



Educational Outcomes by Graduation	Assessment Method and Criteria	Summary of Results	Use of Results
<p>Students should possess a basic understanding of the structure and composition of the Earth. This understanding should be adequate to support the incorporation of Earth science knowledge into the study and practice of a field other than Earth science.</p>	<p>1. The department undergraduate committee assembles a biannual report on collective student progress on Intended Educational Outcomes, including recommendations for changes in the curriculum, to the Department Faculty Retreat. Faculty discuss the strengths and weaknesses of the curriculum and propose improvements. 2. Every five years, an external visiting committee, currently comprising four members of the National Academy of Science, conducts a review of the undergraduate bachelor's degree curriculum by talking with current students and faculty, by examining records of student success after graduation, and by comparing our bachelor's degree program with those of peer institutions. Their report to the Dean of Natural Science identifies strengths and weaknesses in our program.</p>	<p>1. At the faculty retreat in 2006, the undergraduate committee led a discussion of the core classes (which are required of BA students). There was some sense that several of the core courses should be sequenced. 2. In 2001, the visiting committee described our undergraduate bachelor's degree curriculum as outdated in comparison with programs at peer institutions. The suggested that we consider revamping the curriculum along the lines of some of these institutions. In 2006, the same committee acknowledged the dramatic improvements made in the bachelor's degree curriculum after their previous visit.</p>	<p>1. At the Faculty retreat in 2006, the faculty attributed the problem to differences in the teaching approach among the core courses, and directed that the courses all be taught for introductory students without assumptions of prior Earth science knowledge. This approach would eliminate the need for sequencing. 2. In response to the comments of the 2001 Visiting Committee, the faculty redesigned the BA curriculum. The traditional geology course sequence was abandoned in favor of a set of 4 core classes. These core classes represented a modern selection of material to be taught with an eye toward our Intended Educational Outcomes. The new curriculum was put into place for BA students matriculating in 2002. We have not yet had a student graduate with a BA under the new requirements. When we do, we will conduct exit interviews with them to assess their impressions of the curriculum.</p>
<p>Students should possess a basic understanding of the processes that lead to the formation of the Earth, that controlled its evolution, and that operate to change the Earth today. This understanding should be adequate to support the incorporation of Earth science knowledge into the study and practice of a field other than Earth science.</p>	<p>Same as above.</p>	<p>Same as above.</p>	<p>Same as above.</p>
<p>Students should be able to understand concepts and methods learned in introductory university mathematics and science classes and how they are used in describing and learning about the Earth.</p>	<p>Same as above.</p>	<p>Same as above.</p>	<p>Same as above.</p>



