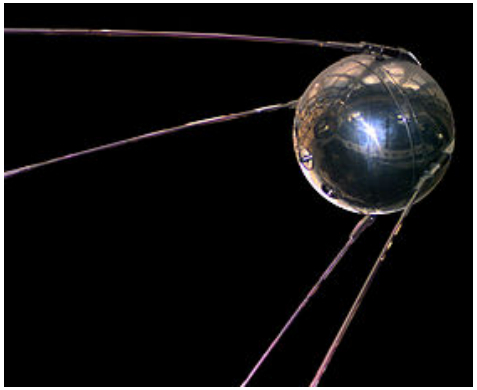
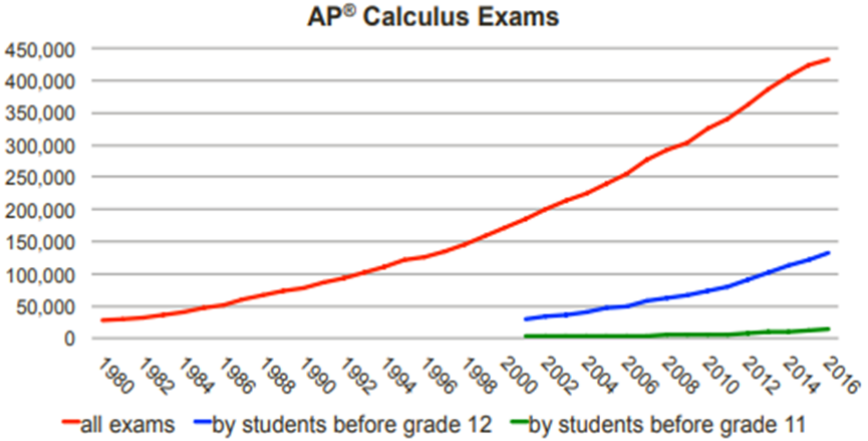
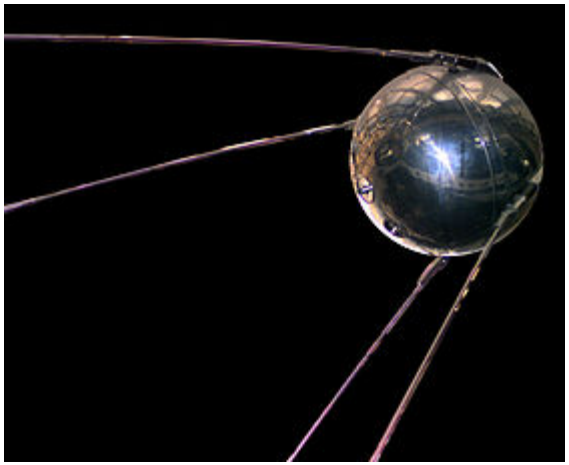
How We Got Here, and Where Away Now?

