

Re-telling the story of College Algebra for Student Success & Engagement



Elizabeth Jones & Lyn Riverstone

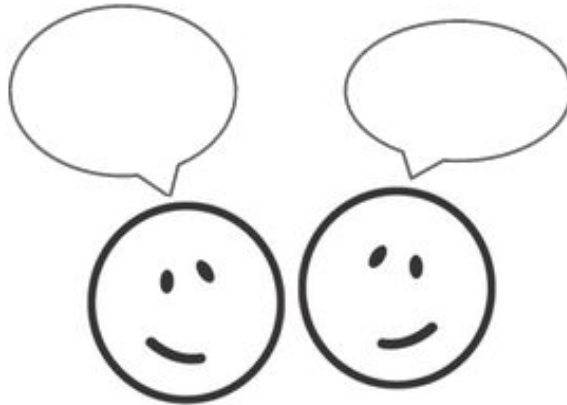
ORMATYC 2018



Oregon State
University

Think – Pair – Share

**Let's consider some issues that might affect your
College Algebra students' ability to succeed in the
course.**



Which of the following have you experienced as significant issues affecting College Algebra students' ability to succeed?



- Irregular/low attendance
- Low level of engagement with course content
- A preference/expectation for rules and procedures
- Unrealistic assessment of their own understanding of College Algebra
- Over-reliance on the instructor to provide the solution method to apply when solving a problem
- Rarely electing to use multiple function representations to aid in problem-solving
- Other issues?

Pair up and discuss...



Thinking about the typical College Algebra textbook,
what is it about the order of the content
that may lead to the issues you identified in the
previous question?

How might the *typical* College Algebra textbook contribute to the low levels of student success in this course?



Textbook

- 1) Starts with linear functions, quadratic functions, ...
- 2) Function families presented individually
- 3) Important & challenging content (logarithmic functions) covered quickly at the last minute

Students

- 1) “Again?! This class is too easy! I don’t need to attend.”
- 2) Often lack skills to build larger mathematical ideas
- 3) Overwhelmed with all things logarithm at once.

We will discuss today...

- Big ideas we are focusing on in College Algebra
- Changes we made to the structure of the topics
- Challenges we have faced and the rewards of overcoming these
- Preliminary data and success stories

Project Outline

The broader context

Our Project

- **Opportunity**

OSU is one of eight universities chosen to take part in this APLU Personalized Learning Consortium grant, funded by the Bill and Melinda Gates Foundation

- **Task**

Integrate adaptive courseware into College Algebra (MTH 111) and increase active learning

