

A Pilot Program Using an ebook and Online Homework in the Calculus Sequence

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Abstract: We will report on our pilot program using an ebook in our calculus sequence for science and engineering students. We will provide examples of how we used the information revealed to modify and assess the course.

The Pilot Program:

Several changes were made in the Fall of 2012 in our calculus sequence for science and engineering students at Manhattan College. We decided to introduce early transcendentals for the first time. We chose Early Transcendentals by Briggs, Cochran and Gillett and agreed to use the accompanying ebook together with its online homework capabilities. We agreed to have our first common final exam. This meant that for the first time we would have to make a decision about using technology as a group.

This paper will report on our pilot program using this ebook with its online homework capability in our calculus courses. We will provide examples of how we used the information revealed to modify the course.

The Beginning:

From the beginning we realized that it was important to listen to the students' voices. We tried to create an atmosphere where the need for conversation was stressed. We also realized that we needed to be explicit about the reasons for our decisions. We began by asking ourselves what we wanted our students to be able to do. We looked at this exercise as a mission statement for the class. The list included:

- We are trying to have students do mathematics on their own.
- We want students to be able to try a problem and if it is not right then try again.
- We want students to get the exact answer.
- We want students to ask questions on what they don't understand only after they have tried the problem on their own.
- We want students to visualize the mathematics.
- We want students to do homework consistently.
- We want to spend less time in class doing trivial problems.
- We want to take the burden of homework problems off the teacher and put it on the student.

Preparation is Important:

We began the process in the Summer of 2012. During this time, we created MyMathLab accounts. We created a practice MyMathLab course and created the first homework assignments. We did the assignments as students would do them. We learned how to read the ebook and use its interactive figures. We collaborated with each other. We sent introductory letters to students explaining what to buy and how to sign in to the course so that they would be prepared to begin calculus I.

During that summer we also made decisions about what features of MyMathLab we would use. We decided to use the interactive features in class for demonstration. We would require that homework be either submitted hard copy or submitted online. We would continue to have class one day per week in the lab where we could use the computer algebra system Maple or MyMathLab.

Lessons Learned During Semester I:

When sections of the east coast were affected by Superstorm Sandy, we realized that the students needed a hard copy of the book and the assignments. During the semester, when we had hardware problems in the classrooms, we realized that the interactive figures in calculus I were better when used by individuals rather than as part of a classroom presentation. We learned that everything takes longer at least the first time around. For example, we spent hours creating homework assignments and doing them as students.

It is important to stress that this endeavor was not a part of a grant. It was simply a departmental decision to adopt this book and use the online homework. As a result, different teachers approached the course in different ways. These different approaches were welcomed. Some teachers made online homework mandatory. Others allowed students to hand in hard copy. Some counted homework grades in the final average. Some gave quizzes on homework questions. Some were strict with access timelines while others let students do homework up to the test date.

Our First Survey:

This was given at the end of the first semester. We asked each student to answer rather general questions about their experiences in calculus I. Each student had used the ebook and its online homework system for one semester.

- **How many hours per week did you spend on:**
 Reading the text 1.5 hours Doing the homework 2.9 hours
- **Did you use the online version of the book, the paper version, or both?**
 Online 19% Paper 27% Both 31% Neither 23%
- **Did you find the online homework helpful ?**
 Yes 91% No 9%

It was particularly interesting that 23% of the students answered that they used neither version of the book when “neither” was not an option. We also realized that a much more detailed survey was necessary.

Our Second Semester—Calculus II Spring, 2013:

We began this semester by sending out a welcome letter to the students explaining what to do to access MyMathLab for the second semester. We had some frustrating difficulties having some students access MyMathLab, but these problems were remedied by our textbook representative. Once again, we suggested that students use the online homework but allowed them to hand it in. We compared their homework grades with their test grades and showed our students the high correlation being doing homework and getting passing grades in the course. We created a more thorough survey and decided that we would give the survey at midterm and share the results with our students.

Our Second Survey:

This was given to our students at midterm time in Spring, 2013. We gave far more detailed questions. We asked our students for their help in determining whether or not we should continue using the ebook and online homework. We gave several minutes at the beginning of class to complete the survey.

