CATL Scholar Program
Center for the Advancement of Teaching and Learning

Application due: February 28, 2006 (5 p.m.)
Please submit a paper copy of the signed cover sheet to Peter Felten, Holland House 109 (CB 2610)

Cover Sheet

Your name	Anthony Crider
Department	Physics
School/College	Elon College of Arts and Sciences
Rank/title	Assistant Professor of Physics
Years of service at Elon **by 5/31/06**	4 years
Campus box	CB 2625
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Title of proposed project:

Testing a "Quest-Points-Level" Game Structure in the Astronomy Classroom

Short abstract of the project (<100 words):

In popular role-playing games, players choose their own quests, receive experience points for completing them, and "level up" to become eligible for more difficult quests. This reward system, distilled into minutes, makes such games highly addictive. I propose to restructure my astronomy classes to offer students quests both in real life and the online world of *Second Life*. I will assess how this structure affects student learning using the Astronomy Diagnostic Test and will present my results both a national astronomy and at "serious games" conferences.

Five–year history of grants awarded to you by Elon's FR&D Committee (list date and nature of each grant):

Summer (2005) Fellowship, "Determining the Rate of Magnetar Flares in Nearby Galaxies"

Have you been awarded, or applied for, financial or other support (reassigned time from Elon, external grant funding, etc.) during the time that you would be a CATL Scholar (2006-08 academic years)?

Fall 2006, Establishing Elon University as a Member of the Physics Teacher Education Coalition
(If I receive the CATL Scholar award, I would request that the reassigned time for this departmental service project be given to Dr. Kyle Altmann so that he might complete it.)

Department chair's comments on this proposal:

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Chair's Signature

Dean's comments on this proposal:

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Dean's Signature

CATL Scholar Program Application

Testing a "Quest-Points-Level" Game Structure in *Introduction to Astronomy*

Dr. Anthony Crider - Department of Physics

PROJECT OVERVIEW

The traditional classroom reward system involves each student completing the same assignments as his or her peers and being evaluated on the quality of the submitted work. For this project, I will create, implement, and test a new class structure built around the mechanics of role-playing games. The "quest-points-level" reward system of such games (*e.g. Dungeons and Dragons*, *World of Warcraft*) allows a player to select from a variety of tasks worth some number of experience points. These points accumulate and allow the player's character to "level up" such that he or she becomes eligible for more difficult tasks. While this structure exists to some extent in higher education, it takes place over a timescale of years (*i.e.* students choose classes, receive grades, and are promoted to the next grade). By distilling the reward system down into much smaller chunks (minutes to hours), role-playing games become quite addictive. My goal is to emulate and test the effectiveness of such a system in my *Introduction to Astronomy* class. Three separate experiences at Elon have led me to believe that such a class structure might lead to substantially more engagement than the traditional framework. I would fuse elements of each into the "quest-points-level" class structure that I propose to create and test.

A. Online homework in the *WebAssign* course management system allows my *General Physics* students to make multiple attempts at a homework problem before the deadline. Since implementing this, I have seen students begin working on problem sets earlier and mentoring fellow students once they have the correct solution. I also see a bit more excitement and less frustration among them as they are "rewarded" for solving a problem as soon as they have completed it successfully.

B. As a gamble last semester, I allowed student groups in my *Introduction to Astronomy* class to spend the final third of the semester designing and executing an outreach or research project. The diversity and high quality of their results surprised my faculty peers and me. I will certainly try this again, and also would like to infuse this level of engagement into the earlier portion of the course, when students are learning the basics of astronomy needed to complete such projects.

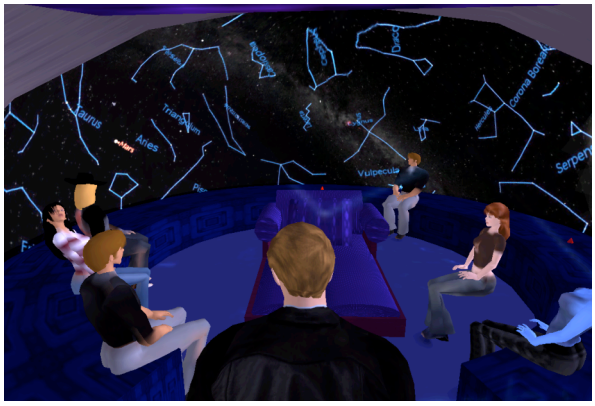
C. For the past year, I have been exploring the online world of *Second Life*. Last summer, I built a virtual planetarium within the "game" of *Second Life* and in the fall was invited to transplant it to the *Second Life* education hub. Just as the easy-to-use *PowerPoint* transformed the way professors communicate with students, I believe *Second Life* will allow even novice programmers to create powerful new environments for education.

With such an open-ended class structure, I am hoping to enhance the most transformative aspect of my course: student observations of the sky. Examples include recording the direction of sunsets throughout the semester, the phases of the moon throughout the month, and the hourly motion of the sky during a single night. While the current astronomy labs permit students to do very short skywatching exercises, these long-term projects must be done outside of class. Similarly, practical considerations make leading a large group to nearby observatories or planetariums during class impossible. Instead, students simply receive bonus points for taking the initiative to visit one. With a "quest-points-level" structure for a class, the bonus points ***become*** the class itself. Students will complete a mixture of real skywatching when the clouds permit and virtual skywatching within *Second Life*. Ultimately, they must choose a collection of projects that will earn them points for their final grade.

