

# 5 Tips to make your Math Talk Inspire Children

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All math students have some knowledge of how to give a good math lecture to fellow students. But what about giving a good lesson to preteens, who are disruptive, unattentive, and most importantly, not yet inspired by mathematics? This is an area where I have a lot of specialized knowledge and experience, so I want to share five quick tips to make your next Math Circles talk amaze more children.

5. Storytelling. All children love stories, so it is usually effective to start your topic off with a clever way you used the math in real life. For example, one class I wanted to introduce the Secretary problem as part of the Combinatorics unit. I explained how if you are in the car, know that there are only three gas stations on the way, and know that you want to stop at one of the gas stations, then the Secretary problem strategy is a legitimate one to use. Of course, coming up with a direct example is usually difficult, so your story may be less clever and/or made up. But either way, students are more likely to listen after they hear your story, and most importantly, they are more likely to respect you.

4. Examples Only. Do not follow the usual mathematical habit of generalizing related examples into one elegant statement. In fact, you should do the opposite – express your theorem using a series of related examples. For example, to show someone for the first time that primes are the multiplicative building blocks of numbers, all you need to do is draw a few integers with their factor trees. Never write anything that looks remotely close to the statement of the Fundamental Theorem of Arithmetic, with all the indices and variables. Also, never show any formal proofs – but you should be building the child's proof intuition for the future by pointing out what could potentially go wrong, ie.  $2*5=3*3$ ; this is not so obvious to a child!

3. Lie a little. Have you ever heard the story, "Gauss added the numbers up to 100 when he was only 2 years old?" Well, I've heard at least four different versions of that story, with his age ranging anywhere from 1 month to 4 years. The 1 month story was probably made up, but don't feel bad for making stuff up if it will only inspire the growth of your kids. Children are gullible, and also forgiving after they grow up and realize that Santa Claus doesn't exist. Once, when introducing the Fibonacci numbers, I brought in a pineapple. After I got their full attention with the fruit, I explained how if you count the grid one way, you always get 8 or 13, and if you count the grid the other way, you always get 13 or 21, the next Fibonacci number. Furthermore, I claimed that when I go to the grocery store, I would count the squares on every pineapple and be unwilling to buy ones with bad ratios because they are a "mutated species". Do I actually do this? Absolutely not. Did my crazy story make a big impact? Absolutely.

2. Do the calculations with your students. Preteens are less good at paying attention and forcing themselves through calculation chores than students in academia. Talking to the board, a practice bad in general, is completely fatal with children. Turn around, say “three plus nine is twelve, carry one” as you write, and be enthusiastic throughout the calculation that is “boring” to you. If you don’t engage the children to make sure they are following along, they might leave your class with nothing.

1. Kiss (Keep It Simple/Short). This is by far the biggest problem with mathematical talks in general and especially those for children: presenters always overestimate the ability of the audience to “get it”. I am not claiming that your students are uninspired or unintelligent. The point is that it is far better to err on this side of monotonicity than to err on the side of overambition. If your talk was too difficult, the students walk away with nothing except frustration and fear of math. If your talk was all review, the students will at least feel confident, solid, and excited to think more on the subject in their own time. It is important, however, that your talk does contain enough substance to maintain the respect of your students. It is alright to tell someone something they already know as long as you are telling it with a twist. All in all, it is a lot more beneficial for a student to see something for the third time than see something where they can’t follow the main idea.

Personally, inspiring children to get into math has been a great passion of mine. I hope you learned something from these tips; do believe me when I say they come from years of refining, and do remember that they are only applicable to teaching younger children seeing math outside the classroom for the first time.