Lessons in How Not to Teach Math

AUG 13, 2013  Barry Garelick 51 Comments

I am a mathematics teacher. I majored in math and, prior to going into teaching, used it throughout my career.

My facility with math is due to good teaching and good textbooks. I fully expected the same for my daughter, but after seeing what passed for mathematics in her elementary school, I became increasingly distressed over how math is currently taught in many schools.

Optimistically believing that I could make a difference in at least a few students' lives, I decided that after I retired, I would teach high school math. To obtain the necessary credential**,** I enrolled in George Mason University Graduate School for Education in the fall of 2005.

The ed school experience did have some redeeming features. Most of my teachers had taught in K-12, and had valuable advice about classroom management problems and some good common-sense approaches to teaching that didn't rely on nausea-inducing theories.

Those theories are inescapable, unfortunately.

Specifically, many education theorists hold that when students discover material for themselves, they learn it more deeply than when it is taught directly. In this vein, the prevailing belief in the education establishment is that although direct instruction is effective in helping students learn and use algorithms and mathematical procedures, it is ineffective in helping students develop mathematical thinking.

According to the establishment, students should be "led" to their discovery of the answers. Providing explicit instruction is considered to be "handing it to the student" and prevents them from "constructing their own knowledge."

"Discovery learning" isn't bad. Most teachers use *some* discovery learning and group work in their classes. Also, staging problems so that they vary slightly from the worked example—so that the students are essentially applying prior knowledge in a new situation (called scaffolding)—has the "look and feel" of discovery. The problem is that the reigning education theory focuses mostly on discovery, with only a nod to direct instruction. That's mistaken.

The worst class I took in education school was on "math teaching methods." It was taught by my advisor at the time. (I say "at the time" because shortly afterward they changed advisors on me, and she no longer taught courses, but worked with Ph.D. candidates. From what little biographical information I have seen about her, she has not ever taught any classes, math or otherwise, in K-12.)

The math teaching methods class was remarkable for its embrace of every educational fad I detest.

One book we had to read was *Integrating Differentiated Instruction and Understanding by Design* by Carol Ann Tomlinson and Jay McTighe. This book is popular in the education school and professional development circuit. Despite its popularity it only served to infuriate me, as evidenced by the missing front cover of the book, which tore off when I hurled it across my bedroom.

The book is emblematic of the doctrine that pervades schools of education. That doctrine holds that mastery of facts and attaining procedural fluency in subjects like mathematics amounts to mind-numbing "drill and kill" exercises that supposedly stifle creativity and critical thinking.

In their discussion of what constitutes "understanding" the authors state that a student being able to apply what he or she has learned (for example, using the invert and multiply rule to carry out fraction division) does not necessarily represent understanding. "When we call for an application we do not mean a mechanical response or mindless 'plug-in' of a memorized formula. Rather, we ask students to transfer—to use what they know in a new situation."

If you accept that, then in math (and other subjects that involve attaining procedural fluency), using worked examples as scaffolding for tackling more complex problems does not require mathematical reasoning nor lead to understanding. That view embodies the educational establishment's notion that procedural fluency obscures understanding. The fact that a student can recognize when, say, fractional division may be required to solve a problem requires some reasoning, as well as application of the procedure itself (mechanical though it may be). Both fluency and understanding work hand-in-hand. As students increase their expertise more non-routine problems appear to them as routine.

Worse than the book itself were the discussions in class that arose out of it. One event stands out.

In a chapter that discussed the difference between "knowing" and "understanding," a chart presented examples of "Inauthentic versus Authentic Work." In that chart "Practice decontextualized skills" (otherwise known as "reading") was listed as inauthentic while "Interpret literature" was listed as authentic.

The professor asked if we had any comments. I asked, "Do you really think that learning to read is an inauthentic skill?" She replied that she didn't really know about issues related to reading.

I normally limited myself to one outburst per class and was now at my limit, but I kept on pushing her and put the argument on a math level. I referred to the chart's characterization of "Solve contrived problems" as inauthentic and "Solve 'real world' problems" as authentic and asked why the authors automatically assume that a word problem that might be contrived didn't involve "authentic" mathematical concepts.

I knew she wanted me to shut up. The class wanted me to shut up. Even I wanted me to shut up. She wrapped the discussion up by saying, "Let's move on."

The distinction the book (and the professor) makes between "authentic" and "inauthentic" learning has been around for a while. This concern about "authentic" versus "inauthentic" work comes from progressive education reformers who believe that it's best for students' school work to be as realistic as possible—that is, focused on learning about and trying to solve "real world" problems.

Educators who promote "authentic learning" mistakenly believe that novices learn the same way that experts do. They believe that students construct their own knowledge by being forced to make connections with skills and concepts that they may not have mastered. The theory is that they learn what is needed in a "just in time" manner, thus providing the motivation for learning, which they assume would otherwise be a tedious and soul killing exercise.

