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Danica McKellar

Girls Get Curves

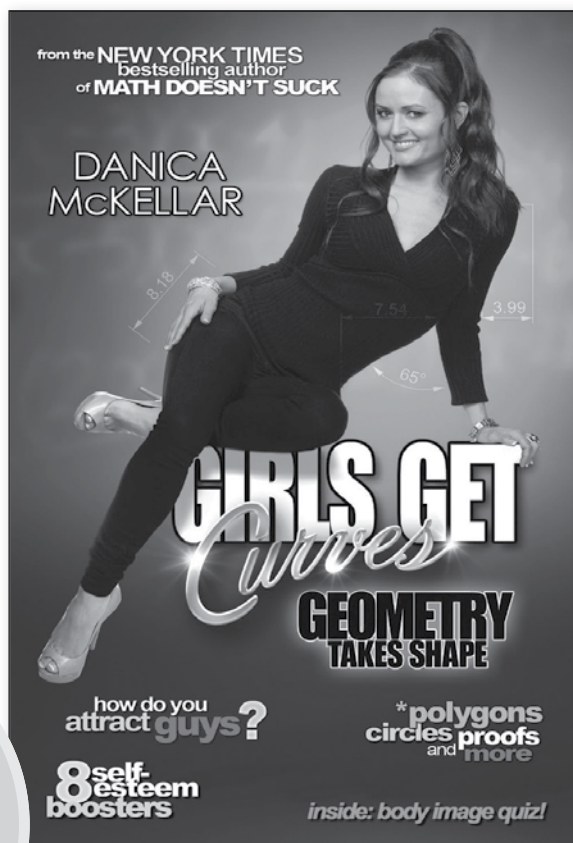
Geometry Takes Shape

Hollywood actress and math whiz **Danica McKellar** has completely shattered the “math nerd” stereotype. For years, she’s been showing girls how to feel confident and ace their math classes—with style! With *Girls Get Curves*, she applies her winning techniques to geometry, giving readers the tools they need to feel great and totally “get” everything from congruent triangles to theorems, and more. Inside you’ll find:

- Time-saving tips and tricks for homework and tests
- Illuminating practice problems (and proofs!) with detailed solutions
- Totally relatable real-world examples
- True stories from Danica’s own life as an actress and math student
- A Troubleshooting Guide, for getting unstuck during even the trickiest proofs!

“I recommend *[Girls Get Curves]* to any preteen girls or teenage girl who struggles with math, wants to learn math in a new way, or can’t get enough math. Basically, all teenage girls.”
—GeekMom for *Wired Magazine*

With Danica as a coach, girls everywhere can stop hiding from their homework and watch their scores rise!



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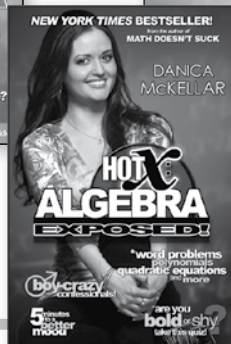
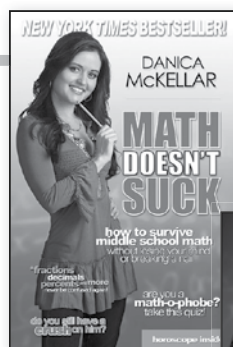
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The Myth of Differentiation in Mathematics: Providing Maximum Growth

After teaching high school mathematics in Maryland for three years, I began teaching sixth-grade mathematics in one of the best school districts in Pennsylvania (according to state test scores) and have been teaching there for the past six years. My high school teaching background led me to differentiate differently from my colleagues. I share my observations of the result of the differences in methodology and my conclusions from those observations, and I offer a plan to implement changes in the way that mathematics is taught.

TYPICAL MIDDLE SCHOOL MATHEMATICS TEACHING PRACTICES

The school district in which I teach uses heterogeneous grouping in the middle schools for all students except for the top few percent of mathematics students,

who are placed in accelerated classes. Differentiation within the heterogeneous classes is based on pretests before each chapter that determine whether a student already knows the material. Common extensions include application projects, more word problems, and activity sheets with larger numbers or a slightly advanced twist on the concept. Providing these types of extensions ensures that the base knowledge of the students in the class remains similar, allowing the district to continue to apply its standard curriculum while appearing to meet all students' needs through differentiation.

However, is the mathematical growth of advanced students as significant as that of average students? Are below-average students really getting the instruction that is most appropriate for them? The extensions we provide for advanced students may help keep them busy and may make them think, but the real effect of such extensions is to slow these students down until the rest of the class catches up. This kind of instruction provides little motivation to advanced students. Meanwhile, lower-ability students find mathematics frustrating as they attempt to learn concepts that build on ideas that they never fully grasped.

PROVIDING STUDENTS WITH TRUE GROWTH OPPORTUNITIES

My previous experience with teaching higher-level mathematics has enabled me

to provide what I think are true growth opportunities within the sixth-grade mathematics classroom. Rather than delay advanced students, I give them access to higher-level material. My class begins the school year in the same way as all the other mathematics classes in the school, but by the end of the school year I am teaching different mathematics topics simultaneously, a result of the students' divergent paths.

I am not trying to promote my approach as a superior method of education. However, when I differentiate instruction, students have shown that they can do amazing things. My sixth-grade students begin the year not knowing how to solve a one-step equation. By the end of the year, some of them can solve systems of equations with four variables and derive the quadratic formula by completing the square—skills that are two to four years beyond their current curriculum. And they love it.

When motivated students are allowed to progress at their own pace, they enjoy mathematics. Many are capable of so much more than what a standard curriculum provides. How many students could take calculus in the first year of high school if they were not kept at the same pace as their peers? At the other end of the spectrum, I have taught quadratic equations to students who struggle with basic mathematics because they

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need to pass a state test of first-year algebra. Shouldn't they be given the opportunity to grow in areas of mathematics that are more appropriate for them?