Dan Teague

NC School of Science and Mathematics







Our Mathematics Curriculum was Designed to Find Me

The Harvard Gazette

NATIONAL & WORLD AFFAIRS

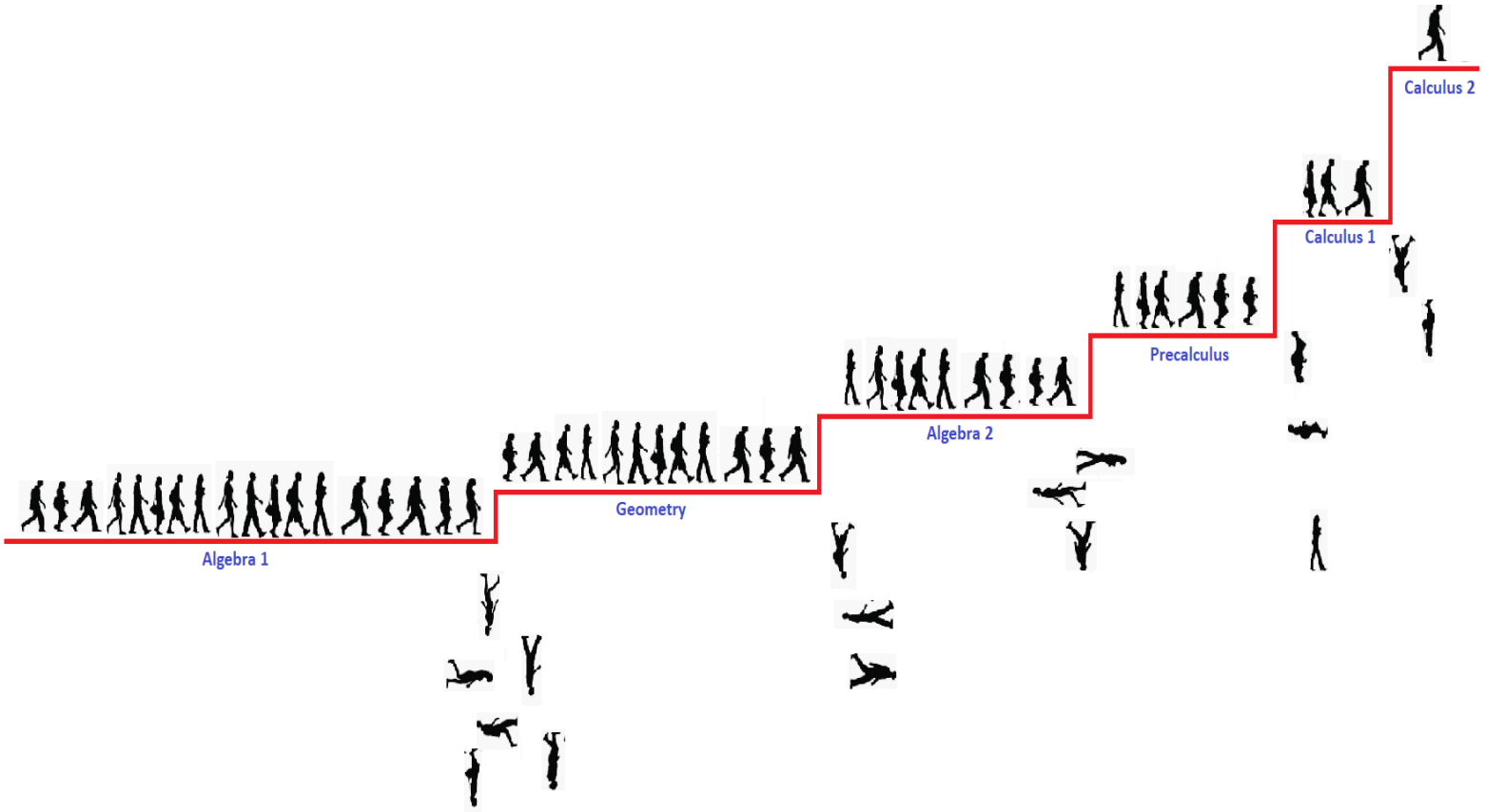
How Sputnik changed U.S. education

A Brief History of Mathematics Education in America
Jessica Furr (Waggener)
Spring 1996

Research at the time showed that children were capable of learning quite advanced topics at much younger ages. What was not discussed at this time was whether or not such subjects as set theory, linear algebra, and formal deductive reasoning should be taught to most students (Barlage). Reform programs were designed for very capable students as if a whole generation of mathematicians were being trained.

Barlage, E. (1982). The New Mathematics: An Historical Account of the Reform of Mathematics Instruction in the United States of America. (ERIC Document Reproduction Service No. ED 224 703)

