SEEING MATH LEARNING COMMUNITIES ALIGNED WITH NHED AND NATIONAL WORK

Math Learning Communities Summit: NHTI – 16 August 2024

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SOMETIMES ADULTS SAY SILLY THINGS

A politician, while presenting their education plan, announces,

"There will come a time when all students will perform above average!"

Why does this statement look odd?

Would the following statement have similar or different meaning?

"In the town of Old Brookmill, all students are above average,"

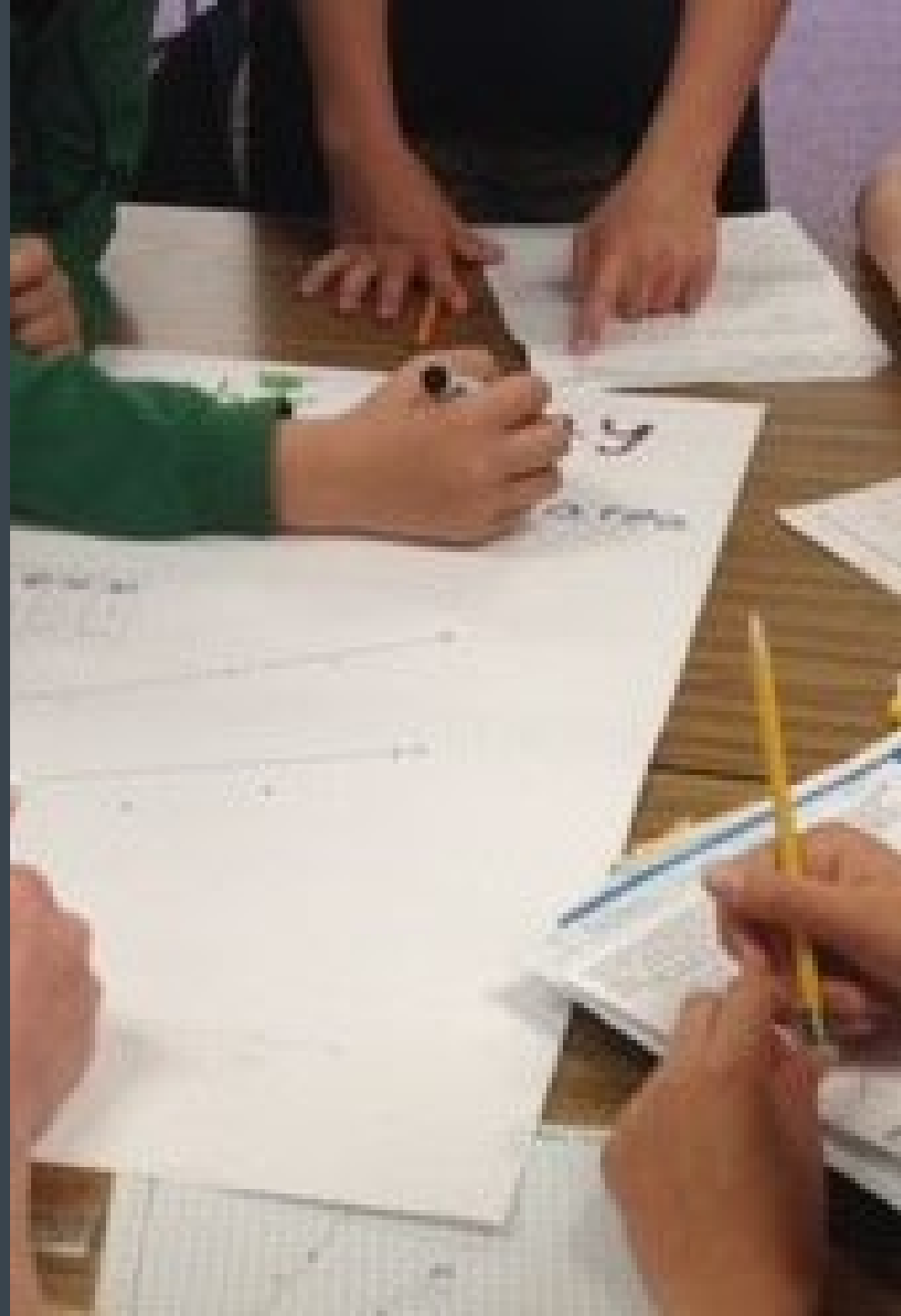
Compare the two statements and explain what the second statement might mean.

