Readin’ and Writin’ to Learn ’Rithmetic
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Introduction
- Reading the textbook before coming to class is beneficial to students.
- Reading math textbooks can be difficult, especially for students in developmental math courses.
- Despite encouraging my students to read their textbook for years, almost none of them took the time and made the effort to do so.
- At the AMATYC conference in Milwaukee, I learned about an effective way to require students to read their textbook before coming to class.

Methods
- This project was carried out with Calculus II students because of their educational interests and maturity level.
- Students were assigned to read specific pages from the textbook in 3 consecutive semesters of Calculus II (Spring 2020, Fall 2020, Spring 2021). This material was to be discussed the next day in class.
- Students were required to write about what they had read, a summary of the material, theorems and/or formulas, questions they had about the reading, and notes after doing the homework.
- The writing was graded for completion. Since the material was not covered well in class, points were deducted if some theorems or formulas were not included.
- The effectiveness of the Reading Assignments was determined by giving a survey to the class at the end of the semester.

Results of Survey

Question 1. I completed ______ of the reading assignments this semester.
   - All: 35
   - Most: 11
   - About Half: 0

Question 2. Of those I completed, I submitted them by their due date ______
   - Every Time: 25
   - Almost Every Time: 15
   - Most of the Time: 6

Question 3. As the semester progressed, I became more comfortable with the process of reading the textbook.
   - Agree: 37
   - Neutral: 9
   - Disagree: 3

Question 4. Reading the section before coming to class helped me understand what we did in class.
   - Agree: 35
   - Neutral: 16
   - Disagree: 5

Question 6. I found the reading assignments to be a vital part of learning in this class.
   - Agree: 23
   - Neutral: 17
   - Disagree: 6

Question 10. Did the reading assignments alter your perception of how a math textbook should be read?
   - Yes: 35
   - No: 11

Question 11. Do you anticipate that this semester’s reading assignments will change the way you read textbooks in future math classes?
   - Yes: 36
   - No: 10

Student Comments

Question 7. Please share anything you appreciated or enjoyed about the reading assignments.
- I enjoyed being able to attempt math by myself. It gave me a lot more motivation when it was my own voice making sense of the equations, numbers, and processes, rather than someone else’s.
- The thing I most appreciated about the reading assignments was being able to have that extra communication with the professor. If I said in the assignment that something confused me, the professor would either leave a submission comment helping me out, or she would discuss it first thing in class the following day...
- I found the reading assignments to be a vital part of learning in this class.
- Completing a reading assignment can take up 30 minutes to 3 hours.

Question 8. Please share anything you disliked about the reading assignments.
- The stress and time. Completing a reading assignment can take up 30 minutes to 3 hours.
- I thought reading the book would become easier as the semester continued, but this did not prove to be the case for me...
- I actually started looking forward to doing them.... I was really excited to see what was next every day. It was part of what made this class awesome.
- That I haven’t had a math class require them.

Question 9. Please share something that surprised you about doing the reading assignments.
- I actually started looking forward to doing them.... I was really excited to see what was next every day. It was part of what made this class awesome.
- The theorems and formulas were a chore; however, I was very pleasantly surprised at the negative comments that I read on the survey. Most of the students saw the value in having to do them.

Question 12. Use this space to write any comments you wanted to make about the above questions, or any other general comments you have.
- I will DEFINITELY be using this technique in future math classes. This was the first semester I had to do something like this and found it extremely helpful.
- I actually started looking forward to doing them.... I was really excited to see what was next every day. It was part of what made this class awesome.
- For future math classes, I won’t be afraid to go into the textbook and learn about the sections. Math words in textbooks are no longer scary.
- Math words in textbooks are no longer scary.
- I will DEFINITELY be using this technique in future math classes. This was the first semester I had to do something like this and found it extremely helpful.

Conclusions

- After the Spring 2020 semester, I tried to make it clear to students that they should not spend more than 30-60 minutes on a reading assignment. I also restricted the pages they were to read in order to leave out proofs and more confusing examples.
- It was generally understood among my students that the reading assignments were a chore; however, I was very pleasantly surprised at the positive comments that I read on the survey. Most of the students saw the value in having to do them.
- Reading assignments are now an integral part of how I teach Calculus II. I appreciate that I don’t have to write on the board the theorems and formulas that the students have ready access to.
- I may try to implement reading assignments when I teach Calculus I again, though the maturity level of the students may prove to be a hindrance.
Q1. I completed _______ of the reading assignments this semester.

   All 35  
   Most 11

Q2. Of those I completed, I submitted them by their due date _________.

   Every time 25  
   Almost every time 15  
   Most of the time 6

Q3. As the semester progressed, I became more comfortable with the process of reading the textbook.

   Agree 33  
   Neutral 10  
   Disagree 3

Q4. Reading the section before coming to class helped me understand what we did in class.

