# The Mathematics Orientation Seminar: A Tool for Diversity and Retention in the First Year of College

Salvatore J. Petrilli
*Adelphi University*

The Mathematics Orientation Seminar: A Tool for Diversity and Retention in the First Year of College

Cover Page Footnote

# The Mathematics Orientation Seminar:
# A Tool for Diversity and Retention
# in the First Year of College

Salvatore J. Petrilli

*Department of Mathematics and Computer Science, Adelphi University, New York, USA*
`petrilli@adelphi.edu`

**Abstract**

In this article I describe Adelphi University's Mathematics Orientation Seminar, a new course that was introduced into the mathematics major to help students find their passion in mathematics and to strengthen the educational community within our department. I discuss quantitative and qualitative results of surveys among students in the Mathematics Orientation Seminar in Fall 2016 and Fall 2017, which suggest that this might be a useful course for other institutions to utilize within any major. Finally, I explore faculty perspectives and describe what I believe to be the final version of this course.

**Keywords:** *mathematics education, retention, first year experience*

> If suddenly
> you forget me
> do not look for me,
> for I shall already have forgotten you.
>
> Pablo Neruda.

## 1. Introduction

There are few professional pleasures available to mathematics faculty as truly gratifying as witnessing the transformation of our students from insecure high school graduates to budding mathematicians.

Being part of their professional journeys into adulthood can make all the committee work and grading in the world seem worthwhile! However, it is a sad fundamental truth of the mathematics major that not every person who starts on this path will finish with a math degree. For some this is because they discover other passions along the way — why even go to college if not to explore new adventures and discover new insights into oneself? — but for many, the decision to leave the amazingly beautiful and simultaneously utilitarian world of mathematics has less to do with new discoveries of self-purpose and more to do with feelings of isolation and frustration.

The ramifications of this travesty go beyond losing a few talented majors here and there and relate to the systemic problem of representation throughout the mathematical community. Female, black, Hispanic, and LGBTQ+ students drop our major at astonishingly high rates compared to their white-male counterparts [3, 7]. An argument could be (and has been) made that the background of many of these groups of students are weaker than their peers and that the rate of noncompletion can thus be explained away [5], at least partially expunging our responsibility as university educators to help remedy the situation.

It does not take much research to see that this argument is at best incomplete and at worst bleatingly false. The hypothesis that the fundamental difference in completion rates is pre-college mathematical education or aptitude has been shown to not hold true in educational institutions ranging from research universities to community colleges across the country [5, 12].

Instead a powerful predictor of success has emerged in the literature: community [5, 12]. Students need the support of a mathematical community that includes students, faculty, mentors, alumni, and staff. They need it to study, to learn, to deal with the inevitable cascade of personal problems which they will encounter over the first four years of adulthood. They need support and they need to not feel lost, alone, or forgotten.

The purpose of this article is to serve as an exploration of building a stronger community within a mathematics department for students and to aid students to successfully complete a major in mathematics. I aim to demonstrate how a one-credit orientation seminar is beneficial to students entering a new major. My hope is that this paper will inspire other educators to implement a similar seminar to aid their students.

To this end I first describe the institutional context that this work was undertaken, in Section 2. Then the orientation seminar that is the main focus of this article, is introduced, in Section 3. Section 4 describes the main research component of this work more specifically. In particular I describe in this section the qualitative and quantitative methods I employed to investigate the effectiveness and impact of the Mathematics Orientation Seminar.

## 2. Institutional Background

In the spring of 2014, Christopher Storm, the chair of the Adelphi University Department of Mathematics and Computer Science, initiated a department-wide movement to revise the curriculum. I was put in charge of overseeing these efforts. The first phase of curriculum revisions began with mathematics, because the mathematics program was the first to undergo an external review in 2017. The Mathematics Orientation Seminar, which is the focus of this article, came out of the conversations we had during this time.

Adelphi University is a predominantly undergraduate institution located in Garden City, New York, on Long Island. In Fall 2017, 5,266 undergraduate students and 2,712 graduate students enrolled at the University. 1,834 of these students enrolled in the College of Arts and Sciences. The number of full-time faculty, including librarians, is 349.[1]

Adelphi has an average class size of 21 students, and a faculty-to-student ratio of less than 1:11. With a six-year graduation rate of approximately 67% and a one-year retention rate of approximately 84%, Adelphi University outperforms neighboring institutions. This is further evidenced by the fact that 98.8% of first year students receive some form of financial aid, and 95.0% of incoming first year students receive institutional support.