- **Did you use the online version of the book while studying?**
Never 46% Sometimes 39% Often 6% Always 9%
- **Did you use the paper version of the book while studying?**
Never 14% Sometimes 43% Often 27% Always 16%
- **In the online version did you use the interactive figures?**
Never 25% Sometimes 33% Often 29% Always 13%
- **Did you use graphing calculators to answer homework questions?**
Never 11% Sometimes 48% Often 30% Always 11%
- **Did you use the online homework to review for exams?**
Never 11% Sometimes 25% Often 39% Always 25%
- **Did you just guess on the online multiple choice questions?**
Never 32% Sometimes 61% Often 3% Always 4%
- **Did you keep the work you did for the online homework to use later?**
Never 11% Sometimes 32% Often 23% Always 34%
- **Did the online homework prepare you for the exams?**
Never 0% Sometimes 25% Often 39% Always 36%

- **How many hours per week did you spend on:**
Reading the text 1.4 hours Doing the homework 3.9 hours
- **Should we continue to use the online text?**
Yes 70% No 30%
- **Should we require the homework to be submitted online?**
Yes 61% No 39%

The students were then asked to elaborate about their reasons about either using the online homework system or discontinuing it. Selected quotes follow.

Why don't you want to use the online homework system?

- It's just easier to use the paper version.
- I learn better with more tangible work. Homework should be done on paper, collected, and gone over in class.
- The homework should be submitted by hand. Math should not be done on a website.
- Often a computer is not readily available to me and so it limits the time I have for homework.
- There is no motivation for doing the homework. There is nothing to physically submit.
- Don't require it. Let the student hand it in if they want.

Why do you want to use the online homework system?

- If you get stuck it will help you solve a problem similar to it.
- Having the help me solve it button and similar exercises helped me figure out the problem on my own without having to wait until the next day to ask.
- Teaches how to do any problem and with unlimited answer system, optimizes chances to earn higher grades.
- To make sure each student is keeping up with the material and practicing.
- It is simpler this way, easier to grade, and it is up to the students to understand the material.
- The questions were challenging and were great for review.
- It provides immediate assessment.
- It was probably the most helpful program I have ever used because it helped teach me how to do some of the problems.
- It benefitted me because I was able to do questions and get them corrected immediately.
- It provided interactive answers along with allowing for similar exercises to be answered if any question was answered incorrectly.

We then asked students to tell us what they liked best and least about the system, regardless of whether they wanted to continue to use it or not.

What did you like best about the online homework system?

- It provided interactive answers along with allowing for similar exercises to be answered if any question was answered incorrectly.
- The direct feedback.
- The “view an example” button.
- The explanations and that you could keep doing similar questions.
- It solidified my understanding of the topics.
- The step by step guide to how to solve a problem.
- There was immediate help if you needed it. It actually made you do the homework. I never did homework before.
- The unlimited tries made it pure practice, like it should be. It motivates you to keep trying until you get the question right.
- The examples gave me a great idea of how to do and understand certain problems.

What aspect did you not like?

- That some questions provided no help.
- Some of the numbers were very messy.
- If your answer is in the wrong form, it is marked wrong.
- No flexibility in the answer.
- Getting the answer wrong because of a small mistake.
- It was very time consuming to type in answers and frustrating when you made a mistake.
- That sometimes it had to be in a specific algebraic form even though the answer was equivalent.
- When it freezes and you have to start all over.

It was overwhelmingly the case that when students talked about learning the material using the homework as a tool, they were enthusiastically in favor of the online system.

Our favorite quote:

- I found the online homework a little pointless at first because you could guess. Once I started to do it correctly it actually taught me the material as I went through it. The online features made it possible for me to learn and be taught by the computer, thus helping me in the class.

What We Changed in the Second Semester

We required that students keep a homework notebook. We told the students that when they came to office hours, they had to bring this notebook with them. In this way, we could see what the students did incorrectly and help them more efficiently. We posted homework on Moodle or handed the assignment out in class. This was done so that students could do their homework using the book if they had some internet access issues. We changed the default setting on the homework assignments to allow them to try homework again. We looked at students' homework grades and followed up with students having problems. We made a better survey. We shared homework assignments with colleagues. We made tests more like assignments. We distributed a

handout about how to do homework online. We emphasized to students the importance of their approach to online homework. We challenged students to provide evidence of a mistake in homework grading. So far, no student has provided evidence that a correct answer was graded as incorrect.

What We Plan To Do Next Semester

We will make sure that faculty members are trained correctly about using the online homework system so as to head off technological problems. We will require the students to submit their homework online. We will include homework as part of the final grade. We will introduce the students to the online homework environment in one or two lab periods early in the semester. We will assign two copies of each homework assignment. One will be graded and one can be used for more practice. We will require the students to keep a homework notebook. We will stress the need for precision and discuss MyMathLab's ability to recognize equivalent answers. We will develop a more detailed survey. Specifically, we will discuss what it means to read a textbook before we ask them if they do. We will continue to gather statistics so as to enable us to assess this program. As always, we will be mindful of students' concerns and make sure that mathematics is the driving force behind any decision we make.