Dana Center
Mathematics
PATHWAYS

Best Practices for Mathematics Co-Requisite Design and Implementation

Becky Moening, Ed.D., Ivy Tech Community College
Joan Zoellner, Charles A. Dana Center

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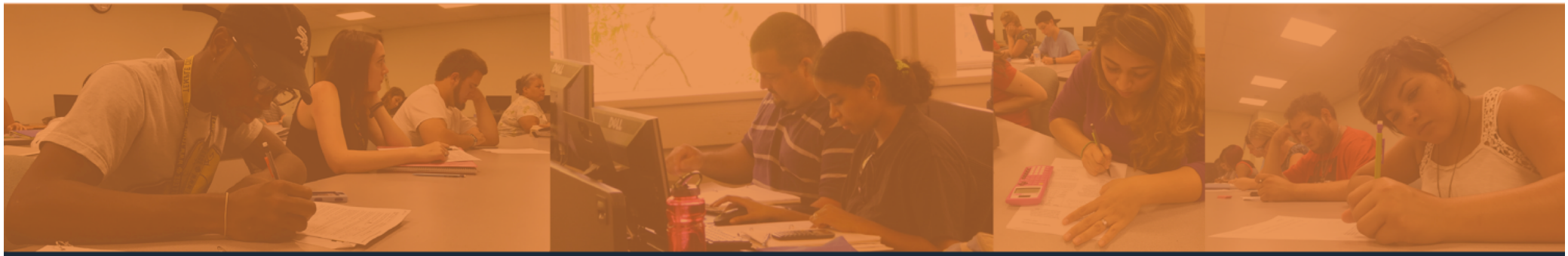


Ivy Tech Stats

- 46 campuses/instructional sites
- 100,000+ students per year
- Co-requisite models for:
  - Quantitative Reasoning (since 2013)
  - College Algebra (still designing and piloting phase)

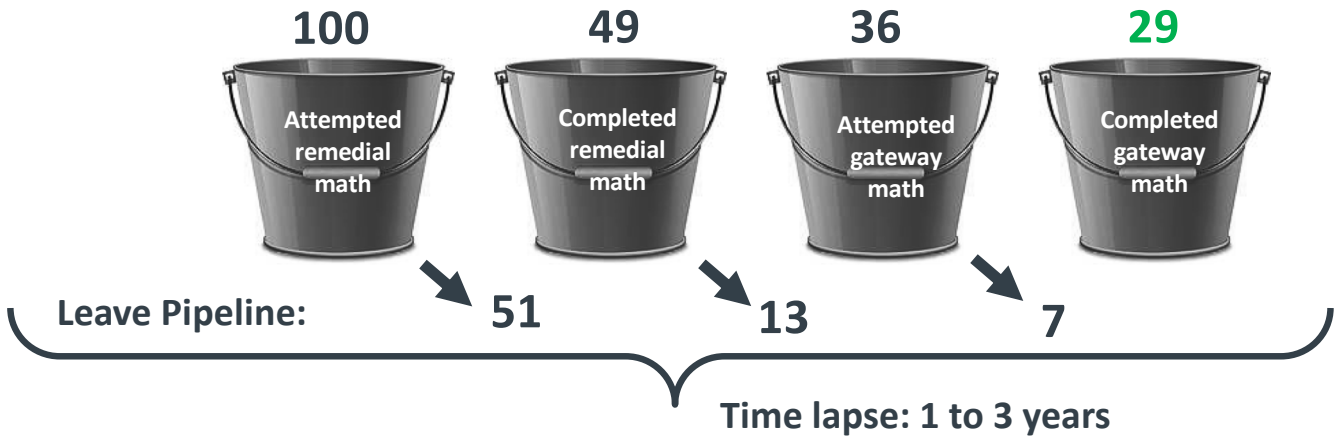
Co-Requisite Model: Quantitative Reasoning

