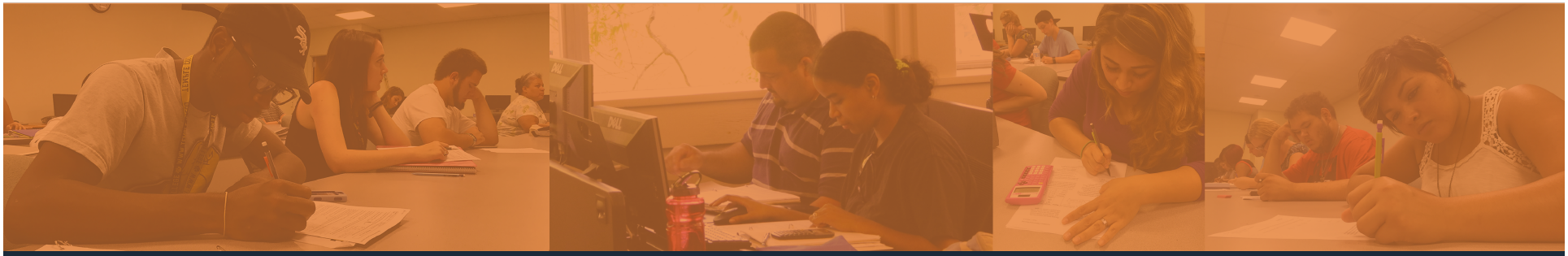
Dana Center
Mathematics
PATHWAYS

Determining the Content of Co-requisite Courses

October 4, 2017



Graphical Analysis

- Look around the room. Which graph best represents how you feel after yesterday's session?
- Stand by that graph.
- Discuss your reasons for choosing that graph with the others who chose it.

