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OREGON MATH PROJECT
Meaningful Math for Every Student

Oregon Mathways Project:
One State's Response to Catalyzing Change

NCTM April 6, 2019
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Presentation Outline

- Oregon Context
- Oregon Mathways
- Specific actions
  - Engagement
  - Pathways
  - Focus
  - On Track

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Oregon Policy Context

- Mathematics requirements are standards-based rather than course-based.
- High school credits are proficiency-based rather than time-based.
- 3 credits of high school math required to graduate.
- Course sequences and options are local decisions.
- 40-40-20 Goal.

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2020 VISION

Transformed math systems
2020 Oregon Math Standards Adoption

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Setting the Stage:
Why High School Math?

- Known Issues:
  - Too many high school math standards
  - Single pathway to calculus
  - Need for more relevant applications
  - Inequitable tracking practices for students and teachers

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**Participatory Leadership: Personal to Systemic**

2014 beginning of a concept

2016 Clarify the idea (small group from ODE including applied math specialist, schools, cc, and university.

2017 Invite broader conversation (math content panel, willing districts, higher education, other agency teams)

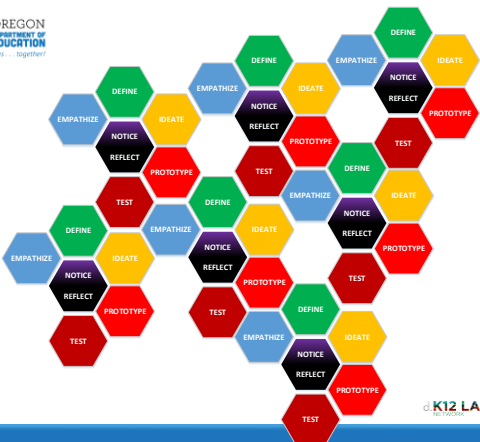2018 Pilot with willing districts and learn from those pilots

2020 Act on what we have learned during math adoption
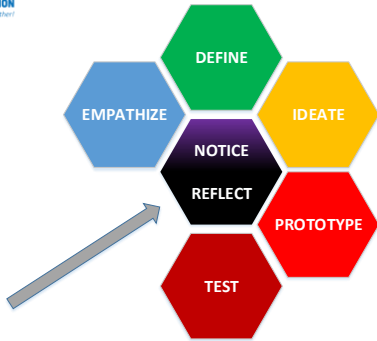
Mathways Connections to ODE Priorities

- Reducing Chronic Absenteeism
  - Identify content necessary and meaningful to all students
  - Engage students with authentic applications
- Increase Graduation Rate
  - Create multiple pathways for mathematics
  - Meet diverse student needs as well as college and career goals
- Freshmen On-Track
  - Open up opportunities for innovation
  - Target instruction for student success

Mathways Initiative

| On Track | Strong Focus |
| Engagement | Pathways |

Mathways Initiative

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Current Pathway Model:
Engineered for Success in Calculus

Elementary → Middle → High School → University (Calculus)

Pathways Model:
Student Math Reality

Elementary → Middle → High School → Trade School / Military / Community College / University / Work / Apprenticeship / Other

Proposed 2+1 Model

College and career math opportunities

Optional additional high school math electives or dual credit college math

HS Algebra 2/ Pre-Calculus (Preparation for Engineering & Physical Sciences Careers)

HS Statistics and Modeling (Preparation for Life Sciences, Social Sciences, & Business Careers)

Applied Mathematics & Mathematical Modeling
Construction Geometry
Financial Algebra
Math in Computer Science
Other Applied Courses
(Preparation for Technical Careers)

2+1 Model

High School Content – Math 2

High School Content – Math 1

K-8 Mathematics Content

The 2

- Not a specific course sequence (based on standards)
- Lesser emphasis on geometry and more on probability and statistics