As mentioned before, Adelphi's mathematics program is offered by a joint Department of Mathematics and Computer Science. The mathematics major enrolls about 20 students each year. In addition to two undergraduate degrees in mathematics (BA and BS), we also provide a B.S. in Computer Science, and, jointly with the School of Business, a B.S. in Information Systems.

---

[1]For all Adelphi University data, see https://about.adelphi.edu/overview/quick-facts/fact-sheet/, last accessed on January 9, 2019.

At the graduate level, the department offers an M.S. in Computer Science and an M.S. in Applied Mathematics and Statistics, which are both scheduled to launch in Fall 2018. In the Department of Mathematics and Computer Science there are 12 full-time faculty and roughly about 25 adjunct faculty.

As a whole, Adelphi finds itself in an excellent position to try to combat problems of underrepresentation of women and people of color in STEM fields: 68.4% of our undergraduates are women, 47% are students of color, and over 27% receive PELL grants. Increasing retention and building community at similarly well positioned institutions could have a major impact on the future demographic composition of STEM fields.

## 3. The Mathematics Orientation Seminar

### 3.1. The Motivation

One of the key outcomes of our departmental curriculum revision discussions was the creation of the Mathematics Orientation Seminar. We decided that we needed a course in the major that could handle questions such as "What can I do with a degree in mathematics?" and "I'm a graduating senior pursuing mathematics education, but I don't want to teach anymore. What are my options?" We had similar motivations that Buck, Grabner, and Roberts [2] describe in their creation of the Special Interest Areas. However, we were looking for something on a smaller scale, because our enrollments are much smaller than Slippery Rock University. The result was MTH 190 (The Mathematics Orientation Seminar).

### 3.2. Fall 2016 Launch

MTH 190 is a one-credit course, which meets once a week for an hour. This course:

> serves as an orientation to the fields of mathematics, career opportunities in the field, and the Mathematics and Computer Science Department. The course concludes with the design and completion of a project in a field of mathematics.[2]

---

[2]The course description is available at http://catalog.adelphi.edu/preview_course.php?catoid=7&coid=48137&print, last accessed on January 9, 2019.

The goal of this orientation seminar was to resolve certain issues that could be captured in the following questions:

1. how do we better prepare first year students to be successful in the mathematics majors? and
2. how do we build a better mathematics community and increase retention for students who do not feel like they are part of the "mathematics family"?

Smith [14] showed that if college students experience an increased exposure to part-time faculty during their first year, then that leads to a significant decrease in student retention. Thus, we wanted this course to expose our students to every full-time faculty member within the department.

Additionally, several studies such as [11, 4] found that interactions with current majors aid students in feeling more welcomed and increase freshmen retention in majors. Therefore, this course was also designed to incorporate substantial interaction with upper-level mathematics majors.

Let me now present the details of the course.

The objectives of this course are as follows:

- Students will be introduced to the faculty of the Department of Mathematics and Computer Science.

- Students will explore their interests in mathematics.

- Students will explore the best practices to succeed as a mathematics major.

- Students will be introduced to the mathematics writing program LaTeX.

- Students will explore topics in pure mathematics, applied mathematics, statistics, and mathematics education.

- Students will develop an appropriate mindset for mathematical problem solving.

- Students will learn about the career options in mathematics.

A week-by-week schedule is presented in Table 1 below. I will now take some time to explore the week-by-week schedule.

**Week 1:** Students are presented with the details of the course through an examination of the course syllabus. Additionally, students get a description of the BA and BS in mathematics, so they know the courses and goals of each program. Additionally, the students are exposed to the major in computer science, information systems and our minors. Once the overview of the course and majors are completed, students are brought to our department, where they see where the faculty offices are located and the locations of our labs. Finally, the students get to meet all the faculty one-on-one and learn what courses each professor teaches and their research interests.

**Week 2:** Current mathematics majors come into the class and describe what they like about mathematics and give five-minute "cute" presentations about fun problems in their areas of mathematics.

**Week 3:** At the end of the previous class, students are given blank copies of the "Best Practices for Succeeding in a Mathematics Major" document. A blank copy can be found in Appendix A. Students are instructed to write down what they think the best ways to address these areas are.

| WEEK | TOPIC DESCRIPTION |
|---|---|
| 1 | Introduction to the department and its faculty |
| 2 | What is my interest in mathematics? |
| 3 | How to succeed in the mathematics major |
| 4 | Introduction to LaTeX |
| 5 | Topics in pure mathematics |
| 6 | Topics in applied mathematics |
| 7 | Topics in statistics, actuarial science, and financial mathematics |
| 8 | Topics in mathematics education |
| 9 | Problem solving |
| 10 | Problem solving |
| 11 | What careers are available with a degree in mathematics? |
| 12 | What careers are available with a degree in mathematics? |
| 13 | Project |
| 14 | Project |
| 15 | Project |

Table 1: Weekly schedule for MTH 190 in Fall 2016.