Old Model at Ivy Tech

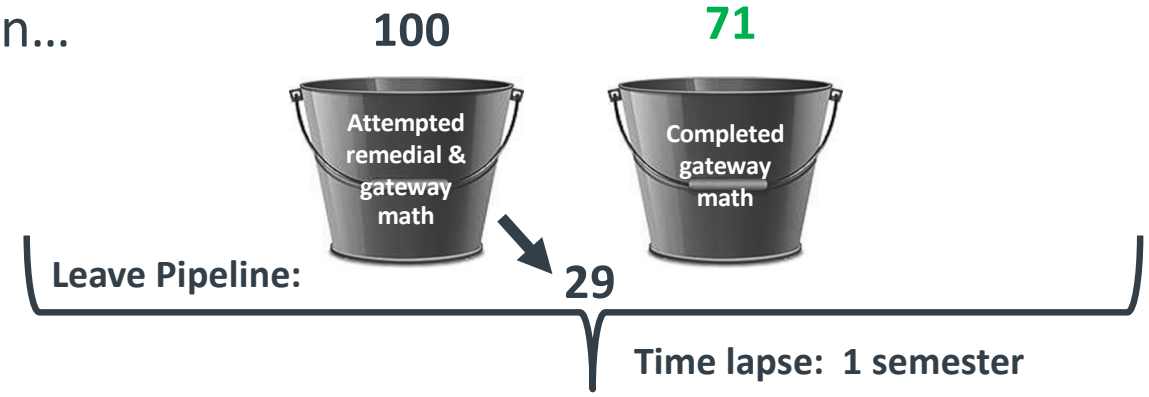
- Traditional pre-requisite
  - 4 developmental courses
    - 2 were 5 credit hour, 2 were 3 credit hour
  - Pass rates were HORRIBLE (under 50%)

Co-Requisite Model: Quantitative Reasoning

In the past, for every 100 students attempting Math remediation…



In Fall 2016 co-requisite model, for every 100 students attempting Math remediation…



Co-Requisite Model: Quantitative Reasoning

The Re-design

- What are the big QR topics we are covering?
- What basic math skills are needed to UNDERSTAND these topics?

Co-Requisite Model: Quantitative Reasoning

Statewide committee

- Made of "Champions"
  - Professional development
    - Full-time and adjuncts
- Constant communication
  - Faculty
  - Student affairs
    - advisors

Co-Requisite Model: Quantitative Reasoning

Course Pairings (Co-Mingle)

Quantitative Reasoning (Math 123)

- 3 credit hours
  - (4 contact hours)
- Meets twice a week

Mathematical Principles (Math 080)

- 3 credit hours
- Meets twice a week
  - Generally before or after the college-level course

Co-Requisite Model: Quantitative Reasoning

Classroom Make-Up

- Support Course Capped at 12
- College Course Capped at Room Capacity (generally 24-28)
- Approximately 12 Co-Requisite Students to Every 12 College-Level Students
- Co-Mingled

Co-Requisite Model: Quantitative Reasoning

Support Course (Math 080)

- Lightly Structured
  - Student driven
- Math Content
  - Same as Math 123
  - Basic skills
- Other Skills
  - Time management, study skills, exam reflection, vocabulary focus

Co-Requisite Model: Quantitative Reasoning

Grading of Math 080

- Quizzes
  - Vocabulary
  - Skills
  - Reasoning
- Organizational Activities
- In-Class Activities
- Test Corrections
- Project Check

Co-Requisite Model: Quantitative Reasoning

College-Level Course (Math 123)

- Collaborative Environment
  - Workbook
    - Statewide
- Math Content
  - Basic Statistics
  - Proportional Reasoning
  - Linear/Exponential Models
  - Conversions

Co-Requisite Model: Quantitative Reasoning

Grading of Math 123

- Exams (3)
  - 1 for each unit
- Projects (3)
  - 1 for each unit
- Quizzes (9)
  - 3 per unit
- Assignments (varies by semester)
  - Webwork
  - Excel

Co-Requisite Model: Quantitative Reasoning

Overall Grades

- Math 123 and Math 080 are separate grades
- If…
  - Pass 123 and fail 080
  - Pass 080 and fail 123
  - Fail both 123 and 080
  - Pass both 123 and 080

Co-Requisite Model: Quantitative Reasoning

Coordinating Activities Between 123 and 080

- Start with 123 Activity/Project
  - What will HELP students be successful
- Example:
  - Statistics Project in Math 123
    - 150 data points, calculate basic statistics, convert to z-scores, create frequency distributions, create histogram/bar graph
  - Math 080 Help Areas
    - Using formulas in Excel, creating graphs, differentiating between histograms/bar graphs

