Description of Proposed Teaching and Learning Strategy

The monthly rent on an 80-square-meter apartment in Monte Carlo is 1150 euros. The monthly rent on a 500-square-foot apartment in Santa Fe, New Mexico, is $800. In terms of price per area, which apartment is less expensive?¹

There’s only one correct answer to this question: the Santa Fe apartment is cheaper (though not by much if you’re considering the move) but getting to the correct answer could be done in any number of ways.

You could, for example:

- Calculate the price in dollars per square foot for both apartments.
- Calculate the price in euros per square meter for both apartments.
- Calculate how many square feet you get per dollar for both apartments.
- Calculate how many square meters you get per euro for both apartments.

In math classes, however, there is a tendency for the instructor or textbook to present one sample solution without regard for the many ways in which students may approach a problem. The result is that students who are perfectly capable of solving mathematical problems feel that their brain is working “wrong” or feel that they don’t belong in a math-based field because they do things differently. Some students will also balk when approaching more difficult problems because their initial approach does not work, and they haven’t trained their brain to look for alternate problem-solving strategies.

In every language or humanities course students take, they engage with the material through reading, writing, and speaking², however, in STEM fields, students have been trained to listen and repeat a specific problem-solving process without discussion. I propose developing a set of best practices for a discussion-based applied mathematics course that will help students build confidence in their mathematical abilities and a set of problem-solving strategies they can apply in many situations.

Using a discussion board or forum, students can propose a method for solving a problem and can explain their thought process to gain a greater understanding regarding how they think about solving problems; this can help both the original student and other students gain insight into different strategies. Alternative methods for solving the same problem could be proposed and the pros and cons of each method could be further discussed. Math and science courses are often considered by students to be memorization heavy and seen as a solitary or independently studied series of classes. However collaboration is key to all STEM fields; students would benefit and learn more about solving problems and how to solve problems through a discussion-based medium and would obtain practice in collaborative interactions essential to STEM.
The students in my online *Quantitative Reasoning* course have already shown that there is indeed a large amount of discussion to be had when focusing on problem-solving strategies rather than just getting the correct answer, and, if funded, I will use this course for the development of best practices.

**Purpose: Impact on student learning, engagement, and retention**

This strategy will help students see math and science problems as approachable and relatable, which is a key factor in student engagement, resulting in better student learning and retention.

In the Spring 2019 iteration of *Quantitative Reasoning*, students were given an online space in which to note where in real life (IRL) they found themselves applying concepts from the course. There were several posts, but one in particular perfectly captured this goal in action:

In the past I have understood, but not truly grasped how curves or weighted grades worked. Usually while calculating my grades, there was always a bit of uncertainty as to whether I was correct. Using the lesson information to calculate my overall grade in another class where professor hadn’t logged any assignments and only handed them back, was super easy this time around. I used the method needed for the 3e quiz question about flight times, and other exercises.

I am a big quotes person. I don’t know who said this, but it comes to mind. “To learn is to know, to understand is wisdom.”

This course has been a unique one for me. Never would I have guessed that a basic math class would help make more sense of my own functioning in the world.

-- March 10, 2019 QR IRL discussion board

**Feasibility**

This can be implemented within any online Learning Management System or discussion board space.

**Application**

This methodology is vital to student learning in all disciplines, but in particular, it is important for students in STEM fields to see that, even in problems with one correct answer, there are *many* right ways to get to that answer.

**References**