Interest in the educational value of "serious games" is rising both nationally and here at Elon. While the military has been using them for years, they are relatively new to academia. In a CATL-sponsored group last fall, I met with other Elon faculty members to discuss the aspects of popular games that could be adopted into an academic setting. The experiment that I am proposing here is related, but orthogonal, to one that is already underway. In a recent *Astronomy Education Review* paper, "Using Role-Playing Games to Teach Astronomy: An Evaluation," Paul Francis describes his use of role-playing in the classroom as a tool for instruction. In one of his games, students play the part of scientists with different facts related to the greenhouse heating of Venus, each attempting to be the first to convince his or her peers to endorse a theory. His work parallels that of the more developed "Reacting to the Past" games developed at Barnard College and used at a host of institutions throughout the country. While these classes employ the "role-playing" aspect of role-playing games, I will instead be focusing on how the backbone of the games, the quests, might motivate students to take ownership of their education.

STUDENT INVOLVEMENT

Students taking part in the experimental *Introduction to Astronomy* course described above will spend roughly two-thirds of the semester completing quest modules created by me. Then, working in groups of four, students will spend the remainder of the semester developing and testing their own astronomy quest module. Last fall, three students worked as docents in my prototype astronomy module, a virtual planetarium that I constructed in the online world of *Second Life*. Aside from hosting open houses for the public (as seen in the picture to the right), they also constructed an information booth from which to greet visitors. In addition to the students taking my class, I will also have a member of my astronomy lab assistant team assist me during the academic year in maintaining the online components of each class module.



PROJECT ASSESSMENT

The Astronomy Diagnostic Test v. 2.0 (ADT; Hufnagel 2002, *Astronomy Education Review*) is the national standard for assessing the learning that takes place in introductory astronomy courses. I have been administering it before and after astronomy classes (both my own and other instructors') for several years at Elon. For this study, I will also be examining the time spent by each student on each task. I can then test to what extent the time spent on a particular subject's "game" correlates to student learning of that subject as measured by the ADT.

FACULTY DEVELOPMENT

With the database of ADT scores that I have collected, I have been able to systematically evaluate practices in my classroom. In 2004, I was awarded "Best Pedagogical Paper" at a regional meeting of the American Association of Physics Teachers for my paper using such data to evaluate the effectiveness of having student groups sit in a "Hot Seat" at the front of the room. As I am now completing my astrophysics research from last summer, I feel the time is right to return again to my pedagogical research. My department chair has arranged for me to teach only two sections of *Introduction to Astronomy* in the fall, making it a perfect time to take the lessons I have learned and rebuild this course.

DISSEMINATION OF RESULTS

The course modules that I develop will largely be administered and collected in the online world of *Second Life*. Thus, I will be able to promote them both at the physics and astronomy education conferences I attend and as well as at "serious games" conferences. In the Budget and Timeline section below, I highlight the planned venues for releasing my results. A byproduct of the fact that much of this will be developed in *Second Life* is its immediate availability to other institutions. As *Second Life* accounts are free, instructors and students from across the country will be able to use the materials I develop within it, as well as contributing their own. Of course, the most fundamental element that I am testing, the "quest-points-level" structure of a course, could be deployed across the curriculum. In the second year of this study, I discuss with Elon faculty colleagues how they might include elements of this work in their own courses.

BUDGET AND TIMELINE

Estimated Annual Budget

$ 300 per year	Annual fee for "4096 square meters" of server space in *Second Life*.
$ 1200 per year	Travel to Games+Learning+Society conference.
$ 500 per year	Three (3) hours per week of student assistance in managing *Second Life* assets.

Phase One – Deploy "Quest-Points-Level" Structure in *Introduction to Astronomy*

While the CATL Scholar program would not technically begin until the fall, it would be crucial for me to create *Second Life* scripts for offering quests, distributing points, and leveling players over the summer. I would also attend the Games+Learning+Society conference in Madison, WI to discover more about current "serious games" issues.

FALL 2006	First trial with two sections (60 students) of *Introduction to Astronomy.*
WINTER 2007	At a joint national meeting of the American Astronomical Society and the American Association of Physics Teachers, I will present my preliminary findings from the two fall sections.
SPRING 2007	Second trial for *Introduction to Astronomy*.
SUMMER 2007	At the Games+Learning+Society conference, I will present my results from the previous year.

Phase Two – Deploy "Quest-Points-Level" Structure in *Astronomy Labs*

FALL 2007	First trial with five sections (150 students) of *Astronomy Labs.*
WINTER 2008	I will begin writing a paper on the use of the "Quest-Points-Level" system.
SPRING 2008	Second trial with four sections (120 students) of *Astronomy Labs.*
SUMMER 2008	I will submit a paper to *The Physics Teacher* summarizing my methods and results.