INTEGRATING SKILLS DEVELOPMENT INTO AN UNDERGRADUATE EARTH & ENVIRONMENTAL SCIENCES PROGRAM AT MCMASTER UNIVERSITY

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INTRODUCTION

Undergraduate programs in the School of Geography and Earth Sciences (SGES) have been designed to meet the present and future needs of graduating students planning to enter the workforce or to pursue post-graduate studies or professional training. The Earth & Environmental Sciences (EES) Honours B.Sc. program provides students with a thorough grounding in the fundamental sciences (math, physics, chemistry, and biology), a broad, interdisciplinary background in earth and environmental sciences and the opportunity to specialize in geosciences, hydrosciences or geochemistry. A fundamental aim of the EES program is to enable students to develop a set of life-long learning skills that promote an on-going ability and desire to learn, and a set of technical and professional skills that permit a range of career choices.

Integrating skill development into the EES program that adequately prepares students for careers in the geosciences has involved three main processes –

- Designing a curriculum that allows systematic skill development for all students,
- Creating an inventory of skills development practices in individual courses, and
- Seeking feedback from alumni.

INVENTORY OF SKILLS DEVELOPMENT PRACTICES IN COURSES

An audit of all SGES courses, noting which skills were taught and/or evaluated, where the skill development occurred and/or was assessed (i.e. lecture, lab, test) and at what proficiency level, was conducted by an undergraduate student (Jenn Sharp) as part of her B.A. thesis. The initial survey was conducted in the summer of 2003, further data were added in 2005 and the survey was fully analyzed in 2006. In order to conduct the survey a series of rubrics were created identifying the characteristics of students with introductory, intermediate, advanced and highly advanced skill sets. We grouped the skills into Research skills, Teamwork skills, Technical skills, Communication skills and Life skills (Figure 2).

Problems with the skills survey:

- difficulty of establishing skill level rubrics
- inconsistency of instructor responses to the survey
- needs to be repeated regularly as instructors change and courses are modified

Positive aspects:

- conducting the survey made instructors more aware of how and at what level they were developing skills in their courses

Oral Presentation Skills

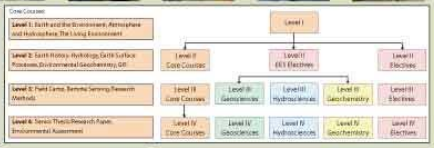
- introduced in Level I (Earth & the Environment) through informal presentation of Rock & Mineral lab results to a small group. Peer evaluation.
- developed in Level II (Earth History) where students make a group presentation to entire lab class (approx 25 students). Peer and instructor evaluation.
- further developed in Level III (Research Methods) where students make short presentations on their own research proposal to whole class (45 students). Instructor evaluation.
- in Level IV students make an individual presentation of their own research (undergraduate thesis work) to a large class of BSc and BA students, their research supervisors and several other instructors. Evaluation by panel of faculty members.

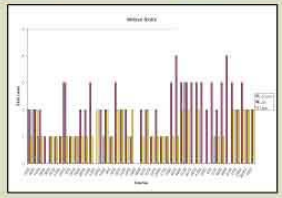
Fieldwork Skills

- introduced in Level I (Earth & the Environment) as a half day field trip (field observation, sketching, logging)
- developed in Level II (Earth History) as a half day field trip focused on sedimentological logging, correlation and paleoenvironmental interpretation
- further developed in Level III (Field Camp) where students spend 12 days, both on- and off-campus, developing hydrological and environmental monitoring, fieldwork planning, paloenvironmental interpretation geologic and structural mapping skills
- students may elect to take an advanced field course in Level IV to more 'exotic' locations such as Costa Rica, Oman, Arizona, the Rockies. Many students design and conduct fieldwork for their thesis work.

CURRICULUM DESIGN

The EES program consists of a common 'core' program (taken by all students), and three specializations selected after Level II (Figure 1). Skill development has been focused in the compulsory core courses.





Critical Thinking Skills

- development of these skills seems to take place systematically
- higher level testing of these skills is required in upper level courses

Written Communication Skills

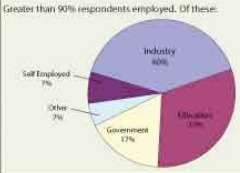
- testing of these skills is at a fairly basic level and there is a need to increase the level of skill development and testing at Levels III and IV

FEEDBACK FROM ALUMNI

In order to determine the skills needed by students upon graduation – and to evaluate the effectiveness of the EES skills development program, SGES have conducted several alumni surveys.

Two surveys of alumni have been conducted to inform skills development in the EES program. The first survey, conducted in 2000 (classes of 1990 to 1998), focused on obtaining information regarding development of personal transferable skills in the academic program and the nature of skills they required in their subsequent working environment. The second survey, conducted in January 2006 (classes of 2000 to 2005) updated this information.

Greater than 90% respondents employed. Of these:



The following skills were identified to be important in the working environment:

- verbal and written communication
- time management
- critical thinking
- problem-solving
- analytical work

Approximately 80% of the respondents were confident with the level of skills they gained from their university education. Approximately 80% of the respondents also felt that their university education had adequately prepared them with the skills they identified as being most significant in their working environment.

Issues:

Over 60% felt they were poorly to adequately prepared in leadership skills.

Over 40% felt that they were poorly to adequately prepared with problem-solving skills and were only adequately prepared with time management skills.

ACKNOWLEDGEMENTS

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