Research Journal of Educational Sciences ISSN 2321-0508
Vol. **9(1),** 23-28, August **(2021)** *Res. J. Educational Sci.*

Get realistic with realistic mathematics education

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Available online at: www.isca.in, www.isca.me
Received 3rd December 2020, revised 8th April 2021, accepted 30th May 2021

Abstract

"Without mathematics, there's nothing you can do. Everything around you is mathematics. Everything around you are numbers" is a quote associated with Shakuntala Devi but every adult would agree to this yet we do not know where do we apply certain concepts. Every child seeks same reasons. However, when such questions are put across, teachers, too, are tongue-tied. Teachers are trying to switch to checking the student's understanding in the test. Thus, I feel there is an urgent need for familiarizing teachers with Realistic Mathematics Education. Being an exploratory research, it will involve a field study wherein questionnaire will be circulated to 7students and their responses will be recorded. It will develop deeper understanding and its real-life application in the students. The teacher will be able to make it relatable and will build an engaging and enriching environment in the classroom for each topic.

Keywords: Realistic math education, realistic math, realistic approach in math, RME

Introduction

Realistic Math Education: It aims at understanding child's thought-process and how he arrived at the solution. Additionally, it strives to make learning easy and relatable to his environment rather than keeping it abstract. RME is an approach that makes the classroom child-centric and thus teacher takes a little back seat and the light is casted on the child. It debunks the teachers' myths that a wrong answer implies absolutely no knowledge about the concept. Thus, keeping all this into consideration, I believe it is time to revisit mathematical topics with the RME lens.

Literature Review: Uzel D. and Uyang S. M. found out that pupils of class 7 have a positive attitude towards mathematics as well as aware of the usefulness of mathematics in daily life after realistic mathematics education is used. It was suggested to find whether students from other units have a similar attitude toward mathematics[1].

Sanchal A. & Sharma S. investigated the impact on Year 10 students' attitudes towards mathematics when learning mathematics in a sporting context. It was found out that when students study Math in a sporting context, they become confident, and find it more meaningful thereby engaging more. It was also suggested that the teachers needed to identify the culture of their students and enable them to see Math in their own context[2].

Mensah, J.K., Okyere M and Kuranchie A. on how teacher's attitude impacts students attitude towards the subject, towards teaching and learning and to make it appealing and interesting for the students[3].

Effandi Zakaria and Muzakkir Syamaun found that RME has the potential to improve the students' learning and progress. It also highlights that students who learnt through RME approach were able to perform better[4].

Julia A, Meindert B and Kees Van P found the benefits of RME among the English and Dutch students' performance comparison. An informal approach can be beneficial at the start and can simplify the standard rules through scaffolding[5].

Dickinson, P., Eade, F., Gough, S., Hough, S. & Solomon, Y. stated that although RME can be time consuming and a challenge to execute in the class, it is a worthwhile effort as it compels the student to answer with a mathematical understanding. It also helps in diagnosing the issues any child may face[6].

Dickinson, P., Gough, S., Hough, S. & Solomon, Y. stated that in a short-term intervention of 12 hours for a topic the RME approach was beneficial, however, claiming it for all would need more research work[7].

Dickinson, P. & Eade, F. concluded in their research that RME has proven as a great approach in enhancing problem solving skills amongst students[8].

Gough, S., Hough, S. & Solomon, Y. argued that bar models also called as the RME approach is essential in improving grasping capacity of formal mathematics[9]. Paul Dickinson, Steve Gough and Sue Hough found that teachers could give time, in the RME approach, to students to express their thoughts and opinions which led to the formal thinking procedure[10].

Paul Dickinson, Susan Hough, Jeff Searle and Patrick Barmby claimed that the teachers agreed upon RME being the appropriate method to teach mathematics to children and all teachers must be equipped with tools to implement this approach. RME helped in retention and deep grasping of the concept than the traditional method[11].

Paul Dickinson, Frank Eade, Steve Gough, Sue Hough have emphasized on how RME helps in making the abstract concept of mathematics relatable and relevant to students with the help of models. This benefits the students in developing their mathematical and logical thinking capacity[12].

Ch. Krisnandari Ekowati, Muhammad Ardi, Muhammad Darwis, H.M.D. PuaUpa, Suradi Tahmir, Gufran D. Dirawan found that RME helps in encouraging students to learn mathematics especially when blended with manipulatives. Thus, builds an active and engaging learning environment[13].