This approach became evident when we watched a video in class—one of many distributed and produced by the Annenberg Foundation. In the video, a teacher had his students do a variety of tasks, ostensibly to teach them about factoring trinomials, such as $x^2 + 5x + 6$. But rather than teaching factoring techniques, as is done in traditionally taught classes, the session was a mélange of algebra tiles (manipulatives that are plastic squares and rectangles that one can use to represent algebraic expressions and to teach factoring) and a graph of the equation being factored (a parabola).

Then the teacher "facilitates" the class into making a connection between the factored equation and where the graph crosses the x axis. The class had not done factoring before, nor solved quadratic equations before, nor done a host of other things that would be important to understand the lesson.

The professor asked us our reactions to the video. I noted that rather than teach them factoring first and having them practice it, he had them doing things that generally came after such mastery. She seemed delighted at my observation and, smiling, said "Yes, so they were able to make connections between factoring, parabolas and solutions of quadratic equations."

But when I replied, "There's so much going on, that I'm not sure what they're learning or if they're learning anything at all," her face went into a frown and she called on another student. Evidently she was so enthralled with the theory that she was unwilling to consider the possibility that, instead of leading to better comprehension of math, it left students confused.

The ed school approach to teaching math seeks to minimize "inauthentic" learning by replacing it with so called "authentic" exercises. But presenting students with a steady diet of challenging problems that neither connect immediately with their prior knowledge, lessons and instruction, nor develop any transferrable skills results in poor learning.

It is like children playing "dress up" in their parents' clothing. The education establishment may believe they are producing "little mathematicians," but the increased enrollments in remedial math courses in universities tell a different and disturbing story.

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Hypnotic • 16 days ago

You are spot on! I am also very disgusted in the way math is taught. My child is prisoner to one of those "understanding" curriculums a la Singapore math (aka Dimension Math 7a). These children are being taught cart before horses and then we wonder why so many cannot even take a basic level college math course and are in remedial math! These children are learning nothing but to be overwhelmed. The book follows NO logical order and quite frankly is a disgrace. I have a professional degree and was educated in the mid 80s so thank gosh I can teach her the way I was taught.

When I do that (yes it's algorthimically) she "gets it" and the look of pure panic and bewilderment fades! Shame on these so called educators who don't believe rote drill and algorithm is the first step toward understanding. Through working within that construct at first, having been taught that way myself, you then grow intuitively and subconsciously in your knowledge. These idiots think you can teach someone advanced math critical thinking skills before they know the basics!

In a nutshell, We produced engineers who designed Hoover Dam and many other engineering marvels who did all the math longhand and with sliderules. They weren't educated with this type of math education. They were products of the old rote teaching! Our education system is succeeding in making children hate math because they are frustrated and then blame it on the student. Meanwhile, that same student, 35 years ago would've done quite well and perhaps even pursued a STEM career.

Makes my blood boil. Thanks for your analysis. They won't learn until it's too late and two plus generations of children are math illiterate.

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Teress Murray • 8 months ago

Problems in elementary math education have intensified over the past couple of decades.And yes there were problems prior to that, there was no golden age.However, complete abandoment of traditional math teaching has been a disaster in my opinion. And I do have 32 years of elementary classroom experience. A very nuanced examination of the issue would have been better. My

suggestions would have been - keep what we had andnstrengthen it. It would have been better to instruct teachers in judicious use of manipulatives, ensure teachers knew math and how it develops through the grades, provide solid remedial help for struggling students, provide excellent math texts, not ideological ones, make sure gr. 1 to 3 teachers had appropriate texts and workbooks, as too often these teachers are given minimal materials and monitor class size. Instead everything good was simply tossed out and the past completely denigrated. And as a parent, I sympathise with Barry. There were many nights I wanted to hurl my daughter's textbook through the patio door and I knew what was going on. The collapse of math education was the saddest disaster I saw in 32 years.

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RainahNess • 3 years ago

Rote practice of algorithms does absolutely have its place. It is vital. Rote practice prior to comprehension? That is questionable at best. --- The question arises, then: How does one assess the stability of one's comprehension of the concepts and how those concepts are 'expressed in mathematical language'..... prior to the student working on rote drills of algorithms? How does one help the student to maintain an awareness of the concepts while working rote drills of algorithms?

1 • Reply • Share ›

Barry Garelick ➚ RainahNess • 3 years ago

I question the use of the word "rote". It literally means repetition, but I assume you intend it to mean "non understanding". That said, rote (i.e., non-understanding) learning is pretty hard to accomplish with elementary math because the very learning of procedures is, itself, informative of meaning, and the repetitious use of them conveys understanding to the user. I do not advocate teaching that leaves the onus on the student to impose their own understanding through procedure, without guidance. As I have shown in many articles that I've written on math education, not even the textbooks from the age so denigrated by people who claim traditional math teaching is ineffective, structured learning that way. And I can go back even further, to the turn of the (20th) Century. Meaning was ALWAYS integral to any widely accepted system of instruction.