The +1

Engaging students in the learning process

Student

IMPROVED STUDENT ACHIEVEMENT

Improving teachers' instructional practice

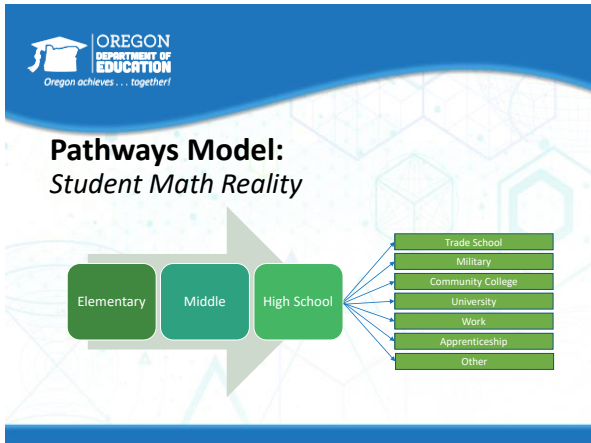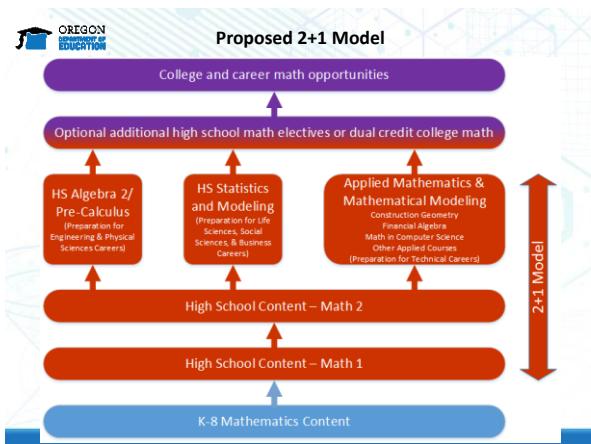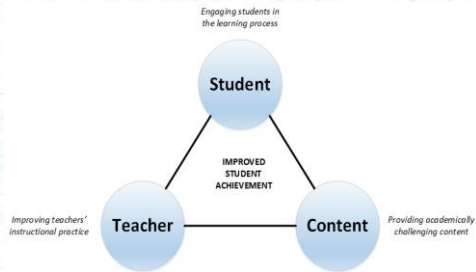**Teacher** —— **Content**

Providing academically challenging content

Mathways Initiative

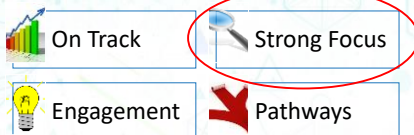| On Track | Strong Focus |
| Engagement | Pathways |

Finding Focus

Issues

- Too many high school standards
- Lack of consistency as educators choose which standards to focus on.
- Recognition the role of Algebra 2 & Pre-calculus to prepare for enrollment in Calculus, but other options also could exist.
- A number of assessments students may need to take in grade 11

Moving Forward

- Identify draft conceptual framework that identifies core content for first two credits
- Use NCTM Essential skills as a framework to organize content.
- Crosswalk to
- CCSS-HS content,
  - Current state assessment framework, and
  - Finding focus regional workshops
- Gather feedback as schools pilot courses aligned to proposed framework.

"Perfect" Standards

"Perfection is achieved, not when there is nothing more to add, but when there is nothing left to take away."
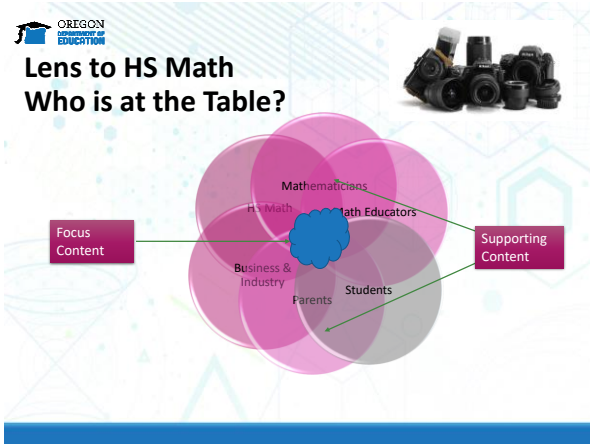
— Antoine de Saint-Exupéry, Airman's Odyssey

Introduction to Lenses

- Who is at the table when content standards are written?
- Who should be at the table that may have been left out in the past?