Judah P. Makony argues that RME is a powerful approach in providing freedom to students from the fear of mathematics and can build the love for learning which can help in attaining conceptual clarity[14].

Jeff Searle and Patrick Barmby highlighted the RME philosophy of higher order thinking, drawing meaning and motivating the students to develop in-depth understanding of mathematics is missed out by many teachers as they aren't aware of it. Thus, maximum efforts must be put in order to spread this approach than the fixed exam structure[15].

Thomas Romberg and Mary Shafer Mathematics when taught in the students' context makes it relatable and more engaging for the student. This improves classroom interaction, thinking skills and the ability to write down the thoughts. Thus, mathematics is better retained and absorbed when taught in the context of students[16].

Desi Rubiyanti: Mathematics can help in developing creative thinking skills. In 21st century skills list, creative thinking is vital and RME has been successful at achieving this. Creative problem solving can be achieved with the help of RME[17].

How to implement RME in classrooms?

Having acknowledged the fact that, a wrong answer doesn't mean the child is completely clueless about what is taught, we now need to carve out a plan to find out what he has understood.

Step1: Select the topic: To begin with, I picked a topic from mathematics which is essential for life and needs to be discussed at length with children. Money, a concept revolving around children who are 5th grader and above, as they go shopping too. Additionally, it has many sub-topics included, like place value, all 4 operations of numbers and unitary method.

Step 2: Preparing questions: If online, prepare a Google form or with any suitable tool, a detailed questionnaire with increasing level of difficulty and no options rather choose a long paragraph answer where they describe the steps.

I prepared six questions which had two easy, two difficult and little confusing and two moderate question on Google form using images.

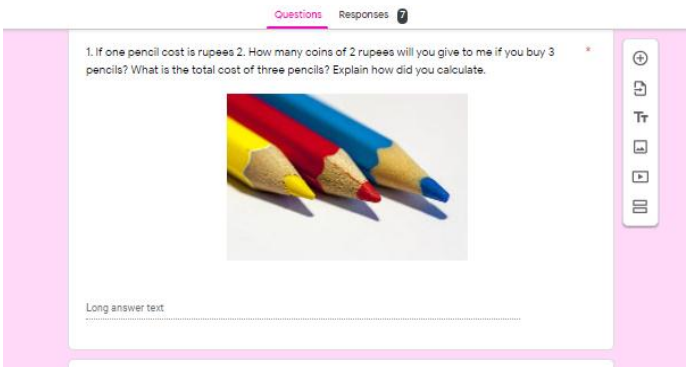

Figure-1: Question-1: 1. If one pencil cost is rupees 2. How many coins of 2 rupees will you give to me if you buy 3 pencils? What is the total cost of three pencils? Explain how did you calculate.

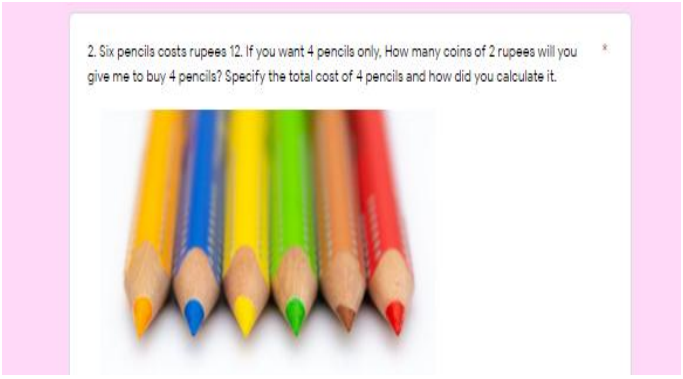

Figure-2: Question-2: Six pencils costs rupees 12. If you want 4 pencils only, How many coins of 2 rupees will you give me to buy 4 pencils? Specify the total cost of 4 pencils and how did you calculate it.

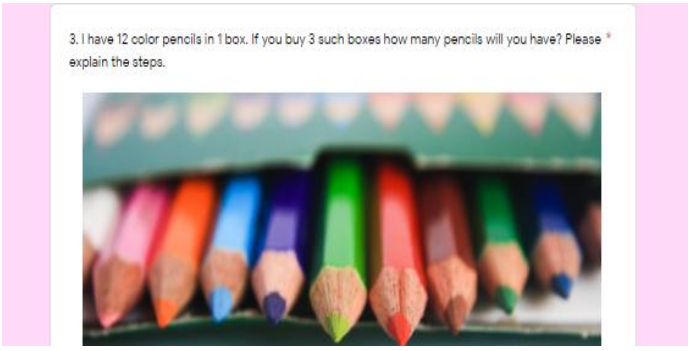

Figure-3: Question -3: I have 12 color pencils in 1 box. If you buy 3 such boxes how many pencils will you have? Please explain the steps.