Co-Requisite Model: Quantitative Reasoning

Instructors

- Math 123
  - Masters in Math, Math Ed, or other area with 18 graduate credits in Math
- Math 080
  - Bachelors
- Original Goal
  - Same instructor for both classes
- Actual Predicament
  - Not enough instructors with masters degrees

Co-Requisite Model: Quantitative Reasoning

Instructor Communication

- Pre-Semester Meeting
- Meetings throughout the Semester
- Shared Content via LMS

Co-Requisite Model: Quantitative Reasoning

Continuous Improvement

- Statewide Committee
  - Member from each campus/region
- Text updates
- New ideas/projects
- Continual individual campus professional development

DCMP Vision

The DCMP seeks to ensure that ALL students in higher education will be:

- Prepared to use mathematical and quantitative reasoning skills in their careers and personal lives,
- Enabled to make timely progress towards completion of a certificate or degree, and
- Supported and Empowered as mathematical learners.

Dana Center Principles for Pathways

Institutions implement structural and policy changes quickly and at scale.

Mathematics pathways are structured so that:

1) All students, regardless of college readiness, enter directly into mathematics pathways aligned to their programs of study.
2) Students complete their first college-level math requirement in their first year of college.

Dana Center Principles for Pathways

Institutions and departments engage in continuous improvement to ensure high-quality, effective instruction.

Students engage in a high-quality learning experience in math pathways designed so that:

3) Strategies to support students as learners are integrated into courses and are aligned across the institution.
4) Instruction incorporates evidence-based curriculum and pedagogy.

We believe this work must be…

Student-centered

Faculty-driven

Administrator-supported

Policy-enabled

Culturally-reinforced

Comprehensive Redesign

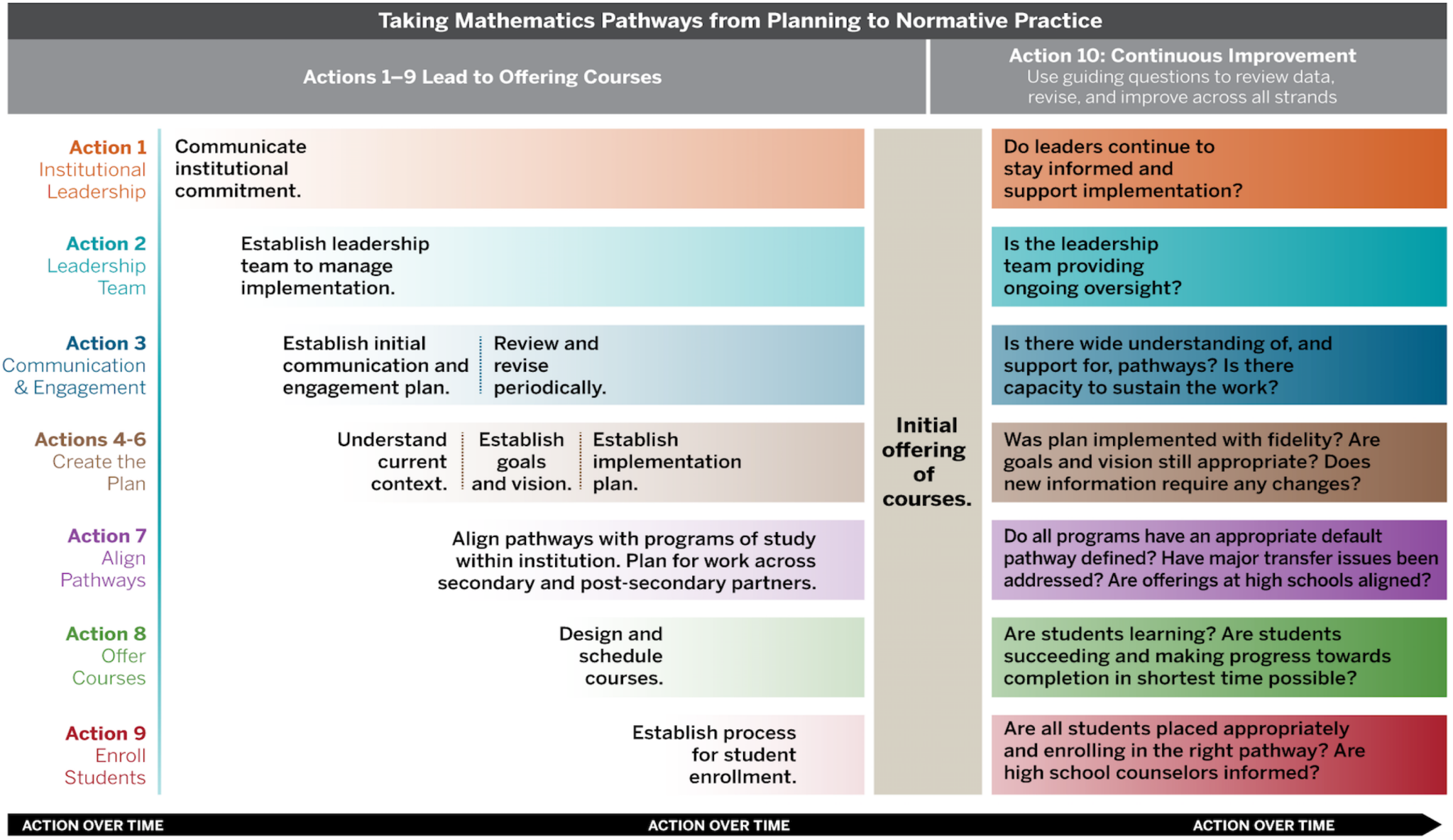
Core elements:

