Making math corequisites work for *you* and *your students*

Kathleen Almy

CEO, Almy Education

ALMY EDUCATION

Solving your math problems

My background

- 25 years teaching math; over 20 in higher education
- Reform work at college, state, and nationally since 2007
- Doctorate in higher ed leadership; dissertation on College Algebra corequisites
- Developmental textbook author
- Led state-level implementation of math legislation in Illinois for 2 years
- Full-time consultant with Almy Education
    - Technical support for 27 colleges in IL
    - Leading a planning and implementation program for 10 colleges in MI
    - Guiding colleges in 7 states through full math redesigns
    - Support math and English

The goal of corequisite courses is to provide **flexible** yet **intentional** support so that a student successfully completes a college-level course.

ALMY EDUCATION

Solving your math problems

What corequisite support is **not**

1. *Only* a recitation/homework/tutoring session
2. *Only* skill development & breaking complex ideas down into smaller chunks
3. Just a concurrent course creating double the assignments
4. More time to teach more new content (or what didn't get finished in class)
5. Disconnected from college-level course

What corequisite support should be/have

1. Easy to sell to students & advisors
2. Extra help and time, not an extra course
3. Time for **learning** (not just teaching)
4. Aligned with curriculum course
5. Time to put things back together to solve problems

STEM vs. non-STEM corequisites

Lessons from **non-STEM** implementations

- 2 hours of support (as lab, extra course, or embedded) works well
- Same instructor for both coreq and college content is easier to implement
- Support time after course is sometimes preferred.
- Comingled or cohorted work well.
- Coreq should focus on just-in-time support and helping students apply prereq skills to college content

Lessons from **STEM** implementations

- Only students needing college algebra/precalculus for their degree or transfer should be enrolled
- Be thoughtful and intentional about prerequisite review (when, how, how often)
- Same instructor for both coreq and college content is most effective model
  - Seamlessly integrated corequisite support
- Support time before the course is sometimes preferred.
- Cohorted may be preferred.
- Use software for algebraic skills remediation (and even placement)
- Use bootcamps
  - Keep them short
  - Focus on active learning (not just tech) and application of algebraic concepts

Corequisite course content

Approaching corequisite content: what, when, how much

- Use backwards design instead of starting with the traditional content
- Non-STEM: Focus on just-in-time support and helping students apply prereq skills to college content
    - Semester will have more developmental content early and less later
    - Let college-level content dictate amount of algebra to include

- STEM: Be thoughtful and intentional about prerequisite review
    - Front load beginning algebra
    - Intersperse intermediate algebra just in time
    - Let College Algebra goals determine level and focus in intermediate algebra

Building or rebuilding a course that works for you and your students

1. Review/state all objectives required by transfer, outcome course, degree, etc.
2. Remove anything not required. Reduce emphasis where possible.
3. Determine most important objectives and level of assessment for each (ESIL lens)
4. Choose assessments and frequency
5. Determine support content needed (cognitive and non-cognitive) and when

ACTIVITY:
Backwards design

Activity: BACKWARDS DESIGN

1. Pick a math course
2. **Where you want to get to:** State the course's goal.
3. **Where you are:** What are current problems with course? What is working?
4. Make a table with two columns: college level content and prerequisite content
    - Fill in the first column with what is required
    - Remove or de-emphasize what you can (cut the clutter)
    - Determine the prerequisite skills needed for each topic