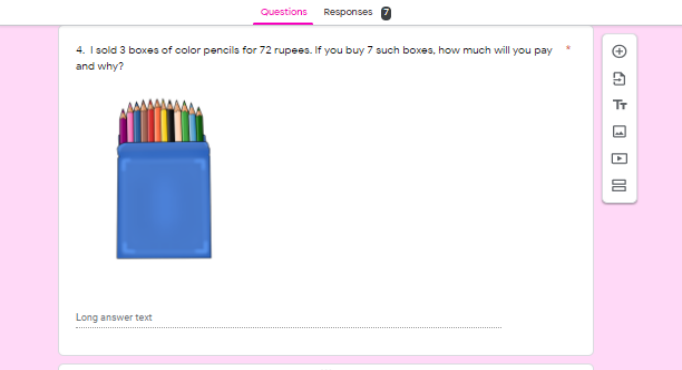

Figure-4: Question-4: I sold 3 boxes of color pencils for 72 rupees. If you buy 7 such boxes, how much will you pay and why?

Figure-5: Question-5: One sharpener costs 1 rupee. 1 box of color pencils cost 24 rupees. Your parents give you a 50 Rupees note and you want to buy 2 boxes of color pencils and 1 sharpener. How much should I return to you and why?

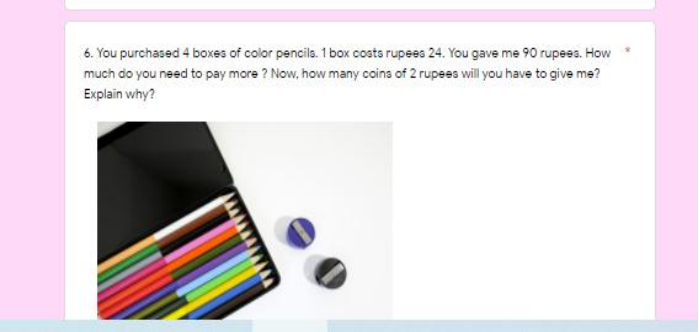

Figure-6: Question-6: You purchased 4 boxes of color pencils. 1 box costs rupees 24. You gave me 90 rupees. How much do you need to pay more? Now, how many coins of 2 rupees will you have to give me? Explain why?

Step3: Explain the students what is expected: Before the test, I spoke to them and asked them to write whatever they understood and that final answer is not important. I want to know the steps or the working. One analogy that worked for me is, if you don't tell the doctor what you are feeling, the doctor can't treat you.

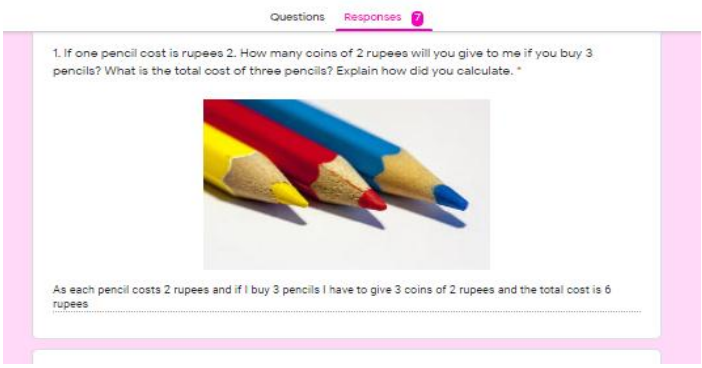

Figure-7: Response-1: 1. As each pencil costs 2 rupees and if I buy 3 pencils I have to give 3 coins of 2 rupees and the total cost is 6 rupees.