AGENDA

- Introductions
- Learning Objective
- NH Math Learning Communities
- NHED work on Exploring Math Pathways in NH High Schools
- Launch Years and Expanding HS Math Pathways work in other states
- Data Science 4 Everyone (DS4E) national framework initiative
- Invigorating High School Math (2021) Steve Leinwand and Eric Milou

LEARNING OBJECTIVE:

Taking a look at how the goal of the Math Learning Communities aligns with the NHED Exploring Math Pathways in NH High Schools work, the work in other states on expanding math pathways, the Data Science 4 Everyone (DS4E) national framework initiative, NCTM's Eight Teaching Practices, and with Steven Leinwand's and Eric Milou's call for *Invigorating High School Math* (2021).



MATH LEARNING COMMUNITIES

NH High Schools + NH Community Colleges = NH Success

Math Learning Communities (MLC) is a supplemental, two-tiered math program available to all public secondary schools to help meet the needs of students who lack a strong foundation in mathematics and are not ready to engage in mathematical reasoning and the application of math required in upper-level and college-level math courses.

https://www.ccsnh.edu/math-learning-communities/

The primary goal of the two-tier strategy to strengthen the math skills of high school juniors and seniors and will have applicability for a cohort of secondary school students who are often reluctant math learners.

The Tier 2 course will also be an excellent opportunity for any high school senior to explore new mathematical concepts while also earning college credit.

EXPLORING HIGH SCHOOL MATH PATHWAYS IN NEW HAMPSHIRE

What are mathematics pathways?

Mathematics pathways enable students to take different paths through the math curriculum, making the math students learn relevant to their programs of study and careers. Model pathways vary but often focus on statistics, quantitative reasoning, or algebra/calculus.

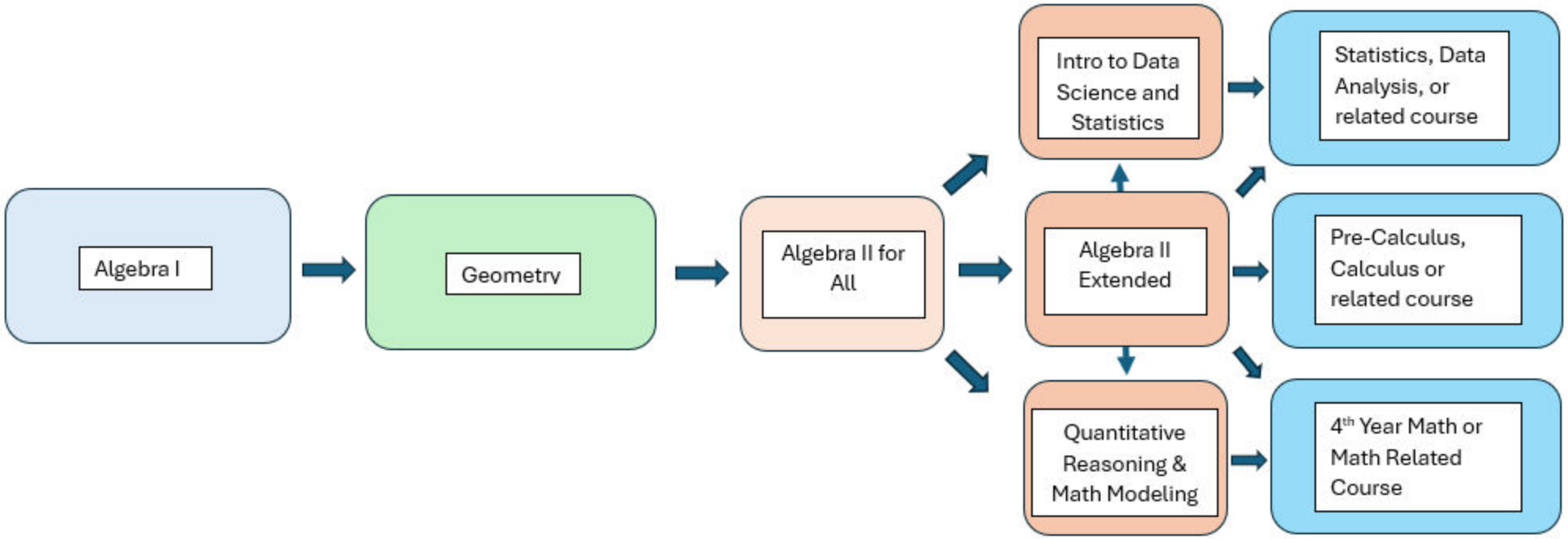
From: *The Case for Mathematics Pathways* (2019), Univ of TX at Austin Dana Center