All of This Was For You



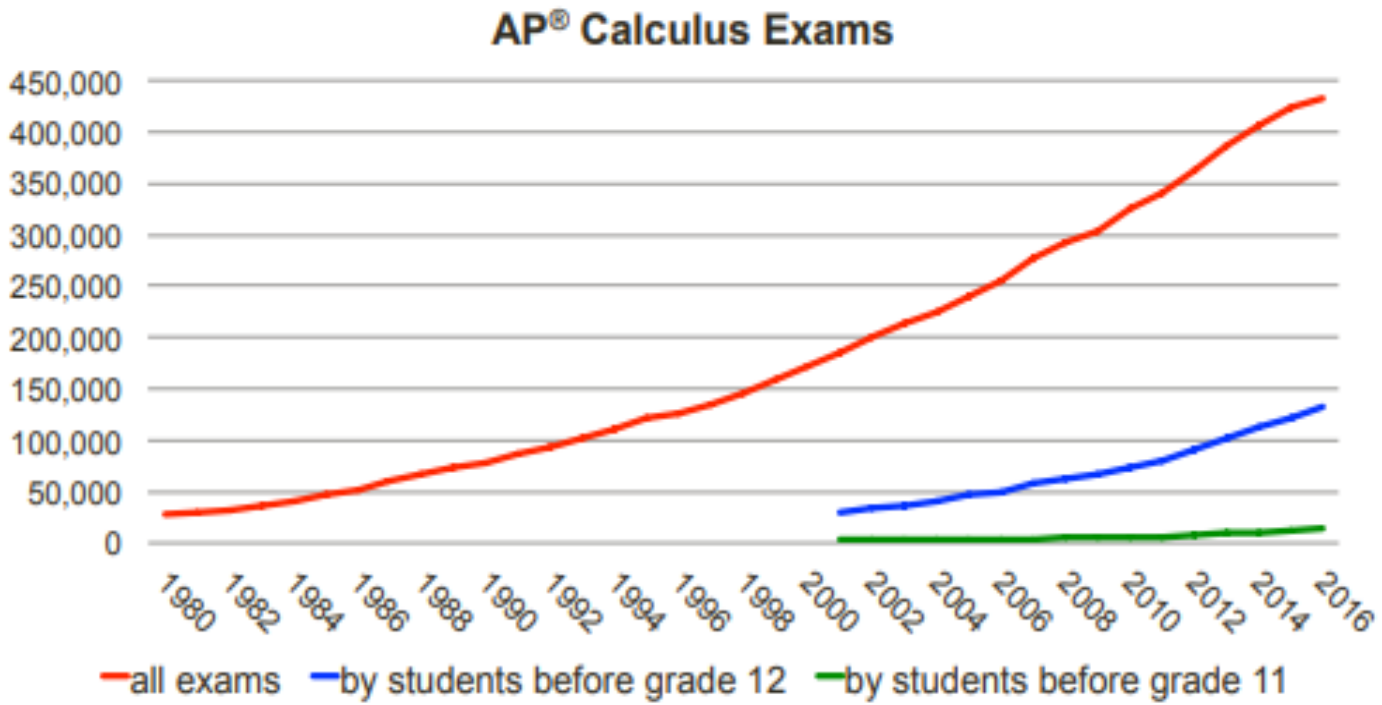
12 year search for David Bressoud

Created for Engineers and Mathematical Scientists

My high school colleagues studied mathematics until they were full and those who staid the longest got to be mathematicians without any special treatment

How students felt about mathematics and themselves as students of mathematics was not considered

Jobs needed formal mathematics or consumer/trade math (non-algebra math)



In 2015–16, at least 800,000 U.S. high school students were enrolled in a calculus class. More than 130,000 students took the AP® Calculus exam by the end of grade 11, more than 13,000 by the end of grade 10.

Winners and Losers

This process advantaged some and damaged many

Any change to advantage more could be seen by the advantaged as a loss

Calculus as the goal and barrier of high school mathematics

More students take calculus in high school each year than take calculus in college

ManyThings are Different Now

Need for mathematics is increasing in many previously amathematical fields (biological and social sciences)

Students taking advanced mathematics courses Precalculus and Calculus in high school have changed

Student's experience in mathematics is vitally important to the field, particularly those who leave early

Each Student's Mathematical Identity is of Primary Importance

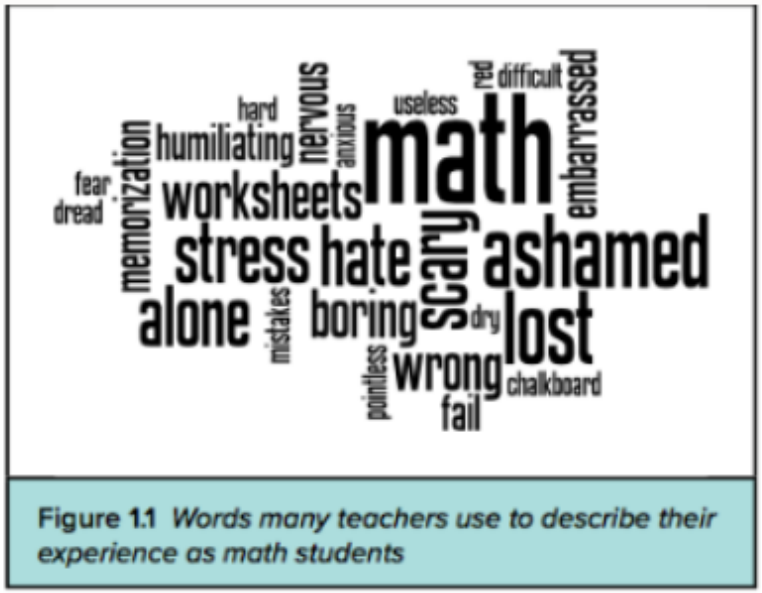


Figure 1.1 *Words many teachers use to describe their experience as math students*