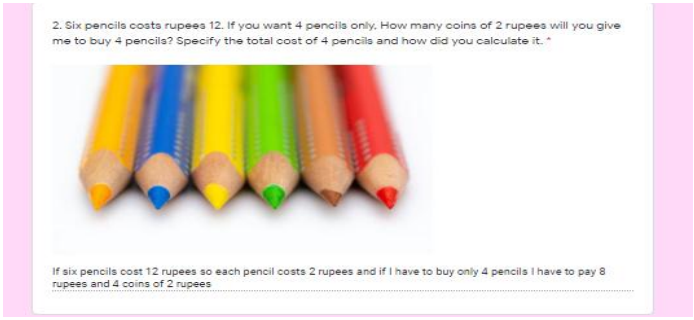

Figure-8: Response-2: If six pencils cost 12 rupees so each pencil costs 2 rupees and if I have to buy only 4 pencils I have to pay 8 rupees and 4 coins of 2 rupees.

Figure-9: Response-3: In 1 box there are 12 pencils so in 3 box there will be 12*3 that is 36 colour pencils.

Figure-10: Response-4: 72 ÷ 3 is 24 so each box costs 24 rupees and if I buy 7 boxes I will pay 24*7 that is 168 rupees.

Figure-11: Response-5: If I pay to you 50 rupees for buying 2 boxes of colour pencils and 1 sharpener which costs 24*2 that is 48 + 1 for sharpener that is 49 so you have to give me 1 rupee in return.

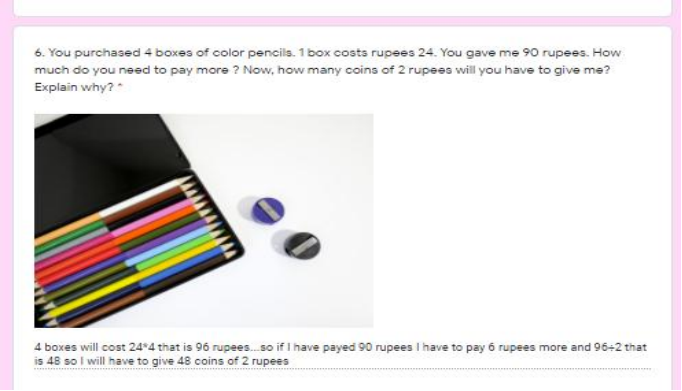

Figure-12: Response-6: 4 boxes will cost 24*4 that is 96 rupees...so if I have payed 90 rupees I have to pay 6 rupees more and 96÷2 that is 48 so I will have to give 48 coins of 2 rupees.

Step 4: Analyzing their answers: Some children will still write direct answers and not the working. Thus, I had to ask them to resubmit. Those who wrote well, it made me realize that they do not go back to the questions to verify it. Some students are not quite efficient with their listening skills and remembering skills hence they make mistakes. While, some are so confident about their answer that they do not check their calculation mistakes hence get incorrect answers.

Step 5: Connect and conduct RME approach: I used the bar model to explain the concept of money for the same questions. You can choose to demonstrate two questions using a bar model, ask the children if this simplifies their learning and understanding and then move on to asking the children to solve the third question with a little scaffolding. Once they are comfortable, give them two to three questions for independent practice and least intervention. This, will make them think loudly about their method of solving and also where did they go wrong and how they complicated the questions for themselves. This will make the "class" room, a "discussion" room. Additionally, when they draw the models in your zoom whiteboard screen, you are able to see and use their model as a support to simplify things for them. Let's take a look at the model.

Bar or Box Model:

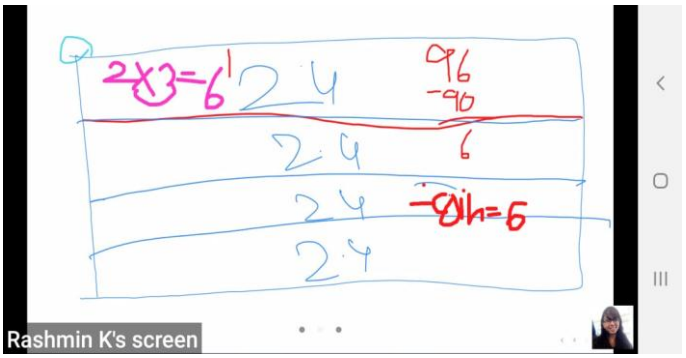

Figure-13: Bar/Box Model on Zoom Whiteboard.