Lens to HS Math
Who is at the Table?

Mathematicians
HS Math · Math Educators
Focus Content
Supporting Content
Business & Industry
Parents · Students

Post-Secondary Lens

- Questions posed
  - What content and habits of mind are needed in students' background in order for them to succeed in entry-level math on your campus?
  - What pedagogical developments have been made within the past decade on your campus to improve student experiences within math courses?
  - Doug Nelson – Central Oregon CC
    - Question 1

Regional Educator Meetings
Spring 2018

Slide 1

NCTM Catalyzing Change Essential Concepts (2018)

Essential Concepts in Number

Essential Concepts in Algebra and Functions
- Focus 1: Algebra
- Focus 2: Connecting Algebra to Functions
- Focus 3: Functions

Essential Concepts in Statistics and Probability
- Focus 1: Quantitative Literacy
- Focus 2: Visualizing and Summarizing Data
- Focus 3: Statistical Inference
- Focus 4: Probability

Essential Concepts in Geometry and Measurement
- Focus 1: Measurement
- Focus 2: Transformations
- Focus 3: Geometric Arguments, Reasoning, and Proof
- Focus 4: Solving Applied Problems and Modeling in Geometry

Oregon Draft Conceptual Framework
60 Concepts

Number, Quantity, and Measurement (NQ - 6)
- Focus A: Number Sense
- Focus B: Measurement

Algebra and Functions (AF – 30)
- Focus A: Algebra
- Focus B: Functions
- Focus C: Connecting Algebra, Functions, and Geometry

Statistics and Probability (SP - 16)
- Focus A: Data Science
- Focus B: Visualizing, Describing, and Using Data
- Focus C: Statistical Inference
- Focus D: Probability

Geometry and Modeling (GM - 8)
- Focus A: Transformations
- Focus B: Geometric Arguments, Reasoning, and Modeling

Slide 2

Oregon Draft Conceptual Framework (2018) — High School Math

Type	Domain	Target	Concept	Standards Statement (Text)
Domain	NQ	NQ		Number, Quantity, and Measurement
Focus	NQ	NQ.A		Number Sense
Target	NQ	NQ.A.1	NQ.A.1	Demonstrate computational fluency with real numbers
Concept	NQ	NQ.A.1	NQ.A.1.1	Fluently determine precise calculations using rational and irrational numbers to make comparisons and solve problems.
Concept	NQ	NQ.A.1	NQ.A.1.2	Use estimation and approximation of calculations to make comparisons and solve problems.
Concept	NQ	NQ.A.1	NQ.A.1.3	Reason quantitatively and use units to make comparisons and solve problems.
Focus	NQ	NQ.B		Measurement
Target	NQ	NQ.B.1	NQ.B.1	Reason quantitatively to solve applied problems
Concept	NQ	NQ.B.1	NQ.B.1.1	Use length, area, and volume measurements to solve applied problems.
Concept	NQ	NQ.B.1	NQ.B.1.2	Use properties of congruence and similarity to solve applied problems.
Concept	NQ	NQ.B.1	NQ.B.1.3	Use graphs and coordinates to solve applied problems.
Domain	AF	AF		Algebra and Functions
Focus	AF	AF.A		Algebra
Target	AF	AF.A.1	AF.A.1	Write expressions in equivalent forms by using algebraic properties
Concept	AF	AF.A.1	AF.A.1.1	Interpret the structure of expressions using algebraic reasoning.
Concept	AF	AF.A.1	AF.A.1.2	Write expressions in equivalent forms to make different characteristics or features visible and solve problems.
Concept	AF	AF.A.1	AF.A.1.3	Perform arithmetic operations on expressions.
Target	AF	AF.A.2	AF.A.2	Find solutions to an equation, inequality, or system of equations or inequalities
Concept	AF	AF.A.2	AF.A.2.1	Solve equations and inequalities in one variable.
Concept	AF	AF.A.2	AF.A.2.2	Understand a problem and formulate an equation to solve it.
Concept	AF	AF.A.2	AF.A.2.3	Solve systems of equations.
Target	AF	AF.A.3	AF.A.3	Understand solving equations as a process of reasoning and explain the reasoning
Concept	AF	AF.A.3	AF.A.3.1	Determine an efficient strategy to find a solution.
Concept	AF	AF.A.3	AF.A.3.2	Purposefully analyze equations (with and without technology) to understand patterns and make predictions.
Concept	AF	AF.A.3	AF.A.3.3	Construct a viable argument to justify a solution method using expressions and equations.
Target	AF	AF.A.4	AF.A.4	Create equations that describe numbers or relationships
Concept	AF	AF.A.4	AF.A.4.1	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
Concept	AF	AF.A.4	AF.A.4.2	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
Concept	AF	AF.A.4	AF.A.4.3	Create equations to solve problems within linear, exponential, and quadratic situations.

