Mathematical Cultures IV

INSA – New Delhi

Algebra, Accreditation, & the American Academy

Madeline Muntersbjorn

University of Toledo

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madeline.muntersbjorn@utoledo.edu

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- **Where are we now?** How math, in general, and algebra, in particular, acts as a barrier to academic achievement in the United States.

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- **How did we get here?** From the Cold War, the Math Wars, the War Against "Dummy Math" to the Common Core: Is anyone winning?

- **Where should we go from here?** How can a study of mathematical cultures help: less theory, more practice, & direct engagement.

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- Students who pass the AP calculus exam start their college career with academic credits on their transcript, often earned in public school at taxpayers' expense.

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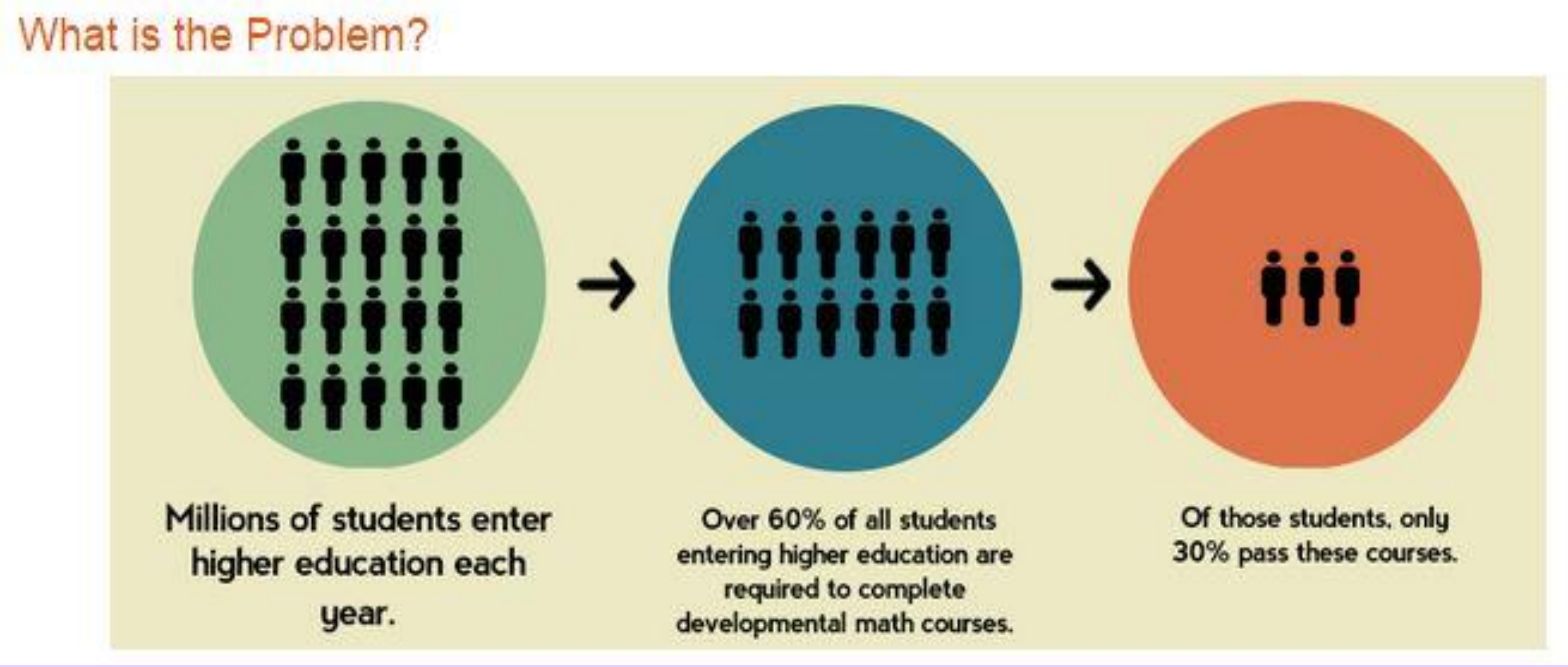
- Many students who take college entrance exams score so poorly they have to register and pay for remedial math courses that do not count towards their degree.

