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

The needs of “metamajors” → Appropriate gateway math course and outcomes → Learning outcomes of support courses
Emerging Texas Math Pathways

**Meta-Major**

1. Liberal Arts, Fine Arts, and Humanities
2. Social Sciences and Social Services
3. Nursing and Health Professions

**Math Pathway**

1. Quantitative Reasoning Pathway—Math 1332 Contemporary Math
2. Statistical Reasoning Pathway—Math 1342 Elementary Statistical Methods
3. Business Pathway—Math 1324 Mathematics for Business
4. Teacher Pathway—Math 1350 Fundamentals of Math I (Math 1314 is a prerequisite)
5. STEM Pathway—Math 2413 Calculus I (with Math 1314 College Algebra and 2312 Pre-Calculus if needed)

Dana Center Mathematics 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
Defining the Content:
Content Backmapping Example

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.

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

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

<table>
<thead>
<tr>
<th>Choose, create, and use models for bivariate data sets.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In the college-level course, students will:</strong></td>
</tr>
<tr>
<td>- Create a graphical display.</td>
</tr>
<tr>
<td>- Analyze data to determine appropriate model.</td>
</tr>
<tr>
<td>- Create the model.</td>
</tr>
<tr>
<td>- Use model for prediction.</td>
</tr>
<tr>
<td><strong>Therefore, they need the ability to:</strong></td>
</tr>
<tr>
<td><strong>These skills should be:</strong></td>
</tr>
<tr>
<td>Taught in support course</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
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

- Procedural Fluency
- Communication
- Conceptual Understanding
- Application
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

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

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

- Psychological & neuroscience research
- Challenging academic work
- Learning & problem-solving strategies

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