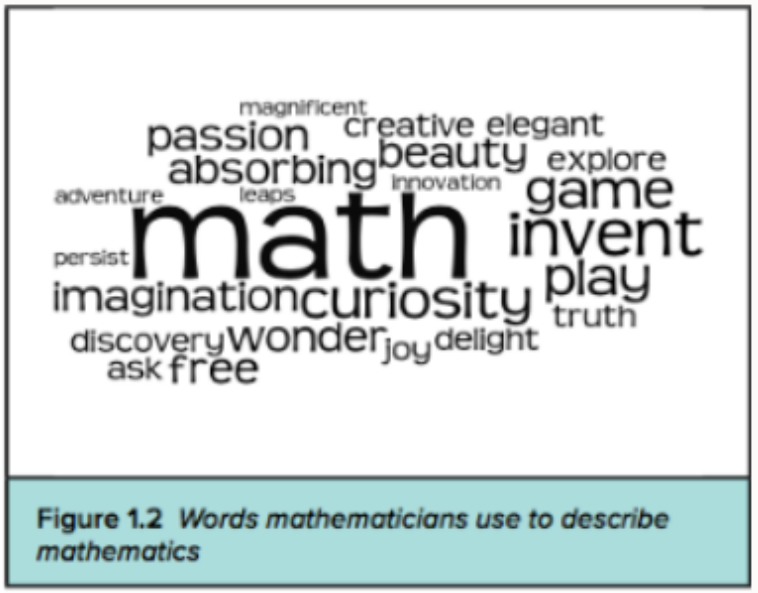


Figure 1.2 *Words mathematicians use to describe mathematics*

Tracy Zager, *Becoming the Math Teacher You Wish You'd Had*

What is Mathematical Identity?

Identity is a person's changing view of him/herself in a given social context influenced by their experiences, personal history, and other events.

Students' mathematical identity is how and who they see themselves as in their relationship with the subject of mathematics and mathematical activities.

Jessica Pierson Bishop, "She's Always Been the Smart One. I've Always Been the Dumb One": Identities in the Mathematics Classroom Source: Journal for Research in Mathematics Education, Vol. 43, No. 1 (January 2012), pp. 34- 74

Teacher's Mathematical Practices

Schoenfeld found that in traditional classrooms where teachers lecture, demonstrate, and then give students assignments where they repeat what they were just shown how to do, students develop a sense that mathematics is a repetitive exercise where they memorize and apply formulas.

If the students broadly identify themselves as people who want to be problem solvers and have engaging careers, they will not select mathematically dominant fields because they perceive mathematics as non-challenging.

Lois Williams, *How to Shape Students' Mathematical Identity*

Mathematical Identity

A student's *mathematics identity* comprises the dispositions and deeply held beliefs they develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in their lives.

A mathematics identity may reflect a sense of oneself as a competent performer who is able to do mathematics or as the kind of person who is unable to do mathematics.

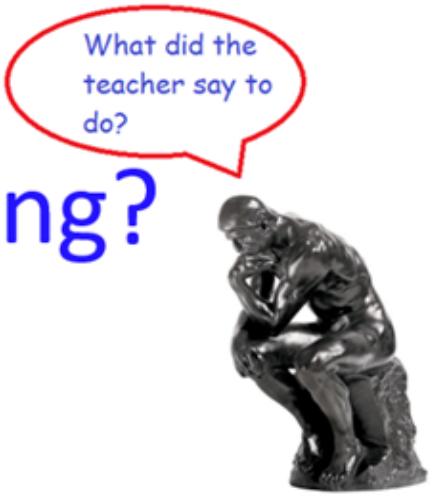
The Impact of Identity in K–8 Mathematics
Aguirre, Mayfield-Ingram, Martin

Ownership

Ownership of the mathematics occurs when students have the flexibility to make decisions about what to solve and how to solve it themselves.

This means they are thinking their way through problems rather than just remembering what they were told to do or repeating the teacher's approach.

How do you do mathematics?



By remembering?

By thinking?

Student Comments on their Modeling Experiences

Never before, in all my math experiences, had I seen a problem as open ended and varying as this one. Working on a problem like this with no obvious answer and many different options was a wholly new experience for me. **This problem helped me visualize the role math could and most likely will play in my future."**

"I liked that in order to find the one of many possible final solutions, you must first solve for one tiny section, how long it takes to get to one floor, and then apply it to the whole process. I think this was also one of my favorite problems because it was a reasoning problem instead of a computation problem."

We see the power of collaboration.

“In my pod, I felt like none of us could have solved the problem on our own but we pooled together our knowledge and we found that it was possible to solve it together.”

“We had to set assumptions to make the project manageable. Even with the assumptions the problem was daunting. We had to break it down logically instead of just trying to plug it into a memorized equation. This thought process is very common in this class, and while I found it confusing and hard, I end with deeper understanding of how to do the problems.”

We can see the relevance of this problem and this process to our lives.

"I don't know what a profession that focuses on efficiency (workplace or public) is called, but I would love to work out things like this for a living."

"In most of my other math classes, the concepts were mostly superficial; in the sense that we only learned the basics and processes of a certain idea without working on how it could be used in real life. Of course, this was often nice and easy, bit if I'm looking to work in a STEM field one day, it is crucial to understand the applications of the different things we learn."