Determining the content of co-requisite courses

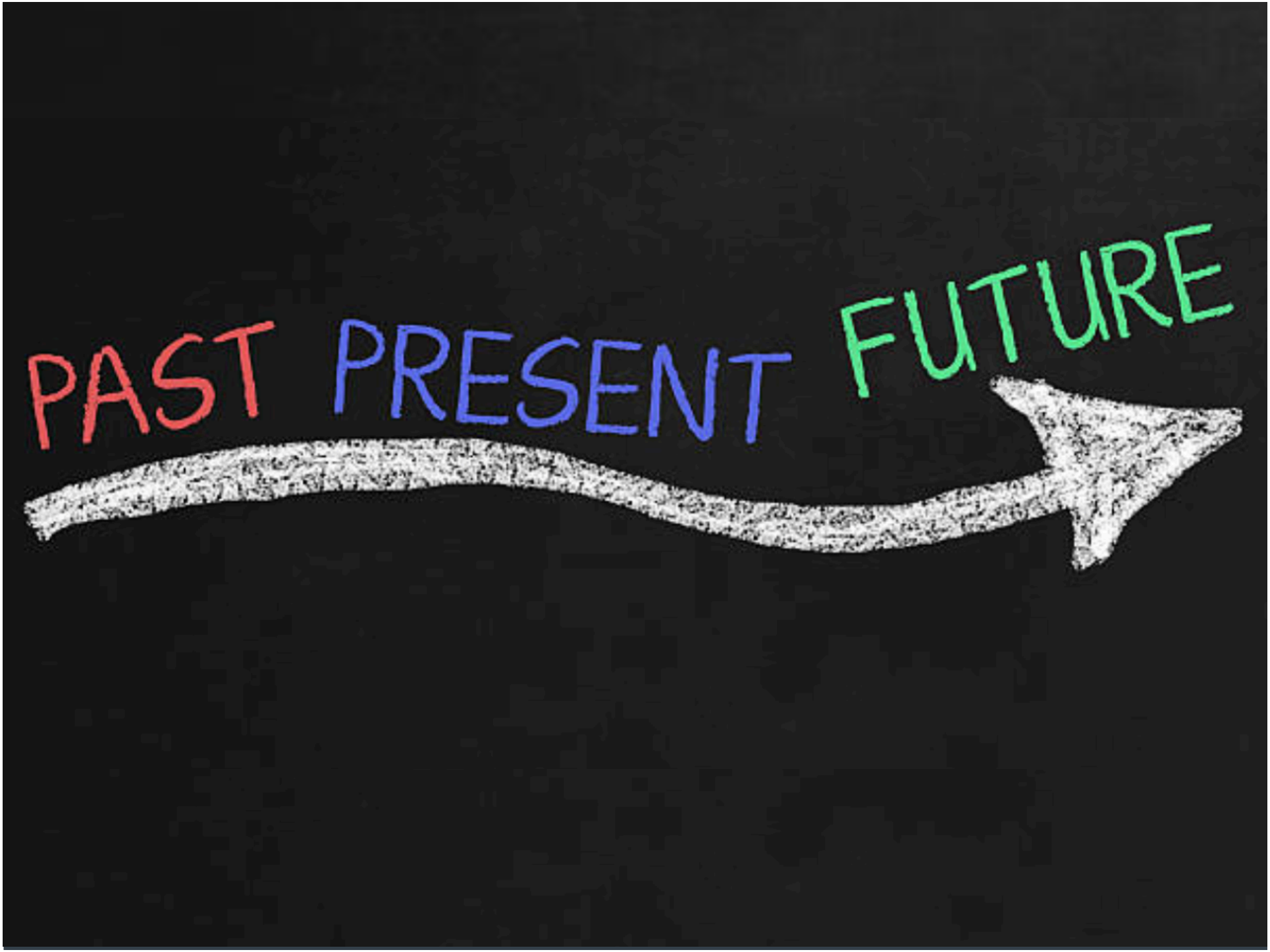
Framing the Day

To:

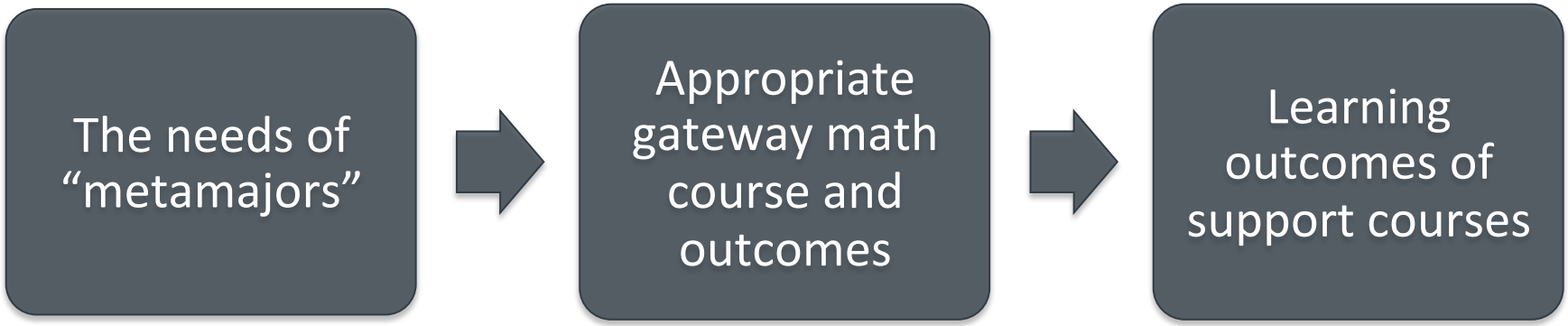
- Increase success and
- Decrease attrition, cost, and excess credit accumulation

Create co-requisite courses that focus on:

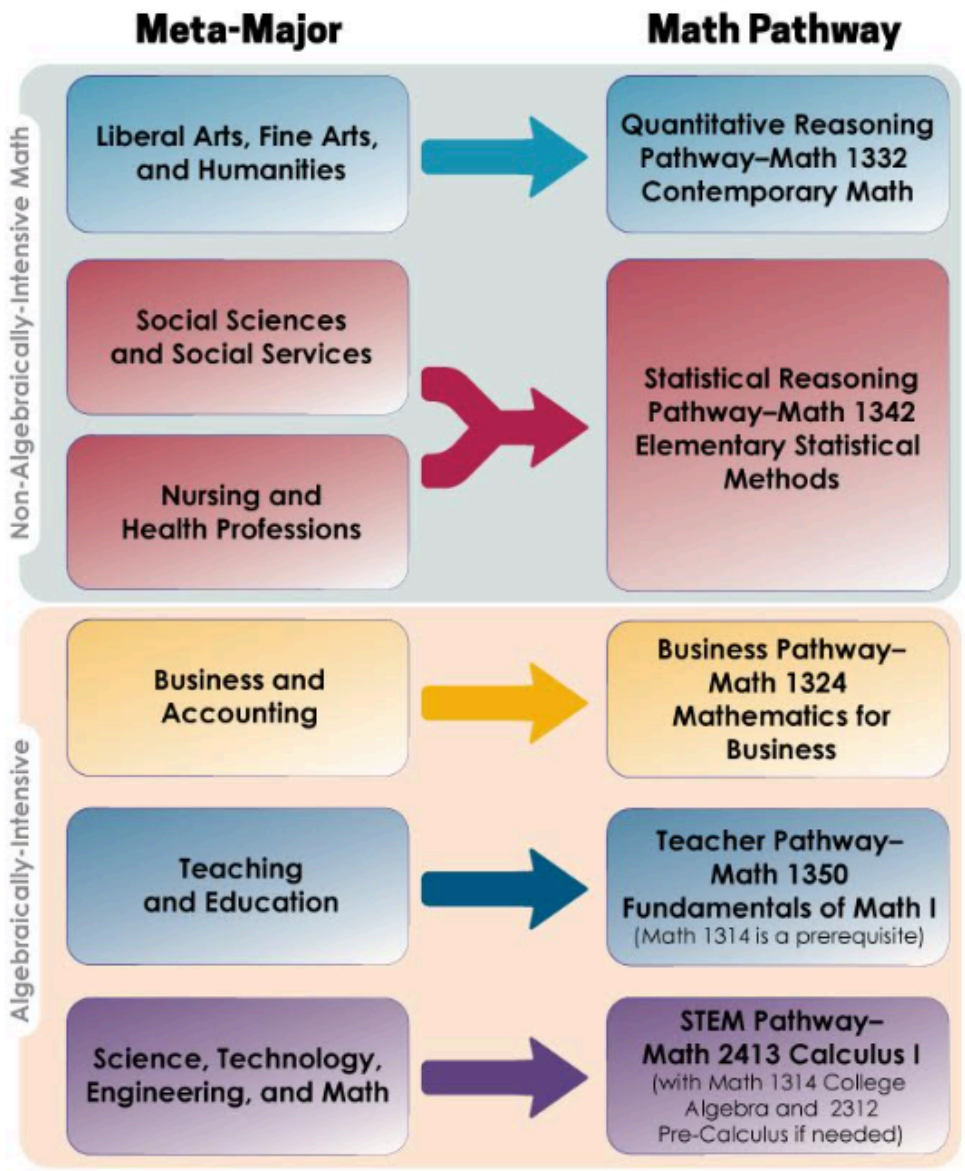
- Math skills essential for success in the college-level course;
- Success skills essential for success in all courses;
- Extended time on college-level content.


PAST
PRESENT
FUTURE

Backward mapping to define content



Emerging Texas Math Pathways



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

Defining the Content:
Content Backmapping Example

Dana Center Mathematics PATHWAYS

The content of support courses (prerequisite or co-requisite) should be selected based on the skills that students need to be successful in the college-level course. This tool is designed to facilitate the process of backmapping learning outcomes for the support course from the readiness competencies of the college-level course.

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.

For prerequisite course structures, consider carefully 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**

Backward mapping to define content

For prerequisite (e.g. boot camp) course structures, consider carefully 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

Activity: Practice

What background skills would prepare students to engage successfully in activities related to this SLO?

Choose, create, and use models for bivariate data sets.				
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**
Create a graphical display.				
Analyze data to determine appropriate model.				
Create the model.				
Use model for prediction.				

Exploring the Concept of Rigor in Mathematics

Why are we exploring rigor?

1) Colleagues question the curricular choices offered to students (e.g. the belief that offering students statistics or quantitative reasoning, rather than a calculus-prep algebra course, is weakening the degree);

2) They ask if it is realistic for students with weak math backgrounds to pass a college-level math course within their first year; and

3) The 17 professional associations of mathematicians which comprise the CBMS have endorsed the idea that there are many areas of mathematics that, when well taught, can serve as appropriate introductions to college mathematics and mathematical thinking and work.

http://www.cbmsweb.org/

Relevant, rigorous courses

- Path to Calculus: *New Directions for the Calculus Track*
  pp. 031-033

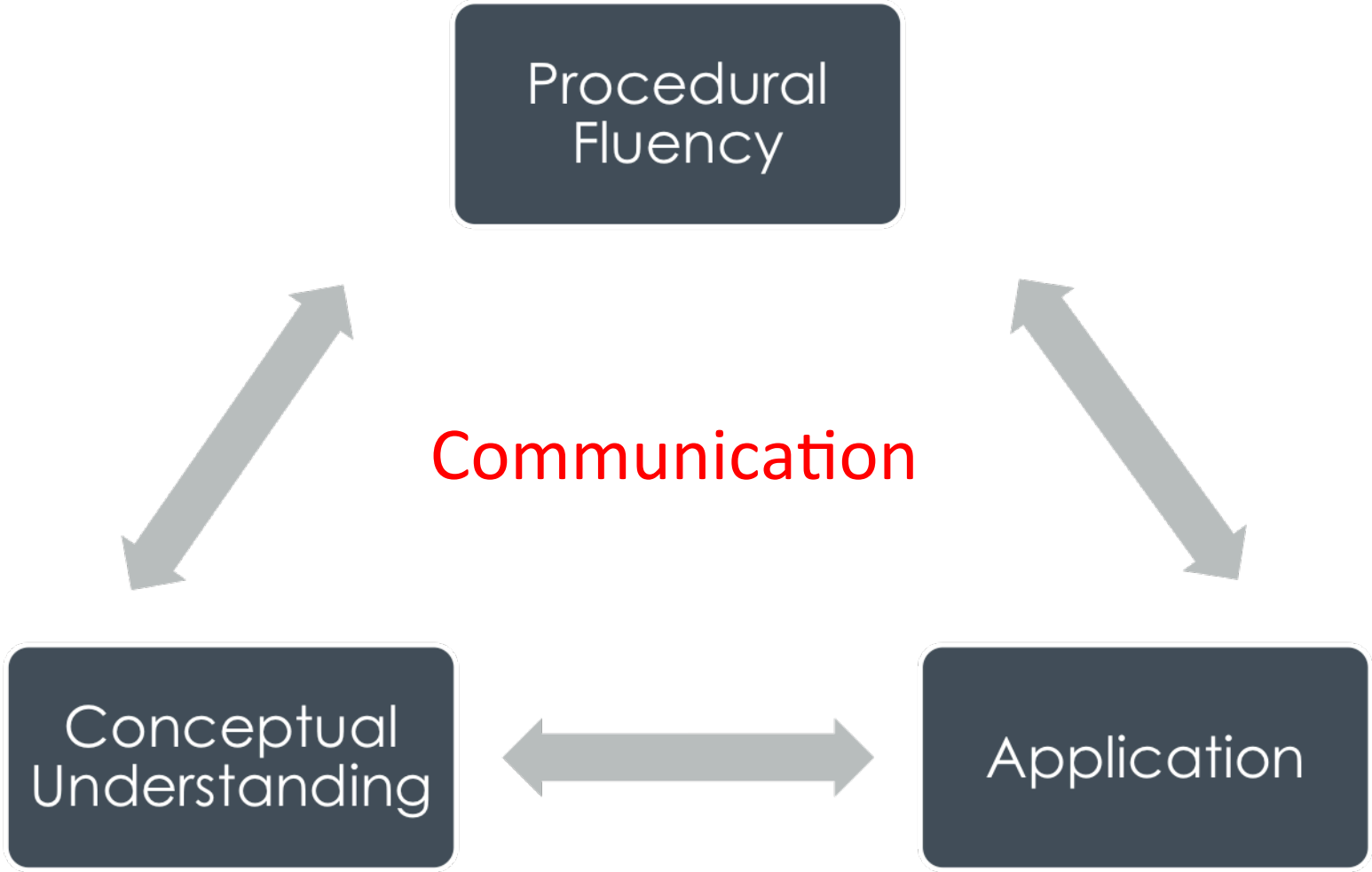
- QR: *2007 CRAFTY Curriculum Foundations II Project: The Arts*
  pp. 031-036

- Statistics: *2007 CRAFTY Curriculum Foundations II Project: Social Science*
  pp. 037-042

Towards a practical view of rigor

- To learn mathematics, all students must have the opportunity to tackle rich problems and productively struggle with them.
- They must not only solve those problems but also be able to articulate the basis of an argument at a level of precision appropriate to the course.
- We should attend to all of our math courses, whether it be statistics-, modeling- or algebra-based, to ensure that they are all taught with rigor.
- Math departments should play an essential role in determining the content of their introductory courses in conjunction with the views of the professional associations and the needs of the institution's various programs of study.

Components of Rigor



Reputation builders:

- Clear delineation between college-level and co-req content (faculty adhere to agreed-upon college-level syllabus)
- Measurable student learning outcomes in each portion of the course (not study hour)
- Use outcomes to build the course calendar
- Backmap to build the co-req calendar
- Consider common exams or common questions

Planning Co-requisite Content

Introduction to Statistics and Co-requisite Support Course Sample Timeline
Adapted from and with thanks to Roane State Community College

Day	Co-requisite Notebook Topics	On-line Lab	*Essentials of Statistics* Triola 5th ed.		MyLabsPlus Assignment
1	Orientation, study habits, time mgmt.; converting between fractions, decimals, percentages; finding a percentage of a number	1	1.1 – 1.2	Orientation; introduction to statistical terms and statistical thinking	1
2	Rounding; estimating; calculating means,	2	1.3 – 1.4	Types of data; collecting sample data	2
3	Decimals, ratios, percent, conversions	3	2.2 – 2.3	Frequency distributions; histograms	3
4	Applications of percent, squares, square roots; order of operations	4	2.4	Graphs that enlighten and graphs that deceive	4
5	Operations on real numbers	5	3.2	Measures of center	5
6	Review of types of data, sampling methods, types of graphs	6	3.3 – 3.4	Measures of variation; measures of relative standing and boxplots	6
7	Review of measures of center and variation	7	Practice Test 1		
8	Comprehensive review of chapters 1 – 3 & basic skills	8	**Test 1**		

Planning Co-requisite Content

14	Comprehensive review: chapters 4 – 5 & basic skills	14	**Test 2**		
15	Area of a rectangle, lower/upper boundaries of regions, identify specified area under a curve, shade the area representing a percentile	15	6.2 – 6.3	Standard normal distribution; applications	11
16	Uniform distribution, standard normal curve, find z-scores, find critical values, determine type of problem	16	6.5	Central Limit Theorem	12
17	Probability/proportion/percent, calculate critical values, deconstruct intervals, identify parts of proportion problems	17	7.2	Estimating a population proportion	13
18	Find the best point estimate, calculate CI estimate for proportion, determine the required sample size	18	7.3	Estimating a population mean	14
19	Review of normal probability distributions and confidence intervals	19	Practice Test 3		
20	Comprehensive review: chapters 6 – 7 and basic skills	20	**Test 3**		
21	Coordinate system, intercepts, graph lines, compare & round decimals	21	8.2	Basics of hypothesis testing	15
22	Slope from graph & points, average rate of change, $\hat{p}, x$ *and* n	22	8.3	Testing a claim about a proportion	16
23	Concepts of slope and analyzing linear relationships	23	8.4	Testing a claim about a mean	17
24	Scattergrams and concepts of linear equations	24	10.2 – 10.3	Correlation; regression	18
25	Review statistical concepts: hypothesis testing, correlation, regression	25	Practice Test 4		
26	Comprehensive review of chapters 8 & 10 and basic skills	26	**Test 4**		
27	Review statistical concepts: all chapters	27	Practice Final		
28	Comprehensive review: all chapters	28	**Final Exam**		

Action Planning

What are your department's next steps regarding:

- Setting detailed course learning outcomes for your gateway course?
- Backmapping outcomes for the support course?
- The development of a course calendar?
- Thinking about the culture the department would like to see in classrooms?

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An engaged learner…

- Takes charge of their own learning
- Is willing to tackle unfamiliar concepts

Internal, mental engagement

Constructing understanding

vs.

Receiving information

How the brain works – psychologically speaking

Growth Mindset

Incremental theory of intelligence

The belief that
academic capabilities
can change with effort

Fixed Mindset

Entity theory of intelligence

The belief that
academic capabilities
are a function of innate ability

Positive academic behaviors:

- Attending class
- Asking for help
- Enjoying the academic process
- Choosing to tackle challenging tasks

How the brain works – psychologically speaking

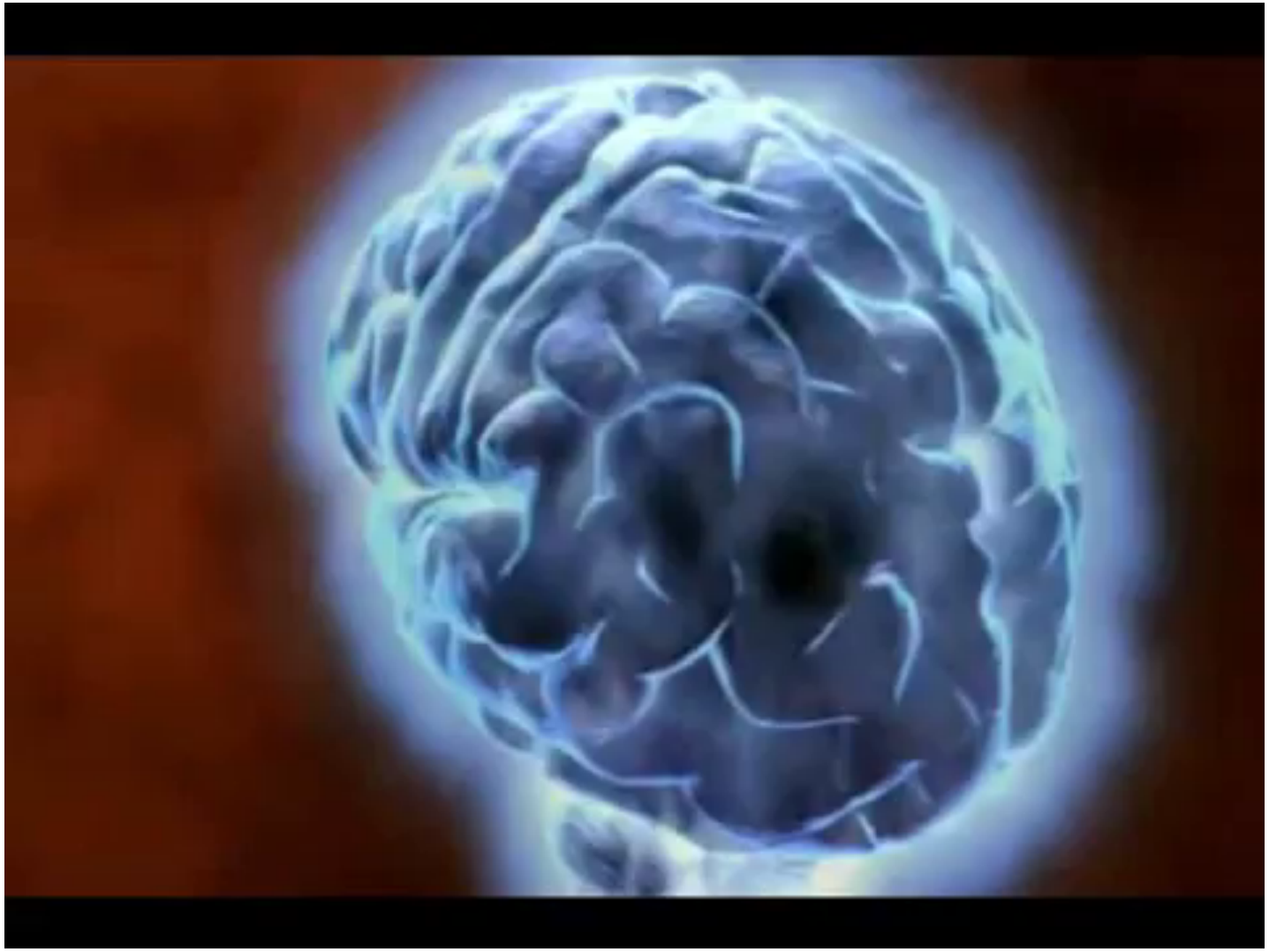
Growth Mindset

Incremental theory of intelligence

The belief that academic capabilities can change with effective effort

How do we help students shift from a fixed mindset to a growth mindset in mathematics?

How the brain works – neurologically speaking



The Complex Brain

With an elbow partner, discuss the following:

- What surprises you about what you have heard about the brain?
