

Twelve Steps to increase your Child's Maths Achievement and make Maths Fun!



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Parents and guardians have incredible opportunities to shape their children's mathematical futures. At times, it may not seem that this is the case, especially when children are going through challenging experiences at school. But I know, both as a professor of mathematics education and a mother of two children, that you have the opportunity to make a huge difference in children's mathematical lives.

One of the most important contributions you can make is to dispel the idea that only some children can be successful at maths, or that maths is some sort of a "gift" that some children have and some do not. This idea has been completely disproved by the science of the brain and learning. The idea that some children can do well in maths and some can't is a damaging myth that is harmful to children's mathematical development. Everyone can achieve at the highest levels of maths in school, if given the right opportunities and support.

Some ideas for you as you work with your child:

1. Never praise children by telling them they are "smart."

This may seem encouraging but it is a fixed ability message that is damaging. When children are told they are "smart," they often feel good, but later when they fail in some situation, as everyone does, they think "Hmm, I am not so smart." Always praise what children have done, instead of the person e.g. "It is wonderful that you have learned how to add numbers", not "Wow, you can add numbers, you are so smart." When children know that learning and hard work make them achieve at the highest levels, their achievement takes off. This idea can be hard to get across to children because TV programmes can communicate the opposite message that some children are "smart" and some are not. They communicate lots of other damaging ideas too – that maths is hard, and it is

only for “nerds.” It is critical to reject these ideas as often and as loudly as you can. Instead keep telling your children that maths is very exciting, and it is important to work hard, as it is hard work that leads to high achievement.

2. Never share stories of maths failure or even dislike.

Research has shown that as soon as mothers say to their daughters: “I wasn’t good at maths at school,” their daughter’s achievement went down. Even if you have to put on your best acting skills, always seem happy – even thrilled when you see maths. When Jo’s children get home, she eagerly asks them if they have any maths homework and if they do she says, “Hooray, can I do it with you?” This sometimes requires some acting on her part. Like many parents, she often dreads maths homework – it can be very stressful for children to be faced with pages of questions at the end of a long day. But whatever the maths homework looks like, be excited about it!

Don’t worry if you cannot do your children’s homework. Ask them to explain it to you. This can be one of the most encouraging experiences a parent can give their children. Jo often tells her own children that she doesn’t know how to do the work they are doing, even if she does, as when they are explaining it to her, they are learning it at a much deeper level. It makes them very happy!

2. Always praise mistakes and say that you are really pleased that your child is making them.

Recent research has shown that our brains grow the most when we make mistakes. Scientists have found that when people make a mistake in maths synapses spark, and there is activity in the brain that is absent when people get work correct. What this means is that we want people to make mistakes! In fact, making mistakes in maths is the most useful thing we can do. But many children (and adults too!) hate to make mistakes. They think it means they are not a “maths person.” It is important both to celebrate mistakes and tell children their brain is growing when they make them.

Jo’s 10 year old recently worked on 2 maths problems and got one right and one wrong. When she got one wrong she reacted really badly saying “I can’t do maths” and other negative things. Jo said to her – “do you know what just

happened? – when you got that question right, nothing happened in your brain, but when you got that question wrong, your brain grew.” She gives this message to her children every time they are confused, are struggling or they make a mistake, these are the most important times in their learning.

3. Encourage children to work on problems that are challenging for them, so that they can make mistakes.

We know that it is really important for students to take risks, engage in ‘productive struggle,’ and make mistakes. Sometimes Jo’s daughter asks for help with her homework when it looks difficult, and she tries to encourage her to have a go first, without her help, saying “I don’t want to take away the opportunity for you to struggle and for your brain to grow!” Keep telling your children that struggle is really important because it will make their brains grow. This is a delicate balance as you don’t want to leave your children struggling to the point that they feel despondent, but always try to encourage as much struggle as you think they can cope with at that time.

Girls, in particular, can sometime have learned to avoid difficult work – usually because they have been praised for being smart a lot, which makes them then want to try and keep that label. Avoidance of harder work is damaging for children and it is one of the reasons that fewer girls pursue maths and science.

