**Adapting the Assessments for a First Mathematics Course for Elementary Education Majors**

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> "*…the true creator is necessity, who is the mother of our invention*." – Plato, *The Republic*

## Introduction

In this paper, we will discuss how assessment adjustments were made in a mathematics for elementary teachers course at a large public university due to the Covid-19 pandemic. The course discussed is the first of a two-course sequence designed to prepare future elementary teachers in the mathematical principles and processes underlying mathematics instruction in grades K-8. The major content areas of this course are operations (addition, subtraction, multiplication, division) within various number systems (whole numbers, integers, rational numbers, and real numbers); ratio and proportional reasoning; problem solving and algebraic thinking. The course is typically taught in a face-to-face format, with students spending much of their class time working either in small groups or alone learning mathematical ideas through a discovery-based approach. Students communicating mathematically within these groups and among the whole class is a key component to this class. During the class time, instructors spend most of their time formatively assessing the students, offering guidance where necessary, but rarely lecturing to the whole class. Summative assessments typically follow traditional paper-and-pencil methods of testing, along with homework assignments and quizzes given approximately once per week.

Of course, all of this went by the wayside in mid-March 2020 due to the COVID-19 pandemic. Originally, our university speculated that it would only be about 2 weeks before the students returned to their face-to-face classes; however, it became readily apparent that this would not be the case, and the courses were designated to be at a distance for the remainder of the semester. What follows is a description of the way the assessments were changed by one of the authors of this paper to meet the sudden change of instructional methods in her course. We share these adjustments in a way that extend beyond this mathematics course and even beyond the field of mathematics. The ideas presented here could be helpful for anyone who teaches an interactive course that is typically face-to-face and is now either remote or hybrid.

## Changes to Course Delivery

Given that all face-to-face courses were cancelled, the choices to deliver the course materials came down to two: the course could be offered in a synchronous environment, where students could "attend" class by logging into a communications system such as Zoom or Collaborate Ultra; or the course could be offered in an asynchronous environment, where no set meetings would be held, but all course materials would be available in a Learning

Management System (LMS). The choice of an asynchronous environment over a synchronous one was done for several reasons, but these were the primary reasons:

- Fewer time constraints. In an asynchronous environment, students can work on course materials when they have time. Without knowing each student's life situation, it seemed inequitable to require students to attend synchronous lectures. Students from poorer backgrounds who may have had limited computer or internet access would have been put at a disadvantage in a synchronous environment. Along the same lines, some students had to work (their parents lost their jobs), and they would have had to drop the class had the course materials been delivered in a synchronous environment when they were to be at their job.
- Fewer location constraints. For those students who did not have internet (or good internet) access at home, they could go to other locations to access the course materials. The authors heard stories of how some students would drive to local fast-food restaurants or even local schools to access their Wi-Fi to download the materials. Had they been forced to attend a class synchronously, it might have been more difficult.

  It should also be noted that 'office hours' per se were not scheduled in this redesign for the same reasons as above; if students had questions, they were told to email the instructors at any time, as opposed to waiting for a certain day/time in order to ask those questions in a synchronous office hour. Each class has a Teaching Assistant who held virtual, synchronous office hours weekly, but no students attended these office hours.

**Changes to Assessment**

In the place of class meetings, weekly class notes were created containing all necessary materials. These included definitions (usually with blanks for the students to fill in various terms), videos, activities, projects, etc. According to the syllabus, a portion of the assessment for the course must be attendance. To accomplish this in an asynchronous environment, students were given full attendance points for completing and turning in their weekly class notes.

For homework and quizzes, the students switched from paper and pencil to work in the MyLab Math (MLM) environment. MLM is an interactive online homework and tutorial system. It has several features that assist students in learning the content, including videos, a textbook, and help buttons that would allow students to view an example of a problem being done (called View an Example), or a step-by-step solution to the problem, with the student typing in key components in the steps (called Help Me Solve This). Students were allowed several attempts on both homework questions and quizzes to allow for mastery of the content. In addition, because of the COVID-19 crisis, the students could access MLM at no additional cost to them as they had already purchased a hard copy textbook from the same publisher. A new part was video homework: students watched videos in the MLM learning environment of children

solving math problems or teachers explaining teaching mathematics conceptually, then answered questions pertaining to the video just viewed.

In the traditional class, the tests were given during class time on specified days and were timed tests. In the redesigned class, tests were given in two parts. One part was a test created in MyLab Math; this test was timed, partially because students were completing their tests in an unproctored environment, so it was thought that having a time limit on it would help discourage dishonesty. The test was created with pooled questions, so MyLab Math chose each test question from a pool of questions and then generated different numbers for each question. Students had three days to complete this portion of the test. The second part of each test was a written portion, consisting of challenging, high-level questions that required deep explanations on the part of the students to complete. Students were given several days to complete this portion of the test. Students could use their available course resources (the textbook, weekly class notes, etc.) on both portions of the test. While these assessments were more authentic at evaluating student understanding of the content, they were extremely time-consuming to grade.

General findings from the spring:

| | Midterm Grades | Final Grades* |
|---|---|---|
| A | 13 | 13 |
| B | 21 | 18 |
| C | 15 | 18 |
| D | 9 | 6 |
| F | 2 | 5 |

*Included are 4 students out of 60 who did not complete the final exam which constituted 25% of their final grade.

The average homework scores in MyLab Math improved for 71.6% of the students. Students could work on homework until they had it correct and could work on late homework with a penalty until the end of the semester. 31.6% of the students improved their average quiz scores in MyLab Math. Quizzes in class were 1-2 paper-and-pencil questions and MLM quizzes were 10 questions.

Student comment: "*I am grateful for all the work you have done to transition your class to online. It is one of the only classes that I feel like I am still getting relatively the same amount of content in. The videos are fun too, thank you for taking the time to find them! Wonderful job!"*

**Continuation this Fall**

The fall semester began as the previous spring semester had ended, with students not attending class face to face. However, there have been some mandated changes; teachers were

directed to teach all their classes in a synchronous environment. This will continue to some degree once students are allowed to attend their classes face to face. Some students will continue to attend class virtually for the entire semester, as they have been given permission to do so. For those that will attend face-to-face, due to COVID-19 social distancing measures put in place at the university, only a fraction of the students can attend the course at any one time, with the rest of the class population attending synchronously online.

However, even given these changes (or perhaps even because of them), the math for elementary teachers' course will continue to use many of the measures from the redesign of the course in the spring semester. MLM will continue to be used for homework and quiz assessments, as well as being used as part of their summative exams. Weekly notes will continue to be given and collected, used as part of their attendance grade.

**Conclusion**

For years, we have been programmed to assess students in very traditional ways (namely, pencil-and-paper exams/quizzes). The Covid-19 pandemic has taught instructors some lessons in assessments. In this transition, we as an instructional team have branched out in our assessments. We are now using more automated homework and quizzes. These assessments provide both flexibility and immediate feedback for our students. We have also been forced to think deeply about our exams (both in terms of exam format and types of exam questions). In doing so, we may be inadvertently serving our students educational needs better. While they now have outside resources at their disposal, the questions being asked on their assessments are requiring higher levels of thinking and communication

We realize this is not the end of a changing educational system. Instead, it is the first of many ways our eyes are opened to different types of assessments that meet our students where they are rather than imposing on them our dated assessment system. We challenge all our readers to do the same.

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