

## College Algebra (MATH 1111) Course Redesign at South Georgia State College

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Mathematics, an important, beautiful subject in which one learns how to think logically, needs purpose and relevance. Increasing DWFI trends in College Algebra warranted a course redesign to foster an appreciation of mathematics, improve motivation, and encourage more student engagement. Bi-weekly discussion boards about math, watching math movies and “creating and/or finding the mistake” critical thinking tasks were assigned in addition to MathLab. The course became purposeful and appealing, and accommodating to students with diverse learning styles. Positive feedback revealed purpose and enjoyment from the new tasks. Student engagement improved and more successful learning outcomes occurred than with MathLab assignments alone.

### STATEMENT OF THE PROBLEM

DWFI rates in College Algebra (MATH 1111) are consistently concerning every semester. Whether face-to-face or online, students report challenges to success including work hours, family commitments, health, time-management, learning disabilities, and motivational factors including the lack of purpose behind taking math in college.

Over the last several semesters, one common theme that has emerged from informal conversations with students in my MATH 1111 classes is that although MathLab, the homework platform in the class, is user-friendly, it is perceived as purposeless busy work lacking relevance to their lives at this point in time. Because many students in my classes admit that math is often neither liked nor perceived to have relevance to their life or career, the course falls to the bottom of their list of priorities. As a result, assignments do not get completed on time and in some cases, get put off indefinitely until the end of the semester with the intent to start working on them all at once, setting up the unsuccessful outcome scenario. Many also feel math is not their strong point and do not persevere because they just do not see the purpose of spending endless hours working on problems that cause stress and endless struggles. This case study documents the approaches taken to help students see the beauty and relevance in mathematics through the redesign of my MATH 1111 courses, focusing on fostering an appreciation of mathematics, improving motivation, and encouraging more student engagement in the course.

### METHODS

As a first step in the course redesign process, I implemented tasks in Desire2Learn (D2L) that invoked communication between peers and imparted knowledge about math in the world. Tasks included bi-weekly discussion boards, critical thinking tasks, movies to watch about math, guided movie notes to submit as homework, and corresponding movie quizzes.

Discussion post topics included: introductions with a short self-made video; find the mistake simplifying rational exponents; sharing movies about math; how math is used in their everyday lives; prove that  $2+2=5$ ; describe prominent mathematicians, create, and share the mistake(s) such as with order of operations or use of the quadratic formula. Each student had to complete at least 2 others.

A variety of contemporary movies and videos with specific math references were also incorporated into the course, including the following: Teletubbies Animal Parade; Pixar Movie; Love Yourself, Justin Bieber; Quadratic Formula Cup Song; Abbott & Costello, 7 into 28; Ma & Pa Kettle, 5 into 25; and Sonic Geometry.

Finally, I created critical thinking tasks using an iPad with video to concoct math problems that contained mistakes, with solutions later written out and explained. Students watched the videos, found the mistake(s) then wrote up their perceived correct version of the problem. Tasks associated included simplify fractional exponents, prove

that  $0=1$ , and solve a radical equation. These tasks culminated in a more challenging assignment that required the students to create their own math problem which contained a mistake. Specifically, for this assignment, students recorded themselves solving the problem and then they uploaded both the video and .jpg or pdf file into a discussion post. This assignment, in particular, generated meaningful and interesting discussions in the class and helped students feel more connected to the course content and to each other.

## OUTCOMES

An end of course survey created in D2L, completed in Fall 2019 and Spring 2020, captured feedback about the new discussion boards, videos/movies, guided movie notes, quizzes, and critical thinking tasks. Over 90% of students responded favorably to the variety of tasks, vs. MathLab assignments alone. Specifically, students reported that the tasks were appealing and easy, they felt more engaged in the course with the discussion boards, they learned more about math without working out math problems, and they appreciated how these activities and assignments contributed to their overall grade in the course.

The discussion posts were designed to facilitate communication while fostering a sense of connection and engagement. Though they were open for two weeks at a time, some students did struggle to manage discussion participation, and some forgot to post altogether. Moreover, there were several instances in which posts were made only 2 hours before the discussion board closed on Saturday evenings, which did not leave ample time for discussion. Overall, though, students in the class liked getting to know their classmates and finding out many interests they shared in common.