During this week, full-time faculty and current students come into the class, and there is an open discussion on filling in the final version of this document.

**Week 4:** Students are taught how to create mathematical documents in LaTeX. Students are given templates for several types of documents, such as articles, beamer presentation, posters, handouts, etc. The goal is to get students familiar with the basic aspects of LaTeX, so they can build advanced skills in later courses.

**Weeks 5-8:** Faculty give interactive demonstrations in their fields of expertise in pure, applied, statistics, and mathematics education. Students are given mini-one hour projects to complete within in different areas of mathematics.

**Weeks 9-10:** In preparation for problem solving, students are asked to read the first part of Pólya's *How to Solve It* [13]. Week 9 is an open discussion on the theory behind problem solving and how best to attempt to solve problems. Week 10 is an open problem solving session. Current mathematics majors come in and facilitate groups of students in solving various problems in mathematics.

**Weeks 11-12:** Alumni of the department come in and speak about their careers in mathematics. We bring in mathematics educators, statisticians, actuarial scientists, financial mathematicians, and computer scientists.

**Weeks 13-15:** During Weeks 13 and 14, students are asked to pick a full-time faculty member that they wish to do a mini research project with. They complete an exploratory paper in pure mathematics, applied mathematics, statistics, or mathematics education. During the final class meeting, students give a five-minute presentation on their research.

*3.3. The Final Project*

After reviewing the work done by Johnston, Webster, and Wilson [8], we wanted to incorporate more student research into the mathematics major. As a result our revised major now includes a year-long capstone research experience. However, we actually wanted our students to be exposed to research in mathematics before their senior year and to experience the thrill of a new discovery — at least for them — early in their academic trajectory. Therefore, we designed the final project in the Orientation Seminar to be an exploratory research project.

Shortly after the midpoint of the semester, each student in the class would have interacted with every full-time faculty member and learned about each of their research interests. They would also have been exposed to several areas of pure and applied mathematics, and statistics, as well as mathematics education. By the time Week 13 rolls in, students would be ready to choose a faculty member to advise their final project based on their area of interest.

Thus around Week 13, students meet with a specific faculty member for about 15-30 minutes to select a research topic in mathematics. Generally, each faculty member will take on two to four students to mentor. Faculty are also willing to be flexible and broad with respect to their interests so that the students (and the related workload) are more or less evenly distributed.

As part of the project students write a 5-10 page paper examining their selected topic in LaTeX. They create a beamer presentation that will be presented at the last class meeting of the semester. See Appendix B for a formal description of the final project.

In the first run of the seminar several students continued working with faculty on their final project topic after the class ended. Some of these students presented their research at the Joint Mathematics Meetings in 2018. We expect that this will occasionally happen in the future as well, but of course we do not require it.

*3.4. The Second Offering of the Course in Fall 2017*

The second run of the Mathematics Orientation Seminar did not include significant changes to the week-by-week schedule; however, there were two minor changes.

First, we removed the week on student interest in mathematics (Week 2), where current students came in and talked about their interests in mathematics. We decided to make this change because the student survey results indicated that the entire class did not gain anything from those presentations. Therefore, that week was replaced by a discussion of academic honesty in mathematics.

We also swapped out the two classes that were devoted to time to work on the final project during class time. The first week was replaced with a presentation on the history of mathematics. The second was replaced with a discussion on the relationship between mathematics and computer science.

## 4. Effectiveness and Impact of the Seminar: Methods and Results

### 4.1. Participants and Materials

In Fall 2016, sixteen mathematics majors enrolled in the Mathematics Orientation Seminar and all completed it. Due to revisions to the major being implemented in Summer 2016, we were not able to register all the first-year students who wanted to be mathematics majors in this course. There were five students who did not take this orientation seminar during their first year; they would do so in Fall 2017.

In Fall 2017, twenty eight mathematics majors enrolled in the Mathematics Orientation Seminar and all completed it.

On the final day of class, students were asked to voluntarily complete a survey with questions about their experience in the Mathematics Orientation Seminar. The full survey can be found in Appendix C. The Fall 2016 results were collected using a hardcopy version of the survey. However, in Fall 2017, I used Google Forms to collect the results of the survey.

### 4.2. Procedures

Students were told about the study and that their participation was entirely voluntary. The major source for the quantitative and qualitative discussion, which follows, came from the anonymous survey that I gave out on the last day of classes, (available in Appendix C).