The goal of this work is to explore the possibility of expanding the pathways for mathematics at the high school level, and in ensuring that these explorations encompass high quality mathematics that could be accepted as part of the general admission requirements at New Hampshire State Universities and Colleges, readying students for college-level learning, while allowing greater choice for students in gaining what is needed for their future career interests.

Nationally there has been a growing recognition that the traditional high school mathematics program sequence of Algebra I, Geometry, and Algebra II leading to Calculus is not what is needed for many of today's careers and with this, a look towards what mathematics is useful within these occupations.

Data fluency as seen through quantitative reasoning, mathematical modeling, data analysis, statistics, and computer science is beginning to be acknowledged as another pathway choice for today's world. With this, Data Science and Statistics are seen as another high school mathematics pathway along with the calculus pathway.

WHY EXPLORE EXPANDING HS MATH PATHWAYS IN NEW HAMPSHIRE?



Expected proposed math pathways for schools who choose to offer

FROM EXPLORING MATH PATHWAYS IN NH HIGH SCHOOLS' WORK

Embedded within the course work are the:

- The 8 Standards of Mathematical Practice
- Mathematical Modeling
- Quantitative Reasoning

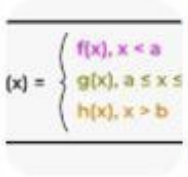
Proposed Algebra II topics that all students should have:

