

Faculty Innovator Grant 2016
Center for Learning and Teaching

Final Report Form

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Project Title: (10 words or less)	Supplemental Critical Thinking Explorations to Promote Discovery and Deeper Comprehension

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1. Describe the specific teaching and learning issues being addressed by the proposal.

The students in Math 101: An Introduction to Mathematics for Critical Thinking are traditionally non-math, non-technical majors who are taking this course either as a prerequisite to Stat 130: Elementary Statistics or to fulfill their general education requirement for mathematics. Many students in Ma101 find mathematics challenging, if not intimidating. The goal of this course is to expose the students to various math concepts while encouraging them to develop critical thinking and problem solving skills that they can then apply to future endeavors. It is helpful to consider the course as a tour of various areas of mathematics that students experience with the guidance of the instructor. Students usually expect that this math class will be similar to the others they have taken where they may have felt more like a spectator instead of an active participant. The usual student expectation is that they will be given seemingly endless, incomprehensible formulas and terminology, and be asked to mimic or regurgitate the solutions to the problems presented. They do not expect to fully understand or engage with the material or understand how it is relevant to their lives. They just hope that they will do well enough to pass the course.

Since many students in Ma101 have had negative experiences with mathematics in their past, it can be difficult to get these students to engage in the discussion or to see how the material applies to everyday life. It is also important to overcome the stigma and fear many of these students have learned to associate with mathematics and help them to have a positive experience with the content. In this project, we addressed this by engaging students in various explorations of complementary topics that are designed to promote individual discovery, broader understanding and interactive discussions.

Additionally, Ma101 is now offered as an asynchronous online course. One of the many challenges when teaching mathematics in an online environment is getting the students to engage with the material through discussion. Students who are intimidated by mathematics tend to be especially difficult to engage in an online environment where their every word, including missteps, are available for the entire class to see. In order to promote an inclusive discussion environment focused on reasoning rather than being "right", a guide for online instructors was created along with example discussion board prompts.

2. Describe the revised specific teaching and learning issues being addressed by the proposal (if applicable):

N/A

3. Describe the development activities involved addressing the learning or teaching issue.

The supplemental explorations expand on various critical thinking skills explored in MATH 101 by combining video mini-lectures with class discussion to encourage students to apply their critical thinking skills to discover various applications and

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implications of topics covered. By splitting each mini-lecture into bite-sized chunks that are easily digestible, the students are encouraged to consider related extensions. Based on student discussion, the instructor could supplement the discussion with additional extensions and explorations.

Each supplemental exploration follows a Socratic approach where students learn through discovery rather than by memorization and are encouraged to ask questions and present their own conclusions. Five Critical Thinking Exploration (CreaTE) activities were created. Each CreaTE activity has between one and seven parts. Each part has a Getting Ready activity, video, and follow-up activity. The five CreaTE activities are:

1. CreaTE 1: Thinking Inductively about Adding Positive Integers
2. CreaTE 2: Thinking Inductively about Adding Positive, Odd Integers
3. CreaTE 3: Pascal's Triangle and Set Theory
4. CreaTE 4: Mental Math
5. CreaTE 5: Blood Types and Set Theory

Each Supplemental Critical Thinking Exploration takes the form of an interactive instructor's guide that accommodates for presentation on an online discussion board, in class, or after class. All activities and videos are available at:
<https://fs.wp.odu.edu/k3smith/critical-thinking-exp/>.