- Aligned math pathways with default or recommended math requirements
- Meta-majors with default or recommended math requirements
- Multiple measures placement
- Enhanced advising for those students still deemed underprepared
- Co-requisite supports for those students

Implementation: A Broad Framework

Stage of Implementation	Description
Getting Started	Commitment and leadership
Planning	Collect and review data to define problem, establish goals, and create a plan.
Implementing	Carry out the plan.
Continuous Improvement	Evaluate and improve.

Implementation Process

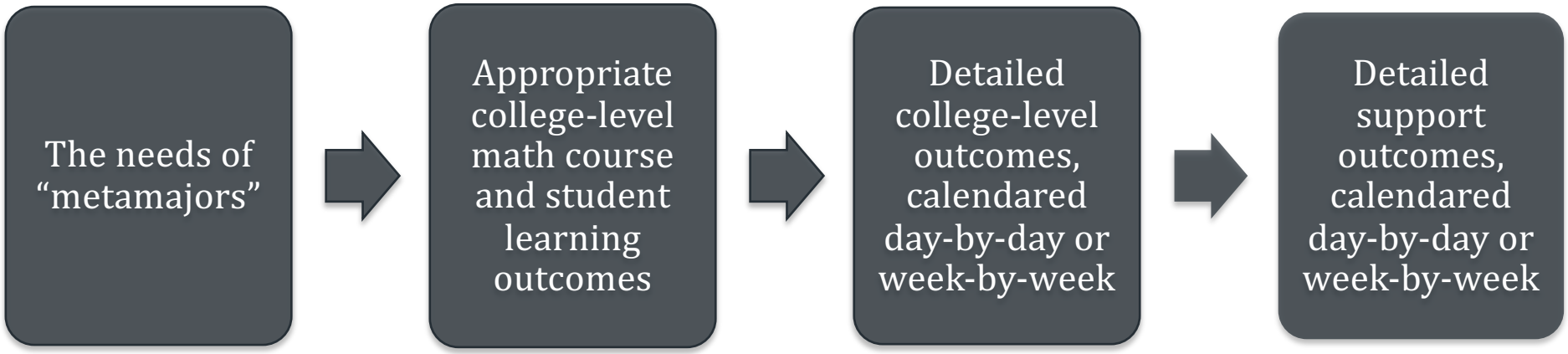


Supporting the Desired Student Experience

Defining the content of prerequisite and co-requisite courses

- How do we take underprepared students from where they are to a level of preparedness for the college-level course?
- Rather than requiring prerequisite or co-requisite courses that are historical artifacts, consider what content is essential to success in the college-level course.