Corequisites at the classroom level

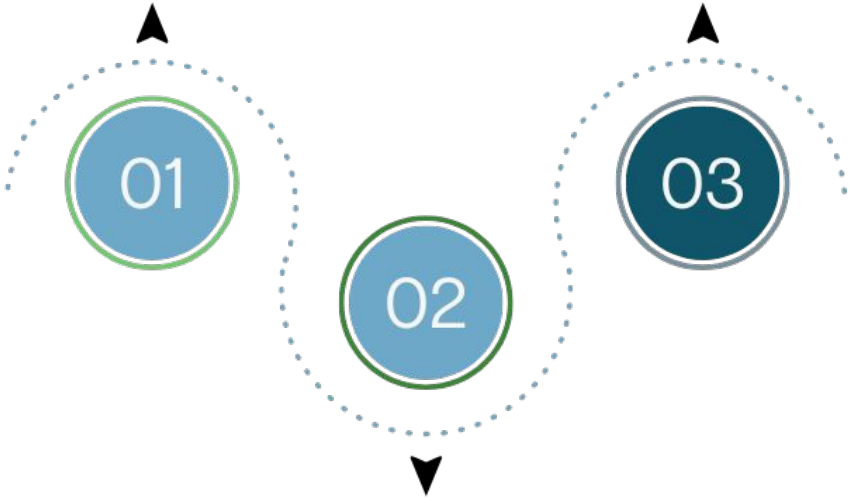
COREQUISITE CONTENT

PREREQUISITE SKILLS

Fills skill gaps; incorporates technology

COLLEGE CONTENT SUPPORT

Bridges the gap from developmental to college objectives



STUDENT SUCCESS TOOLS

Provides support for college's challenges

ALMY EDUCATION

Solving your math problems

Why Math Literacy was an effective developmental course

- Designed with intention by faculty across the country, then tested and refined over time
- Culled content and reviewed the need for every objective
- Spiral approach to content development allows for progress over time
- Embedded student success content
- Relevant content with emphasis on problem solving
- Incorporated active learning in every lesson; little lecture
- Incorporation of technology
- Online practice for skill differentiation and immediate feedback & paper work to demonstrate understanding of concepts
- Application of concepts to the college level

Template for building engagement & learning

1. **ASSESS**
2. **(Re)TEACH**
3. **EQUIP**
4. **SCAFFOLD**
5. **APPLY**

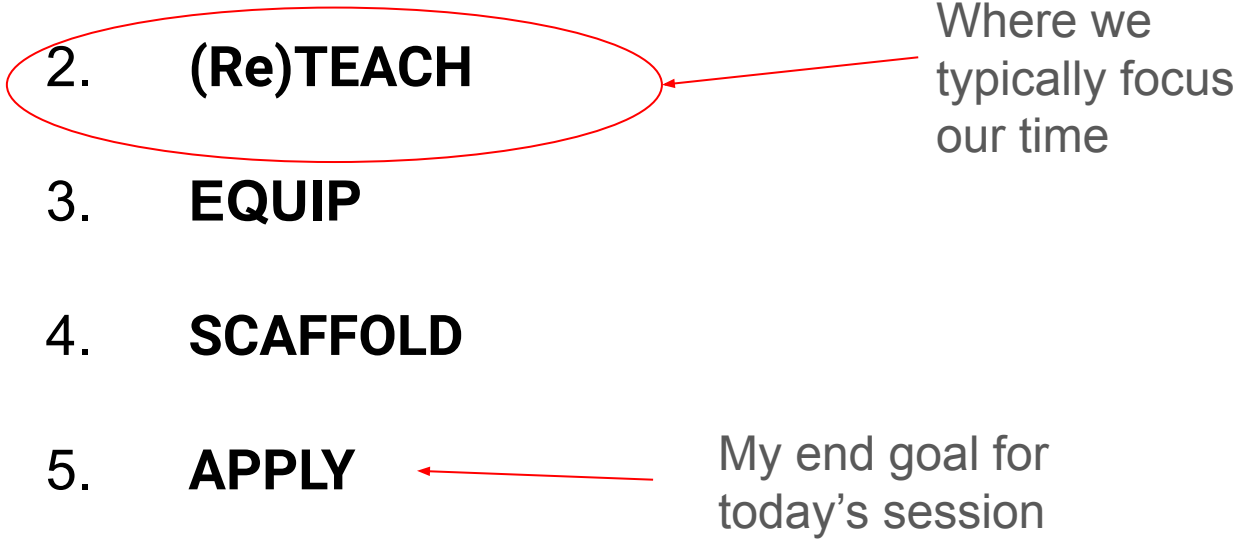
Template for building engagement & learning

1. **ASSESS**
2. **(Re)TEACH**
3. **EQUIP**
4. **SCAFFOLD**
5. **APPLY**

Get creative! Work to “hook” students in while getting the information you need to teach effectively.

Template for building engagement & learning

1. **ASSESS**
2. **(Re)TEACH**
3. **EQUIP**
4. **SCAFFOLD**
5. **APPLY**



Student perspective

What’s in it for me?

Template for a math class period (corequisite or not)

1. **ASSESS**: Get input on needs (exit slip, Desmos activity, look at online system homework scores)
2. **(Re)TEACH:** Prerequisite skill development (get active and have students work)
3. **EQUIP:** Incorporate student success - either specific to our class work or where they are in the semester
4. **SCAFFOLD**: Do bridge problems (examples to come); analyze approach
5. **APPLY**: College-level content - do problems from course content this week; active learning; apply expert thinking

Tips using the template for a corequisite class period

1. Adjust proportion of each component to student needs. **BE FLEXIBLE!** :)

2. Make a worksheet for each week with a prompt for student success and a bridge problem.

3. Prep each week with creating contingency problems/prompts/questions for each aspect of template.

Challenge yourself to incorporate creativity, novelty, relevance, and **variety**.

- Building Thinking Classrooms (BTC) tools are excellent for varying your approach.