Slide 3

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- On Track
- Strong Focus
- **Engagement**
- Pathways

Attending to Mathematical Rigor

For the activity we just did:
What concepts, skills, and applications were addressed?

Conceptual Understanding

Procedural Skill and Fluency

Application

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Math in Real Life – Highlights

- Lane County
- Central Oregon
- Portland Metro
- Oregon State University
- Southern Oregon
- Eastern Oregon

Stretch
Shapes.net

Characteristics of Rich Context Lessons

1. The approach shown has **high potential for student engagement.**
2. The context of the lesson is **authentic** and **mirrors real-world applications.**
3. The lesson offers the opportunity to **leverage significant mathematics.**
4. The lesson demonstrates the **application of math practices using appropriate tools.**
5. The lesson portrays **math as a part of effective CTE-STEM practice**, including critical thinking, communication, and boundary-spanning problem solving.

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Linking Math and Context

Introduce the Context
Investigate the Math in Context

Make the Math Explicit

Revisit the Context

Assess the Math in Multiple Ways

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What might impact our race?

What assumptions can we make in order to simplify our strategy?
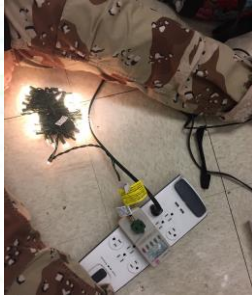
What information do we need in order to plan our race?

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If you were to add your chosen snack to your daily food intake, how many steps would you have to take to burn the equivalent number of calories?

How long will it take a string of LED lights to pay for itself?

How can we use linear equations to find the breakeven point?

Students use proportional reasoning and angle measurement to analyze a hypothetical bee hive location and the related food sources visited by the bees.

Students decide if the distances to food sources and duration of waggle dances for the five locations are proportional.
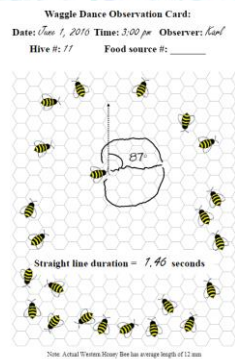
Mathways Initiative

On Track   Strong Focus

Engagement   Pathways

Students On Track

Issues

- Students are tracked into courses with the same title but different expectations
- Students have had minimal opportunity to engage in grade level content
- Intent of the "algebra 1 and above" requirement is to raise the floor and give all students the opportunity to engage in high school content in 9th grade

Moving Forward

- Work with teachers to shift mindsets and challenge assumptions about student capabilities
- Create structures to provide additional support for student that may need assistance
  - (e.g. summer opportunities, platooning algebra with an additional course, shift pedagogy to active learning practices)

The New Teacher Project:
The Opportunity Myth

THE OPPORTUNITY MYTH

What Students Can Show Us About How School Is Letting Them Down —and How to Fix It

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Sharing Knowledge:
SFUSD Webinar

San Francisco Detracking: One District's Story

Oregon Department of Education
March 12, 2019

www.sfusdmath.org   @SFUSDMath

https://youtu.be/jMjeso6_HVc

Policy Briefs

https://www.oregon.gov/ode/educator-resources/standards/mathematics/Pages/Oregon-Math-Project.aspx

Coming Up

- Moving Mathways Forward Pilots
- OMP Academy
- 2020 Math Content Panel