UNH Outreach Scholars Program Project Proposal

by

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Project Title: The Creation of a New Discovery (Formerly Called Gen-ed) Mathematics Course

Project Description: I am developing a new general education mathematics course (now called a Discovery course). Specifically, this Discovery course will be an Inquiry course. For those unfamiliar with this new approach that UNH is taking, this would be likened to our present system of designating certain courses as “writing intensive.” Just as writing is considered vitally important, no matter what one’s chosen discipline is, learning through inquiry will now be considered a fundamental feature of the Discovery Program.

Background Information/statements of the Issues/problem: The inquiry component of the Discovery Program distinguishes itself through the following instructional features:

• encouragement of curiosity, initiative, and risk taking;
• development of critical thinking skills;
• shifting responsibility to students for their own learning;
• enhancing intellectual development and maturity; and
• engendering habits of lifelong learning.

I have numbered this course MATH 401 (for the time being) and am calling it Mathematics for the Liberal Arts.

I have created an entire syllabus (see attachment), but the course integrates an inquiry-based approach to learning mathematics with two components that are dear to my heart; namely, community outreach, and service learning.

Project Details: Two excerpts as found in the syllabus (attached) will give the reader the gist of what this course is all about:

In a nutshell: The class will be broken into houses (a la Harry Potter). Each house will work as a team throughout the semester. The houses will work on problems presented in class, and more notably, on designing mathematics “experiments” of their own where, ultimately, they will be presented to a classroom of kids in an area K-12 school. This will be discussed in greater detail during the first class, but essentially the idea is this: you will be learning to think critically, engage in high-order reasoning, all through problem-based learning. Rather than viewing the professor as the vessel of all mathematical knowledge, and viewing your role as merely learning that knowledge piece by piece as the class progresses, instead you will be learning mathematics through an inquiry-based approach. Piaget (a renowned cognitive developmental theorist), said it best when he said “To know is to construct. To construct is to know.” Hence, the hope
is that I will facilitate an environment – with appropriately chosen activities – for each of you (in concert with the peers in your house) to construct your own knowledge through inquiry. Ultimately, your house will devise its own mathematical experiments, and collectively, you will go into a given classroom (say, a 5th-grade class here in a Manchester school) and lead them through an experiment so they, too, can learn through inquiry, all the while constructing their own knowledge.

**Social Responsibility Option:** This is a program wherein my students from *Mathematics for the Liberal Arts* tutor at-risk youth in the community with one of the partnerships I’ve created; e.g., after-school tutoring programs at the Manchester Boys and Girls Club and the Salvation Army. It is expected that participating students will put in a *minimum* of 25 hours, keep a journal (which I will retain for my records at the end of the semester), and participate on a regular basis, as the kids come to depend on the tutors. In that regard, if you choose this option you must commit to it; i.e., you can’t start it and then change your mind later. *Flexibility* in not only your schedule, but also your personality, is a necessary ingredient to making this option work. Further details will be discussed in class.

One area I’m particularly interested in exploring, is a partnership with NASA through their Office of Education. During this past year, the speaker that had the most impact on me was Dr. Anngienetta R. Johnson, Assistant Associate Administrator for Education Lead for Exploration Systems at NASA. I would not do her justice by trying to condense her entire talk here in this proposal, but suffice it to say that NASA’s Space Exploration Steering Council is looking to partner with America’s education community. Among other things, they want to inspire students to pursue careers in Science, Technology, Engineering, and Mathematics (STEM). Moreover, they want to expand/develop the pre-college STEM pipeline. And what really excites me beyond all that, is that they especially want to target those children that have been traditionally underrepresented. This is the group of children (at-risk youth) I have been working with for the past seven years or so here in Manchester. I have been working with children from grades 7-12, but I would like to expand that to K-12. Additionally, my hope would be to offer this course in Durham as well, and thus, develop partnerships in Durham and Dover (and surrounding communities). I would like to form new partnerships in Manchester, as well, but the reader should know that I have already formed four independent partnerships through the years: (1) Manchester YouthBuild Odyssey; (2) ALPHA (The Alliance for the Progress for Hispanic Americans); (3) The Manchester Boys and Girls Club; and (4) The Salvation Army. I actually misspoke; I have not been working with these kids *per se*, but rather, my *students* have. I have called this the *Social Responsibility Option* while teaching MATH 420: Finite Mathematics. Now, through this new course, I see an opportunity to join service-learning with community outreach through a partnership with NASA. A classic win-win situation for everyone involved, but most notably for the children, especially the underrepresented.
This text I chose for this new course provides “excursions” into a variety of mathematics. The excursions are organized into four independent parts, each consisting of four chapters: (1) Social Choice; (2) Management Science; (3) Growth and Symmetry; and (4) Statistics. The book is written in an informal, very readable style, with pedagogical features that make the material both interesting and clear. Coverage centers on an assortment of real-world examples and applications, demonstrating the usefulness, relevance, and attractiveness of liberal arts mathematics.

**Available Resources Within the University:** Leitzel Center for Mathematics, Science, and Engineering Education, UNH Outreach Scholars (both former, present, and future scholars), and the Office of Sponsored Research.

**Implementation Plan:** I have completed the first phase of implementation, in that I have created a rather thorough syllabus, including the actual text and topics to be covered. I consider this a work in progress, but I do believe this syllabus represents an excellent starting point from which to nuance what will become an first-rate course. Next, I need to contact the Leitzel Center (Karen Graham) for possible collaboration, NASA’s Office of Education (Dr. Anggienetta R. Johnson) for partnership possibilities, the Chair of the Mathematics Department (Eric Grinberg) for feedback and support, and the Discovery Program Implementation Office (Joanne Curran Celentano) for feedback and their approval, not necessarily in that order. Apropos to the University’s approval process, I plan to submit a version of this proposal to the Discovery Program Implementation Office for a grant to fully develop this new course (e.g., refining the course by, among other things, incorporating feedback from the above constituent groups).

**Evaluation Plan:** It’s premature to design the implementation plan at this point in that the partnership(s) has not been developed nor defined. That said, I would like to secure grant funding for a longitudinal study to follow the children that are exposed to the community outreach and service-learning component of the course over and extended period of time (measured in years). This would be especially interesting if I (we) can offer this course in Durham as well (which would be my plan). Obtaining data from say, Durham and Dover (and surrounding communities) and Manchester (and surrounding communities) would provide for a richer sample of children to draw inferences from.