The current trend is to impose "understanding" via inefficient procedures. If one learns that "to demonstrate an understanding of multiplication" one needs to draw some area diagram, one will automatically and mindlessly draw such diagram every time an explanation is required. Not different from memorizing FOIL or "invert and multiply" for fractional division ... except wasting a much longer time. And resulting in a "rote understanding" via the "drilling" of understanding. The assumption that understanding MUST come before procedure is wrong. Sometimes it comes before, sometimes after, sometimes during.

1 • Reply • Share ›

This comment was deleted.

Barry Garelick ➚ Guest • a year ago

Glad you enjoyed the article. If you like this type of stuff, my book "Math

Education in the US: Still Crazy After All These Years" is a compilation of articles I've written over the past 10 years. http://www.amazon.com/Math-...

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RainahNess ➚ Barry Garelick • 3 years ago

While I think that you and I agree overall:

The following should be stated in any conversation about teaching mathematical data which can be memorized:

Rote learning of, say, multiplication facts, can be accomplished without understanding, because multiplication facts *are* recalled through verbal memory (as opposed to addition/subtraction, which are recalled in cooperation with spatial sense).

While textbooks of past and/or present might contain instruction in what multiplication is, some students need more review of the concept over time than a given textbook provides.

Therefore, it is important for math teachers to realize that they need to inquire into the meaning of multiplication from each student periodically.

A 'demonstration' by drawing, say, the square footage of a room, can be memorized short term, and then the concept forgotten when a student is having to

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1 • Reply • Share ›

Barry Garelick ➚ RainahNess • a year ago

And many seem to presume that traditionally taught math in previous eras did not reinforce the meaning/concepts of multiplication, but focused instead on just a times-table perspective. That is a false but prevalent view of how math was taught.

1 • Reply • Share ›

RainahNess • 3 years ago

1) Discovery really only works well, on a consistent basis, when discovery occurs in real life settings: farming, sewing, weaving, and the like..... 2) Group think does not promote thinkers of all in the group. Group think involves leaders and followers. It stifles individual responsibility for exploring, understanding, and retaining. And it provides a systematic training in 'excuse making' for those who have to follow in 'group think' 'discovery scenarios'. --- 3) STILL: Discovery? Even 'discovery of mere abstractions' in math? It worked great for Fred Hoyle without 'real life settings'. He had a great working/investigating relationship with his mother, and that helped him 'discover' a LOT of mathematical relationships. SUMMARY - Discovery IS great..... It just can't be manufactured at the classroom level. At least, I haven't discovered a successful attempt at such to date..... Miquon Math tried hard..... it was pretty close to the goal, but not readily transferable. Too many "math teachers" don't really know how to think for themselves in the first

place. ---- That's the biggest problem, right there - - - - and that problem is amplified exponentially more when people who can't really think for themselves are called 'the experts'.

1 ^ | v • Reply • Share ›

Kid • 3 years ago

As a high school student who attends the #1 STEM high school in the country, I realize that the smartest students are so successful because of what they do at home. Most teachers are very incompetent and the students know more than them. (Of course, there are exceptions, but this is usually the case.) Students rely on their highly educated parents and intelligent parents to teach them what they don't learn in school. Also, I have noticed that Chinese and Indian students almost always are the top students.

It would help for education systems to realize that everyone is not equal. Everyone has different strengths. Some students will understand concepts faster than others. All this bullshit about "authentic" learning is, as I said, bullshit.

Of course, there's probably nothing I can do about all of this, since as one of the smartest, there's no way I'm becoming a teacher.

2 ^ | v • Reply • Share ›

Caroline Richardson • 4 years ago

Gosh. Today my son math teacher told him that his 3 1/2 years at Kumon was hindering his learning as when given a simple faction multiplication all he could do was provide the answer without providing the complicated factorial number line and associated picture (I have no understanding of this) to "why" the answer was so. He used his computational knowledge and just knew the answer. When did jousting knowing the correct answer start being incorrect?

3 ^ | v • Reply • Share ›

Thomas • 4 years ago

This discussion board perfectly illustrates the problem I see as a 31 year veteran of high school mathematics teaching. You have two people playing tennis--David and Goliath--smashing the ball back and forth. The crowd, i.e., the public school students, passively sit in their seats taking it all in. Too much emphasis is being placed in this battle of ideas, and too little responsibility for learning is being placed on the shoulders of the students and parents. The great lie in all of this is that some of the kids can't learn, so we need to figure out ways to make the system completely egalitarian. Where I work, matriculation is more important than learning, and so is social promotion in the elementary and middle schools. Students know about the safety net and they give up at an early age. By the time they get to high school, they and their math teachers are perfectly set up for failure. The kids are watching the game instead of being brought into it. Are we afraid to make students, parents, and caretakers measure up? What I am saying is that we can shrink the size of the tumor, the kids who really "can do, but won't do," and then focus on the rest with more specialization. The middle third can do much better.

3 ^ | v • Reply • Share ›

RainahNess ➚ Thomas • 3 years ago

In the past, Thomas, your response would have been pretty accurate to most people's thinking. But there is more to this. In the past, parents and students owned responsibility

for the students' education *most of the time anyway*. Today, that is occurring less and less. But even back when parents/students owned repsonsibility by and large, there were students who tried hard who struggled. Because of them, the big-government crowd has been working the general public hard to make the responsibility the school's and the schools' alone. They can get more money that way, and with that money, they have more power. Not that all teachers aim for that, but many well meaning teachers get sucked into the liberal hype. ---- THE SOLUTION? UNDERSTANDING EDUCATIONAL LAW. IT HAS BEEN UNDERSTOOD SINCE THE DAYS OF QUINTILLIAN IN ROME. CHARLOTTE MASON ESPOUSED ANOTHER EXPRESSION OF IT JUST OVER 100 YEARS AGO. NANCI BELL'S WORK TODAY RESTS FAIRLY WELL (not perfectly - but fairly well) ON EDUCATIONAL LAW. ----- But liberals don't want to believe in educational law any more than they want to give credibility to natural law as it was understood during the Colonial Age/Revolutionary Period in North American history. --- IN PARTICULAR: a) visualization skills are not used as heavily by the best of mathematicians, b) visualization skills are *necessary* for many students of physics and etc. to push through..... therefore, if those skills are not taught, some absolutely astoundingly talented American students, gifted

see more

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Georgfelis • 4 years ago

Generally, classical math education leaves students knowing How to solve problems, with a fairly vague idea just Why it works. Discovery Math seems to believe that a fractionally larger knowledge of Why excuses graduating children who will never be able to figure out How to fill out their own tax return.

1 • Reply • Share ›

SteveH • 4 years ago

Discovery is neither necessary or sufficient, especially when it's only done in groups in class. So much time is wasted. As I always say, only one person in the group actually discovers anything and then proceeds to directly teach it (probably poorly) to the rest of the kids in the group. However, it will warm the cockles of the teacher's heart to see so much "active learning". Students need to "figure out" lots of things and the main vehicle for doing so is homework. Any engagement or motivation developed in class group work quickly disappears when the real learning has to be done at home. I would prefer flipping the class where students read about or watch videos introducing new material at home, but then do group homework in class. They would get immediate feedback on all of the skills (and understanding) they need, not have just one big wasted time "discovery" of the day. Unfortunately, many teachers see flipping as giving them more time to waste in group discovery in class.

All you have to do is look at any proper math textbook to see a careful development of ideas and problem variations. I have tutored many students who clearly understand the concepts, but cannot deal with any slight variation in problems. I tell them that they HAVE to do all of the problems themselves at home. Their understanding will be challenged by the problems. This is not about doing drill and kill for 50 long division problems. This is not about speed. It's about the understanding that comes with doing (by oneself) all sorts of different problem variations. Think

see more

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Ted Spickler • 4 years ago

Fascinating discussion. A middle ground to this debate is found in the details of how we understand things. The mind really does "discover" conceptual understandings but the route to that discovery requires practice with facts and information including skill development. So if a teacher insists that "discovery" is the proper route to understanding, that expressed opinion, although correct, is insufficient without including all the necessary bits and pieces needed to construct the understanding. The typical practice of "constructivism" too often misses the need to place before the student all the facts and information needed for their brain to complete the discovery. The bits must be there in a tacit sense or else the "Aha" moment fails to occur. Practice and skill development is thus necessary. See the PowerPoint presentation under "About" at www.tacitknowledge.org for a more complete discussion of this.

2 • Reply • Share ›

isnow ➚ Ted Spickler • 2 months ago

I think your post is right on the money. I am currently taking a class in Differentiated Instruction (textbook is by Tomlinson) and I noted a couple of things - there are about 2 sample lessons in the entire book that have to do with math, and those are elementary school level. As part of one assignment, I am supposed to find some valuable resources to share, but they must be published no more than 3 years ago. I haven't found anything on differentiated education for mathematics published after 2010. My conclusion is that it is apparently more work than it's worth to do a lot of this type of multi-level discovery lessons. Here's something else I know after teaching high school math for 20 years: Regardless of how they came by the knowledge, it is a whole lot easier for students to learn algebra when they know their times tables! But teaching those times tables, because it involves rote memorization, has fallen way out of favor with elementary education "experts." Never mind that it pays big dividends later on.

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Jorod First • 4 years ago

Education is big business. It must be kept mystical so that it is left to the "experts" to divine.

5 • Reply • Share ›

Nancy Krasa • 4 years ago

You and your readers may like our book, Number Sense and Number Nonsense: Understanding the Challenges of Learning Math, by Nancy Krasa and Sara Shunkwiler (Brookes, 2009). It reviews the cognitive and neurocognitive research on math learning and math disabilities, in plain English. Readers have been quick to express their gratitude that we stress how little is actually (scientifically) know about effective math pedagogy.

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Guest • 4 years ago

Agree with sentiment, but disagree on details. Modern math and statistics is computer based. Kids get turned off by math because they think professional math is just harder problems solved

Kids get turned off by math because they think professional math is just harder problems solved by hand. Once you get the concepts math and statistics are not much more difficult than a word processor.

Just as we abandoned the abacus, and adopted the calculator, modern math instruction needs to be focused on using computers to solve polynomials and such.

I once told a high school math teacher about this and he laughed and said, "that would be teaching them to cheat!" I responded that the real world does it that way and he clearly had no concept of that.

I use math and statistics heavily, and my grade school education did everything possible to turn me off on it. The fundamental problem is the high school teachers are incompetent and lazy. There are a few that are great and they deserve 10x what they get paid, but the bulk are useless at minimum wage.

5 ^ | v • Reply • Share ›

disqus_MHw7a2dXsU ➚ Guest • 4 years ago

This is like saying, if you want to understand force and acceleration, go drive a car. They use the principles of force and acceleration, so simply using cars will give someone an understanding of those physical principles. We used to use oxen and horses, but now we have cars, so use them.

3 ^ | v • Reply • Share ›

Anne Salter ➚ Guest • 4 years ago

I both agree and disagree; I taught high school students who rely so heavily on their calculator that even if they punched in the numbers incorrectly, they cannot tell because they have no number sense and therefore cannot estimate what the answer should be - they just reply: it must be right, the calculator says so!
We need students who understand multiplication such as rows x columns, no. of groups x no. of item per group, etc. They also need to know multiplication tables otherwise they cannot simplify fractions.

2 ^ | v • Reply • Share ›

april showers ➚ Guest • 4 years ago

I concur wholeheartedly and feel that it is bordering on criminal that high school students are graduating without expert level and certificated knowledge of Microsoft Office Professional Suite, Quickbooks, Adobe and Cisco and all the other software skills required to actually get a job.

When I was in high school, we learned typing, shorthand and business math including how to work an adding-listing machine along with our academic curriculum so that at graduation, we had a choice whether we wanted to go to college or begin a career. Also, for those of us that paid our own way through college, those skills paid the tuition. I don't see that there is any difference between learning how to use those machines in my day and the full range of tools available today.

1 ^ | v • Reply • Share ›

Fred Garvin • 4 years ago

As far as the "authenticity" movement: one may wish to read "The Authenticity Hoax" that was published a few years ago. While philosophical in nature, it blasts the trendy notion of authenticity in many areas.

3 • Reply • Share ›

Steve • 4 years ago

I was disappointed when the Fairfax County school system tried to teach my elementary school sons math skills in the early 2000's without memorization of the multiplication tables. Teachers were unhappy with any memorization, because it didn't lead to "understanding". So we did it at home. Same thing for history. Socialist Justice is socialism, Marxism, and communism-lite. There's only one place in education for politics, that's the Political Science department.

9 • Reply • Share ›

E_Pluribus_Pluribus • 4 years ago

The simplest explanation for theories --- such as constructivism --- emanating from schools of education is IQ. I had a long letter published in the Wall Street Journal a decade or so ago detailing the Graduate Record Examination scores of aspiring education graduate students versus students in other fields of graduate study. Education majors along with social work majors were at the left tip of the GRE bell curve for total quantitative and verbal GRE scores. Math, engineering, physics were at the right tip.

Presumably, professors of education, who come up with the theories promoted in schools of education, were once education majors. It's beyond absurd to place the education of children under the direction of education majors.

5 • Reply • Share ›

SteveH ➚ E_Pluribus_Pluribus • 4 years ago

I see a distinct line between those teachers who are certified in a subject area and the education generalists of K-6. When our state started requiring subject certification starting in seventh grade, they were able to get rid of the fuzzy CMP math program and replace it with proper math textbooks that aligned with what the high school was doing. The eighth grade algebra course was the same as the one in high school. CMP, which only covered a few topics ("with understanding") in algebra, left students completely unprepared for geometry in high school. This change also benefited language preparation which was forced to properly prepare students for a second year course as a freshman.

I see a huge pedagogical wall between high school and the lower grades. Lower grade teachers have little to no practice with the skills and content knowledge of a specific field. Their field is educational pedagogy, and according to Barry, they do their best to transfer (not allow discovery) their rote ideas of how kids need to learn. The dominant goal in K-6 is full inclusion and differentiated instruction. The only way to get this done is by lowering expectations, spiraling, and putting all of the onus of learning on the student. However, they talk of balance, understanding, and 21st century skills (see, they like some sort of skills) as cover for low expectations. I'm generally pleased with my son's high school courses in terms of skills and content. K-6 was a whole other world. Seventh and eighth grade was a funny middle ground. Many high school teachers go about their business

teaching their subjects well while letting all of the top-down, real world, integrated fuzzies control the public discussion - probably a wise decision.

1 ^ | v • Reply • Share ›

E_Pluribus_Pluribus ➚ SteveH • 4 years ago

SteveH, you are right about the "huge pedagogical wall between high school and the lower grades." I should have been more precise in my previous post. The "pedagogical wall" you identify is reflected in mean Graduate Record Examination (GRE)scores. Of the eight or so education majors --- including Education Administration (the decision-makers/policy-makers) , all but one have mean total GRE scores on the left tip of the GRE bell curve. That ONE exception is Secondary Education. The mean GRE score for Secondary Education majors is right in the middle of the bell curve distribution for mean GRE scores of 51 graduate fields of study.

2 ^ | v • Reply • Share ›

Ben Orlin • 4 years ago

Certainly it's a mistake to purge computations and algorithms from the curriculum, just as it's a mistake to build the curriculum entirely around those computations and algorithms (without reference to higher-level thinking and the synthesis of ideas). A balanced approach is always best.

I came sideways into the profession, and never really attended ed school, but you and others argue persuasively math ed programs tilt too far away from computation/mechanics. I'd believe it.

Do you find the same is true in classrooms? I've encountered far more students who are computationally fluent and conceptually illiterate than the other way around.

2 ^ | v • Reply • Share ›

a_math_teacher ➚ Ben Orlin • 4 years ago

I have been teaching high school math for 15 years and I think students' computation skills have weakened in that time period. I see many college-intending students who do not know their multiplication tables and who cannot do standard multiplication or long division. It's very sad. So often they are hanging on to lattice multiplication with no clue as to why it might be valid. So much for conceptual understanding....

5 ^ | v • Reply • Share ›

SteveH ➚ Ben Orlin • 4 years ago

I guess you will have to accept that there is a world out there that you haven't seen. Maybe you have seen kids like my son who was properly prepared by me at home. Perhaps you don't know about all of the notes sent home to parents telling us to practice "math facts" with our kids. Have you seen TERC or Everyday Math in action. I had to deal with EM for 5 years with my son. Some bright kids at his school still didn't know the times table in fifth grade. It could be the teachers, but it was not. Everyday Math specifically tells teachers to "trust the spiral" and keep moving through the material. You have to see the workbooks to understand. I call it repeated partial learning. Teachers take NO responsibility for ensuring skills. EM provides "Math Boxes". It's completely up to the student. The philosophy is that

skills. EM provides "Math Boxes". It's completely up to the student. The philosophy is that "kids will learn when they are ready". It's all about full inclusion.
In that same fifth grade, during a parent/teacher meeting about Everyday Math, everyone talked about "balance" and how good it was. However, nobody defined it or explained why the skills portion of that balance was not getting done. "Balance" is a throw-away term. It is superficial and used to get parents off of their backs while they continue to control all of the details. To ask for details requires one to challenge their authority and risk retaliation against one's child.
I don't know of any school system that surveys their best math students about what real teaching and reteaching goes on in their homes or with tutors. It would be an easy thing to

see more

Ben Orlin ➚ SteveH • 4 years ago

It's a big, diverse country. My point isn't that computational fluency is over-emphasized everywhere. My point is, in fact, precisely what you're rightly telling me: "you will have to accept that there is a world out there that you haven't seen."

1. I came up on Everyday Math, K-5. The program worked great for my school (a wealthy suburb, to be fair). We didn't get any extra computational practice at home; teachers just supplemented the program with a little practice during the schoolday. Lots of those kids now have degrees and careers in STEM.

2. The high school I've taught at serves a low-income immigrant population. Almost all of the kids entering my 11th-grade class could factor a quadratic. Almost none of them understood what a "quadratic" really is.

3. My wife teaches undergrads at UC Berkeley, and it's the same story. Computational fluency in spades; conceptual understanding in thimble-fuls. Lots wind up failing intro calculus, because they need both.

4. My sister is a K-8 math specialist. She sees the same thing with the teachers she coaches - they happily drill kids on, say, long multiplication. But the kids

see more

Guest ➚ Ben Orlin • 4 years ago

You might find Emily Willingham's article on Everyday Math at Forbes to be of interest--particularly the comments: http://www.forbes.com/sites...

Nik Stouffer ➚ Ben Orlin • 4 years ago

Our affluent school district had Everyday Math for 6 years. Parents complained that the kids were lost and most Middle school teachers complained that the kids were not prepared. Kumon opened up and became very popular in our area, suddenly the test scores started to rise. The elementary school administrators continued to ignore the problem and the

elementary school administrators continued to ignore the problem and the parents supplemented education. Most parents find out the hard way, that if your school has Everyday Math, you will be paying big bucks to a learning center or tutor to teach your children, unless you have the skills to teach at home. The best teachers I know, close the door, do their own thing and toss most everyday math homework. The 'Math Museum" is the biggest waste of time, having kids interview their parents to find out how far they traveled is a huge waste of time, measuring your bed with your hands is a huge waste of time. Most teachers just throw these waste of time exercises out the window and replace with real computation practice, and some teachers don't know any better. I tutor middle school students in my district who still count on their fingers and don't know their multiplication tables. Everyday math is an abject failure, affluent parents make it work because they have the money to prevent the failure.

6 ^ | v • Reply • Share ›

Ben Orlin ➚ Nik Stouffer • 4 years ago

I'll have to look more closely at Everyday Math with adult eyes. My own hazy memory of elementary school involves lots of computational practice, in addition to more conceptually targeted lessons (though I recall none of the ones you mentioned specifically).

As I said, purging computational practice from the curriculum is insane. But the rhetoric I'm reading in these comments seems to focus on the negatives of other forms of math instruction, rather than the positives of computational practice.

I'd like to bracket the issue of whether those other forms of math teaching are good/effective/worthwhile. Maybe they are. Maybe they aren't.

The real issue is that we need computational practice back in classrooms where it has been removed. Getting that back in the classroom seems more important to me than getting programs like Everyday Math out.

^ | v • Reply • Share ›

SteveH ➚ Ben Orlin • 4 years ago

Apparently you don't understand that programs like Everyday Math and TERC take out computational practice in classrooms. As I said before ...

"I had to deal with EM for 5 years with my son. Some bright kids at his school still didn't know the times table in fifth grade. It could be the teachers, but it was not."

Nick is telling you the same thing. What sort of additional evidence are you looking for? I'll try to provide it. We are telling you our first-hand specific experiences. They are not just our views or opinions. Clearly, you are in the early stages of understanding what is going on nationally.

You say:

You say:

"I'd like to bracket the issue of whether those other forms of math teaching are good/effective/worthwhile."

Get copies of Singapore Math workbooks and compare them with Everyday Math workbooks. I used Singapore Math with my son at home while all of

see more

1 • Reply • Share ›

SteveH ➚ Ben Orlin • 4 years ago

The problem is not weak versus strong teachers. It's about what teachers are taught in ed school, as Barry clearly explains. Although you admit that what you see might be less common than what others see, it doesn't seem to have altered your conclusions. Claiming that students need both skills and understanding is, and has never been, an issue. The issue is how they are defined and whether they get done.

1 • Reply • Share ›

Ben Orlin ➚ SteveH • 4 years ago

I'm interested in listening to your experiences, comparing and contrasting them to mine, and seeing how my understanding of math education can grow.

My feeling right now is that you're insisting, without much additional evidence or effort at mutual understanding, that your view is right and mine is wrong. That might be true. That might be false. Either way, it doesn't strike me as very helpful.

• Reply • Share ›

SteveH ➚ Ben Orlin • 4 years ago

Do a search for Kumon in the Berkeley area. How many do you find? Look at the whole Bay Area. It's pretty amazing. They are filling a need. Go ask them. Have your wife ask her students what help they got in K-12 at home or with tutors. She should be starting to see students who had EM and TERC. They've only been around for 10 years or so.

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Nik Stouffer ➚ Ben Orlin • 4 years ago

I have found that there has been a decrease in computational fluency within the past 20 years due to elementary school math programs Everyday Math, Investigations and similar programs. These programs leave the students conceptually illiterate. These programs are scourge on society afflicting students for decades and should be eliminated from the elementary schools.

1 • Reply • Share ›

Guest ➚ Ben Orlin • 4 years ago

It depends on the classroom/school. I have seen students at an elementary school who are not mastering basic math facts, and other essential skills. It also depends on the math program being used. In schools that use programs such as Investigations in Number, Data and Space, and Everyday Math, and other such programs, student mastery is poor, unless students receive tutoring, or other outside help such as Kumon, Sylvan and the like.
I have taught in high school algebra classes where some students still count on their fingers to add and subtract, and cannot do basic math operations without a calculator. So it varies.

^ v • Reply • Share ›

paul137 • 4 years ago

Unlike the many initiatives and ideas in education that amount to drooling, manifestly stupid fads, the idea of "constructing one's own knowledge" has some sense behind it. At least it's my experience that, when I figure something out for myself (I'm a physicist), I understand it better and retain it better than if I'm shown it by someone else.

Nevertheless, in his usual cut-to-the-heart of the matter way, Thomas Sowell used just a few words to point out the flaw in this attractive idea:

"What is more important in math, that children 'know the right answers to the questions' or that they 'struggle with the process' of trying to find the right answers? Among professors of education, 86 percent choose 'struggling' over knowing.

"This is all part of a larger vision in which children 'discover' their own knowledge rather than have teachers pass on to them the knowledge of what others have already discovered. The idea that children will 'discover' knowledge that took scholars and geniuses decades, or even generations, to produce is truly a faith which passeth all understanding."

That's from 2005 in http://townhall.com/columni...

4 ^ v • Reply • Share ›

Obi-Wandreas • 4 years ago

See this study here for a detailed analysis of why that sort of teaching doesn't work: http://igitur-archive.libra...

The use of "inauthentic" by the professor is telling. She wants to sound as though she is striving for deep significant links between the mathematical subject matter and herself and the students. Really, she just read "Catcher in the Rye" too many times and let it justify her narcissism. There are few things more arrogant than to believe that the knowledge of the universe has no value unless it serves you and your precise current position directly. It's a small-minded philosophy that makes it impossible for a person to grow.

