

## NORD GRANT PROPOSAL

VINCENT GRAZIANO  
DIRECTOR OF SOPHOMORE MATHEMATICS

**ABSTRACT.** With funding provided by a NORD grant I plan to streamline how lectures are conducted at the level of sophomore mathematics. The grant will cover the cost of new technology upon which the project will heavily rely. The technology will be leveraged to change how course material is presented by the lecturer and how it is recorded by the students. I expect the result will be a deeper engagement in the classroom. The outcome measure will be carried-out using self-assessments, midterms, and comparisons to students in other courses.

### 1. NEED

The mathematics, applied mathematics, and statistics department has introduced large-sized lectures for their Sophomore mathematics curriculum this semester. This represents a major change in approach to teaching these courses. In the past course size has been between 25-35 students in a section. This semester our Calculus III course has 78 students currently enrolled.

The larger size lectures puts additional challenges on the instructors and students. For example,

- (1) Addressing all the questions that arise in class becomes very difficult.
- (2) The classrooms are not well-suited for mathematics lecture. The rooms are narrow and very long. Students in the far reaches of the room can have trouble reading the blackboard. The physical distance from the board and the lecturer make it difficult for the student to fully engage in the lecture.

These difficulties inflame the usual challenges that come with teaching these courses. For example,

- (1) How to teach the entire curriculum? (Calculus 3 for example has many necessary topics)
- (2) How to optimally explain the material? How to give nice instructional examples in class?
- (3) How to balance thinking and asking more questions in class with note-taking?
- (4) How to make the lecture notes most helpful?

### 2. PROPOSAL

The funding from the grant will be used to purchase a Microsoft Surface Pro 4. This is a very special “computer” with regards to its hardware capabilities. For the purpose of this proposal there are two essential capabilities.

- (1) The device runs a full-fledged operating system with strong CPU processing power.
- (2) The device is optimized for input from a stylus.

There is no other device available at this time that can do both of the above, let alone do both well.

The first capability is essential for running mathematical demonstrations in class. The preferred platform is *Mathematica* and the specifications of this device (given in the budget proposal) will allow for advanced mathematical computation and visualizations.

The second capability is going to be used in many ways. The screen of the device will be displayed overhead in the classroom. Lectures notes will be written directly on the device. Students will see these notes projected onto a screen for discussion during class. After class these notes will be saved as a PDF and distributed electronically to the class.

After implementing these ideas the next step will be to setup software to display the notes in real-time on the student's devices during lecture. This software will make it possible for students to take notes on the notes.

### 3. EXPECTED IMPACT

Students could now attend class and not take notes. Of course, this is not the goal. The goal is to lighten the burden of note-taking. The less they have to record the more they can: think, ask questions, and write those answers. I am truly looking for a paradigm shift. Taking notes is not inherently bad, rather I am looking to optimize the amount and the kind of notes that the students take.

I foresee students marking up the digital version of the lecture notes while studying or working on problem sets. As they become more accustomed to the format I think we will observe students marking up each others' notes in collaborative efforts.

The use of the projector for the class notes will also alleviate issues that have arisen due to the shape and layout of the lecture room. The notes will be more legible from the back of the room than they are written on a blackboard.

### 4. OUTCOME MEASUREMENT

I plan to make use of self-assessment for a majority of the feedback. Particular measurements of interest will be: how much time was spent on a topic, how much then used the lecture notes, how much they took notes on the notes. These measures will be compared to how well they answered a related question from the midterm. Measuring time-spent on a topic is a great way to keep track of students' engagement in the course.

Sometimes students are not good judges of whether an intervention has had an expected impact. Sometimes instead they are expressing how the intervention made them feel. Some carefully designed surveys will try to tease the two issues apart.

That said, I plan also to measure class performance on the whole to other sections. We will be investigating whether statically significant differences in course grades.

### 5. SOURCE OF FUNDING

Due to a cut in the department's non-salary budget funds are extremely tight. To not further strain the resources of the department the chair (David Singer) and I kindly request the needed funding for this research project through a NORD grant.

## 6. BUDGET

The budget proposal is for a *Microsoft Surface Pro 4* and important related accessories. As follows:

Microsoft Surface Pro 4 <small>Intel i7, 16GB Ram</small>	\$1619.10
Warranty	\$149.00
Keyboard	\$116.99
Display Adapter (Mini)	\$35.99
Display Adapter (Wireless)	\$49.95
Pen Tip Kit	\$9.00
Express Shipping	\$16.99
<b>Total</b>	<b>\$1997.02</b>
<b>Granted</b>	<b>\$2117.98</b>
<b>Balance</b>	<b>\$120.96</b>
ZomeTool: Platonic solids	\$72.15
<b>New Total</b>	<b>\$2069.17</b>
<b>Balance</b>	<b>\$48.81</b>

I have received no previous NORD grants.

DEPARTMENT OF MATHEMATICS, APPLIED MATHEMATICS, STATISTICS