Quantitative Reasoning

College-level Problem

Bilqis gets a credit card, with 17.99% APR compounding daily. She uses the card to buy a $900 plane ticket. She does not make any payments during the interest-free grace period. Her first payment is due 35 days after the grace period ended. Following the fine print in the credit card agreement, the minimum payment is calculated to be 1% of the outstanding balance after applying the APR; or $25, whichever is larger. What is her outstanding balance? What is her minimum payment? If she pays the minimum payment what will her new balance be?

Bridge Problem: Exploded View

Bilqis gets a credit card, with 17.99% APR compounding daily.

She uses the card to buy a $900 plane ticket.

She does not make any payments during the interest-free grace period.

Her first payment is due 35 days after the grace period ended.

Following the fine print in the credit card agreement, the minimum payment is calculated to be 1% of the outstanding balance after applying the APR; or $25, whichever is larger.

What is her outstanding balance?

What is her minimum payment?

If she pays the minimum payment what will her new balance be?

Precalculus

College-level Problem

State all transformations in the function

$$f(x) = -3(x + 8)^3 - 5$$

Bridge Problem: Hold constant & separate

Identify the role of the number 4 in each function:

$$f(x) = x^2 + 4$$

$$f(x) = 4x^2$$

$$f(x) = (x + 4)^2$$

$$f(x) = x^2 - 4$$

Statistics

College-level Problem

13. Income and Education In Problem 15 from Section 4.1, a scatter diagram and correlation coefficient suggested there is a linear relation between the percentage of individuals who have at least a bachelor's degree and median income in the states. In fact, the least-squares regression equation is $\hat{y} = 1103x + 31{,}955$ where y is the median income and x is the percentage of individuals 25 years and older with at least a bachelor's degree in the state.

(a) Predict the median income of a state in which 25% of adults 25 years and older have at least a bachelor's degree.

(b) In North Dakota, 28% of adults 25 years and older have at least a bachelor's degree. The median income in North Dakota is $66,321. Is this income higher than what you would predict? Why?

(c) Interpret the slope.

(d) Explain why it does not make sense to interpret the intercept.

From Sullivan, *Statistics: Informed Decisions Using Data*, 6e

Bridge Problem: Similar but simpler

Kudzu vines are invasive and can exhibit incredible growth in favorable conditions.

Suppose a vine's length is given as $L = 525 + 9t$, where L is in inches and t is the number of days since July 1.

Identify and interpret the slope and y-intercept of this linear function.

From Almy & Foes, *Math Lit*, 3e

Bridge Problems

Bridge the gap between developmental and full college level content

Contextualize skills in a doable way

Can be applied or not; many ways to create them

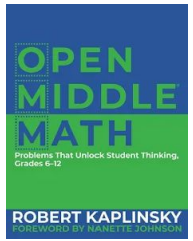
> Non-Googleable problems are a great resource
> (check out this checklist on creating them)

Less is more!

OPEN MIDDLE®

OPEN MIDDLE MATH PROBLEMS HAVE:

- **A CLOSED BEGINNING**
  —all students start with the same initial problem.
- **A CLOSED END**
  —only one correct or optimal answer.
- **AN OPEN MIDDLE**
  —multiple strategies to approach and solve the problem.



Open Middle Math. Kaplinsky (2019)

OPEN MIDDLE - Factoring Quadratics with Undefined C

Directions: Fill in the blanks by finding the largest and smallest integers that will make the quadratic expression factorable.

Tags DOK 3: STRATEGIC THINKING A-SSE.3 ROBERT KAPLINSKY

$$2x^2 + 3x + \square$$

Smallest Integer (type in at right)	

Largest Integer (type in at right)	

-9	-8	-7	-6				6	7	8	9
-5	-4	-3	-2	-1	0	1	2	3	4	5

OPEN MIDDLE - Create a System of Two Equations

Directions: Using the digits 1 to 30, at most one time each, fill in the boxes to create a system of two linear equations where (3, 2) is the solution to the system.

Tags DOK 3: STRATEGIC THINKING A-SSE.3 ROBERT KAPLINSKY

$$\begin{cases} \square x + \square y = \square \\ \square x + \square y = \square \end{cases}$$

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

Low floor high ceiling problems

How do you create them?

- Use and/or modify multiple choice questions from the book.
- Pick wrong answers that correspond to common misconceptions.
- Voting question libraries for math classes are available at: http://mathquest.carroll.edu/

ACTIVITY:
Designing your corequisite class period

Activity: DESIGNING YOUR COREQUISITE CLASS PERIOD

Pick a math course and topic

1. How can we assess student needs?
2. What skills might need to be taught or retaught?
3. What are some student success skills or activities for this time of the semester?
4. How can we bridge the gap to college-level content?
5. What college-level problem do you want them to work on and how?

Contact

Kathleen Almy
kalmy@almyeducation.com