Just-in-time Interventions in a Quantitative Reasoning Course
— Melisa Hendrata, Eyob Demeke and Suzanne McEvoy

As we continue to live in the age of big data, quantitative literacy becomes an essential skill for every college graduate to acquire. In many institutions, General Education (GE) math courses such as college algebra are the terminal math course for many non-STEM students. However, more often than not, students in GE math courses, especially the non-STEM majors, wonder when, if at all, they would be able to use the algebra knowledge they have gained from these GE math courses. We would like to tell you how we redesigned one of our GE math courses and employed several intervention programs to improve student success.

The math department at Cal State LA recently redesigned one of its GE math courses, Quantitative Reasoning in Today’s World (Math 1000), to respond to the above question and also to comply with the California State University (CSU) Executive Order 1110 that eliminated developmental math across the CSU system effective Fall 2018. Math 1000 is taken by non-STEM majors and covers a wide range of topics that conspicuously show the critical role math plays in society. Students who are underprepared and would have required developmental math will enroll in a mandatory support course.

The redesigned Math 1000 engages students in learning how percentages are used and abused, the power of compounding (saving plans, investment, loan payments, credit cards, mortgages), statistics, and voting theory. Math 1000 students are also required to complete two signature assignments: a short essay on the role of math in their respective major and an Excel-based project where students are required to collect data, analyze it, and then write a reflective essay based on their analysis. One of the Excel-based projects provides students with an opportunity to investigate the cost of time-to-degree (e.g., what is the financial consequence of delaying graduation by a few semesters?). All Math 1000 sections are coordinated by Eyob Demeke, who developed the common course syllabus, pacing guide, exams, and led bi-monthly meetings with Math 1000 instructors.

Smart Start
Cal State LA has a historically high number (52%) of entering freshmen who are underprepared for college-level math coursework. They come from under-resourced urban high schools, where 64% come from low-income families, and 45% are first-generation college students. For many of them, GE math requirement is one significant barrier to overcome in the first year of their undergraduate career. The intervention programs that can promote student success are indeed necessary.

Cal State LA Smart Start is a program designed to provide academic support for first-year students. In the past years, Smart Start had successfully developed the Supplemental Instruction (SI) for a developmental math course in which the pass rates of SI students were consistently higher than the non-SI students. Following the changes in the structure of the first-year math course, Suzanne McEvoy and Melisa Hendrata designed and implemented several intervention programs run under Smart Start: Math Early Alert, group advisement, and SI.

Math Early Alert. Math Early Alert is an academic support system that allows instructors to identify “students of concern” who may benefit from group advisement or academic support. Instructors respond to surveys about student progress three times, called checkpoints, during the semester. The survey for the first checkpoint was given early in the semester (around week 3) in an attempt to catch behavior issues before they evolve into academic issues. The next two checkpoints occurred a week after each exam. Attendance issues, incomplete assignments, or unsatisfactory performance on quizzes/tests are considered indicators of students’ risk of failing the course. The students who were indicated as being “of concern” by their instructors were then contacted to attend group advisement and SI sessions.

Group Advisement. Almost all students in Math 1000 were first-time freshmen. For many of them, especially those who are first-generation college students, the transition from high school to college is challenging. During group advisement sessions, students met with Smart Start advisors who gave them guidance in time management, developing good study habits, and directed them to SI to improve their performance in the course.

Supplemental Instruction. Supplemental Instruction (SI) pedagogy is based on the concept of a small group, hands-on, active learning in a collaborative, supportive, friendly environment. SI leaders use strategically developed worksheets and questions to help lead students through group discussions to greater conceptual understanding.
Although Math 1000 comes with a support course that covers just-in-time algebra, students are not necessarily able to see the connection and apply these skills in their Math 1000 course. The application-oriented nature of Math 1000 topics requires students to be able to understand the problems, break them down into steps, and apply the algebra skills to solve it. This is indeed where SI pedagogy plays its role in bridging this gap.

Worksheets and SI activities include problems with various complexity. The following are typical questions in this course:

You want to purchase a new car in 3 years and expect the car to cost $30,000. Your bank offers a plan with a guaranteed APR of 5.5% if you make regular monthly deposits. How much should you deposit each month to end up with $30,000 in 3 years?

Suppose that you are 38 years old now, and you would like to retire at the age of 65. Furthermore, you want to have a retirement fund from which you can draw an income of $54,000 per year—forever! Assume an APR of 6%, both as you pay into the retirement fund and when you collect from it later. How much do you need to deposit each month to reach this goal?

Students who needed to review basic algebra were given preliminary exercises involving order of operations, percentages, and exponents, before attempting to solve the above questions.

The SI leaders are facilitators who encourage collaboration and discussion among group members to help students gain a better understanding, as well as the ability to use their reasoning and algebra skills to tackle such complex problems. Typically, SI sessions are conducted either before the content course, or directly after. Because of the high number of Math 1000 sections, the SI sessions are held in the form of an open workshop that runs two days a week from 9 AM–5 PM. Students from any Math 1000 section could voluntarily attend any SI sessions. As the number of students in SI sessions could vary from hour to hour, the SI leaders must be flexible in using techniques that work best. Think-pair-share was one of the most used techniques when there were only a few students, while group discussion was employed when a larger group of students were present.

Results and future improvement

In fall 2018, faculty responses in Math Early Alert surveys indicated a total of 180 students (out of 503 students enrolled in Math 1000) were at-risk of failing the course. Although all of these at-risk students were contacted via email by Smart Start for advisement, only 54 students responded and attended SI sessions. The bar graph shown below compares the performance of SI and non-SI students in fall 2018 semester. The SI students passed the course at a higher rate (92%) than the non-SI group (66%).

Although the result from our first semester is encouraging, we realize that
more work needs to be done to increase SI attendance. In the past, mandating SI attendance for developmental math students, and mandating attendance in calculus workshops for at-risk students as done by our math colleagues [MAA FOCUS vol. 28(5), May/June 2008], have proven to be very effective in improving overall pass rates in these courses. For the upcoming academic year, we are going to look into policies pertaining to mandatory attendance in SI sessions for academically at-risk students who are taking Math 1000.

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