4. Describe the learning outcomes attained by the project.

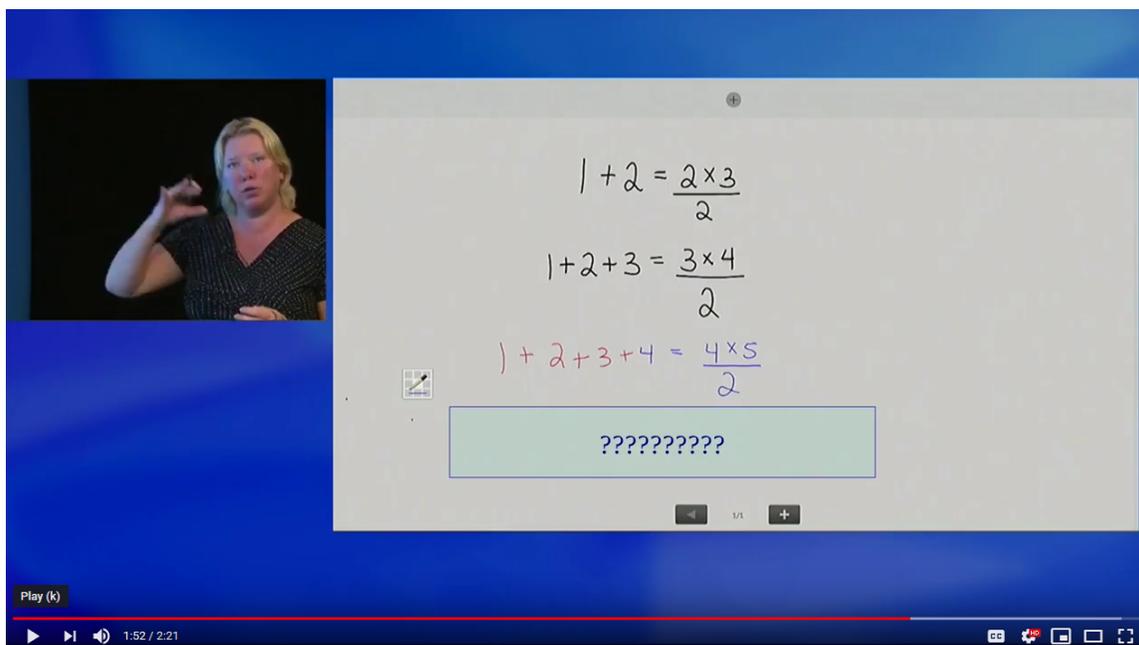
While the decrease in budget did not allow for implementation in an online setting, Ms. Davis has presented some of the content in her class and anecdotally reported positive results.

The following example was Part 1 of CreaTE 1. Observe the pattern below and come up with the next few lines.

$$\begin{aligned}1 + 2 &= \frac{2 \times 3}{2} \\1 + 2 + 3 &= \frac{3 \times 4}{2} \\1 + 2 + 3 + 4 &= \frac{4 \times 5}{2}\end{aligned}$$

A screen capture from the video for this part of the activity is shown on the next page.

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The video leads the student to discover that the only thing that is changing is the last number being added. Therefore, they can predict the right-hand side of the equation based on that last number. Then, the video ends by asking the student to fill in the last line. The next video starts where this one left off.

After all 7 parts of CreaTE 1, the instructor's guide posts additional questions that instructors can use to encourage students to generate their own variations and work on them individually and collaboratively.

5. Describe unexpected outcomes, if any.

N/A

6. Describe the impact of the completed project on your colleagues, department, college, or community.

All instructors in the department will be able to use these explorations which present the students with extension problems related to particular topics in the course. The resources are housed on Ms. Smith's faculty website which is accessible to all instructors teaching MATH 101. The videos are hosted on YouTube. In fact, they are available to the general public. The implemented approach could certainly be adopted for other courses as well. Mathematics courses taken by education majors would be particularly well suited to this approach.

7. Describe how the project can be a model, template, or prototype for use by other instructors.

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Because the activities are freely available online with instructor's guides and the videos are available on YouTube, it would be very easy for other instructors to use them. The videos could be linked to or embedded in an online course or shared live in class.

8. Describe the technology used to help address the issues described in the proposal.

The videos were recorded in the studio in Gornto using new smart wall hardware. The videos were edited using ActivePresenter for video and Audacity for audio. ActivePresenter is free for non-commercial use. Audacity is free and open source. The introductory animations were created in Windows Movie Maker.

The videos have been shared on YouTube. YouTube was chosen because it is a freely available video hosting service for which all ODU instructors have accounts. It is also very widely used and familiar to students. Links to the videos are included on the webpage for each activity.

Making the videos available on YouTube provides benefits outside of individual classroom use. By hosting the videos publicly, other instructors and students outside of ODU can use them as an Open Educational Resource (OER). There are opportunities to extend this work by and make the full explorations available as OER in the future.

9. Describe products, if any, that are a result of the project.

This project has resulted in a series of activities and videos. The these are freely available at <https://fs.wp.odu.edu/k3smith/critical-thinking-exp/>.

10. Describe the future plans for this project, if any.

N/A

11. Attach a financial report with updated Budget Plan Matrix.

Final Budget Matrix

Budget Item (equipment, personnel, software, etc.)	Qty	Total Cost	Source of Funds	
			Amount from FIG	Amount from Other Source
Stipend for Professor Davis	1	\$750	\$750	\$0
Stipend for Ms. Smith	1	\$750	\$750	\$0