   Agree 37  
   Disagree 9

Q5. I found it beneficial to read the textbook before class so that we had more time to work examples.

   Agree 35  
   Neutral 6  
   Disagree 5

Q6. I found the reading assignments to be a vital part of learning in this class.

   Agree 23  
   Neutral 17  
   Disagree 6

Q7. Please share anything you appreciated or enjoyed about the reading assignments.

   Although I didn't enjoy it in the moment, I really appreciate that it forced you to keep up with the material. I also liked that you were able to tailor the class period to more of the questions we had. As an example, if several people were having issues with an example in the book, you would cover that in class in addition to the worked out problems.

   It is not normal to have to read in math class so I appreciated the different approach to learning. It kept things fresh and interesting rather than just doing the same things that I have been doing for math classes over the last 15 years.

   I think the reading assignments were a fantastic way to ensure that we showed up to class prepared for the material we would see. It was definitely nice to have so many points accounted for by doing what we should have been doing anyway.

   I didn't always enjoy these reading assignments because reading from a math textbook is always a bit challenging but I really do think it helped to push me to come to class prepared with some fore-knowledge about what we were going to be discussing that day, which in turn helped me stay on top of homework and the rest of the pacing in the class. I would most likely not have done any of that reading if it hadn't been a part of the grade and I think I performed better because of it.

   For some of the sections, the textbook covered it enough to the point where I could get a start on the homework, and for anything I didn't understand I could just save for class so it would become clear after. It also helped see kind of what the book would require for the work as compared to for class.

   The reading assignments were very useful in helping me get into the habit of reading the textbook. Before I would rely too much on the class and additional videos to learn what I could have just read from the book, when honestly it's much better to first read and understand as much as I can and then have class and etc fill in the gaps.

   I really appreciated that every single question that was asked on the reading assignments was answered. Either through a comment on the assignment submission or clarified in class the next day.

   I enjoyed being able to attempt math by myself. It gave me a lot more motivation when it was my own voice making sense of the equations, numbers, and processes, rather than someone else's.
I like that doing the reading assignments taught me the importance of seeing the material before class and now I can utilize this skill in future classes. I feel like the way you split the assignments, having an A and B part for some sections, was really helpful in breaking down the difficulty of those sections. The videos that go with the readings really helped too. I also really appreciated the fact that you would answer any questions we had if we wrote it in our reading.

I liked that we were all familiar with the examples, so when you talked about them in class we all knew what you were talking about. I think it provided more substantial learning of math. I think it should be required in all math classes. It is the source material for everything you learn and it doesn't make any sense to not use it.

I found that the section where we were asked to write down formulas helped me to remember these formulas and recognize their purpose and form early in the section as I was actively looking for things to add to this section of the reading assignment.

The thing I most appreciated about the reading assignments was being able to have that extra communication with the professor. If I said in the assignment that something confused me, the professor would either leave a submission comment helping me out, or she would discuss it first thing in class the following day. Having that extra bit of communication with her was very helpful and made me overall more comfortable in the class as it progressed.

They make you think about the concepts abstractly, without relying on problems. If you do them, I have found that you don’t need to do much homework. By putting the effort into understanding the reading assignments every day, you can mostly just show up for the test and do well.

I appreciate that the reading assignments disciplined me to copy down all the formulas and definitions. Writing those down helped me learn and memorize them and I could also go back to look at them in my notes when studying. It was very useful and I wouldn’t have done it if I wasn’t assigned those reading assignments.

Getting exposed to the material before it was presented in class. That way you might have your questions ready the day the material is presented, and not get stuck as much during the night you are actually doing the problems, then needing to wait until the next class period to get help. It was probably about as close to a flipped classroom setting you can get in math, and still make that concept work effectively. I guess this corresponds to Q4.

Just coming into class with background makes the process of learning faster as you have an inkling of an idea about what’s happening. When you recognize something it’s much easier to build off of that rather than starting something completely new with no background on it. For me this helps create stronger connections with the material given.

Q8. Please share anything you disliked about the reading assignments.

I didn't dislike anything directly correlated to the reading assignments, but sometimes it did get to be a bit much with the homework, quizzes, reading assignments, and watching videos all in one night.

Some of them were rather long and confusing so I don't feel like they were a worthwhile use of time. I could have spent those moments working on problems or doing something else.

I didn't dislike the reading being assigned. Sometimes, I think there was a quick turnaround from a big homework assignment or an exam to having a reading due the next day. This may have led to a few homework assignments being rushed. That's about all I can think of.

I mainly want to say that I think the reading assignments could have been a good idea but I'm dyslexic and do not learn well while reading, so I personally think the reading hurt me because I didn't learn much from it and it took away from a lot of my homework time since it was graded.

