themselves questions. They learn what sequence and what lines of thinking will help. While doing so, children will make mistakes, but it will be more meaningful than practising simply to arrive at the correct answers. Children should solve word problems and frame them too. Word problems allow them to engage with practical mathematics, which can help them understand textbook problems as well.

In conclusion

Teaching is complex work. Some people also say that we cannot teach anything to anybody, only provide an environment for learning. Largely, I agree with this because to learn something, thinking or mental processing is essential, which cannot be achieved through pressure, but only through intrinsic motivation. We want children to struggle with questions. Context can be of great help with this. However, context alone may not be sufficient. There are other crucial factors involved as well. For example, the environment in the classroom and at home, the physical and mental health of the students and teacher, children's own interests, inclinations, and so on. Teaching has to be mindful of these factors.

Translated from Hindi. *Translator: Hemant Gahlot* *Vetter: Simran Luthra*

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