- **Team**

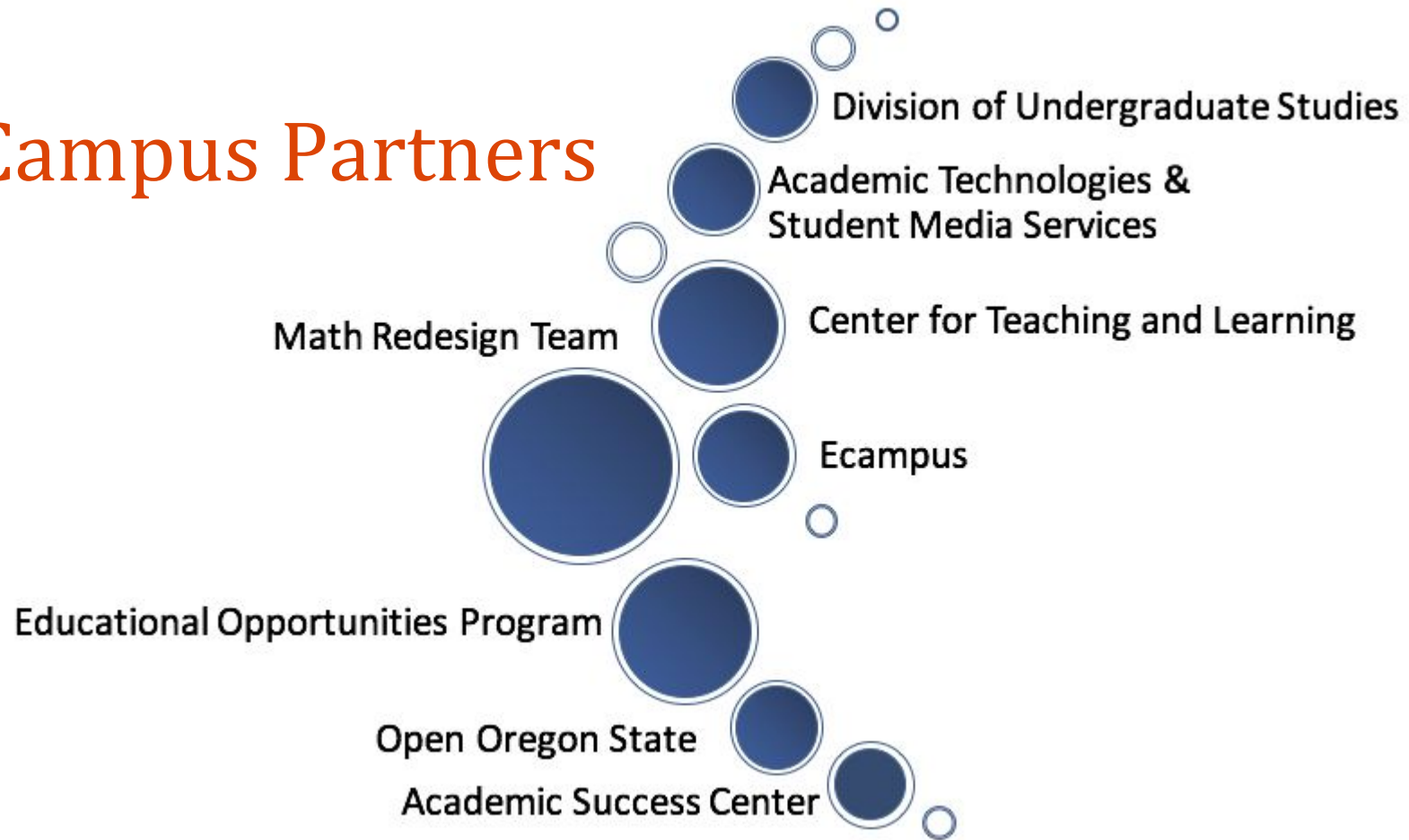
Seven math instructors + TONS of support

- **Our Goal**

Create the BEST College Algebra course using evidence-based pedagogies and design strategies!



Campus Partners



Project Elements

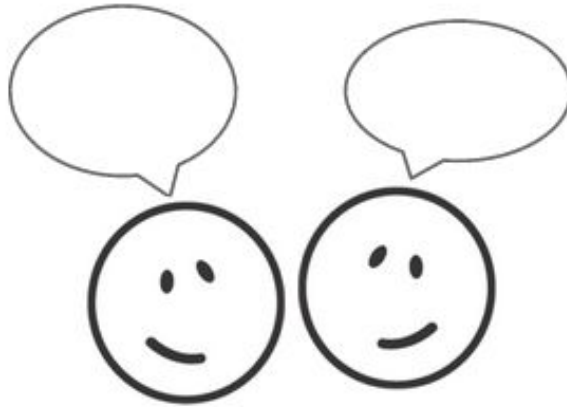
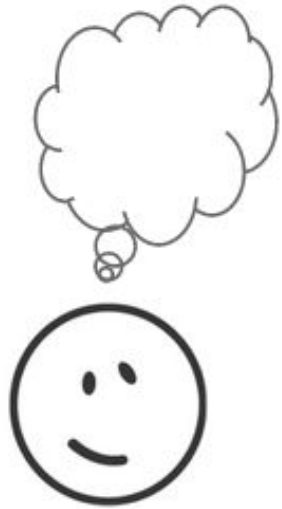
- Adaptive courseware (ALEKS)
- Active learning
 - Further developed guided worksheets
 - Added Learning Catalytics (responseware)
- Undergrad Learning Assistant program
- Common LMS site with instructor resource module
- Tight coordination across sections, including Ecampus and INTO
- Gradescope for grading common exams

Our New Story
of College
Algebra

The New Order—Major Themes

Think – Pair – Share

What are the Major Themes in College Algebra?