For most of the sections since it was already confusing, reading the book honestly made it more confusing than it needed to be. Especially since most of the examples didn't model the work itself because it was either too simplistic or too complicated. The only sections that the book really made make sense were the ones that we could see for ourselves made certain connections without it needing to be spelled out.

Something I disliked about some readings was the frustration that came with not being able to understand certain concepts, especially new ones. I found myself thinking way too hard on what to write because I was very lost. Even with the opportunity to ask questions, there were times where I wanted to write, "Cannot write down questions because too many..." The reading assignments were very helpful to get an idea of what was coming though.

Sometimes, however, the reading was just too filled with minutiae or too difficult to grasp without further assistance, and it felt like I was just reading words on a page without getting anything out of it. That rarely occurred, but it is worth noting.

A good amount of examples didn't have good step by step explanations or did something but didn't explain why they did that. They also only showed some techniques, or like focus on one way to solve a problem.
Some sections had a lot of formulas or techniques included in them so it was hard to decide which formulas to put in the reading assignment.

A lot of It I skimmed. I personally don't get too much out of the formal proofs, and I find the examples hard to follow. I don't really "dislike" this, but I feel like it belongs here rather than in Question 7.

I would say at times the reading assignment would seem almost not worth the time, due to the brevity of a topic or the lack of material to write on. (sections like 11.4)

The summary aspect. Reading a math textbook is one thing, but putting that math textbook into my own words was always not fun. I understood that it was to help see if we learning from the reading and knew what it was saying, but I personally really disliked writing about the section in a few sentences. Something to keep in mind though is that I'm not a huge fan of reading comprehension and have always hated it. So the math textbook definitely was a new twist on that…

It always felt like a chore right after class. I wanted to focus on the homework after class, but reading and comprehending text takes a lot of energy. After finishing the homework I was exhausted and couldn't get the most out of the reading assignments. Therefore I began to treat them as a chore instead of a learning experience and did them first thing after class.

The stress and time. Completing a reading assignment can take up 30 minutes to 3 hours.

Q9. Please share something that surprised you about doing the reading assignments.

It's hard to summarize math textbooks.

I thought reading the book would become easier as the semester continued, but this did not prove to be the case for me. It may just be that the material continued to get harder, but it seemed to remain at the same difficulty level all semester for me.

I was surprised by how simple they became. At the beginning of the semester, I was not entirely sure what I was doing, but eventually I got the hang of it and they weren't as much of a confusing burden.

That it helped me to stay on task and complete the homework at the correct pacing for the semester.

What surprised me the most was that I usually understood what was going on in the reading.

It took a lot longer than I thought it would, even when the sections were short because I had to figure out what I felt was important to write down, but also had to fill the assignment requirements.

There were a few that I just skimmed over because they were confusing. But when I took the time to read it all over once more, examples clicked and I understood what was going on. Very satisfying.

They can surprisingly take a long period of time, sometimes, for even short readings.

I was surprised by how much of it stuck in my head because at first I didn't quite understand it all but like I still seemed to remember it.

I actually started looking forward to doing them around the time we got to Taylor Series. I was really excited to see what was next every day. It was part of what made this class awesome.

I was surprised at how easier it was for me to go back in the book and study what I was working on because I learned it from the book first. Using class time to clarify what I read helps solidify the concepts, and when I am confused a week later I can look back in the book and figure it out again.

It surprised me to see how just writing notes while I read made such a huge impact on my absorption of the material and how I could more clearly explain section topics to my study group.

What surprised me was that I was actually able to read math textbooks and understand it somewhat. I know that sounds funny, but at the beginning of the semester I thought I would have a really hard time being able to read the textbook because it is a math one, but after sitting down and actually taking the time to do it, I was able to understand concepts myself, having only just read it, which was pleasantly surprising to me.

Surprised how helpful it was to read ahead before class honestly.

That I haven’t had a math class require them.
Honestly what I was most surprised by was how many “shortcuts” the examples take without explaining the method. This seemed to get worse on the reading assignments after Spring Break. In previous classes I would have probably just glanced over the examples, and take whatever the author did in the problem as gospel, and never questioned it. But actually reading along and doing the problems, you notice a lot of little things. I started asking “but how did you get to that next step?”

I was surprised at how readily I procrastinated on pretty easy assignments until late at night, despite not having much at all to do throughout the day except think about how I should be doing my reading assignments.

The most surprising thing for me was being able to read a math book. I have never done, but it was good experience.

Q10. Did the reading assignments alter your perception of how a math textbook should be read?

Yes 35
No 11

Q11. Do you anticipate that this semester’s reading assignments will change the way you read textbooks in future math classes?

Yes 36
No 10

Q12. Use this space to write any comments you wanted to make about the above questions, or any other general comments you have.

