Supporting Students and Faculty to Thrive in Online Math Courses

Lynae Warren, Associate Mathematics Professor, SUNY Empire State College

Lewis Hosie, Instructional System Coordinator, Carnegie Math Pathways

This program of work is supported by The William and Flora Hewlett Foundation, the Bill & Melinda Gates Foundation, the Lumina Foundation, The Kresge Foundation, the Carnegie Corporation of New York, the Great Lakes Higher Education Corporation, the ECMC Foundation, and the National Science Foundation’s grant DUE-1322844 and grant DUE-1820830 in cooperation with the Carnegie Foundation for the Advancement of Teaching and WestEd
shorturl.at/frKQ1
Session Outline

● Background on the Carnegie Math Pathways

● Our design principles for fully-online Pathways and how they informed the development of a faculty preparation course

● Examples from two implementation models

● Bright spots, challenges, and lessons learned
Triple the Success in Half the Time (2011-2017)

- **Statway**
  - Baseline Success - 2 Years: 15%
  - Statway Success - 1 Year: 51%

- **Quantway**
  - Baseline Success - 1 Year: 21%
  - Quantway Success - 1 Term: 59%
Key Aspects

● Collaborative Learning

● Productive Persistence
  ○ Growth Mindset, Social Belonging, and Productive Struggle

● Supplemented with Community of Inquiry (CoI) model
  ○ Teaching Presence, Cognitive Presence, and Social presence
Design Principles

Always welcoming
Supportive
Collaborative
Intentional
Coherent
Interactive
Preparation Course for Fully-Online Pathways

- Design Principles and CoI framework
- Welcome Package for your Online Course
  - Includes some adapted Productive Persistence activities (e.g. Contract and Syllabus Activities)
- Implementation Models
- Getting Ready to Teach Online
- Synchronous and asynchronous strategies
  - Includes some adapted Productive Persistence activities (e.g. Group Noticing Routine, Growth Mindset Phrases)
- Discussion Topic Bank
Welcome Package Example: Contract Activity

Setting Course Expectations and Creating Productive Classroom Norms

Introduction

Quantway Cohort Contract

By signing below, I agree to fulfill the following requirements for participation in Quantway, and acknowledge that I understand the requirements for continued enrollment.

Specifically:

- I commit to successfully completing Quantway with the members of my cohort.
- I commit to helping all of my cohort members understand mathematics and complete Quantway.
- I will come to class everyday prepared to participate in all classroom activities.
- I will contribute to creating a productive classroom atmosphere that supports everyone learning.
- I will keep an open mind and a positive attitude, and will be willing to try out new learning strategies and study skills.

Signature: ______________________ Date: ____________

- “Which of these commitments will be hardest for me?”
- Ask students to reply to at least two comments about how they can support each other to successfully meet all parts of the contract.
- Create a list of support strategies gathered from the discussion thread and post this list in an accessible, permanent place in the course.
## Implementation Model Characteristics

<table>
<thead>
<tr>
<th>Implementation Model 1</th>
<th>Implementation Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully online synchronous/asynchronous mix</td>
<td>Fully online, fully asynchronous</td>
</tr>
<tr>
<td>Students work in groups synchronously in IM chats</td>
<td>Students work in groups on group discussion boards-(required)</td>
</tr>
<tr>
<td>Students do online homework individually</td>
<td>Students do online homework individually</td>
</tr>
</tbody>
</table>
**Example from Implementation Model 1**

**Instant Messenger Transcript**

<table>
<thead>
<tr>
<th>Instructor</th>
<th>what is the difference between the two groups?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student 1</strong></td>
<td>Group 1 does use tobacco and has high cholesterol, and Group 2 does not use tobacco and has low cholesterol.</td>
</tr>
<tr>
<td><strong>Student 2</strong></td>
<td>Group 1 smokes, high cholesterol group 2 does not, low cholesterol</td>
</tr>
<tr>
<td>Instructor</td>
<td>/</td>
</tr>
<tr>
<td>Instructor</td>
<td>correct</td>
</tr>
<tr>
<td>Instructor</td>
<td>we will be looking at graphs of the two groups</td>
</tr>
<tr>
<td>Instructor</td>
<td>read 2a</td>
</tr>
<tr>
<td>Instructor</td>
<td>now we have 500 people in Group 1</td>
</tr>
<tr>
<td>Instructor</td>
<td>how many of those would you expect to suffer a heart attack?</td>
</tr>
<tr>
<td><strong>Student 2</strong></td>
<td>500/10 = 50 people</td>
</tr>
<tr>
<td><strong>Student 1</strong></td>
<td>500*.40= 200 people</td>
</tr>
<tr>
<td>Instructor</td>
<td>/</td>
</tr>
<tr>
<td>Instructor</td>
<td>/</td>
</tr>
<tr>
<td>Instructor</td>
<td>correct, 200 people, 500*.4= 200</td>
</tr>
<tr>
<td><strong>Student 2</strong></td>
<td>where did the .40 come from? I'm confused</td>
</tr>
<tr>
<td>Instructor</td>
<td>it said 40% of the people would suffer a heart attack, so 40% of 500 = .40*500=200</td>
</tr>
<tr>
<td><strong>Student 2</strong></td>
<td>I see it now on the first page</td>
</tr>
<tr>
<td>Instructor</td>
<td>Does that make sense Leah?</td>
</tr>
<tr>
<td><strong>Student 2</strong></td>
<td>yes it does</td>
</tr>
</tbody>
</table>

**Lesson Content**

**PROBLEM SITUATION: THE EFFECT OF REDUCING RISK**

A new drug advertises that it “reduces the risk of heart attack by 50%.” In order to better understand the benefits of this drug, you will examine heart attack risk for two different groups.

**Group 1** consists of individuals in Africa who are

- 40 years old,
- do not have Diabetes Mellitus,
- smoke tobacco,
- have high cholesterol, and
- have high blood pressure.

**Group 2** consists of individuals in Africa who are

- 40 years old,
- do not have Diabetes Mellitus,
- do not smoke,
- have low cholesterol, and
- have high blood pressure.

The World Health Organization reports that individuals in Group 1 have a greater than 40% chance (or risk) of suffering a heart attack within 10 years. The same report indicates that individuals in Group 2 have a less than 10% risk of suffering a heart attack within 10 years.
Students solve challenging problems collaboratively and asynchronously, online. (Sakshaug or Warren, 2007 - present)

Linked to **Community of Inquiry** (Garrison); Teaching presence, cognitive presence, social presence

Addresses the why and how of collaborative educational experiences; thinking and learning in a purposeful community of inquiry.

Presence: a sense of identity created through purposeful and open communication
Lesson Content

PROBLEM SITUATION: USING SCREENING TOOLS TO MAKE DECISIONS

In the previous lesson (N.8), you learned how difficult it is to decide on a cut-off value when trying to identify people who may have cancer. There can be benefits to certain cut-off values, but also drawbacks. A screening tool’s sensitivity and specificity can help quantify how effective the screening tool is. In this lesson, we will examine other factors that are important when analyzing the effectiveness of screening tools.

There are a variety of probabilities, or likelihoods, associated with analyzing the effectiveness of screening tools. Specificity and sensitivity are two examples, but there are many others. Describing these probabilities in everyday language can sometimes be very difficult. Doctors and scientists who study screening tools have to be careful about how they describe and distinguish between these probabilities.

When answering questions about a test’s effectiveness, it is important to read each question carefully to determine the right proportion. For example, consider the following two questions:

- Q1: If a screening tool is given to a person without cancer, what is the probability that the screening tool will suggest that cancer might be present?
- Q2: If a screening tool suggests that cancer is present in a person, what is the probability that the individual does not have cancer?

Discussion Topic Question:

Compare Q1 with Q2. Are these two questions asking the same thing, phrased in two slightly different ways? Or, are these two questions asking for different information, and their answers could be different? Explain.
SB: They are asking two different things. Q1 is screening people without cancer, while Q2 is screening people with. Q1 tests more people than Q2. For Q1 936 are tested, while Q2 only 264 are tested. [For 7] My answers were very close. Sensitivity was 20% and specificity was 94% for questions 3 and 4. For question 7 sensitivity is 23% and specificity 94%

SA: I agree that question one is looking at the individuals who do not have cancer. I believe that question two is looking at only those who tested positive for cancer and what percentage received a false positive. What do you think?

SB: My answers changed after realizing I was now looking at the probability correctly. I figured out that for Q1 the probability that the screening tool will suggest that cancer might be present is 5.98%. I figured this out by using the number of people where cancer wasn't present, but the screening test was positive. And for Q2 its a high probability rounded up to 80%. I figured this out by using the number of people where cancer was present and the screening was negative. Does this make more sense to you? If feel like Q2 should have a low probability.

SA: For questions two, I looked at only the people who tested positive for cancer, which was 109. Of the 109 who tested positive, 56 dd not actually have cancer. I divided the 56 by 109 and get 51% rounded.

SB: I see and understand the way you did it. I was using the column under "Cancer is present". I did this because the screening tool is giving to patients with cancer, so I'm seeing that 53 with cancer tested positive, and 211 tested negative. The way your doing it with the columns across, I would use the top row because the question suggests that cancer is present and use 56 which is the number of patients where cancer isn't present. Your way makes more sense to me now. Thank you!

SE: I know I am not in your group, but wanted to chat with a group that is chatting I also got the same values for the sensitivity and specificity that you did. However for Q2 I got 51.4% - I looked at the column where the screening tool was positive, then I looked at how many people did not have cancer - so the total with a positive result was 109, of those 109 people, 56 did not have cancer. I divided 56 by 109 to get 51.4%.

SB: Yes, this is what I did also.
Interesting Points and Positives

● Tutor is trying to support without telling too much.
● Some want to just do online homework: Math as task completion.
● Students are engaged in real-life problem solving.
● Some examples of meaningful dialogue, sharing resources.
● Math majors want to take the course to get their grades up: there is a risk of telling others how to solve the problems
Challenges and Lessons Learned

- Establishing non-mathematical opening norms in synchronous IMs
- Helping instructors to notice opportunities for math-related productive struggle in IMs and how to take advantage
- Instructor/Student turn taking
- Getting students to engage with one another
- Timing of course flow and engagement
- Demanding workload
- Building community with cognitive challenge
Student Comments from Model 2

I think I have learned a decent amount, I know more about math used in different fields that I didn’t prior to taking this course.

I think I’ve learned a lot about quantitative reasoning and how to problem solve more efficiently.

I feel that the discussion boards were helpful at times when other students were struggling with similar problems but at times it was hard to get any feedback.

I am torn on this. When the group chats, it can be very beneficial, but not all the groups are very active so it’s not as easy to stay in touch. It would help if there were a live message option – like messenger or something to alert you when there was a post on the message board.

...in order for me to get a good grade on an assignment I am doing alot of research to find out how to solve a problem and I try my best to get the answers correct before giving up if I am having a lot of trouble of it.

The way the professor has set up the groups. We are able to interact and help each other out. Also, if I reach out to her she replies quickly and provides thorough feedback.

I expected this class to have tutorials or lessons on how to actually solve the problems in the assignments.
Questions?
To learn more, visit our website at:

www.carnegiemathpathways.org

Lewis Hosie
Carnegie Math Pathways,
WestEd

Lynae Warren
Empire State College

This program of work is supported by The William and Flora Hewlett Foundation, the Bill & Melinda Gates Foundation, the Lumina Foundation, The Kresge Foundation, the Carnegie Corporation of New York, the Great Lakes Higher Education Corporation, the ECMC Foundation, and the National Science Foundation’s grant DUE-1322844 and grant DUE-1820830 in cooperation with the Carnegie Foundation for the Advancement of Teaching and WestEd