### 4.3. Quantitative and Qualitative Results: Student Surveys

Based upon the student responses to the anonymous survey at the end of the semester (Appendix C), I was able to study student outcomes from this Orientation Seminar. Here we share some of my observations.

The first question asked, *Has this seminar changed your feelings towards being a mathematics major?* Out of the total sample ($n = 43$), 63% of the responses indicated that it had changed their feelings. However, the qualitative results showed that a majority of the students did not want to change their major, but rather changed their perspective towards the mathematics major. In Fall 2016, one student noted, "I am very excited to continue with math. This course showed me various different areas of math.

It helped me focus on a certain area that sparked my interest." Another student noted that "When I chose mathematics as my major, I was not completely sure about it. However, this course has given me the confidence I need to continue in this major." Finally, "This course has increased by knowledge and it has helped me feel more prepared to be a math major."

The Fall 2017 qualitative results were similar. One student noted "It has showed me all of the options that I have as math major and has also been the reason why I added on a second major as well as a third minor." Another student stated, "Being a math major is not going to be an easy ride through college." Finally, "I feel like I am much more aware of the many topics involved with math. In high school, I would always assume math goes one way and that Calculus was the last math that could be learned. But now I understand that it is a never ending tree that branches off and still grows in many directions. It has really opened my eyes up to the many different routes."

The seminar showed some students that the mathematics major was not what they wanted. For instance, in Fall 2016, a student stated "I didn't realize the things that went into being a math major and am thinking of switching." A student in the Fall 2017 section stated, "I am a mathematics major because I am thinking about being a high school mathematics teacher, but in this course I learned about how much education is changing. This makes me unsure of whether I want to stay in the math major, but I am glad this course has informed me of the changes in the education world." This may seem to be a negative result of the course; however, it is beneficial for a student to decide early in the college career that a major is not right for them.

The second question asked, *Has this seminar changed your feelings towards your career goals with a degree in mathematics?* Out of the total sample ($n = 43$), 42% of the responses indicated that it had changed their career goals. In Fall 2016, one student stated, "I would like to be a statistician now instead of a teacher." Another student stated: "I didn't know what I wanted to do at first. Now I want to go to law school and also get a degree in computer science." Also, "At first, I only had math as my major. But this course has made me realize that it would be better if I had a minor. Therefore, I am taking computer science as a minor."

The Fall 2017 section yielded similar qualitative results. One student noted, "I am not sure if I want to be a math teacher anymore." Another student stated, "I am unsure if I want to continue with teaching. After the presentations I started thinking about pursuing the study of probability or math history."

In Fall 2016, a majority of the students wanted to be future teachers and have maintained that desire. The following student's response describes their feelings: "I want to be a math teacher. This course has given me tools to achieve my current degree path." In Fall 2017, there were more students without a definitive career path. The seminar gave them new perspectives to consider. "I still do not know what I would like to do with my career after college but now with the information I learned in this class as well as my majors and minors, I know that I will have a lot of options and I am very excited to explore them more during my next 3 and a half years at Adelphi."

Questions 7-15 from the survey were Likert Scale questions, where **1** indicated **Not at All** and **5** indicated **Very Much**. In what follows I will cluster questions 7-15 into two categories: *Feelings About the Department and the Mathematics Major* and *Skill Sets Acquired.*

Table 2 below presents the results about students' *Feeling About the Department and the Mathematics Major.*

One of our main goals in developing the Orientation Seminar was to help students feel more comfortable with the department, the major, and finding their passion in mathematics. The results collected from this survey indicate that the interactions with the full-time faculty and current mathematics majors have made them more comfortable with the department and the faculty.

Responses to question 25 of the survey (which asked: *What part of the seminar was the most useful for you?*) indicate that this was indeed the most useful part of the course. A representative student from the 2016 section indicated that the most useful part of the course was "Being able to meet the department, work with a different faculty member, and being able to explore into a topic I am passionate about." In 2017, the feelings did not differ; here is another student's response to question 25: "Meeting all the professors at the beginning of the semester." These feelings are consistent with that found by Nicpon *et al.* [11].

| Question Number | Question | Fall 2016 Median Response | Fall 2017 Median Response |
|---|---|---|---|
| 7 | I would feel comfortable enough interacting with most members of the Math and Computer Science Faculty. | 3 | 4 |
| 9 | I have found or begun to find my passion in mathematics. | 4 | 4 |
| 10 | I am more confident in my career path now than before I started the course. | 4 | 4 |
| 12 | I feel more comfortable seeing a professor for office hours. | 4.5 | 5 |
| 13 | I feel more likely to seek out help from our department's tutors. | N/A | 5 |

Table 2: Feelings about the department and the mathematics major.