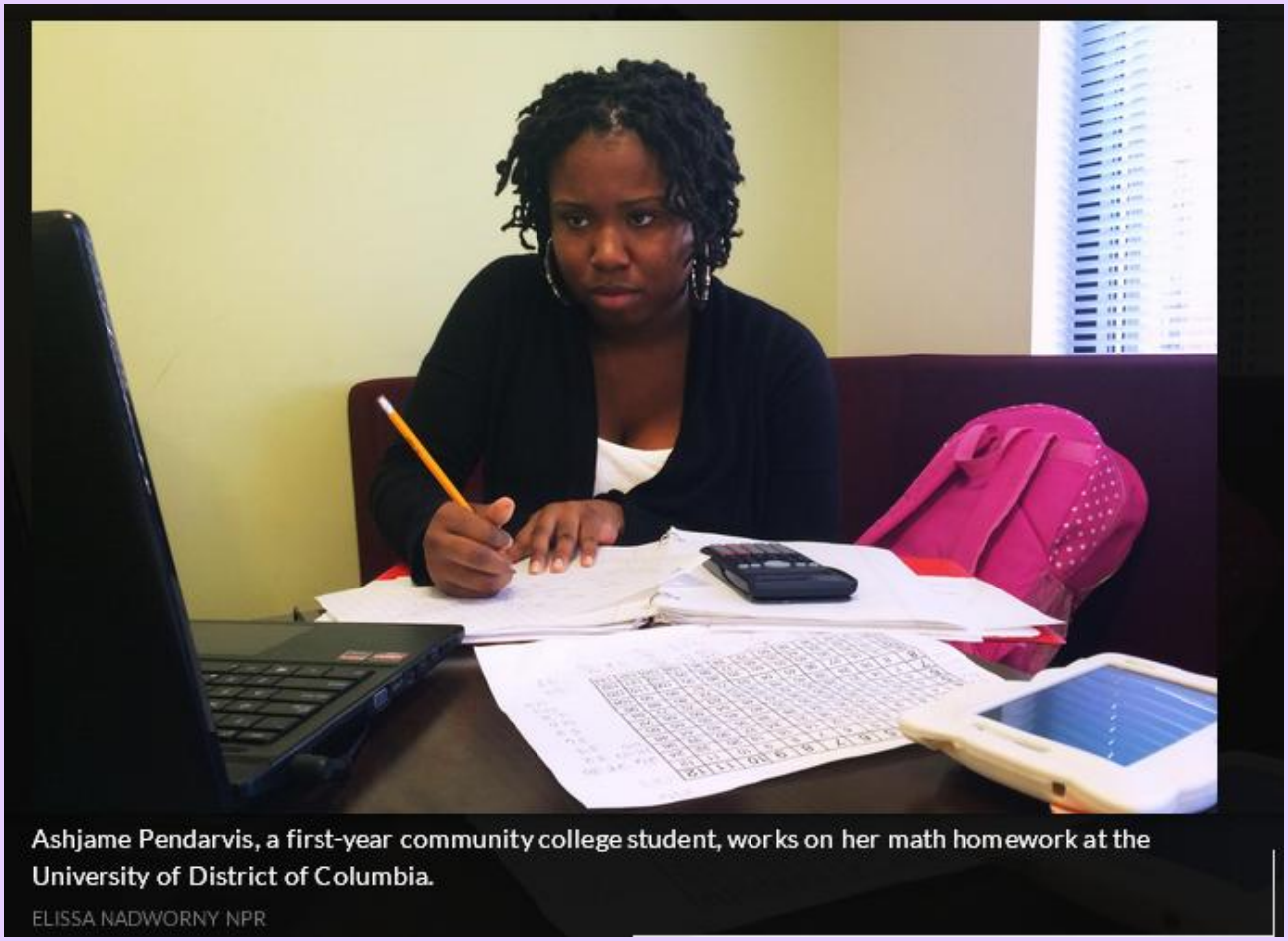


Tony Bryk, President of CFAT: "…developmental mathematics is where aspirations go to die."
"Traditionally, only 5% of the 13 million community college students enrolled in developmental mathematics courses earn college level credit within one year. This high rate of failure cannot simply be attributed to a single source, such as poor curriculum materials or disengaged students, but the entire system."