Backward Mapping to Define Content



Backward Mapping to Define Content

Mathematics pathways content:

- What learning outcomes does each gateway math course need to serve the appropriate pathway?
- What are the readiness outcomes for each gateway course?
- What will help underprepared students achieve readiness for the college-level course?
  - Mathematical content
  - Learner success strategies

Backward Mapping to Define Content

Carefully consider which skills may need to be reinforced in the college-level course or may even be best saved for initial introduction in the college-level course.

An example from a Quantitative Reasoning course is shown below.

Demonstrate procedural fluency with real number arithmetic operations.				
In the college-level course, students will:	**Therefore, they need the ability to:**	**These skills should be:**		
		Taught in support course	**Reinforced in college level**	**Taught in college level**
Calculate absolute change.	Select and perform the four basic operations.	X		
Calculate relative change.	Calculate a percentage.	X		
	Interpret a percentage.	X	X	
Compare two budget categories over time.	Calculate absolute and relative change.			X

Backward Mapping to Define Content

Lesson Number	Co-Requisite Course Content	Homework Content	In-Class Activity Content
6A	Read scatterplots	Read a scatterplot; read a nutrition label	Make predictions by using a visual sense of variability; determine which of two variables is a more accurate predictor of a response variable
6B	Identify increasing and decreasing trends	Upward and downward trends in scatterplots; explanatory and response variables	Given a scatterplot, identify associations between two variables as positive or negative/strong or weak
6C	Arrange decimals in order; use inequalities to compare numbers; identify linear and non-linear patterns	Distinguish between linear and non-linear patterns	Use scatterplots in conjunction with their corresponding correlation coefficient values to determine the strength and type of association between two variables
6D	Identify explanatory and response variables and types of correlations that may exist	Identify explanatory and response variables	Explain why association does not imply causation; identify potential confounding variables in situations in which a cause-and-effect conclusion is not reasonable

Activity: Practice

Pick a SLO for one of your gateway courses. What background skills would prepare students to engage successfully in activities related to this SLO?

Learning Outcome 1:				
In the college-level course, students will:	**Therefore, they need the ability to:**	**These skills should be:**		
		Taught in support course	**Reinforced in college level**	**Taught in college level**
(add or remove rows as needed)				

Activity: Discussion

- How would you use this activity to create pre-requisite courses?
- Would the process be different for creating a co-requisite course?
- What was your biggest take-away from this activity?
- What additional questions do you have about back-mapping?

Questions?

Contact Information

- Becky Moening, bmoening21@gmail.com
- Joan Zoellner, joan.zoellner@austin.utexas.edu
- General information about the Dana Center
  www.utdanacenter.org
- DCMP Resource Site
  www.dcmathpathways.org
- To receive monthly updates about the DCMP, contact us at
  dcmathpathways@austin.utexas.edu

About the Dana Center

The Charles A. Dana Center at The University of Texas at Austin works with our nation's education systems to ensure that every student leaves school prepared for success in postsecondary education and the contemporary workplace.

Our work, based on research and two decades of experience, focuses on K–16 mathematics and science education with an emphasis on strategies for improving student engagement, motivation, persistence, and achievement.

We develop innovative curricula, tools, protocols, and instructional supports and deliver powerful instructional and leadership development.

2017

The University of Texas at Austin
Charles A. Dana Center

Defining the Content:
Content Backmapping Template

Dana Center Mathematics PATHWAYS

To identify learning outcomes for support courses, list the specific skills from the learning outcomes of the college-level course in the first column. In the second column, identify the competencies needed in order to successfully engage in activities that develop the skills in the first column. Those competencies become the descriptors of the learning outcomes of the pre/co-requisite course.

Course:

State- or institution-level course description:

Learning Outcome 1:				
In the college-level course, students will:	**Therefore, they need the ability to:**	**These skills should be:**		
		Taught in support course	**Reinforced in college level**	**Taught in college level**
(add or remove rows as needed)				

Learning Outcome 2:				
In the college-level course, students will:	**Therefore, they need the ability to:**	**These skills should be:**		
		Taught in support course	**Reinforced in college level**	**Taught in college level**
(add or remove rows as needed)				

Copy and paste additional tables as needed to backmap each course outcome.