Table 3 below presents survey results related to the *Skill Sets Acquired.*

| Question Number | Question | Fall 2016 Median Response | Fall 2017 Median Response |
|---|---|---|---|
| 8 | I feel I am better prepared to study for a math course. | 5 | 5 |
| 15 | I feel comfortable using LaTeX. | 3 | 4 |
| 11 | I expect to use the knowledge and skills gained from this seminar. | 5 | 5 |
| 14 | I feel I have gained valuable problem solving skills. | 4 | 4 |

Table 3: Skill sets acquired.

The majority of the students in the seminar felt that they gained the necessary skills to navigate successfully through the mathematics major.

Question 27 from the last page of the survey (where students were asked: *What were the three most important lessons that you expect to be able to use in the remainder of your Math career?*) support this claim. One student in the 2016 section stated, "If I can't solve a problem, start with something similar that I understand." Another student stated, "Talk to professors. They are there to guide you." In the 2017 section, a student stated, "You learn math by doing math problems." A second one stated "Do as many problems as possible and don't be afraid to ask for help from professors and peers." The feelings expressed by the students are all positive and indicate that they have moved into the right frame-of-mind to succeed in the mathematics major.

Interestingly, in Fall 2016, 50% of the students stated they agreed very much with the statement that they have gained problem solving skills (as a response to question 14). For question 29 at the last section of the survey (asking: *How could the seminar be improved?*) majority of students gave responses such as this "More math problems." There is a cognitive disconnect here, because the students have not realized that we are giving them skills to use in the major as a whole. This is indicated by the facts that 63% indicated they are prepared to study for a math course and that 69% expect to use the skills from this seminar in other courses. Brown and Walter [1] state that students do not start to feel comfortable with problems until they solve lots of them. In other words students will not start to see the benefits of these skills until they start to use them. Pólya [13] indicates that once students start to see how problems are related, then they can apply new problem solving techniques. Thus, it is only a matter of time before they start to utilize the skills they have obtained.

This above disconnect was not present in the Fall 2017 section of the Orientation Seminar. Students in this section expressed that they have gained problem solving skills that will be vital for the rest of the major. A representative student stated "This course taught me how to think critically and how to spend time understanding what a question is asking in mathematics."

Next, let me discuss students' reported experiences with LaTeX. In Fall 2016, 80% of the students felt very comfortable with using LaTeX. However, question 28 from the last part of the survey (*What topics should be added to this seminar?*) indicated that they needed more practice. A representative student stated "More LaTeX tutorials." Lamport [10] states that one learns the foundations of LaTeX and then picks up advanced techniques as needed.

Students indicate that they have basic knowledge for using LaTeX. These students will gain advanced techniques in later courses.

The Fall 2017 section surveys yielded very different results on the students' experiences with learning LaTeX. Over 50% of the class stated that they found the least helpful part of the course was the demonstration on LaTeX. A representative student stated that "I learned all about LaTeX from the website!" Students were given a link to a LaTeX how-to-guide created by Dr. Tuval Foguel, a Professor of Mathematics at Adelphi University (available at http://home.adelphi.edu/~tfoguel/Have%20Fun%20with%20LaTex.htm)

Finally a discussion of the Self-Assessment of Learning Objectives section from the anonymous survey is in order. In this section (containing questions 16-24), students were first asked to identify what they considered were the three main learning objectives of this Orientation Seminar, Then they needed to evaluate their own knowledge of the topic before and then after the seminar.

In Fall 2016, there were four objectives that majority of the students indicated as being most important in this seminar: *Learning LaTeX* ($n = 11$, 69%), *Finding a Passion in Mathematics* ($n = 9$, 56%), *Learning About the Mathematics Major and the Department* ($n = 11$, 69%), and *Interacting and Working with the Full-Time Faculty* ($n = 9$, 56%). Table 4 below summarizes the Fall 2016 results.

| Objective | Median Response Before | Median Response After | N | Percentage |
|---|---|---|---|---|
| Learning LaTeX | 1 | 3 | 11 | 69% |
| Finding a Passion in Mathematics | 3 | 5 | 9 | 56% |
| Learning about the Mathematics Major and the Department | 1 | 4 | 11 | 69% |
| Interacting and Working with the Full-Time Faculty | 1 | 4 | 9 | 56% |

Table 4: Student perceptions of course objectives in Fall 2016.

While designing the course, the department considered learning LaTeX to be a secondary objective of the course. However, students viewed this as one of the main learning objectives. Kaput [9] states that there are social changes within the classroom with regards to technology and the emphasis on learning new technologies. This social feeling is prevalent in K-12 education and students might be bringing this view to the college classroom. However, a majority of students also viewed learning about the department, interacting with the full-time faculty, and finding a passion about mathematics as the next major objectives of the course. Nicpon *et al.* [11] and Dixon, Rayle, and Chung [4] have found that this is what first-year students want when they come to college. First-year students want to feel that they belong to the college community, and the results from the survey find that the students who took the Orientation Seminar feel like they are part of a community.

In Fall 2017, the three top objectives that were indicated by the students were *Learning about the Mathematics Major and the Department* ($n = 15$, 35%), *How to be a Successful Mathematics Major and Finding a Passion in Mathematics* ($n = 13$, 30%), and *Problem Solving* ($n = 13$, 30%). Table 5 summarizes the Fall 2017 results. It was pleasant to see that *Learning LaTeX* fell off as an objective and was replaced by *Problem Solving.*

| Objective | Median Response Before | Median Response After | N | Percentage |
|---|---|---|---|---|
| Learning about the Mathematics Major and the Department | 2 | 5 | 15 | 35% |
| How to be a Successful Mathematics Major and Finding a Passion in Mathematics | 3 | 4 | 13 | 30% |
| Problem Solving | 3 | 4 | 13 | 30% |

Table 5: Student perceptions of course objectives in Fall 2017.

Other objectives that were mentioned, but not in the majority, were learning about different career paths, a life in mathematics education, and learning about alumni experiences.

## 4.4. Faculty Thoughts on the Seminar

Our department faculty had already been very excited about the Mathematics Orientation being offered before Fall 2016; however, they got even more excited after the first offering of the course. I asked for feedback from the faculty and here are three representative responses:

> *The math orientation seminar is a great opportunity for our freshman to get exposed to our faculties research interest. And for us to work with our freshman on a one to one basis.*

> *One of the math orientation assignments was for students to meet with each professor in the department (including computer science faculty) and ask for advice. The students whom I met were all gracious, respectful and appreciative. It wasn't just about giving advice, but learning what the students' goals were, and it was a great opportunity for both students and professors to get to know and understand each other better.*

> *I don't really have opinion on the curriculum revision, but I think the seminar is a very good settings for first-year students. It not only gets the students to know the expertise our department has to offer, but also opens a window for their future interests / development.*

## 4.5. The Future of the Mathematics Orientation Seminar

During the final writing of this paper, the department was preparing for the third offering of the Mathematics Orientation Seminar. We feel that we have reached the point where the course has become what we want it to be. Table 6 presents the week-by-week syllabus for the Fall 2018 semester.

We removed the week devoted to an introduction to learning LaTeX, because almost every student understood how to use LaTeX from the website created by Tuval Foguel, as mentioned earlier. Instead we plan to have weekly assignments that are required to be typed in LaTeX, so that students get continuous practice throughout the semester.

Also, we removed all the topics about mathematics education. The rationale behind this decision was that our mathematics education students are exposed to all the aspects of education through our School of Education.

| WEEK | TOPIC DESCRIPTION |
|:---:|:---|
| 1 | Introduction to the department (majors and minors) and its faculty |
| 2 | How to succeed in the mathematics major |
| 3 | Panel discussion with current students |
| 4 | Academic honesty in mathematics |
| 5 | A brief history of mathematics |
| 6 | Topics in pure mathematics |
| 7 | Topics in applied mathematics |
| 8 | Topics in statistics, actuarial science, and financial mathematics |
| 9 | Written communication in mathematics |
| 10 | Oral communication in mathematics & project section |
| 11 | Problem solving |
| 12 | Problem solving |
| 13 | Relationship between mathematics and computer science |
| 14 | Careers in mathematics |
| 15 | Project presentation |

Table 6: Weekly schedule for MTH 190 in Fall 2018.

These topics are now replaced with a panel discussion with current students, where the class will discuss with current students best practices to succeed as a mathematics major. The two remaining weeks will now be devoted to written and oral communication skills in mathematics.

## 5. Recommendations and Future Research

Recent work on college student retention established that it is important for first-year college students to build a relationship with full-time faculty and current students. There are many studies, such as Gandhi-Lee, Skaza, Manti, Schrader, and Orgill [6], examining factors related to student success in the STEM fields. Most of these studies are based on race, gender, socio-economic status, etc. However, a large hole in the literature becomes evident: there really are not many studies about how institutions and departments can build a community to make all students feel welcomed. In addition, there seems to be a scarcity of studies on helping students in mathematics find their passion.

Future research can and will hopefully entail collecting longitudinal data on the effects of this type of Orientation Seminar. It is still to be determined which of the suggested course content and activities might be most effective.