- How is the bridge or pathway metaphor helpful in understanding how our brains change when we learn?

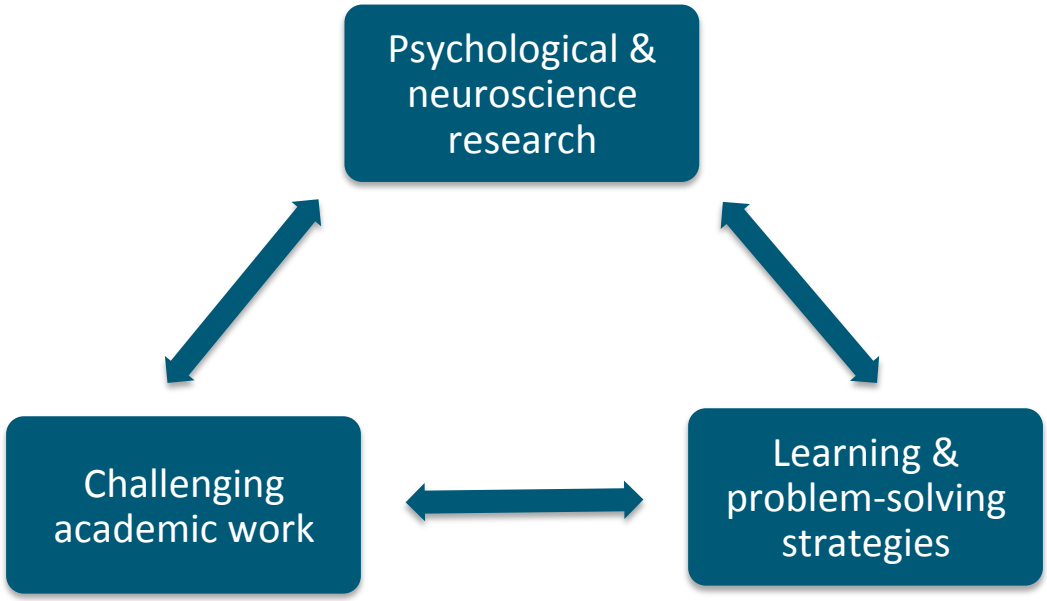
Purposeful engagement…

…means choosing to engage your brain in the same way people choose to change their muscle strength or overall fitness by going to the gym or participating in sports:

1. Make a choice
2. Put forth effort
3. Persist in that effort over time

More on Mindsets

It's not just about effective effort.



Classroom culture and climate

Developing Learner Strategies

Provide explicit instruction in:

- How the brain learns.
- What it means to come to class prepared.
- When and how to seek help.
- How to monitor your own learning.

Packet and Box folder:

- Sample preparatory activity
- Building a Learning Community ideas
- Help Seeking Activity
- Developing Self-Regulation Activity

Activity: Plan for action

Create a plan for defining the content of support courses for underprepared students. Record ideas for how you will:

- Design the course mathematical content
- Design the learner-strategy content