Students also reported having learned more about math by watching the movies or videos and thought the guided movie notes helped them keep engaged, alert and focused on the task, helped them to organize the content and key points, and helped them remember what they watched in order to successfully pass the quizzes and discuss the content in some discussion posts. Some indicated they liked seeing how math is used in real world scenarios, and how math is even used to make movies. Many stated they appreciated the movie study guides as homework assignments because these were easy to complete, provided connections to the real world, and opportunities for long-term learning.

The critical thinking tasks that involved creating and finding the mistake(s) were challenging yet engaging. Students sometimes reported no mistakes, even in instances where there were several visible mistakes. With this exercise, there were times students sometimes felt intimidated, lacked confidence, and were afraid of thinking they found a false error. Interestingly, when they created a problem containing a mistake, then provided the correct version, sometimes the correct version had new mistakes. This suggested that their basic algebra and critical thinking skills were still being developed, which evoked further rationale for such important critical thinking exercises. The “find the mistake” tasks were reported as difficult at times but enlightening to discuss the potential mistakes in the forums as ideas could be exchanged with peers.

While students completed the required MathLab assignments, they thought the D2L tasks made the course more interesting, promoting more meaningful, long-term learning about math than with MathLab alone. They also felt hopeful about still passing the course even without scoring well on some MathLab assignments. For some, this was their second attempt at taking MATH 1111, which made it even more important to find opportunities to convey enthusiasm for and engagement in the course and the subject overall.

## PLANS FOR CONTINUATION AND EXPANSION

A continued exploration into the underlying causes of DWF1 rates could reveal opportunities for embellishing the curriculum and updating the course objectives in order to address the needs of students learning math in this current decade.

Given the favorable student feedback from informal conversations and online course evaluations, the current redesign approaches will be continued in MATH 1111 and piloted in math modeling, pre-calculus, calculus, and statistics. While MathLab will still be used for skill and mastery, discussion posts will be used to promote dialogue and critical thinking, and movies will impart more interesting applications of math.

A hybrid flipped-classroom model for discussion posts could be implemented in the future, whereby students select movies about math and then compose their own movie study guides and quizzes to use. The collaborative group component and leadership opportunities could potentially constitute a high impact practice for the course and momentum initiative.

The critical thinking tasks, find the mistake(s), will be developed, and implemented into all bi-weekly assignments. The best impact would be for students to design the problems with mistakes and have their peers analyze them. Problems could range from such as solving for a variable to rational exponents or more complex log or exponential equations. Students could either present the mistake and a correct solution at the whiteboard whereas online, they record a problem-solving video with their phone to record themselves and upload the clip into D2L. Rubric-guided instructor and peer feedback could be provided.

## LESSONS LEARNED AND POTENTIAL IMPLICATIONS

Enhancing the course with some enjoyable tasks improved engagement, dialogue and motivation. Discussions and movies were perceived to be relevant to the real world and fostered an interest to connect virtually with peers. The two-week open discussion intervals were often completed in the last 10 minutes of class. Hence, future discussion posts will be assigned so the post occurs the first week and replies during the second along with detailed expectations of the quality regarding the replies.

The critical thinking tasks involving peer analysis of mistakes made by others, while perceived as more challenging, fostered original thought, creativity, and the ability to elicit judgements. Along with improved course grades, student feedback on this course redesign was important with considering future course envisions. Students like to partake in opportunities to voice what they find meaningful, purposeful, and useful in a modern world math course to keep them interested and motivated enough to want to engage in more in the course.

An important implication is that updating the course objectives for college algebra could be on the horizon. For example, objectives could include the following: develop an appreciation of the quantitative tools used to present, understand, and explain issues arising in the media and in students' daily lives; heighten oral and written communication skills of mathematical ideas to foster expressing quantitative evidence in support of an argument or purpose; and strengthen the ability to judge and draw informed conclusions. Finally, these objectives added to current course objectives could provide the motivation and perceived purpose for more meaningful, successful learning outcomes.