One way to approach a broader study might include tracking incoming first-year students and the influence of such a seminar until the end of their senior year. Through such a study, researchers might be able to determine if the course content and activities are statistically significant in helping students find their path in the mathematics major. In addition, a larger quantitative and qualitative study across disciplines could prove illuminating.

Many institutions seem to expect that students entering college already know their passion or will serendipiously find it somewhere in their fateful mathematical journey. But as our students mature into adults, they need exposure to the myriad of different fields and problems in mathematics. They should know what the faculty members in their own classes feel passionate about! They need to know, starting in the first week of classes, that we are all part of their community and that they are not alone. I hope that this paper will influence other institutions to offer a similar seminar to help build such a community and to aid students in finding their passion in their early on in their selected major.

# References

[1] Brown, S. and Walter, M., *The Art of Problem Posing*, 3rd ed., Lawrence Erlbaum Associates, Mahwah NJ, 2005.

[2] Buck, R., Grabner E. M., & Roberts, G. B., "Mathematics, Curriculum, Careers." *PRIMUS: Problems and Issues in Mathematics Undergraduate Studies*, Volume **8** Issue 2 (1998), pages 184-190.

[3] Chen, X., "STEM Attrition: College students' path into and out of STEM fields", (NCES 2014-001) National Center for Educational Statistics, US Department of Education, Washington D.C, 2013.

[4] Dixon Rayle, A., and K. Chung, "Revisiting first-year college students' mattering: Social support, academic stress, and the mattering experience", *Journal of College Student Retention: Research, Theory & Practice*, Volume **9** Issue 1 (2008), pages 21-37.

[5] Fullilove, R and Treisman, P., "Mathematics Achievement Among African American Undergraduates at the University of California, Berkeley: An Evaluation of the Mathematics Workshop Program", *The Journal of Negro Education*, Volume **25** Issue 3 (1990), pages 463-478.

[6] Gandhi-Lee, E., Skaza, H., Marti, E., Schrader, P.G., and Orgill, M.K., "Faculty Perceptions of the Factors Influencing Success in STEM Fields", *Journal of Research in STEM Education*, Volume **1** Number 1 (2015), pages 30-44.

[7] Hughes, Bryce B., "Coming out in STEM: Factors affecting retention of sexual minority STEM students", *Science Advances*, Volume **4** Issue 3 (2018), DOI:10.1126/sciadv.aao6373. Available at `http://advances.sciencemag.org/content/4/3/eaao6373.full`, last accessed on January 8, 2019.

[8] Johnston, W. W., Webster, J. E., & Wilson, C. J., "An Introductory Research Experience in Mathematics for Undergraduates", *PRIMUS: Problems and Issues in Mathematics Undergraduate Studies*, Volume **27** Issue 4-5 (2017), pages 451-460.

[9] Kaput, J. J., "Technology and Mathematics Education", in *Handbook of Research on Mathematics Teaching and Learning*, edited by Douglas A. Grouws (The National Council of Teachers of Mathematics (NCTM), MacMillan, New York, 1992), pages 515-556.

[10] Lamport, L., *LaTeX: A Document Preparation System*, (2nd Edition), Addison-Wesley Professional, Massachusetts, 1994.

[11] Nicpon, M., Huser, L., Blanks, E., Sollenberger, S., Befort, C., and S. Kurpius, "The relationship of loneliness and social support with college freshmen's academic performance and persistence", *Journal of College Student Retention: Research, Theory & Practice*, Volume **8** Issue 3 (2007), pages 345-358.

[12] Paulson, A., *Transition to College: Nonacademic Factors that Influence Persistence for Underprepared Community College Students*, Doctoral Thesis: University of Nebraska-Lincoln, 2012.

[13] Pólya, G., *How to Solve It*, Princeton University Press, Princeton, 1945.

[14] Smith, C., *The Impact of Part-Time Faculty on Student Retention: A Case Study in Higher Education*, Doctoral Thesis: University of Missouri-Kansas City, 2010.

## A. The Best Practices Document

Below is a copy of the Best Practices document we have developed for our Mathematics Orientation Seminar. See Section 3.2 for how we used it in Week 3 of the Fall 2016 installment of the seminar.

**ADELPHI**
**UNIVERSITY**
College of Arts and Sciences

**BEST PRACTICES TO SUCCEED AS A MATHEMATICS MAJOR**

| | |
|---|---|
| **STUDENT AND INSTRUCTOR RESPONSIBILITIES** | |
| **ATTITUDES, STUDY METHODS, AND TIME MANAGEMENT** | |
| **PROBLEM SOLVING** | |
| **OBTAINING ASSISTANCE** | |
| **LEARNING MATHEMATICS (ACTIVE LEARNING)** | |
| **IN CLASS** | |
| **OUTSIDE OF CLASS** | |

**B. The Final Project Description**

Each student will be assigned a faculty mentor based on their mathematical interest. Students will meet with a faculty member for about 15-30 minutes to select a topic of interest in mathematics (e.g., an interesting theorem, a historical figure in mathematics, etc.). Students will then write a 5-10 page paper examining their selected topic. The paper will have a tentative structure as follows:

If Pure/Applied Mathematics:

- Introduction.