I think that the reading assignments should continue to be implemented in this math course. It forced me to keep up with the work and I feel it did the same for my peers. In complete honesty, I probably wouldn't have read the book much if it wasn't a graded assignment as I find math books a bit confusing and hard to understand!

Over I am surprised that reading is beneficial in math. Especially, when it contains the hits of how to solve the problem or will raise a question. Which I can ask to clear my understanding about a certain topic.

Reading assignments were an interesting and new way to learn the material! As long as they were not extremely long, I feel like they helped me get a better grasp on what was going on in the section. When the reading assignment was long, some of that understanding went away as my brain was being crammed with information and I was not sure what to focus on.

The reading assignments are a great tool for ensuring student preparedness for class. As someone who was already used to reading the book before class, it was nice to get points for the work I was already doing. That being said, there may have been times that I modified my note-taking process because I knew someone else would see it. All in all, the pros outweigh the cons.

The only reason I did the reading was because it was worth points.

I enjoyed your class I honestly just felt like the reading assignments helped a little, but actually made me end up doing worse in the class since I felt like I had to spend more time on them for the grade and then have to skip homework sometimes.

I personally feel as if the reading assignments should be optional because for me it just made everything more confusing and made me a lot more frustrated trying to figure out how it connected. The only important things I found were writing down the formula's. The examples they did made close to no sense until you did it with us in class, so I honestly feel like it wasted time I could have used on the book work, the quizzes, or even the reviews. I am sure others feel different though, which is again why I said it should just be optional. It could even be an extra credit thing you put at the end for those who fall short in other aspects. Though, it did teach me comprehension so there's a plus.

I will DEFINITELY be using this technique in future math classes. This was the first semester I had to do something like this and found it extremely helpful. THANK YOU DR. MENNING!!

I'd say that 8 times out of ten it is beneficial to read the textbook sections prior to coming to a course session about them.

I really think if I continue this type of reading in future classes, it will help me understand concepts better as opposed to "memorizing" formulas and equations.

Although a sincere effort in reading assignments required more upfront effort than just doing homework problems, the investment pays dividends if you push through. It seems easy to view time spent on reading assignments as time that could otherwise be spent doing routine problems, however, I think that is self-sabotage. Students in grade school should have it explicitly and forcefully put to them that they can either A) spend an hour thinking hard about a math concept, or they can B) do 20 hours of mechanical labor consisting of 50 rote problems and “memorizing” formulas. Put like that, I can't understand why anyone would opt for all that hard work for a likely worse result.
For future math classes, I don’t be afraid to go into the textbook and learn about the sections. Math words in textbooks are not longer scary.

Reading assignments can be helpful, but understanding “book language” is tough for some people. Personally, understanding book language is tough for me and it was a good experience by reading a math book.

I think reading the textbook as homework is a fantastic idea that should be made a habit at lower levels of math. I would suggest the assignments go one step further and make a journal part of the required materials or a separate notebook that can be devoted to personal notes. I think it would have been beneficial if I had started doing this even in algebra. I would also say that students should create a lasting space where they keep nothing but formulas. In lower-level math classes, it’s not as prudent, but once you reach calculus it’s imperative to write down every formula and have a place to reference them.
Calculus II

Reading Assignments

The goal of reading assignments is to help you build habits that will serve you well in this course and later in your college career. Hopefully, this practice will help you establish a norm for what it takes to be ready for class and will help you do the basic work associated with navigating tests and asking questions as a college student.

- Most of us are not used to reading a math text, but as you progress through your math or engineering courses, this will become a norm. This assignment gives you a low-stakes chance to get used to reading a mathematical text.
- We might not always understand what we read. This is fine, as class time exists to help clarify that material. However, class time moves quickly, and it can be good to note questions early and think about their wording. The “questions” section is a good place to practice formulating questions about the material.
- The “notes” section is optional. The idea is to return here after having completed the homework and record the types of exercises and concepts that were problematic. If you have a document you can refer to when studying for a test that reminds you of where you were, what questions you needed to clear up, and what types of problems you might want to study, this will help you study more efficiently.

The reading worksheets will be graded on a participation scale – you have either submitted relevant work in each section or you have not. I plan on looking at the submitted reading assignments before coming to class in order to make the most of our class time.

I want these Reading Assignments to be a normal part of your notes. I have imagined that this will manifest in two different ways:

- If you use a notebook to take notes in class, I advise you to complete your Reading Assignments in your usual notebook as though you are taking notes in class. To submit the assignment, you can take a picture of your writing and submit it in Canvas.
- If you use loose paper and a binder, you are welcome to use the following worksheet as a sort of cover sheet for each day’s notes. I will provide the worksheets to you throughout the semester if you choose to use them. To submit the assignment, you can take a picture as mentioned above.
Write a few sentences summarizing the section.

Formulas and techniques to remember:

Questions and concerns after reading: