Math1010: Progress Report Emina Alibegović

The University of Utah demands of all of its graduates to complete a course that will fulfill a quantitative reasoning requirement. Depending on the students' concentration, this requirement may be fulfilled through courses taken during freshmen year as they prepare for the courses necessary for their major, or it may be a course students postpone until their junior or senior year. Math1010, Intermediate Algebra, is the course that is intended to prepare the students for a successful completion of Math 1050, as they prepare for Calculus, or Math 1030, which is a terminal mathematics course.

In order to improve students' performance in this course as well as their preparedness to take subsequent courses, we have implemented several changes over the course of the past few years. We outline some attempts at changing the classroom structure, and the results we have seen.

- Flipped classroom: The students are asked to view the instructional videos and work through the problem sets before coming to the classroom. Classroom time is then devoted to resolving the questions students have through new sets of problems which are more challenging than the ones they had encountered previously, and then extending that understanding to application-level problems.
- Audience response systems: In order to encourage active engagement with the material and in class, we started using clickers which allowed the instructor to check students' understanding in class, offer immediate feedback on success with a given problem and address problems which proved challenging for majority of students.
- Online sections: These sections have experienced similar changes in the same time frame. The instructional videos we mentioned above were made for the improvement of online sections originally. They were supported by problems sets, notes, and discussion forums embedded in the Learning Management System.

We noticed positive changes in the students performance in the large sections (larger than 50) in which these were implemented. The table below shows results we observed through Spring of 2014. In the following table S will stand for small sections (50 students or fewer), L will stand for large sections, and O will stand for Online sections.

	Average pass rate (C) in %			Average pass (C-) rate in $\%$			Average GPA		
	before F11	after F11	Δ	before F11	after F11	Δ	b F11	aF11	Δ
S	67.60 ± 13.13	72.08 ± 10.66	4.48	72.42 ± 13.25	75.24 ± 11.22	2.82	2.47	2.53	0.06
L	69.08 ± 9.06	76.55 ± 8.25	7.47	73.55 ± 9.34	79.65 ± 7.02	6.10	2.48	2.64	0.17
Ο	48.30 ± 8.57	64.95 ± 5.09	16.65	53.88 ± 9.24	67.09 ± 4.31	13.21	1.96	2.33	0.37

	D rate			E rate			W rate		
	before F11	after F11	Δ	before F11	after F11	Δ	before F11	after F11	Δ
S	12.09	10.20	-1.89	18.02	15.64	-2.39	8.67	7.79	-0.88
L	10.08	9.92	-1.01	15.85	10.73	-5.12	6.21	3.60	-2.61
Ο	13.94	12.23	-1.71	32.19	20.68	-11.51	14.01	7.98	-6.03

Let us take a closer look at the students who did not pass the class:

After observing several instructors, it became obvious that the instructional methods we are advocating are not used as intended. Majority of classes are still operating on a traditional, lecture model. The clickers are used to collect attendance instead of serving as a tool to improve instruction. Students are not engaged in ways we are asking them to. Small sections show no progress at all, and are not performing better than the large sections, which would be natural to assume. In the past semester we have started implementing the following changes:

- 1. Textbook: current textbook does not reflect the order or the manner in which the material is presented. In addition, it seems to encourage the lecture style instruction. To mitigate this we started a move to new materials. The instructors of the course have created a workbook whose goal is to increase students' problem solving skills and ensure engagement in the classroom. The materials have been piloted in three sections in the fall of 2013 and spring of 2014. A separate table for these sections will be shown.
- 2. Small sections are asked to use clicker technology as well as new materials. These changes have not been instituted completely yet.
- 3. Community: utilize discussion sections of canvas course to improve collaboration between students in and outside the classroom. This component of the courses needs to be strengthened. The new textbook's publisher is working on an environment where this type of engagement can be easily implemented and monitored.
- 4. Instructional strategies: the instructors are asked to engage in type of instruction they are not familiar with. Even though the philosophy and strategies have been shared in collective meetings, it is clear that the additional support is necessary. During the spring semester a group of instructors has been meeting regularly to discuss issues and progress, to collaborate on writing exams and homeworks. These meetings will continue in further semesters.

Section	Average Pass w C	Average Pass w C-	Average GPA	D rate	E rate	W rate
all	73.51	76.82	2.54	9.47	13.71	5.35
S	74.37	75.62	2.49	8.57	15.81	9.09
L	75.48	78.35	2.54	10.08	11.56	4.28
0	62.95	64.82	2.24	10.35	24.83	9.54

Here are the complete results from the Fall 2013 and Spring 14:

In the following table we segragate the large sections according to the materials and methods employed:

Section	Average Pass w C	Average Pass w C-	Average GPA	D rate	E rate	W rate
all L	75.48	78.35	2.54	10.08	11.56	4.28
traditional	80.44	81.67	2.69	9.42	8.90	4.40
new	71.35	75.59	2.41	10.63	13.78	4.19

After considering the results presented in the last table, it may appear that the traditional sections are more successful than the new ones. Results we have collected through the departmental final exam make us cautious about drawing such conclusion at this time. We are in the process of collecting data tracking the students success in the subsequent mathematics courses which may help understand the situation more clearly.