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Instructional Methods That Spark Curiosity (Part 2)

Jon R. Star, Ph.D. • November 2007

Topic: Encouraging Girls in Math and Science
Practice: Sparking Curiosity

Highlights

- Students need support to nurture an interest that is still forming. Teachers can make a big difference.
- Teachers can try to make connections between the math and science in class and the way it is used out in the world, especially in math and science careers.
- Teachers can also integrate music and other elements that students may be able to relate to.
- District administrators and principals can help synthesize information for teachers about good resources to draw from (e.g., useful websites).
- Additional planning time and shared prep periods can help teachers strategize, collaborate with each other, and implement these recommendations. Teachers should be given the opportunity to observe other teachers in action.

About the Interviewee

Jon R. Star is currently Assistant Professor in the Graduate School of Education at Harvard University. Star was an Assistant Professor for five years in the College of Education at Michigan State University and earned his Ph.D. in Education and Psychology at the University of Michigan in 2001.

A former middle school and high school mathematics teacher, Star's research focuses on students' learning of mathematics, particularly algebra. Star has published in top-tiered journals in mathematics education and educational psychology; he was recently an author of a US Department of Education practice guide on Encouraging Girls in Math and Science. In addition, Star is a co-PI on two large US Department of Education-funded projects, one which studies the role of contrasting examples in algebra learning, and one which studies students' learning of ratio and proportion. Complementing his research on student learning of mathematics, Star is an experienced teacher of in-service and pre-service mathematics teachers.

Full Transcript

We're encouraging teachers to think about big and small changes in their practice they might consider that can encourage students to be interested in math and science. Finding the things that students are curious about, whether they're context or real world events or historical events, or things that are going on in their town, or things in youth culture that are interesting to students. Or using things like cooperative grouping or technology, or thinking about the word problem context and students' names, we could make a long list of little things that, again, teachers will think are good practices. But they're good practices because they get students interested, and we know that that short-term interest—that situational interest or curiosity is linked to long-term interest.

The research is mostly geared with the older students in this area about long-term interest, because that's when it's most—that's when it's closest to being fully formed. At earlier ages it's still in development. What that means in practice is that the younger students might need a little more support and encouragement to keep that interest going. We imagine long-term interest as something—again, it's something that's from within and something that you're—it's sort of self directed. "I pursue things, I choose to pursue things myself. I seek out, I'm not frustrated by challenges." But for a younger student—if they're just beginning to think they might be interested in something—if they experience some sort of set back or frustration, they may need a little extra support and encouragement to keep them going along those lines and not be turned off by that.

So it's sort of a—it's a nurturing role that teachers play once a student's interests are just starting to emerge, particularly in math and science. There are a lot of reasons why, say, a girl who is just discovering that she might be interested in math and science could get turned off by that. She could believe that there

aren't many women who pursue that career and, "Why should I do that?" And she might think that the only people who pursue that career are people who are naturally gifted in math, "And I'm not. So I shouldn't go on that path. I just did my homework last night, and I thought I was good at math. And it was really hard, and I must be bad in math."

So there's a lot that teachers need to do to nurture once students are starting to develop senses of their own abilities about a subject area and realizing that they might be interested in it as well.

What role models can help do—and what teachers can do themselves even—is try to make connections between the math and science that's going on in class and the way math and science is used out in the world, especially in math and science fields. So, for example, if I'm in a science class in middle school and I have my students doing a lab about a particular activity, and a student is very curious about this lab— I've designed it well so that it's something that sparks students' initial curiosity—then if subsequently a student realizes that, "Hey, that thing I just did is what people actually do when they pursue a science career," then that becomes a really important link in furthering their long-term interest and making them think differently about possible career trajectories.

So making those linkages between what you do in class, in the math and science classes, and the ways that math and science are used in different kinds of careers seems critical.

In the practice guide we make a recommendation that one way that teachers can spark students' initial curiosity is by making activities and context for problems that we're working on to be relevant or meaningful to students' lives. And one concern that some teachers might have is teachers may feel like they're just not in touch with what students are interested in. What's—who's the latest pop star? What's the latest sort of cultural fad? It's impossible for teachers to keep up with that. It's hard enough with your own kids, much less the 30 kids in your class, times six. So our recommendation is not suggesting that that's what teachers should do—that you should start buying all the teeny bopper magazines and learn about what's going on with all the cultural stuff for teens. But rather that it's just one tool in your arsenal. It's just one thing that you should think about. It's one possibility.

Teachers know what students are interested in beyond those fads. You know what kind of puzzling situations or what sort of current events or historical events students have found interesting in the past. Expert teachers have a wealth of knowledge to draw on about what's interesting to students. So this isn't just about the latest movie. It's about much more than that. It's about relevance to kids' lives. And certainly there's a lot about kids' lives that has changed over time, but there's also a lot that has stayed the same—that teachers with experience can draw upon to make classroom activities relevant and interesting to kids.