In one of Carol Dweck’s studies participants took maths problems that they all solved correctly. Half of the participants were praised for being “smart” and half for “working hard.” When offered a choice of a follow up problem that was easy or hard, 90% of the participants praised for being smart chose the easy problem, whereas most of those who were praised for working hard chose the harder problem. This tells us that the praise we give children has an immediate effect on them. It also gives us some important clues into gender inequities in maths participation rates.

4. When you help your children, do not lead them through work step by step, as this takes away important learning opportunities for them.

We often help children by doing the hard part of a problem, such as working out what the problem is asking, and then get children to do something easier, such as a calculation. Consider this scenario:

Book question:

Carlos started with 12 sweets, he gave some to Janice, then he had 8 sweets, how many did he give to Janice?

Child: I don't know how to do this.

Parent: Well, Carlos started with 12 and now he has 8 so what is 12 take away 8?

Child: 4

Parent: that's right!

In this scenario the child may feel good but the parent has done the hardest part of the problem, which is making sense of the situation. It would be more helpful to ask your child to draw the problem out, including, if they wish, pictures of Carlos and Janice and the sweets, or restate the problem in their own words. Try not to lower the cognitive demand of a problem when helping, or do the thinking for your child.

5. Encourage drawing whenever you can.

The whole of mathematics could be taught visually, which would help millions of children, but few classrooms encourage drawing and some students believe it to be babyish. Yet mathematicians draw all of the time, they do this because sketching a problem helps them really see the important mathematical ideas. Drawing and restating problems both help children understand what questions are asking and how the mathematics fits within them.

7. Encourage students to make sense of maths at all times.

Children should never think that maths is a set of rules that they need to follow (although they often have good reason to think this!). As they work, keep asking "does that make sense to you?" "Why" or "Why not?" Discourage guessing! If children seem to be guessing, say "Is that a guess? Because this is something we

can make sense of, not guess about.” Mathematics is a conceptual subject, and students are only successful if they think conceptually about maths. Here are some questions you can ask children to keep them thinking conceptually:

- What is the question asking you?
- How could you draw this question?
- How did you get that answer? (ask this whether the answer is right or wrong)

- Can you share your method with me?
- Can you try a different way of solving this?
- What does addition/ probability /ratio etc mean?

- In what other situation could we use this?
- Would this method work with different numbers?
- What is important about this work?

8. Encourage students to think flexibly about numbers.

Research has shown that the biggest difference between primary students who are successful and those who are not is not that the higher achievers know more, but that they think flexibly with numbers. It is critical that children develop number sense, which means that they think flexibly with numbers and can change and regroup them. For example, a student with number sense faced with a problem such as $41 - 17$ would not use an algorithm such as:

$$\begin{array}{r} 3 \\ 41 \\ - 17 \\ \hline 24 \end{array}$$

Nor would they count up from 17 or down from 41; they would change the numbers to something like “40 - 16,” which is a much easier question.

Often when students struggle with maths early on, they are given more practice with methods, facts or skills. This is not what they need. They need a more conceptual understanding of maths and they need to develop number sense.

Many students can go on to fail algebra. The reason for this is not that algebra is really difficult, but that the students lack number sense, which is the most important foundational base students can have.

9. Avoid timing children or encouraging faster work.

Flash cards and timed tests have been shown to produce maths anxiety in students. Scientists can now examine brain scans when people work on maths and these have shown that timed conditions create maths anxiety. Maths facts are held in the working memory part of the brain, and scientists have found that when people are stressed – adults or children – their working memory becomes blocked and maths facts cannot be accessed. The emphasis on speed in maths classrooms is one of the reasons for widespread underachievement and adults feeling like maths traumatized people.

10. When children answer questions and get them wrong, try and find the logic in their answers – as they have usually used some logical thinking.

For example, if your child multiplies 3 by 4 and gets 7, don't say "That's wrong," say "Oh, I see what you are thinking; you are using what you know about addition to add 3 and 4. When we multiply, we have 4 groups of 3..."

11. Give children maths puzzles. These have been shown to inspire children mathematically and are great for their mathematical development. Award winning mathematician, Sarah Flannery reported that her maths ability and enthusiasm came from the puzzles she was given to solve at home.

12. Play games.

Games are helpful for children's mathematical development. Any game with a dice and/or cards will help.

Go to <http://www.familymathnight.com/resources/familymathnight.php> for some family game ideas and more parent tips.