Series and Sequences

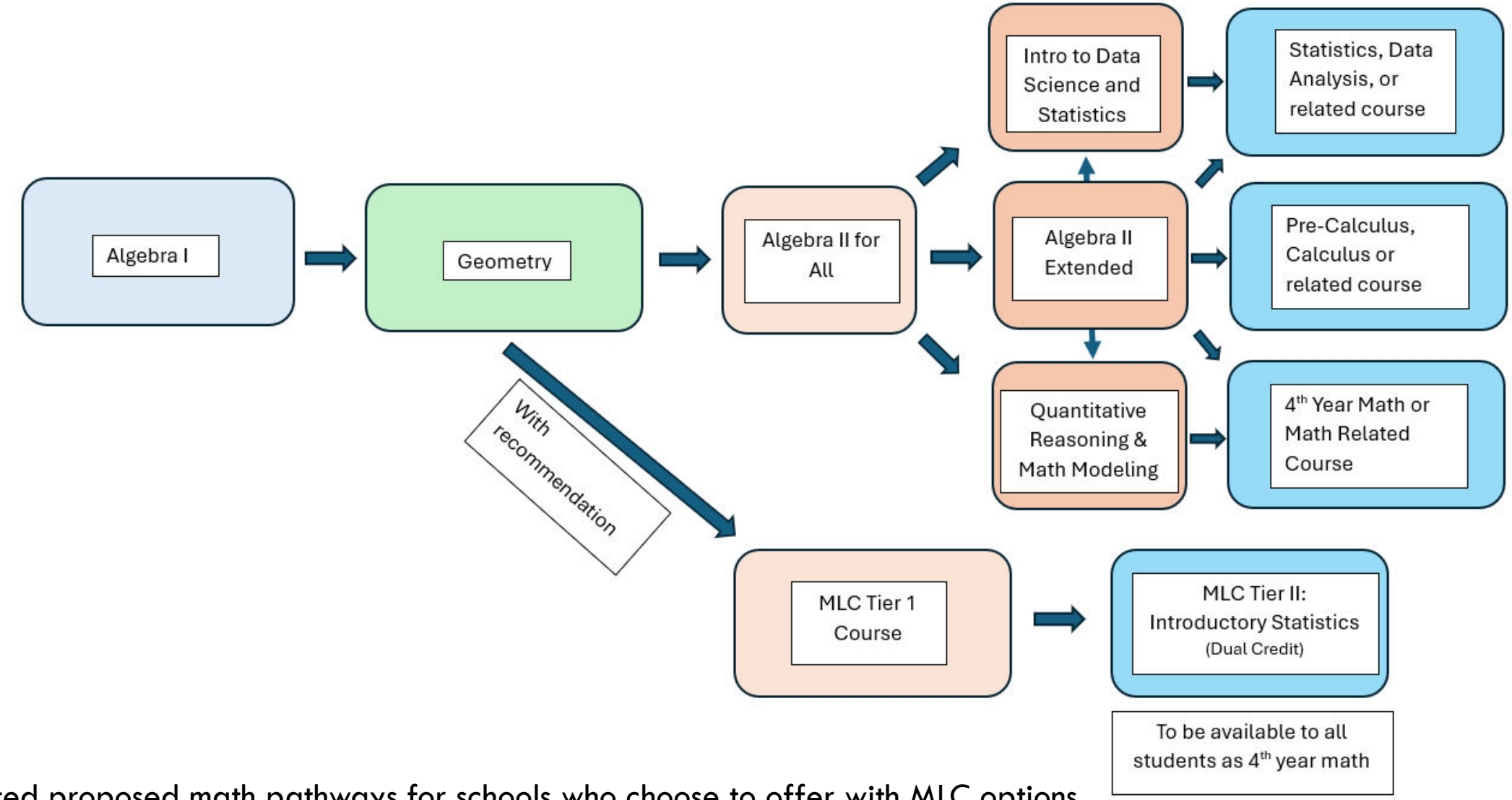
Functions, Inverse Functions, and Transformations

Polynomial Equations, Functions, and End Behavior

Complex Numbers, Radical and Rational Equations and Functions



More Non-Linear Functions, Logarithems, Absolute Value, and Piecewise



Expected proposed math pathways for schools who choose to offer with MLC options

HOW DID WE GET HERE?

Freakonomics Podcast: Ep 391 Oct. 2019

https://freakonomics.com/podcast/americas-math-curriculum-doesnt-add-up-ep-391/

America's Math Curriculum Doesn't Add Up

Most high-school math classes are still preparing students for the Sputnik era. Steve Levitt wants to get rid of the "geometry sandwich" and instead have kids learn what they really need in the modern era: data fluency.

Launch Years Initiative – Dana Center, UTX-Austin (2019)

https://www.utdanacenter.org/our-work/k-12-education/launch-years-initiative

Math Should Be a Way, Not a Wall

For far too many students, math is a wall—not a way—to their postsecondary and career success. In fact, the Mathematical Association of America calls math "the most significant barrier" to finishing a degree—and ultimately to a path of greater opportunity for all students. One of the most urgent education issues of our time is ensuring access to an excellent, more advanced mathematics education for all students.

Began with what is now the Mathematics Transition to College Course https://www.utdanacenter.org/our-work/k-12-education/launch-years-initiative/launch-years-initiative-course-frameworks

LAUNCH YEARS INITIATIVE

- The Launch Years Initiative supports the scaling of mathematics pathways from high school through postsecondary education and into the workplace, aligned to students' goals and aspirations.
- Twenty-two states have joined this work, along with national organizations and leaders in mathematics education.
  - While not a formal member of the Launch Years cohorts, NH does participate in the monthly states' meetings
- States are focusing on different areas, including designing and implementing postsecondary and high school mathematics pathways, modern math courses and content, and advising practices.