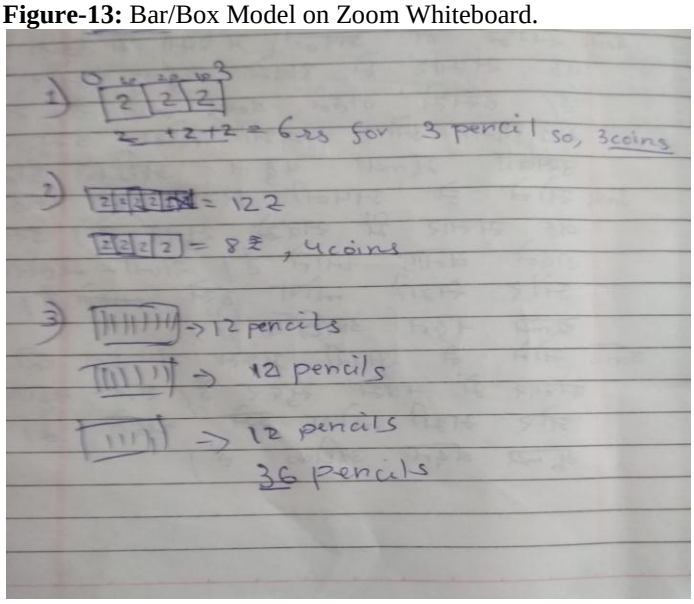

Figure-14: Students' work.

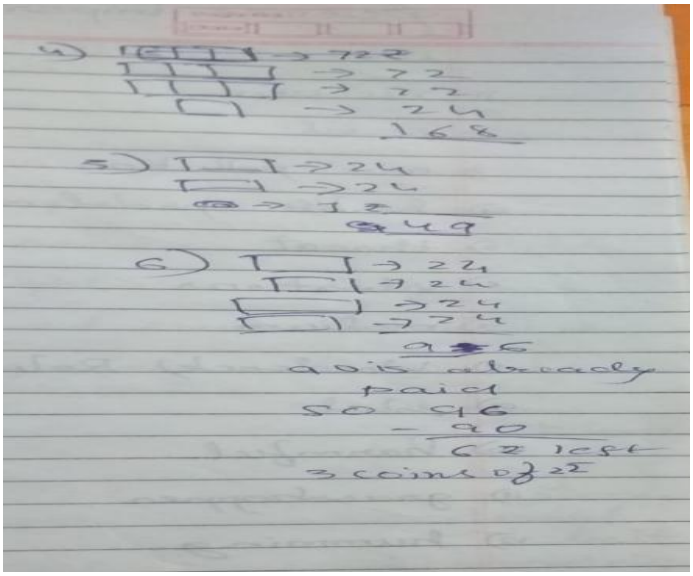

Figure-15: Contd. student's work.

After the class, I insisted them to give an honest feedback and share their thoughts and experience, either in audio or written format.

I am paraphrasing below all the feedback that I had received from my students.

Feedback: It is an essential part of the exercise as it is an eye-opener to find out if it can be taken to the larger classrooms or not. Sometimes, certain approaches are more suitable for a smaller group while some for a larger group only. Furthermore, children are the best critic as they openly convey if they dislike or disagree with something.
Hence, I collected feedback from students to understand if this approach helped me achieve my objective. Enlisting the feedback below;

It made the class interesting but some students themselves complicated the questions because of no visuals.

They said that they are always in a hurry which also causes them to make mistakes. For some students, bar model is helpful in avoiding mistakes. Visuals help in understanding and calculating quickly and it is time-saving.

In certain questions where otherwise multiplication was done, due to visual model, there is room for addition and thus, chances of getting the right answer increased which boosts confidence.

Avoids double calculation due to same pattern of sums. Some questions get converted into simpler operations like multiplication into addition due to pictorial representation like unitary method related sums.

Challenges faced: If the concept has already been explained then using bar model might be a little boring for some students who are habituated and comfortable with the traditional method.

Students who usually score above average may find this a little slow in processing as their imagination skills have developed.

Using bar model is easy but understanding how a bar or box is made can frustrate the students sometimes.

Conclusion

Taking into account the overall experience of students, we were able to make the class interactive and engaging. Yet, I believe there is a lot of work that needs to be put into action from teachers' side from the initial years of concept establishment. It made me realize that RME will work best for students who are yet to be introduced to new concepts and in remedial teaching. It will work for those whose abstract ideas are not as quickly formed as other students in their class. Lastly, it also opens doors to divergent thinking. RME is the platform that helps teachers to accept that there is no single way of arriving at the solution and more than one approaches can be correct too. This re-establishes the confidence and belongingness in the child towards the class and love for mathematics.

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