Program Development Plans

School of Natural Sciences
Bachelor of Science in Earth Science

Educational Outcomes by Graduation	Assessment Method and Criteria	Summary of Results	Use of Results
Students should gain an understanding of the structure and composition of the Earth .	<p>1. The department undergraduate committee assembles a biannual report on collective student progress on Intended Educational Outcomes, including recommendations for changes in the curriculum, to the Department Faculty Retreat. Faculty discuss the strengths and weaknesses of the curriculum and propose improvements.</p> <p>2. Every five years, an external visiting committee, currently comprising four members of the National Academy of Science, conducts a review of the undergraduate BS curriculum by talking with current students and faculty, by examining records of student success after graduation, and by comparing our BS program with those of peer institutions. Their report to the Dean of Natural Science identifies strengths and weaknesses in our program.</p>	<p>1. At the faculty retreat in 2006, the undergraduate committee led a discussion of the core classes. There was some sense that several of the core courses should be sequenced.</p> <p>2. In 2001, the visiting committee described our undergraduate BS curriculum as outdated in comparison with programs at peer institutions. They suggested that we consider revamping the curriculum along the lines of some of these institutions. In 2006, the same committee acknowledged the dramatic improvements made in the BS curriculum after their previous visit.</p>	<p>1. At the Faculty retreat in 2006, the faculty attributed the problem to differences in the teaching approach among the core courses, and directed that the courses all be taught for introductory students without assumptions of prior Earth science knowledge. This approach would eliminate the need for sequencing.</p> <p>2. In response to the comments of the 2001 Visiting Committee, the faculty redesigned the BS curriculum. The traditional geology course sequence was abandoned in favor of a set of 4 core classes. These core classes represented a modern selection of material to be taught with an eye toward our Intended Educational Outcomes. The new curriculum was put into place for BS students matriculating in 2002. The first students to fully experience the new curriculum will graduate this year. We will conduct exit interviews with them to assess their impressions of the curriculum.</p>
Students should gain an understanding of the processes that formed the Earth, affected its evolution, and that operate to change the Earth today.	Same as above.	Same as above.	Same as above.
Students should be able to apply concepts and methods learned in mathematics, chemistry, and physics, to Earth science.	Same as above.	Same as above.	Same as above.
Students should have a core of basic technical skills (laboratory, field measurement, and computation).	<p>BS students are encouraged to engage in research projects with faculty and to participate in summer research opportunities with faculty at other institutions. In these activities they become involved in front-line science projects which exposes them to state of the art research techniques. We conduct exit interviews with these students to assess the collective success of our program in achieving Intended Educational Outcomes. We also consider the number of scientific presentations (and in a few cases submission of scientific papers) by our BS students to be an excellent indicator of success.</p>	<p>Presentations (oral or poster) at major scientific meetings and manuscripts submitted by BS students 2005 8 presentations 2004-2005 4 manuscripts submitted, 3 accepted and 1 declined</p>	No action required. We will continue to assess this intended educational outcome.
Students should possess basic familiarity of the scientific literature, and basic skill in the oral and written communication of scientific results.	Same as above.	Same as above.	No action required. We will continue to assess this intended educational outcome.



Educational Outcomes by Graduation

Assessment Method and Criteria

Summary of Results

Use of Results

Students will possess a solid understanding of the nature and origin of the materials that compose the Earth	<p>1. The department graduate committee conducts an annual evaluation of the collective performance of first year graduate students on a written qualifying exam, and of second year students on the preparation of a research proposal and the oral defense of that proposal before a faculty committee.</p> <p>2. The department graduate committee assembles a biannual report on collective student progress on Intended Educational Outcomes including recommendations for changes in the curriculum to the Department Faculty Retreat. Faculty discuss the strengths and weaknesses of the curriculum and propose improvements.</p> <p>3. Every five years, an external visiting committee, currently comprising four members of the National Academy of Science, conducts a review of the graduate curriculum by talking with current students and faculty, by examining records of student success after graduation, and by comparing our MS program with those of peer institutions. Their report to the Dean of Natural Science identifies strengths and weaknesses in our program.</p>	<p>1. In 2006, the graduate committee did not identify weaknesses in this Intended Outcome.</p> <p>2. In 2006, no problems with this Intended Outcome were brought to the attention of the Faculty Retreat.</p> <p>3. In 2006, no problems with this Intended Outcome were mentioned by the visiting committee.</p>	No action required at this time, but we will continue to evaluate this item.
Students will possess a solid understanding of the physical and chemical processes that operate in the deep interior, outer shell, and at the surface of the Earth	Same as above.	Same as above.	No action required at this time, but we will continue to evaluate this item.
Students will possess a knowledge of the geologic record of terrestrial and oceanic Earth processes and of life on Earth.	Same as above.	Same as above.	No action required at this time, but we will continue to evaluate this item.
Students will have the ability to use appropriate quantitative and analytical techniques in the conduct of research investigations.	<p>Students are encouraged to prepare and submit a scientific manuscript to an internationally recognized peer-reviewed journal. This manuscript describes the use of quantitative and/or analytical methods used by the student. External peer-review is the most rigorous assessment available in science. Reviewers are aware of the state of the art in research methodology. Success in publication is indicative of the proper use of research methods.</p>	<p>This assessment tool was initiated for students starting the MS program in 2002. Since then 20 manuscripts have been submitted by MS students. Of these 14 have been accepted for publication, 5 are currently in review, and 1 has been declined.</p>	<p>During the 2006 Faculty Retreat, department faculty discussed the importance of scientific publication and revised the MS requirements to require the preparation and submission of a manuscript to a journal deemed acceptable to their faculty advisor. This change will take effect for incoming MS students in 2006.</p>



Educational Outcomes by Graduation

Assessment Method and Criteria

Summary of Results

Use of Results

Students will possess significant skills in scientific communication, both written and oral, and the ability to read and comprehend the scientific literature in their field of research.