- Background to their topic.

- Mathematical examination of their topic.

- Examples/Applications.

- Conclusion.

If Historical Mathematics:

- Introduction.

- Historical Background.

- Key Players.

- Historical Examination.

- Examples/Applications.

- Conclusion.

If Statistics:

- Introduction.

- Mathematical/Statistical Background.

- Examples/Applications/Statistical Tests.

- Data Analysis/Samples.

- Conclusion.

The report will be written up in LaTeX. In addition, during the final exam period, students will give a short presentation on their final project.

## C. Final Survey: Mathematics Orientation Seminar Evaluation

The Mathematics Orientation Seminar is a required 1-credit class for all students who are new to the Mathematics major, as well as to those who recently declared the Math minor. Please complete this questionnaire as completely as you can.

Your responses will be treated confidentially. Your instructor will NOT KNOW which answers are given by which student.

**Basic Information and General Overview.**

1. Email address (required by Google Forms)

2. On what day were you taking the seminar? Mark only one oval.
   ⬯ Monday                     ⬯ Friday

3. Has this seminar changed your feelings towards being a Math major, or a Math minor? Mark only one oval.
   ⬯ Yes                        ⬯ No

4. Briefly explain your previous answer.




5. Has this seminar changed your feelings with respect to career goals after you obtain your degree? Mark only one oval.
   ⬯ Yes                        ⬯ No

6. Briefly explain your previous answer.

**Improvements.**

Please choose the option that best matches your opinion.

7. I would feel comfortable enough interacting with most members of the Math and Computer Science Faculty. Mark only one oval.

   NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

8. I feel I am better prepared to study for a Mathematics course. Mark only one oval.

   NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

9. I feel I have found or begun to find my passion in Mathematics. Mark only one oval.

   NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

10. I am more confident in my career path now than before I started this course. Mark only one oval.

    NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

11. I expect to use the knowledge and skills gained from this seminar. Mark only one oval.

    NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

12. I feel more comfortable seeing a professor for office hours. Mark only one oval.

    NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

13. I feel more likely to seek out help from our department's tutors. Mark only one oval.

    NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

14. I feel I have gained valuable problem solving skills. Mark only one oval.

    NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

15. I feel comfortable using LaTeX. Mark only one oval.

    NOT AT ALL ⬭ 1 ⬭ 2 ⬭ 3 ⬭ 4 ⬭ 5 VERY MUCH

**Self-Assessment of Learning Objectives.**

In this section, please identify what you believe to be the three most important learning goals, and assess how much your knowledge of each goal before the seminar and after.

16. First learning goal:

17. First goal: Knowledge before seminar Mark only one oval.

    NONE  ⬭ 1    ⬭ 2    ⬭ 3    ⬭ 4    ⬭ 5  CONVERSATIONALLY

18. First goal: Knowledge after seminar Mark only one oval.

    NONE  ⬭ 1    ⬭ 2    ⬭ 3    ⬭ 4    ⬭ 5  CONVERSATIONALLY

19. Second learning goal:

20. Second goal: Knowledge before seminar Mark only one oval.

    NONE  ⬭ 1    ⬭ 2    ⬭ 3    ⬭ 4    ⬭ 5  CONVERSATIONALLY

21. Second goal: Knowledge after seminar Mark only one oval.

    NONE  ⬭ 1    ⬭ 2    ⬭ 3    ⬭ 4    ⬭ 5  CONVERSATIONALLY

22. Third learning goal:

23. Third goal: Knowledge before seminar Mark only one oval.

    NONE  ⬭ 1    ⬭ 2    ⬭ 3    ⬭ 4    ⬭ 5  CONVERSATIONALLY

24. Third goal: Knowledge after seminar Mark only one oval.

    NONE  ⬭ 1    ⬭ 2    ⬭ 3    ⬭ 4    ⬭ 5  CONVERSATIONALLY

**Wrapping up.**

25. What part of the seminar was the most useful for you?

26. What part of the seminar was the least useful for you?

27. What were the three most important lessons that you expect to be able to use in the remainder of your Math career?

28. What topics should be added to this seminar?

29. How could the seminar be improved?

30. Any final comments?