2 ^ v • Reply • Share ›

Stephanie Sawyer • 4 years ago

Thanks for the trip down memory lane! I took my math ed courses in the mid-90s, and the whole "construct your own knowledge" was just starting to get teeth. While all this theory sounds so cool, two things:

cool, two things:
1.) My students in the 90s could do basic arithmetic. My students today, in 9th grade Algebra 1, cannot. They fall apart if fractions or decimals or percents appear.And a number of them cannot even handle negative signs. If we lived in a whole number world, then yeah, this philosophy works.
2.) I had such a great lesson plan in my math ed class that espoused this nonsense that none of the adults understood it, so I failed the peer evaluation. Basically, I gave everyone 2-1/2 cups of rice (measuring cups and all) and asked them to figure out how much each person would have to get if we (groups of 3) were to share the total amount of rice equally. They were all mad because they didn't know they were just finding an average. Which was supposed to be the point of the lesson. So, I managed to show that both traditional (where you learn HOW to find an average) and constructivist (you figure out what the hell an average is) methods were lacking. I failed the instructor evaluation as well!
6 ^ v • Reply • Share ›

Beth • 4 years ago
As a lit teacher, I know that students must have excellent reading comprehension skills before they can "interpret" literature. There is nothing more "inauthentic" than so-called interpretation without adequate comprehension of the words being interpreted. Math is one of my least favorite areas because it's so much harder -- but I thank God that I was forced to learn the basics by rote and drill so that I was able to go further than I would have thought; trig and stats in college wasn't a breeze but I had been given the tools to learn. Sure, discovery is good -- but you can only discover what you've been prepared to see.
10 ^ v • Reply • Share ›

Brian_Manhire • 4 years ago
I'm a musician, not a pedagogy expert; but it seems to me that "drill and kill" is essentially what is well known in musical performance as "practicing." And my experience as both a musician and an engineering professor (now retired) is that "practice makes perfect." Just sayin'
12 ^ v • Reply • Share ›

SteveH ➚ Brian_Manhire • 4 years ago
Education people think more like artists, where it's all about creativity; where one can be famous and end up having a one-man show of totally white paintings. Well, maybe John Cage's 4'33" fits that category. However, in general, musicians can't fake skills or understanding. One may not like Bartok or Schoenberg, but you can't fake the skills needed to understand or play them well. Educators would like to approach math top down, from an understanding standpoint, but in reality, true understanding can only happen in layers as skills are developed. One might perform a rote version of "Fur Elise" or "Fantasie Impromptu", but the problem is not solved with more talk of understanding. The problem is solved with more practice and skills. Some are accused of playing music like rote robots, but the solution is to save those pieces until skills and musical maturity are properly developed. One might be able to learn how to appreciate music at a very high level without playing any instrument, but performance is supposed to be the goal of education, and a performer's level and type of understanding is different. Unfortunately, many educators don't see that the goal of education is math performance, not math appreciation.
8 ^ v • Reply • Share ›

cyberschoolmom • 4 years ago

Wow, you just described a free online course I'm taking at Stanford: "How to Learn Math" to prepare teachers to teach the new Common Core.
It all seems great in theory, and I have enjoyed some of the exercises, but without a background in math it just seems like curious puzzles. As you say, I do not see the connection yet between them and math concepts. The other issue you did not bring up is that there is an emphasis in these classes on accepting mistakes as a good thing - that mistakes mean MORE learning is taking place, and even to not correct them. The reason is they want to encourage students not to feel bad about not getting math because bad feelings discourage students from believing they can do it. Now, I am totally on board with curbing a fear of math and having a growth mindset is fabulous, but putting these two concepts together is dangerous. Teachers might not realize that the students are not learning anything until its too late; when
they fail the standardized test. And then the teacher and students will be blamed, not the math model and curriculum standards that Common Core is forcing on them.

6 • Reply • Share ›

SteveH • 4 years ago

It sounds like the teacher facilitated the class into discovering what she wanted them to discover. This is so ironic. Direct instruction for discovery learning. The teacher was clearly acting as the sage-on-the-stage. "Let's move on."
Of course, most all successful STEM-prepared students get there with direct instruction, nightly individual homework, and traditional textbooks for algebra, geometry, algebra II, pre-calc, and calculus. That's assuming they can recover (with help at home or with tutors) from 6 years of TERC or Everyday Math. You would think they would be curious about how that happens.

Reform K-6 curricula like MathLand and Everyday Math have been around for 20 years or so, but we still hear educators blame that awful, rote, traditional math. Maybe something else is going on, but they can't think outside of their tiny pedagogical box.

4 • Reply • Share ›

Mike • 4 years ago

I've seen this firsthand as well - I was a math grad student who worked in a program that helped out geometry teachers in inner-city Philadelphia high schools. "Discovery learning" was a big part of what they were required to do, and it was pretty much as ineffective as you say. Other than this somehow being "progressive," as you label it (unless you mean it in a different way than I usually see on this site), I agree with how weak these learning techniques are.

The theory behind this model of learning sounds a lot more like desperation to find an academic solution to a problem in the absence of data, as if a new style of learning would reverse poor academic trends in certain schools. It's an attractive idea to the right mindset, but absent Big Data backing up their methods, I would never allow my local school board to go in this direction.

Since you just went through this course, were you ever told of studies that showed higher test scores in mathematics from this sort of instruction? I would love to know if there is evidence anywhere that it actually works.

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