REFLECTIONS ON THESE CONTRASTING METHODS

Which nation will be the more prosperous—a nation that ensures that all its citizens meet a minimum standard of education or a nation that strives for the maximum educational growth that each student can achieve? The United States has been the former, trying to ensure that no child is “left behind.”

Imagine, instead, an education system that encourages students to experience as much true mathematical growth as possible, regardless of age. Imagine an education system that delivers instruction at exactly the appropriate level and in the appropriate area for each student, rewards students for their brilliance and hard work by allowing them to progress to higher-level mathematics, and works with lower-ability students to ensure mastery of key concepts without feeling the pressure of time constraints.

Students of the same age would be in very different places mathematically. No students would have gaps in their mathematical understanding. All would be mathematically prepared to provide the highest level of contribution to society that they are capable of. Achieving this kind of system requires two steps: sufficient motivation for education institutions to change and a plan to make such change possible.

MOTIVATION FOR CHANGE: ASSESSMENTS

No Child Left Behind is succeeding in ensuring that all students are being educated. However, the assessments that this program has spawned are advancing educational policies that are detrimental to the nation.

Current assessments ensure that all students have met a minimum standard for their grade level, leading schools to focus their energies on the least able students. We give the most educational attention to the students least likely to use it. Although this approach may seem humanitarian, it fails to produce

what our country needs.

Instead, all state assessments should be growth-based, giving schools credit for how much students have grown—that is, how much material they have mastered. This kind of assessment would change the schools' focus: Producing the most growth possible for all students would be the goal. Striving to reach that goal could revitalize our nation.

State tests should be computerized tests that determine the development level of students in all areas of mathematics. The assessment would start in one branch of mathematics at a level slightly below the expected level, as set by the school district, and progress upward until a student could no longer correctly answer questions. At that point, students would move on to questions at the expected level in the next branch of mathematics. Schools would be evaluated on the amount of growth exhibited by students compared with an expected growth norm that may take into account predetermined developmental or socioeconomic factors.

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A PLAN: MAXIMIZING THE GROWTH OF EVERY STUDENT

Teaching effectively to prepare students for a growth-based assessment would be difficult. If the goal is to allow students to “be all they can be” and provide for each one’s maximum possible growth, then every student will learn different amounts of material every year. As a result, students of the same age will be years ahead of or behind other students their age. The traditional classroom no longer seems practical. Deciding how best to approach this challenge will require much thought and discussion.

My main point is that educating for maximum growth for every student is superior to ensuring that every student meets a minimum standard. Here is one plan that seems logical.

I believe that a *really good* computer program could do a better job of meeting students’ needs than I can while trying to teach a whole class at once. Many programs currently available—such as Cognitive Tutor, Study Island, Apex Math, SmartMath, IXL, and ALEKS—are moving in a positive direction, but none of them is there yet. However, I am confident that, given sufficient resources, a program capable of transforming mathematics education can be produced, perhaps in cooperation with one of the programs mentioned.

A quality computer program would include these properties:

- It gets to know the student as the student is learning mathematics—his or her likes, dislikes, struggles, topics to review, strengths, and so on.
- It engages and motivates, providing the student with levels.
- It incorporates games and allows the student to earn rewards. I envision a sim-civilization game in which the civilization develops with students’ mathematical growth—from addition (allowing commerce with their classmates) to quadratics and trigonometry (helping them aim their catapults).
- It quickly diagnoses problems and moves within the web of the vast curriculum to aid the student.
- It ensures continued mastery through spiraled checks.

- It allows students to work within the program at any time, from anywhere. If students want to put in extra work to progress mathematically, they can. This flexibility will allow lower-ability students to put in more work to find success and allow motivated students to excel.
- It provides easy-to-use reports to aid in monitoring progress.
- It gives official assessments in secure locations to ensure that the student is the person making the progress.
- It has hands-on application opportunities woven throughout its framework.

Creating such an extensive program would require the best programmers who design popular games to work alongside expert educators. The amount of time and money needed would seem to be a huge obstacle. However, given the financial rewards for producing a program so good that nearly every student in the nation would want to use it, such a program would easily pay for itself. In any case, something truly transformative could be created, and doing so would be worth the time, effort, and money.

In this more individualized approach, teachers would still have important roles, but they would be very different from their roles today. Teachers would serve as another resource to students as they work; provide hands-on application and collaboration opportunities; monitor progress; provide coaching, encouragement, and support; and create a supportive learning community.

In some ways, teachers would need to be more qualified to teach in classrooms that use such a program than to teach in a traditional classroom. To be effective, teachers would need to be able to help students with several different years’ worth of material without having the chance to review it, as they would before teaching a lesson. Teachers would also guide students in applying what they have learned.

EMPHASIZING THE INDIVIDUAL

Differentiation, individualized education, self-directed learning—we have only just begun implementing the concepts behind all these buzz words. It is time to take these concepts to the next level, to

unlock all the potential of our students through truly customized learning. It is time to meet each student where he or she is and help all students grow. It is time to stop limiting students’ growth to keep them on pace with their peers. It is time to stop forcing students to move on before they are ready.

We now have a tool that, if used properly, will allow education institutions to provide this kind of instruction. American students can rise to and surpass the levels of their international counterparts. We need to give them the right tools, support them, and then let them go.



JASON LEE O'ROARK,
joroark@uscscd.k12.pa.us,
teaches sixth-grade mathematics for Upper St. Clair School District in Pennsylvania. With a team of teachers, he also conducts the 5th–6th grade Calcu-Solve competition at Duquesne University in Pittsburgh.

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