Another concern that teachers might have about these recommendations about making activities interesting for students is that creating interesting activities is very time consuming. It's very hard for teachers to find time in their busy days to come up with a brand new, interesting exploration or activity that pursues some content area in math and science. It's very, very challenging. So we're not suggesting that teachers turn

over their lives to that kind of planning, just that teachers can look for existing activities that they can use and adapt for their own purposes.

There are a ton of activities available from a variety of resources that teachers have developed that pursue different content areas, different aspects of math and science that are interesting. There are labs you can download lesson plans from, there are a lot of materials in both math and science. So we're not suggesting that teachers reinvent the wheel. We're merely suggesting that teachers should become convinced that the importance of such activities in stimulating students' interest—that it might be worth the extra few minutes to go looking around for those lesson plans that might be useful as a different way to teach this.

And this is an area that school administrators can help as well in. Given all the resources that are out there about different kinds of lesson plans on the internet, it's really overwhelming for teachers to say, "Go out and try to find an activity that does X or Y." So district administrators, principals, can try to help synthesize that information. What are some of the best websites that teachers should go to? What are some of the different ways that other teachers have taught this activity that have proved to be very effective? So that's an area where teachers need some help and that administrators can really support them and help them implement these recommendations.

In terms of what districts and principals and administrators can do to help teachers implement these recommendations, no matter what the recommendation is, the two things that teachers need more of—ask any teacher—it's time and money. And this is no different for the recommendations we're making, but I think there are ways that we can think about what that means—time and money—a little more concretely.

In terms of time, what teachers need to implement these recommendations is really about planning time. And planning time might mean that teachers have common prep periods so that when one teacher is not teaching a class, there are other teachers not teaching at the same time so they can get together and talk, not only about what they're teaching, which teachers talk about anyway. What they're teaching, where you're at, when's your test—but also how you're teaching. What activities are you using to get at this idea? Did students find it interesting or not?

So those common prep periods really give teachers time for those kind of conversations, which are critical. A complementary thing that comes along with time is that teachers need the opportunity to watch other teachers teach. It's sort of an irony in our educational system that the only time you ever watch anyone else teach is when you're learning how to teach in the first year. And after that, you're on your own. You never see anybody else teach. I'm often in high school math classrooms for veteran teachers of 30 or 35 years experience and I say, "When was the last time you ever watched anyone teach, other than yourself?" And many of them say it was when they student taught, 30 years ago. We need to have opportunities for teachers to watch each other teach and learn about other teachers' strategies, other activities that teachers are doing, how those activities are implemented. That seems a critical part of learning to teach

and implement these activities.

When I was learning to teach and in my first years of teaching, that turned out to be particularly critical for me. I was in a school where all the math teachers had a shared office. And so we didn't have an assigned classroom, we had a shared office that we actually used. So we would go teach our class, come back and stay at the office together. And during our off periods, there were always teachers around and we would talk. And not just sort of small talk, we would have substantive conversations about how I taught this lesson, how it went. "How did you teach that lesson? What worked, what didn't work? Is there a particular problem that you used here that really got students interested and engaged in this topic?"

So in my learning to be a teacher, that was absolutely critical. And we would encourage administrators to think about ways to get teachers to be in an office together and to use that time. It's not just a space, it's about using the time that they're given for productive conversations. That seems very important.

There's a lot that teachers of math and science can learn from other content areas as well. It's a way that we can, again, make math and science interesting. If we know that some students are particularly interested in music, for example, as a context—then there is a lot of mathematics in music, and music also can be linked to many topics in science. So that's a great example of ways that we can build on students' curiosity.

Students may be knowledgeable, interested in, or curious about music. Music might be relevant to their own personal life. So I'm going to make use of music in the way that I teach math. Now again, we're not suggesting that I design a whole six-week unit on music and math and don't cover the other stuff I was supposed to cover. It's rather thinking about, "How can I integrate the mathematics in music with the content I have to cover anyway?" And that's—there's a lot of resources out there that do so in this particular example and in other examples. That's what we're asking teachers to think more carefully about. "How can I build on what students find relevant and interesting already and connect that to math and science to spark their initial interest in math and science?"

Teachers may feel like, "Oh, that's just good teaching." And it is. That's just good teaching—making contacts relevant to students' lives, introducing things that students find interesting and they want to explore. But what some teachers may not realize is that that can have a big impact on students' later, full-blown, individual interest or long-term interest in math and science. Math and science become something that students have positive memories of doing tasks and problems that they found interesting, that they were curious about, that they enjoyed working with, and it— the subject becomes something that is meaningful and interesting and fun for them.