https://www.utdanacenter.org/our-work/k-12-education/launch-years-initiative

LAUNCH YEARS INITIATIVE

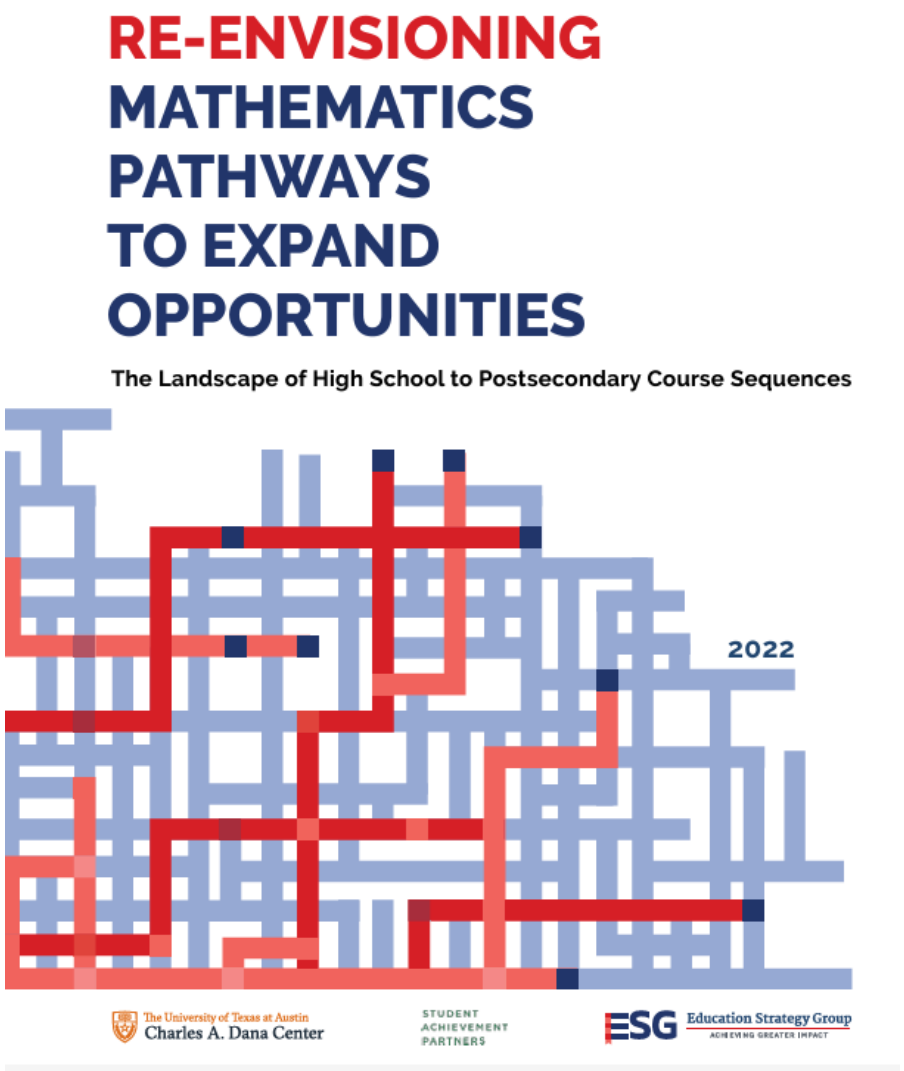
Resources and Reports for the Launch Years Initiative

Launch Years is committed to a vision in which…

- every student learns rigorous and meaningful mathematics.
- the mathematics courses in every high school are intentionally designed to propel students to a postsecondary option that will in turn open the way to high value careers.
- our nation benefits from a population who has the quantitative reasoning skills to fully participate in the economy and our society.

