Designing an Effective Corequisite Program

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What is Learning?

Learning is embedding new knowledge in the rich soil of what you already know

Marlieke van Kesteren at VU University Amsterdam
Outline

1. Structure of Corequisite Courses
2. Professional Development
3. Affective Domain
4. Prestats and Algebra Activities
5. Challenges
6. Next Steps
7. Student Feedback
New Corequisite Courses

Units are in parentheses

**Fall 2018**

Prestatistics (6 + 2)
Intermediate Algebra (5 + 3)

**Spring 2019**

Statistics (4 + 2)

**Fall 2019**

Trig (4 + 1)
Trig-Precalc (6 + 2)
Applied Calculus (5 + 1)
Placement

- Non-transferable courses
- Transferable courses
Embedded Counseling

- Coordinating faculty and counselors
- 4 classroom visits
- Activities
- Outside class

- Communication between faculty and counselors during semester
A Typical Day

- Math activities
- Mini-lectures
- Affective domain activities
Why Group Work?
Embedded Tutoring

- Hiring
- Training
- In class
- Debriefs
Students’ Evaluation of Tutors

- He doesn’t tell you exactly what you did wrong. He lets you think about it and find out yourself, and I like that.
- He is very helpful and will elaborate on a problem if not done correctly. He always talks to us as students and as well as peers.
Students’ Evaluation of Tutors

- The only problem with him is the language barrier so sometimes it’s a bit confusing on both him and the students, but overall he gets the job done.
- Very intuitive and friendly.
- He’s good. He’s smart. Explained things better than the teacher.
Goal of Course

Have students and faculty embed new knowledge in the rich soil of what they already know.
Professonal Development

- Training faculty
- Bimonthly meetings
- Paid time
- Release time
Affective Domain

- Belonging
- Support groups
- “Grow your brain”
- Grit
- Reading apprenticeship

- How does math tie into your career?
- Three Rs (relationship, relevance, rigor)
- Counselors
- Seemless integration
Importance of Empathy

“High personal warmth with high active demandingness”

Judith Kleinfeld (1972)
Goal of Course

Have students embed new knowledge in the rich soil of what they already know
Activities: As Many of the Following as Possible

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
Activities: As Many of the Following as Possible

- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
For which type of car, domestic or imported, has fuel efficiency improved the fastest? Explain.

<table>
<thead>
<tr>
<th>Year</th>
<th>Domestic (miles per gallon)</th>
<th>Year</th>
<th>Imported (miles per gallon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>33.1</td>
<td>2007</td>
<td>32.2</td>
</tr>
<tr>
<td>2011</td>
<td>32.7</td>
<td>2009</td>
<td>33.8</td>
</tr>
<tr>
<td>2012</td>
<td>34.8</td>
<td>2011</td>
<td>33.7</td>
</tr>
<tr>
<td>2013</td>
<td>36.0</td>
<td>2013</td>
<td>36.6</td>
</tr>
<tr>
<td>2014</td>
<td>36.7</td>
<td>2014</td>
<td>36.0</td>
</tr>
</tbody>
</table>
Fuel Efficiency Rubric

Goals met are in red:

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
The Power of Debate

A person of which ethnicity is more likely to oppose the Death Penalty?

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>Caucasian</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favor</td>
<td>128</td>
<td>953</td>
<td>108</td>
<td>1189</td>
</tr>
<tr>
<td>Oppose</td>
<td>140</td>
<td>414</td>
<td>81</td>
<td>635</td>
</tr>
<tr>
<td>Total</td>
<td>268</td>
<td>1367</td>
<td>189</td>
<td>1824</td>
</tr>
</tbody>
</table>
Death Penalty Rubric

Goals met are in red:

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
Experimentation

On a graphing calculator, graph a group of lines to make a starburst like the one below. List the equations of your lines.
On a graphing calculator, graph a group of lines to make a starburst like the one below. The intersection point is \((0, -3)\). List the equations of your lines.
Slope Experimentation Rubric

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
Groundbreaking Research

Design as many measures of consistency as you can to determine the more consistent basketball player for each player’s first 20 games.

<table>
<thead>
<tr>
<th>Game</th>
<th>Points Scored in 2017–2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stephen Curry</td>
</tr>
<tr>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>3</td>
<td>37</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
</tr>
</tbody>
</table>

(There are actually 20 rows of data.)
Basketball Rubric

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
Who’s More Consistent?

Curry: $s = 7.4$, $IQR = 9$, $Range = 30$

Durant: $s = 3.7$, $IQR = 4$, $Range = 12$
Multiple Solutions

Estimate when the total revenue from television, radio, and multimedia was equal to the revenue from telecommunication devices. What was that revenue?

<table>
<thead>
<tr>
<th>Year</th>
<th>Television, Radio, and Multimedia</th>
<th>Telecommunication Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>56.3</td>
<td>65.5</td>
</tr>
<tr>
<td>2012</td>
<td>52.0</td>
<td>69.8</td>
</tr>
<tr>
<td>2013</td>
<td>47.5</td>
<td>73.6</td>
</tr>
<tr>
<td>2014</td>
<td>45.5</td>
<td>77.2</td>
</tr>
<tr>
<td>2015</td>
<td>44.0</td>
<td>79.9</td>
</tr>
</tbody>
</table>
Media Rubric

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
Power of Debate

Which distribution has the smallest standard deviation? The largest? **Explain.**

Dist 1:

Dist 2:

Dist 3:
Standard Deviation Rubric

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
1. A student tries to solve the equation $x^2 + 6x - 5 = 0$:

\[
\begin{align*}
  x^2 + 6x - 5 &= 0 \\
  x^2 + 6x &= 5 \\
  x^2 + 6x + 9 &= 5 \\
  (x + 3)^2 &= 5 \\
  x + 3 &= \pm\sqrt{5} \\
  x &= -3 \pm \sqrt{5}
\end{align*}
\]

Describe any errors. Then solve the equation correctly.
Conceptual Development

2. A student tries to solve the equation $4x^2 - 8x = 12$:

\[
\begin{align*}
4x^2 - 8x &= 12 \\
4x^2 - 8x + 16 &= 12 + 16 \\
(2x - 4)^2 &= 28 \\
2x - 4 &= \pm \sqrt{28} \\
2x - 4 &= \pm 2\sqrt{7} \\
2x &= 4 \pm 2\sqrt{7} \\
x &= 2 \pm \sqrt{7}
\end{align*}
\]

Describe any errors. Then solve the equation correctly.
Completing the Square Rubric

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
Multiple Solutions

The scores from Test 1 and Test 2 for our class are described by the following two dotplots. A student in our class earned 80 points on Test 1 and 78 points on Test 2. The student thinks that he or she did worse on Test 2. What would you tell the student?
Tests 1 and 2 Rubric

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
Symbolic Intensive Work

1. \( \frac{3}{5} + \frac{7}{2} \)
2. \( \frac{b}{2} + \frac{b}{3} \)
3. \( \frac{x - 2}{4x} + \frac{x + 3}{6x} \)
4. \( \frac{5}{x - 3} + \frac{2}{x + 4} \)
5. \( \frac{w}{(w + 3)(w - 5)} + \frac{4}{(w - 2)(w - 5)} \)
6. \( \frac{3}{x^2 + 3x + 2} + \frac{2}{x^2 + 7x + 6} \)
7. \( \frac{x + 1}{x^2 - 16} + \frac{x - 2}{2x - 8} \)
8. \( \frac{a + 1}{10a^2 + 13a - 3} + \frac{a - 2}{2a^2 - 5a - 12} \)
Rational Expressions Rubric

- Students work collaboratively
- Address fundamental concepts
- Unfamiliar problems
- Address students’ misconceptions
- Low floor high ceiling
- Single question
- Contextually rich
- Multiple solutions
- In-depth debates
Challenges

- Students
- Tutors
- Faculty
- Counselors
Next Steps

- Training faculty
- Bimonthly meetings
- Designing activities
- Hiring faculty
Ultimate Goal

Strong vision and commitment shared by all:

- Students
- Faculty
- Embedded tutors
- All counselors
- Dean of counseling
- Dean of math/science
- Vice president of instruction
- President
The worksheets are helpful. They help me learn a lot more about the topics.

I believe group work does and doesn’t work. It does work if my partners are talking and interacting with me. However it doesn’t when there is no communication.
The group work is by far the best way to learn and understand the content. With such a long class period, it is almost essential.

Group work has been able to provide me with a different perspective on how to solve the problem and gives me an easy option to ask for help.
For More Information
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