

LITRE Grant Pre-Proposal Submission Form

Submit by e-mailing to litre@ncsu.edu as PDF or RTF document by October 1, 2004. Form and RFP available at <http://litre.ncsu.edu>. Receipt of your proposal will be confirmed within 24 hours.

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1. Project Title: Integrating Interactive Learning into the Geosciences
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2. Project Coordinator: Name: Carrie Thomas
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Campus Phone:5-7839
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3. Other Participants (List any persons other than yourself who will be participating in this project):

John Fountain, Head, MEAS
Donna Wolcott, Director of Undergraduate Programs, MEAS
Edward Stoddard, Assoc. Professor, and MEA 110 lab coordinator.
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4. College or Unit: Physical and Mathematical Sciences
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5. Department: Marine, Earth, and Atmospheric Sciences
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6. Project Description (Describe what you plan to do):

We plan to integrate computer-supported inquiry-based learning into lower-division courses in the Department of Marine, Earth, and Atmospheric Sciences (MEAS). These courses are used annually by thousands of NCSU students to meet their general education requirements for natural science courses with an accompanying laboratory. Our goal is to migrate to a format that integrates hands-on student inquiry and instructor input, replacing at least some of the current large lectures and their independent lab sections. This format, Student-Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP) has been successful in the NCSU physics program. The current model of stand-alone lectures with separate labs is a less effective way to communicate science concepts, and in particular, allows students' faulty preconceptions to go undetected and unchallenged. In contrast, a learning environment that fosters hands-on, student-initiated, hypothesis-driven exploration is more effective in helping students grasp concepts, and in revealing and correcting misconceptions, as recent research has shown. This type of teaching cannot be done in the teaching labs in Jordan Hall as now configured. Lab tables and seating are fixed and students cannot work in teams. LITRE funds will be used in a pilot study to up-fit a renovated teaching space with modular tables that can accommodate group work and with a digital projection system that can integrate computer-assisted learning using existing laptop computers. A student will be hired to work with faculty to create computer-assisted learning modules. Funds from Education and Technology Fees (ETF) and from the National Science Foundation purchased the laptops, which use wireless technology, and the mobile cart for transport and storage.

Additional departmental funds have been committed to cover the costs of removing the fixed benches and demonstration station in one lab for the pilot project. In Spring, 2005, paired sections of MEA 110, Geology Laboratory I, will be taught in the group-learning format and in the traditional format. The two sections will be compared on learning gains (outcome-based assessment), persistence of misconceptions (interviews and pre-post-tests) and attitudes toward science.

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7. Estimated number of students affected (If your proposal is for a small pilot project, you may want to distinguish between short term and long term impact):

In the pilot project, we will pair a minimum of two modified sections of MEA 110, Geology Laboratory I, with two traditional sections, taught at the same time. Each section contains 18 students, and the number of students involved in the assessment will be 72. If student outcomes are significantly improved, as we anticipate from past SCALE-UP projects in Physics, we will continue to evolve our teaching space and course architecture to accommodate SCALE-UP. We plan to convert one 90-person lecture section of MEA 101, Physical Geology, with companion MEA 110 labs to two SCALE-UP modules beginning in Fall 05, and plan to increase the number of SCALE-UP modules in the following semesters. Construction of Jordan II, scheduled for occupancy in Spring, 2007, will expand our options for more SCALE-UP sections.

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8. Project Objectives (Describe what you hope to accomplish via this project, i.e. what are your goals? In particular, explain why you think this will enhance student learning. If it is successful, what long-term impact will your project have on your department or college or the university?):

We can create a superior learning environment that facilitates use of computer technology and allows group exploration of hypotheses. Current laboratory space was designed for unidirectional information distribution: the instructor lectured and demonstrated principles, and students worked individually on hands-on activities. The success of SCALE-UP prompted some sections of MEA classes to be taught in an interactive mode this year, with students working together and using laptop computers to augment work with specimens and materials. Laboratory exercises frequently involve either water or rocks, which are incompatible with computer use. The use of wireless laptops was developed specifically to deal with diverse laboratory uses. Piloting of the concepts in Spring 2004 and this Fall has shown that the wireless configuration is well suited to the exercises, but the lab configuration is not. Instructors and students were frustrated by the physical constraints in the teaching space. The lab benches are fixed to the floor with work stations spaced uniformly along them. Group work requires students to sit on the bench, or stand around a work station. In some situations, learning was hindered because there was no mechanism for simultaneous display of digital information to the whole class. In this project, we will remove the fixed seating and replace it with tables that allow flexible configuration of the learning environment. An interactive digital pad interfaced with a laptop (Wacom tablet) will allow diagrams and digital editing to be projected, to assist with mid-course corrections during hypothesis-testing exercises.

Students will be able to work in groups to brainstorm about scientific principles, generate hypotheses, and then test them. This type of learning has been shown both to debug preconceived, erroneous concepts and to integrate the principles into a student's working intellectual repertoire. See # 7 for additional information on impact on the department and university.