In support of this vision, the Launch Years Initiative, partner organizations, and others supporting the initiative developed the following reports and other documents.

https://www.utdanacenter.org/our-work/k-12-education/launch-years-initiative/launch-years-initiative-resources-and-reports

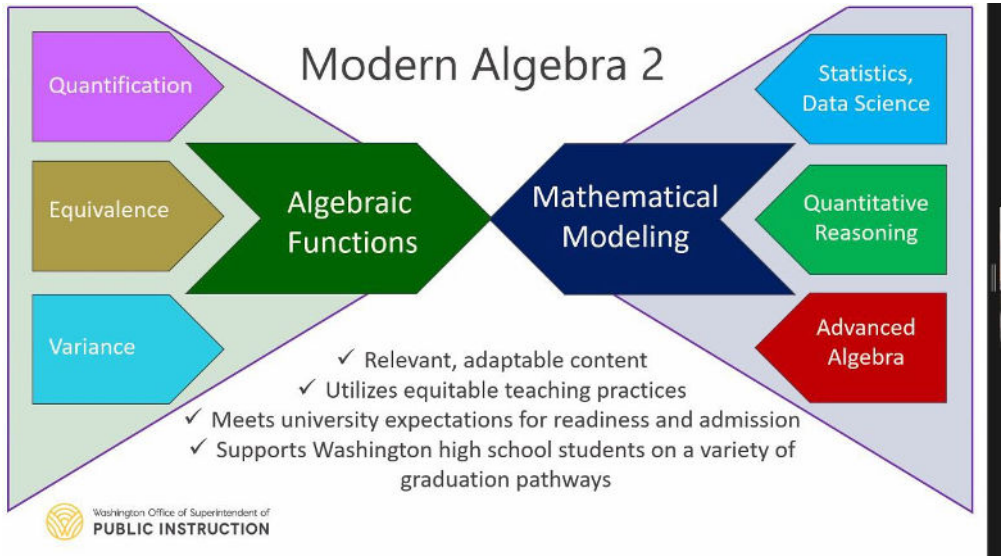


https://edstrategy.org/resource/re-envisioning-mathematics-pathways-to-expand-opportunities/

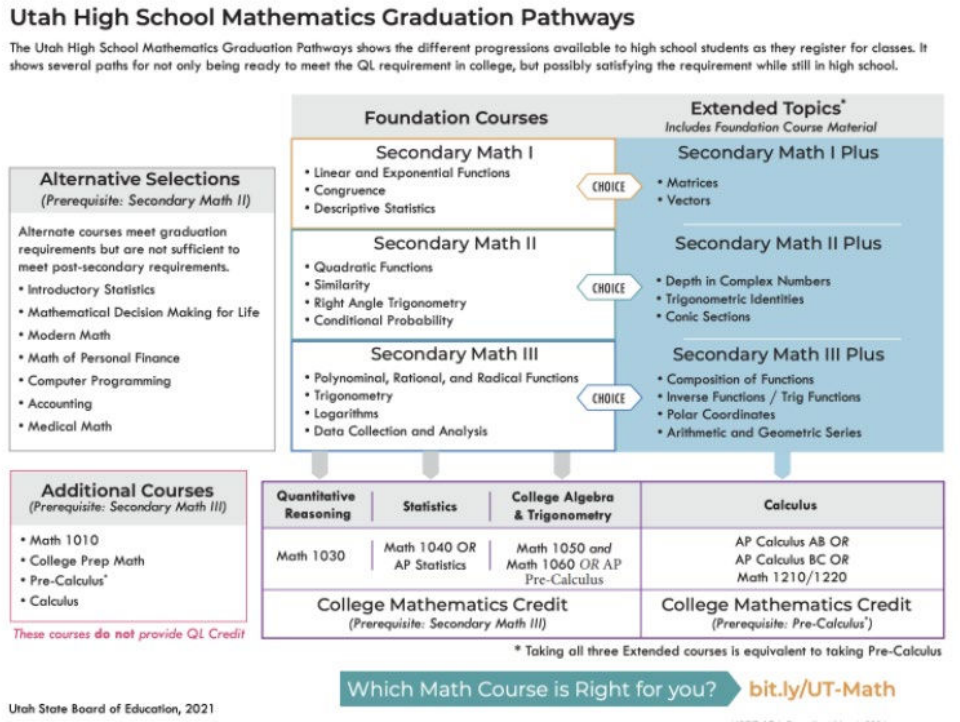
LAUNCH YEARS INITIATIVE

SOME WORK WITH OTHER STATES

Washington State



Utah



FREAKONOMICS AND DATA SCIENCE 4 EVERYONE (DS4E)