What are the Major Themes in College Algebra?

Think Big

Relatively few students will ever complete the square again after taking this class!

What do you hope they will remember 5 years after taking your class?



Pair up and discuss...



Thinking about the typical College Algebra course, what are the major themes that you want students to understand, or what do you hope they will still be able to do long after the course?



Share



Our Big Ideas

- **Graphs are Useful Tools**
 - Helpful for understanding & solving problems and checking answers
 - Not just an end product
- **Starting with a Basic Set of Functions, we Can Build New Functions**
 - Transformations
 - Function algebra
 - Inverses
- **Connections Between Function Representations and Forms**
 - Graphical, Numerical, Symbolic, Verbal Representations
 - Vertex (quadratic), Factored and Standard form of a polynomial
 - Log/Exponential Forms and Properties
 - Solving Equations/Inequalities graphically
- **Mathematical Modeling and Interpretation in Context**

Textbook Sections Touched on in Week I

Intro to functions (1.3)

Linear functions (1.4)

Quadratic functions (3.1)

Polynomial functions and terminology (4.1)

Absolute value definitions and functions (2.5)

Piecewise defined polynomials (2.4)

Rational functions (4.6)

Radical functions (4.8)

Exponential functions (5.3)

Logarithmic functions (5.4)

Algebra and
Trigonometry with
Modeling and
Visualization, Fifth Ed.,
Rockswold

New

The Big Ideas in the Story of College Algebra

- **Chapter 1:** What are Some Fundamental Functions?
- **Chapter 2:** What Can We Learn from a Graph?
- **Chapter 3:** How Do We Transform a Given Function?
- **Chapter 4:** What Can We Learn from an Equation?
- **Chapter 5:** How are Different Representations of Functions Connected?
- **Chapter 6:** How Do We Combine Functions?
- **Chapter 7:** How Do We Solve Equations and Inequalities?

Reordering College Algebra

Why Do It?

- The new order shakes up students' ideas of what they do and don't know. This feels different from high school algebra courses.
- Students apply common themes to various functions instead of trying to memorize separate rules for each type of function.
- Provides more time to understand difficult concepts. Logs and exponential function are covered throughout the term.
- When students don't know how to solve something symbolically they sketch a graph or use another representation.

Diverse Students

- Less likely to have been taught by highly qualified teachers
- More likely to have been tracked to lower level classes
- More likely to have been taught procedures over concepts

Diverse students are often very good procedurally but have never been asked to think conceptually or even seen that kind of thinking modeled.

Results

So far...

Students....

- Attend class consistently throughout the term
- Engage with course content at higher levels
- Use multiple representations
- Use tools like DESMOS to check their understanding
- Report enjoying the class

Transforming a Natural Log (Final Exam W2018)

(2 points) Given that $f(x) = \ln(x)$, which of the following is a transformation of f that has been shifted left 7 units and stretched vertically by a factor of 2? Bubble one answer only.

A. $h(x) = 2\ln(x + 7)$

B. $h(x) = \frac{1}{2}\ln(x) - 7$

C. $h(x) = \frac{1}{2}\ln(x + 7)$

D. $h(x) = 2\ln(x - 7)$

E. $h(x) = \ln(2x) - 7$

Solving a Log Equation (Final Exam W2018)

(5 points) Solve for x .

$$-7 + \log_4(x + 3) = -5$$

QUESTIONS?



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The Speakers

Lyn.Riverstone@oregonstate.edu and Elizabeth.Jones@oregonstate.edu

Lyn Riverstone

- Senior Instructor in the Oregon State University Mathematics Department.
- 20 years experience teaching introductory college mathematics
- Passion for team course development.
- Extensive training in the implementation of evidence-based teaching practices.
- Coordinated instructional team that worked to extend this story of Algebra from EOP to all College Algebra courses at OSU.

Dr. Elizabeth Jones

- Mathematics Instructor for the Educational Opportunities Program at Oregon State University.
- 25 years experience teaching Mathematics at the university level and in designing curriculum.
- Inspired by my students, from traditionally underserved populations, to find ways to help them build the big ideas in College Algebra.