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9. Projected impact on NCSU (Describe possible ways in which you feel your project outcomes could be used to benefit NCSU.):

Enrollment in GER courses in MEAS exceeds 5000 annually, and 95% are in courses with a laboratory component. In the long term, as more sections can be taught in SCALEUP mode, students will learn more and more accurately, and have a better appreciation of their natural environment and the science behind it.

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10. Project Assessment (Describe how you plan to measure whether the project achieves your goals. This should include how you will know about effects on student learning.):

MEA 110 is a one-credit, optional companion lab to MEA 101, Physical Geology. The lab combines a lecture segment and hands-on exercises with geologic maps, rock and mineral specimens, etc. Each semester, multiple sections of MEA 110, Geology Laboratory I, are taught by teaching assistants (TA). Each TA is generally assigned at least two lab sections. For experimental control, two teaching assistants will be asked to teach one lab in an unmodified space using traditional methods (control) and a second lab section in the newly renovated lab (treatment). We will do this for at least two pairs of sections, making every effort to choose concurrent sections to control for time of day effects (see matrix below for specifics). Because it is difficult to control the diversity of students registering for a specific lab section, we will randomly select a sub-population of students enrolled in traditional labs for comparisons.

Experimental Design Matrix:

Scheduled:	Monday 3:40-6:30	Wednesday 3:40-6:30
TA 1:	Traditional in Jordan 2105	SCALE-UP in Jordan 2104
TA 2:	SCALE-UP in Jordan 2104	Traditional in Jordan 2105

First, we hypothesize that learning gains on key course learning objectives will be higher in the treatment group than in the control, or traditional, group. We will assess learning gains in both the control and treatment populations using course grade statistics (performance on quizzes, homework and tests), performance on individual, key test and homework questions, attendance records, and comparisons of pre and post test scores. All scoring will follow strict rubrics to control for grade inflation and differences in grading style. Additionally, examples of student work and grading will be reviewed by the project team to ensure that grading is equivalent between sections and teaching assistants.

Second, we hypothesize that misconceptions will persist more frequently in students

exposed to the traditional laboratory environment than in students exposed to the modified classroom. We will assess the efficacy of the SCALE-UP model in reducing the persistence of misconceptions using pre and post tests and personal interviews. We have identified two misconceptions we will explore: The perceived equivalency of weathering and erosion and the structure of the inner Earth.

Third, we hypothesize that students' attitudes toward science will improve more from semester beginning to end in the modified labs than in the traditional labs. As part of a NSF funded project Thomas and Fountain have received permission to modify and use the Views about Science Survey (VASS) on students enrolled in our courses. We will administer the survey to students during the first and last labs to compare their responses.

C. Thomas will be responsible for coordinating the assessment portion of this project. This responsibility will be met as a part of her normal job duties, thus no additional funds are requested. After the experiment has begun we plan to continue to use Carrie Zelna as a resource for assessment should we need to modify our approach or have difficulty implementing our plan.

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11. Staffing and Support (Who will receive funds dispersed under this grant and what will they do?):

Faculty and TA salaries and some technical support are in place. Additional funds will cover the costs of student assistance to help develop computer-based learning modules for certain labs and to provide technical support.

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12. Financial Support Requested (Dollar totals are all that is required here. All funds must be used by June 30, 2005):

EPA salary total:

SPA salary total:

Other salary (consultants, student assistants, etc.): \$3,000

Equipment (including hardware and software): \$400 for a Wacom Tablet

Costs associated with assessment (if any):

Other financial support requested: trapezoidal tables 8 (48x60") = \$750

Additional Explanation of how funds will be used (You may leave this blank if you feel you have already provided this information.):

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13. Staff Support and/or Technical Support Requested (Describe any technical and/or staff support that you are requesting under this grant, i.e. how many hours of staff time and for what purpose? Do not include here staff time for staff you plan to hire yourself. If you plan to do your own hiring, include that cost under item #12.):

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14. Total support requested (Add costs from item #12 and item #13 converting the hours requested in item #13 @ \$40/hr): \$4150

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15. Timetable for Implementation (When will the various stages of your project will be completed?):

Currently ongoing: Redesign of laboratory modules for SCALE-UP mode.

Dec. 1-3: Contents of Jordan 2104 moved, stored, and protected.

Dec. 6: Demolition work will begin.

Jan. 4-7: Technology installation and testing.

Jan. 18: Laboratories begin meeting.

April 25: Week of lab finals.

May: Assessment analysis, Final Report preparation and submission.

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16. Human Subjects Protection (If your proposed project involves research using human subjects, you will need approval from the Institutional Review Board for the Protection of Human Subjects in Research (IRB) prior to final approval. IRB information is available at <http://www.ncsu.edu/sparcs/irb/>. N/A

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17. Release: By submitting this proposal the applicant grants the LITRE Advisory Board permission to make this proposal available as an example for future grant applicants. All personal information will be removed if this proposal is used as an example.