- Began with a book, Freakonomics: A Rogue Economist Explores the Hidden Side of Everything (2005) by Steven Levitt (Univ of Chicago) and Stephen Dubner.
- Zarek Drozda, a grad assistant for Dr. Levitt in 2019, helped build the social impact incubator (RISC) with Dr. Levitt. DS4E was then launched through this center.
- Zarek also served as a Data Science Fellow at the US Dept. of Education.
- Zarek is currently the Executive Director of DS4E.

DataScience4 everyone

Data Science4 Everyone is a coalition advancing data science education so that every K-12 student is equipped with the data literacy skills needed to succeed in our modern world. Equitable access to data science education is an opportunity to open doors to higher education, high-paying careers, and an engaged community.

Created by the University of Chicago Center for RISC and organized in partnership with The Learning Agency and the Concord Consortium, we support a growing community that knows that the data revolution has transformed modern life, and we need to prepare our students.

https://www.datascience4everyone.org/

Do we need a 'Common Core' for data science education? A national framework for teaching data skills gains momentum Javeria Salman. 07/04/2024 Hechinger Report

- In 2024, DS4E assembled 11 focus groups that met over five months virtually to debate on the foundational knowledge of data and artificial intelligence that students should acquire and begin conversations on a national framework for.
- At the end of June 2024, representatives from these groups met at the University of Chicago to share out.
- On 15 August 2024, DS4E plans to release its initial draft – feed back will be requested from educators, parents, and others.

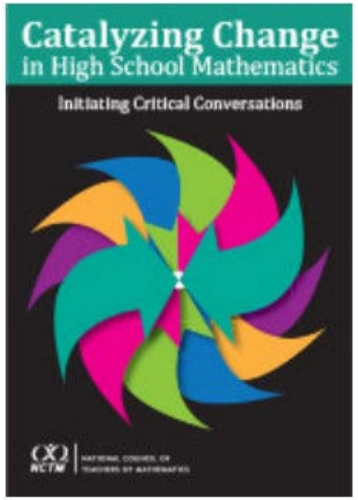
https://hechingerreport.org/do-we-need-a-common-core-for-data-science-education/

The New Hampshire Department of Education and Data Science 4 Everyone will be hosting a New England Data Science Summit on October 23rd, 2024.

This event will take place concurrently with the 2024 Association of Teachers of Mathematics in New England's Regional Conference and will spotlight the importance of data science and data science education.

TWO WORKS LOOKING AT CHANGING HS MATHEMATICS:

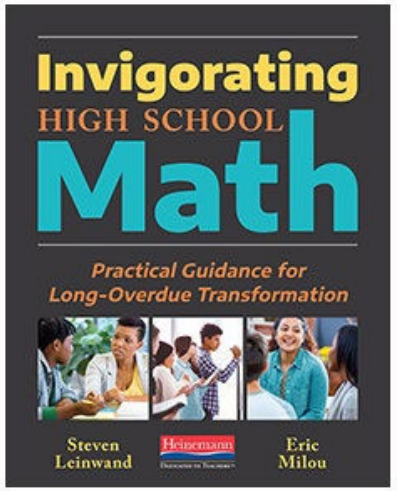
Catalyzing Change (NCTM. 2018).



"The evidence overall suggests that the status quo with respect to learning outcomes from high school mathematics is unacceptable" (p. 3).

Invigorating High School Math (2021)

Steven Leinwand and Eric Milou



"It is clear that the status quo is no longer acceptable and major changes in course organization, mathematical content, pedagogy, and assessment are long overdue" (p.3)

CATALYZING CHANGE IN HIGH SCHOOL MATHEMATICS

(NCTM 2018)

Identify and address critical challenges in high school mathematics to ensure that each and every student has the mathematical experiences necessary to increase their opportunities for personal and professional success.