Gail Mellow, president of LaGuardia Community College in Queens, NY:

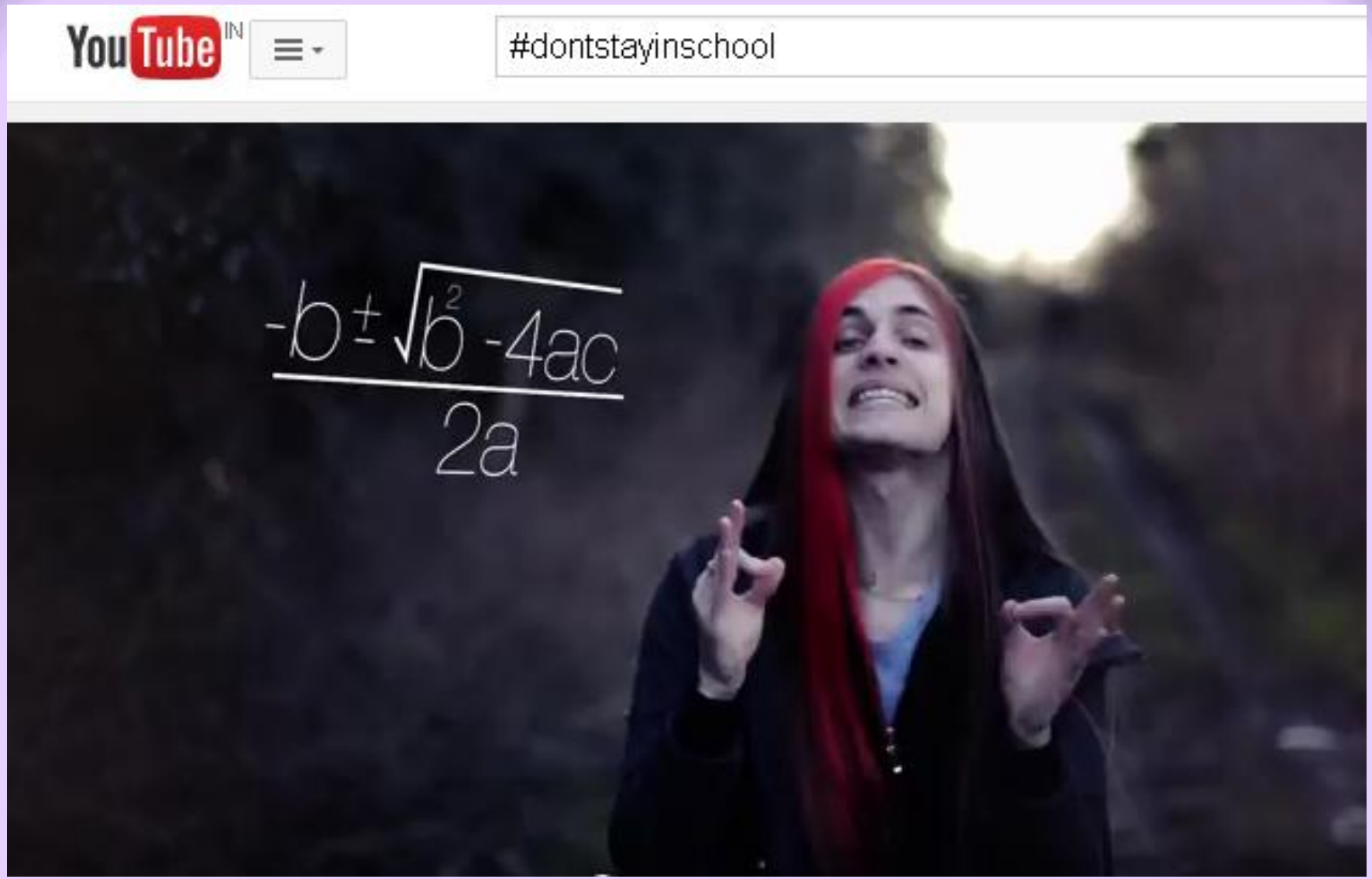
“’Algebra is useful if you're going to be compounding chemical substances for a manufacturing firm or if you're an engineer," Mellow explains. ‘But understanding statistics, probability, levels of risk — whether for retirement planning or the risk of your kid getting a concussion in football — those are real-life issues people will face.’”

Do early childhood educators need algebra? Will learning algebra give them life skills?



Ashjame Pendarvis, a first-year community college student, works on her math homework at the University of District of Columbia.

ELISSA NADWORNY NPR



“That’s absolutely insane!”

Should taking algebra be mandatory for all adolescents?

NO:

- Freedom!
- Useless!
- Some adolescents are not ready for algebra because their arithmetic skills need work.
- Some will never be "ready" for algebra for biological reasons.

YES:

- Tradition!
- Discipline!
- We need more college STEM majors to compete in global economy.
- We need to close the achievement gap.

How did we get here?

- The Cold War
- The Math Wars
- The War Against “Dummy Math”
- The Common Core

The old “new” math:

The space race caused Americans to panic – what if we lose the Cold War because the Soviets are better at mathematics than we are?

