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# Capstone Experience for Geoscience Students at the University of Maine: Integrating Fieldwork, Laboratory Analysis and Multimedia Technology in a Teamwork Environment


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**Final Report for Period:** 06/1997 - 05/1999**Submitted on:** 07/10/1999**Principal Investigator:** Belknap, Daniel F.**Award ID:** 9750879**Organization:** University of Maine

Capstone Experience for Geoscience Students at the University of Maine: Integrating Fieldwork, Laboratory Analysis and  
Multimedia Technology in a Teamwork Environment

**Participant Individuals****Senior Personnel****Name:** Belknap, Daniel**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Dr. Belknap was not originally a co-PI on this project, but took over when Dr. Spencer-Cervato left the University of Maine. He was an informal advisor during the writing stages, however. He became lead PI in 1998, and with Dr. Yates has sheperded students through the Capstone Experience required by the University of Maine, and in fulfillment of this projects goals.

**Name:** Spencer-Cervato, Cinzia**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Dr. Spencer-Cervato is the initiator of the project, she conceived and wrote the proposal, and began the construction of the computer laboratory in concert with Dr. Yates. She developed the curriculum concepts for the Capstone projects now in use. Dr. Spencer-Cervato left the University of Maine in 1998, at which time Dr. Belknap became the lead PI.

**Name:** Yates, Martin**Worked for more than 160 Hours:** Yes**Contribution to Project:**

Dr. Yates was a co-writer of the proposal, and used his expertise in computers and networks to design and construct the new Computer Laboratory in the new Bryand Geological Sciences Building, occupied by Geological Sciences in the summer of 1997. He has continuing involvement in the Capstone course and almost daily interactions with students in the lab and with network problems.

**Post-doc****Graduate Student****Undergraduate Student****Partner Organizations****Other Collaborators**

None

**Activities and Findings****Research Activities:**

The major accomplishments of the NSF Capstone Project include setting up a computer and network laboratory for Geological Sciences, Institute for Quaternary Studies and associated disciplines at the University of Maine. In setting up this laboratory the following acquisitions have been integrated into a networked laboratory within the new Bryand Global Sciences Center on the Orono campus. Internet connections and on-campus links allow use of World-Wide Wide resources, campus libraries, computing facilities, printers and plotters, as well as Local Area Network CDÆs and archive resources. Within geological sciences the network and archive ôGAIAö allows efficient storage and interchange of data, files, and ideas. The primary hardware and software acquired on this project includes:

4 Macintosh PowerPC 7300 Computers

- 4 Macintosh iMac Computers
- 5 Gateway Pentium 200 Computers
- 1 HP DeskScan Scanner
- 1 HP LaserJet 4000 TN Laser Printer
- 1 HP Color Laser Printer
- 1 HP DeskJet 1200C Color Inkjet Printer
- 1 HP CD-ROM Writer
- 1 Adaptec Toast CD-ROM Writer
- 1 HP LHPro Server with 54 Gbyte Array of Hard disk Storage
- 1 Laserdisc Player
- 1 Video Frame Acquisition Card
- Novell Intranetware Server Software
- CIT Software Licences
- Geology Educational Software

The original goals of the NSF Capstone Project were to set up the laboratory described above, but more importantly to use it as a core resource to build an integrated, hands-on learning environment for undergraduates in Geological Sciences and related disciplines. This is in line with national as well as UM campus goals, such as the requirement for campus-wide Capstone Experiences, instituted as a requirement in 1996. Our 1999 graduation class of seniors has completed their Capstones, using the equipment and proposed projects of the NSF project. Future classes will continue to benefit from this project. The 1999 seniors were widely spread in their interests, and completed primarily individual projects. The 2000 and later seniors will have more coordinated efforts toward group projects, more emphasis on web-based products, and an earlier start with field trips and gathering resources. The projects completed include:

#### Senior Capstone Projects:

Julie Bartlett - artwork for new building - concept for a geologic timeline display

John Burns - Consideration of a bedrock source for arsenic in domestic wells of Bayside, Maine: poster presentation at Maine Geological Society meeting

#### Geological Society meeting

Anthony Jackson - Cape Rosier Mine, Coastal Maine: web site virtual field trip

Katherine Skinner - Arsenic mobility in groundwater from Zimapan, Mexico: geochemical computer modeling using PHREEQC software to examine variances in pH and pe: poster presentation at Maine Geological Society meeting

#### Senior Theses (and Capstone Projects):

Amy Benoit - A record of atmospheric Hg deposition in Maine peat bogs: evidence for an industrial point source in Orrington, ME? Senior Honors Thesis and presentation at departmental seminar.

