Rebecca Machen – SASC Mathematics Program Coordinator
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Increasing success of diverse students in STEM majors through the improvement of college algebra materials

Objectives:

- Enhance the curriculum with inclusive content, specifically focusing on representing people of color, women, and non-binary persons
- Implement new technology
- Create self-assessment placement process

SASC's Fall 2017 section of precalculus (MATH-1150) achieved its goals of enhancing the curriculum, implementing new technology, and creating a self-assessment. In Summer 2017, a senior instructor was hired to develop precalculus on a new online platform and with a new textbook. The instructor created a self-placement exam for students to take on the first day of classes and again during the second week after a week of review. This was an essential piece to the project, because CU no longer requires students to take a placement exam for mathematics courses; instead, there is a predictive algorithm used for placement purposes based on the student's prior math performance. The exam was administered on August 27th and September 1st. Following the second exam, students were given information about switching into College Algebra (course prior to precalculus) and Calculus (course following precalculus) based on their scores and comfort with the material.

Over the course of the semester, more inclusive content was added to the course, primarily through the creation of problems in the online homework system and through in-class worksheets. The instructor also used new technology, clickers, to informally assess student knowledge on topics covered in the lecture. The use of clickers in small class sizes (< 20) is new to SASC, and instructors have decided to implement this practice in their other courses for the spring semester.

Assessment Plan

- Compare past semester data on course performance
- Measure student persistence by analyzing year-long performance (will provided update in May 2018)

Based on the analysis from past semesters, student performance, as determined by final grade in course, was nearly identical to the prior fall semester. In Fall 2016, students in SASC's section of MATH-1150 Precalculus had an average course grade of a 2.49; Fall 2017, the course average was 2.46.

The slight difference in grade performance could be attributed to several factors, such as the change in textbook and homework software, the change in instructor (Fall 2016 – senior instructor, Fall 2017 – new instructor), the small population sizes of the SASC precalculus

classes, the change in mathematics placement practices at CU, and the level of preparedness in first-year students.

Based on semester grade data, the preparedness of first-year students in precalculus may be the strongest reason for the difference in final grades. Since SASC made significant changes in how precalculus was taught from Fall 2016 to Fall 2017, main campus grades were analyzed; there was a 0.585 difference in final grades from Fall 2016 to Fall 2017, which could support the notion that first-year students in Fall 2017 were less prepared than Fall 2016.

The results, when considering the noted differences in the Fall 2016 and Fall 2017 semesters, could suggest that the use of technology, addition of inclusive content to the curriculum, and new self-assessment had a positive impact on student success, assuming that SASC's first-year students were less prepared Fall 2017 than in Fall 2016. The SASC math program will continue to utilize the technology (MyOpenMath) and self-assessment, as the slight difference in grades is not strong enough to cause a reversion to the prior model of instruction and assessment. SASC will monitor subsequent final semester data to ensure the changes are supporting student success.

Broader Impacts

- Share results with MATH, APPM, Discipline Based Educational Research (DBER) group, Gold Shirt Engineering Program, and Miramontes Arts and Sciences

Regarding the impact with the Math department, SASC was able to recruit the Math Undergraduate Chair, Nat Thiem, to attend a one-day seminar on inclusive pedagogy in the classroom. The seminar focused on the five dimensions of multicultural education: inclusive content, metacognition, classroom climate, inclusive pedagogy, and inclusive excellence. Information about the use of technology, clickers, and the new online platform, My Open Math, will be shared at a meeting this spring with the coordinator of precalculus.

An unrelated but notable broader impact that has resulted from this project is that this project supports CU's interest of using Open Educational Resources to enhance the student experience and reduce cost. Students in precalculus with SASC were not charged any fees for their textbook, online homework system, or self-assessment since the course utilized My Open Math. This reduces the costs to students by $240.

Next Steps

- Future Assessment Plans
- Implementing the changes in other SASC math courses
- Improving the use of the Open Education Resource

The last analyses will be completed after Spring 2018 and will measure student persistence rates through the sequence and major choice at the end of the study. Since the project has an assessment piece that cannot be completed until after the spring semester, presenting at DBER will happen next fall. I plan to personally invite faculty from math, engineering, and applied math to attend the presentation.

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The SASC math program has already begun to implement practices from this course into other courses, like Calculus and College Algebra. The calculus faculty will use clickers for informal assessments and have created a self-assessment using MyOpenMath. College Algebra is only taught once per year in SASC, and in Fall 2018, the faculty member will utilize all of the precalculus materials for the course (technology, software, self-assessment).

The week before the Fall 2018 semester begins, SASC math faculty will be expected to further develop their courses in MyOpenMath and make tweaks in the self-assessment exams. Specifically, there is a coding feature in MyOpenMath that allows faculty to fine tune problems to include different features (graphs, specific functions, videos), and this will be the main focus during this weeklong training.