For complicated reasons, this fear ultimately led to the inclusion of abstract set theory in elementary school mathematics curriculum.

The Math Wars

Team Discipline:

Students should learn math by watching expert authorities do problems on the board and then following their example on homework exercises – practice makes perfect!

Algorithms rule!

Team Discovery:

Students should learn math by tackling practical problems and working the answers out in teams. Teachers are nurturers, not torturers – problem solving is fun!

Manipulables FTW!

The War Against Dummy Math

- "Changing the Odds" Research suggested that an efficient way to narrow the achievement gap between privileged and disadvantaged students would be to require all students to take algebra.
- Equity 2000 was tested in six locales with "a high percentage of minority students", one in each of the College Board's geographical districts.
- Lots of students failed algebra! But even more students passed algebra than had been enrolled in the course prior to the experiment.

From No Child Left Behind to the Common Core:

- George W. Bush implemented NCLB in 2002 to hold schools accountable for meeting academic achievement goals.
- Unlike Equity 2000, there was less emphasis on paying teachers to acquire new skills and more emphasis on generating data to find out which schools were ‘failing’ and should be closed.
- Is the Common Core really anything more than old wine in new bottles?

Where do we go from here?

- Mathematics is neither created nor discovered but is cultivated : humans use symbols to domesticate wild relations such as '**x** is greater than **y**' and '**z** belongs to **u**" and "**a** owes me **c**."
- As a social and symbolic set of practices, mathematics is cultivated in such a way that we come to regard the rules, relations, and objects of mathematics as independent of any actual human activity even though their use expands the scope of possible human activity.

Ernst Mach (1838-1916)
"The Economical Nature of Physics,"
Popular Scientific Essays

"All so-called axioms are such instinctive knowledge. ... The greatest advances of science have always consisted in some successful formulation, in clear, abstract, and communicable terms, of what was instinctively known long before, and of thus making it the permanent property of humanity" (pp. 190-1).

“Here is an example of a sentence that perfectly describes itself:”

There is no such thing as “pure” math:

What we call “pure” mathematics is actually mathematics applied to itself. All mathematics is applied to the solution of problems. Not all mathematics is applied exclusively to the solution of problems in the natural and social sciences. Algebra, in particular, is mathematics applied to more than one kind of mathematics at once.

Is this a “pure” musician?

Henri Poincaré

"Many children are incapable of becoming mathematicians who must none the less be taught mathematics; and mathematicians themselves are not all cast in the same mould. … It is quite useless to seek to change anything in this, and besides, it would not be desirable. … And so **we must resign ourselves to the diversity of minds, or rather we must be glad of it**" (SM p. 120).

“L’Union Morale” (1912)

Le Ligue Franaçaise d’Éducation Morale

- “Let us guard against imposing uniform methods on all; that is unrealizable and, moreover, it is not desirable. Uniformity is death because it is a door closed to all progress” (Last Essays, p. 116).

- “Gardons-nous d’imposer à tous des moyens uniformes, cela est irréalisable, et d’ailleurs, cela n’est pas à désirer: **l’uniformité, c’est la mort**, parce que c’est la porte close à tout progress” (**DP**, p. 256).

Lancelot Hogben (1895-1975)

"The most brilliant intellect is a prisoner within its own social inheritance. .... Beyond a certain point clever people can never transcend the limitations of the social culture they inherit. When clever people pride themselves on their own isolation, we may well wonder whether they are so clever after all. ... To be proud of intellectual isolation from the common life of mankind and to be disdainful of the great social task of education is as stupid as it is wicked. ... No society, least of all so intricate and mechanized society as ours, is safe in the hands of a few clever people."

([1937] 1967), *Mathematics for the Million*, p. 10 & p. 14.

Conclusions

- I am deeply suspicious of attempts to segregate peoples into kinds, those who can benefit from algebraic training and those who do not need it. Part of what it means to be a person is to be a self-reflective and symbol wielding creature. By engaging in algebraic reasoning and representation we enhance uniquely human cognitive skills.

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- I am deeply suspicious of attempts to segregate peoples into kinds, those who can benefit from algebraic training and those who do not need it. Part of what it means to be a person is to be a self-reflective and symbol wielding creature. By engaging in algebraic reasoning and representation we enhance uniquely human cognitive skills.
- I am just as suspicious of attempts to impose one brand of algebraic instruction on all the peoples for it not only weakens our educational efforts but also rules out the kind of learning that is only possible when we consider multiple instantiations of the same idea and ask, why are these two expressions equivalent? And which representation is more suited to the task at hand?