NCTM | NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Essential Concepts in High School Mathematics

Catalyzing Change identifies a set of Essential Concepts from the content domains of number, algebra and functions, statistics and probability, and geometry and measurement. These concepts represent the most critical content from these content domains—the deep understandings that are important for students to remember long after they have forgotten how to carry out specific techniques or apply particular formulas.

Essential Concepts in Number

- Together, irrational numbers and rational numbers complete the real number system, representing all points on the number line.
- Quantitative reasoning includes, and mathematical modeling requires, attention to units of measurement.

Essential Concepts in Algebra and Functions

Algebra

- Expressions can be rewritten in equivalent forms by using algebraic properties, including properties of addition, multiplication, and exponentiation, to make different characteristics or features visible.
- Finding solutions to an equation, inequality, or system of equations or inequalities requires the checking of candidate solutions, whether generated analytically or graphically, to ensure that solutions are found and that those found are not extraneous.
- The structure of an equation or inequality (including, but not limited to, one-variable linear and quadratic equations, inequalities, and systems of linear equations in two variables) can be purposefully analyzed (with and without technology) to determine an efficient strategy to find a solution, if one exists, and then to justify the solution.
- Expressions, equations, and inequalities can be used to analyze and make predictions, both within mathematics and as mathematics is applied in different contexts—in particular, contexts that arise in relation to linear, quadratic, and exponential situations.

Connecting Algebra to Functions

- Functions shift the emphasis from a point-by-point relationship between two variables (input/output) to considering an entire set of ordered pairs (where each first element is paired with exactly one second element) as an entity with its own features and characteristics.
- Graphs can be used to obtain exact or approximate solutions of equations, inequalities, and systems of equations and inequalities—including systems of linear equations in two variables and systems of linear and quadratic equations (given or obtained by using technology).

https://www.nctm.org/change/

INVIGORATING HIGH SCHOOL MATH (2021)

A FRAMEWORK FOR INVIGORATED HIGH SCHOOL MATHEMATICS			
GRADE	**COURSES**		
9	Integrated High School Mathematics 1		
10	Integrated High School Mathematics 2		
11	**Quantitative Literacy Pathway**	**Statistics Pathway**	**Calculus Pathway**
	The mathematics of real-world problem solving, modeling, financial literacy, and effective citizenship: students intending to follow paths in technical fields, liberal arts, and communications	The mathematics of data, uncertainty, and chance: students intending to enter health, social science, and business fields	The mathematics of functions and change: students intending to enter STEM and natural science fields
12	A range of fourth-year math options, including AP Statistics, Introduction to Data Science, Financial Mathematics, Mathematical Modeling, or Discrete Mathematics		Precalculus or Calculus or AP Calculus or AP Statistics

A Game Plan for Invigorating High School Math "The Status Quo is No Longer Acceptable" CMC-North Dec. 2021

Three Differentiated pathways for relevant, meaningful, appropriate mathematics for grades 11 and 12.

EXPANDING AVENUES OF MATHEMATICS SUCCESS FOR NH HIGH SCHOOL STUDENTS

LAUNCH YEARS INITIATIVE

22 States involved – in New England have Maine, Massachusetts, and Rhode Island. New Hampshire informally participates

https://www.utdanacenter.org/our-work/k-12-education/launch-years-initiative

EXPLORING HS MATH PATHWAYS IN NH

Goal is to explore the possibility of expanding the pathways for mathematics at the high school level; ensuring that these explorations encompass high quality mathematics that could be accepted as part of the general admission requirements at New Hampshire State Universities and Colleges, while allowing greater choice for students in gaining what is needed for their future career interests.

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HB 1167

GRADUATION REQUIREMENT CHANGE IN NHED 306'S???

A 0.5 credit in statistics or data analysis is proposed as a change in the required courses of study for high school graduation.

Last draft found of NHED 306's proposed changes found in State Board 11 April 2024 Meeting Materials.

Also see *First Annual Report to Gov. Hassan from the STEM Task Force on K-12 Education (2016). pp 10 - 14*

THANK YOU

Please feel free to reach out with any questions or for support in making changes in increasing students mathematical learnings, understandings, and skills.

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