Riley Brown - Evidence for magma mixing in the Lucerne Granite, Maine: Senior Thesis, presentation at Geological Society of Maine, and departmental seminar.

In addition to the specific Capstone Project, the computer laboratory has become a hub of activity for undergraduates and graduate students in the building. It is an essential part of the research activities for at least 15 graduate students, and is also used by faculty. In the past year seven MS students have completed their theses, using the computing and network resources as essential tools in their work:

#### Masters Theses Completed

Heather Franco 1999 - Sensitivity analysis of a simple ice-sheet model

James Kaste 1999 - Mobility of cosmogenic and bedrock-derived beryllium in Maine

Meredith Kelly 1998 - Surficial deposits in Western Victoria Valley: a record of paleoenvironments in southern Victoria Land, Antarctica, since middle Miocene time.

Kari Kimball 1999 - Modelling road-salt contamination of aquifers in Winterport, ME

Jeff Rogers 1999 - Mapping of subaqueous, gas-related pockmarks in Belfast Bay, Maine using GIS and remote sensing techniques.

Stacy Shafer 1999 - Image processing and GIS analysis of Peruvian Beach Ridges: El Niño and seismic components of coastal change

Jon Warzocha 1999 - Effects of geology and topography on regional groundwater flow in the Glacial Lake Agassiz peatlands, Northern Minnesota.

Finally, a number of Geological Sciences Courses make substantial use of Capstone Grant Facilities during the year for course assignments and laboratories. These include:

- GES 101 Introduction to Geology  
 Computer-based plate tectonic demonstrations  
 Revised Lab Manual Produced using CD-ROM Topographic Map Series
- GES 332 Analytical Methods  
 Labs Requiring Computer Software analysis of large analytical data sets
- GES 333 Introduction to Petrology  
 Digitized Petrographic Photomicrographs and computer-based image analysis
- GES 416 Structural Geology  
 Interactive Courseware  
 Computer-based Structural Geology Labs
- GES 417 Introduction to Geophysics  
 Computer-based Geophysics Labs
- GES 591 Introduction to Meteorology and Climatology  
 Computer-based climate modeling labs

### **Research Findings:**

The preliminary findings are that all levels of instruction and student research in the Department of Geological Sciences have been improved by the computer laboratory. The specific goals of the undergraduate Capstone Experience are beginning to be met, but will require continuing refinement. In particular, the first senior class required to complete a Capstone Requirement was given a flexible set of choices, some succeeded brilliantly with theses, virtual field trip web sites, etc. Some were not as well organized. In the coming year we will start in the fall semester, design a field-based introduction for many or all of the undergraduates involved, and complete the integrated program originally envisioned. At the graduate level, the additional resources have been a resoundingly successful addition for the needs of MS and Ph.D. candidates.

### **Research Training:**

Besides the accomplishments described above for the student participants, the PI's have gained valuable experience advising the Capstone Experience students. We have made a number of mistakes, and the loss of the original PI caused a gap in integration, but have a clearer course of action to make this a better and continuing program.

### **Education and Outreach:**

Establishment of websites, such as the virtual field trip prepared by senior Tony Jackson, will be a valuable resource for public access to local geology and ongoing research. This will be expanded in the future. In addition, participation by students and faculty from this project in the Geological Society of Maine (a regional group of more than 350 students, faculty, professional geologists, K-12 educators, and citizens) is a front-line contact for outreach. The annual spring student seminar series will continue to be a major venue for the 'public presentation' requirement of the Capstone Experience.

### **Journal Publications**

### **Books or Other One-time Publications**

### **Web/Internet Sites**

#### **URL(s):**

<http://www.geology.um.maine.edu/>

#### **Description:**

### **Other Specific Products**

### **Contributions**

#### **Contributions within Discipline:**

Education - demonstration of integrative learning-based education using field, laboratory, web-based, and traditional resources.

Geology - development of website 'virtual field trips' and other database resources to be available on line.

#### **Contributions to Other Disciplines:**

#### **Contributions to Education and Human Resources:**

Graduation requirements completed by six UM seniors - Capstone experience

Contribution to completion of seven MS students.

Contribution to progress of 8 other MS and Ph.D. students.

Contribution to development of new learning-based educational methods by three faculty members.

#### **Contributions to Science and Technology Infrastructure:**

Reported above

#### **Beyond Science and Engineering:**

Reported above

### **Categories for which nothing is reported:**

Partner Organizations

Other Collaborators

Any Journal

Any Book

Any Product

Contributions: To Any Other Disciplines