1. Students are required to make an annual oral presentation to the students and faculty on the progress and results of their research. Their presentation is reviewed in writing by those attending and the comments are used collectively for the assessment of our program. The faculty receives immediate feedback on the degree to which students possess skills in oral scientific presentation.

2. Second year students prepare a written research proposal. This proposal is reviewed by a faculty committee, and then presented and orally defended by the student before the committee. Through this process, faculty receive continuing feedback on the level of student performance in communication skills.

3. Students are encouraged to prepare and submit a scientific manuscript to an internationally recognized peer-reviewed journal. External peer-review is the most rigorous assessment available in science.

1. This evaluation tool has been in place since 2002. Faculty and students indicate that student communication skills are strong and improving. Both groups have noted that the presentations would be more effective if more faculty attended regularly.

2. Faculty assessment of the written proposals and the oral defenses indicates that the quality of communication skills of our students is improving.

3. This assessment tool was initiated for students starting the MS program in 2002. Since then 20 manuscripts have been submitted by MS students. Of these 14 have been accepted for publication, 5 are currently in review, and 1 has been declined.

During the 2006 Faculty Retreat, department faculty discussed the importance of scientific publication and revised the MS requirements to require the preparation and submission of a manuscript to a journal deemed acceptable to their faculty advisor. This change will take effect for incoming MS students in 2006.



Educational Outcomes by Graduation	Assessment Method and Criteria	Summary of Results	Use of Results
<p>Students will possess a sophisticated understanding of the nature and origin of the materials that compose the Earth at a level consistent with teaching the broad range of these subjects to general students and a subset of these subjects to students focusing on the study of Earth Science.</p>	<p>1. The department graduate committee conducts an annual evaluation of the collective performance of first year graduate students on a written qualifying exam, and of second year students on the preparation of 2 research proposals and the oral defense of those proposals before a faculty committee.</p> <p>2. Students serve at least one semester as Teaching Assistants in Earth Science courses. Their performance is evaluated by their students in a departmental version of the standard Rice University Student Course Evaluation. These evaluations and assessment of the faculty member are evaluated by the Department Graduate Committee annually.</p>	<p>1. In 2006, the graduate committee did not identify weaknesses in this Intended Outcome.</p> <p>2. In 2006, there have been no problems with teaching assistant activities of graduate students.</p> <p>3. In 2006, no problems with this Intended Outcome were brought to the attention of the Faculty Retreat.</p>	<p>No action required at this time, but we will continue to evaluate this item.</p>
<p>Students will possess a sophisticated understanding of the physical and chemical processes that operate in the deep interior, outer shell, and at the surface of the Earth at a level consistent with teaching the broad range of these subjects to general students and a subset of these subjects to students focusing on the study of Earth Science.</p>	<p>3. Beyond the second year of study the Department Graduate committee prepares an annual report on each PhD student, documenting student progress, and suggesting changes to the students program. This activity provides the committee with a comprehensive view of program success. Based on this process, the committee assembles a biannual report on collective student progress on Intended Educational Outcomes including recommendations for changes in the curriculum to the Department Faculty Retreat. Faculty discuss the strengths and weaknesses of the curriculum and propose improvements.</p> <p>Same as above.</p>	<p>1. In 2006, the graduate committee did not identify weaknesses in this Intended Outcome.</p> <p>2. In 2006, there have been no problems with teaching assistant activities of graduate students.</p> <p>3. In 2006, no problems with this Intended Outcome were brought to the attention of the Faculty Retreat.</p>	<p>No action required at this time, but we will continue to evaluate this item.</p>
<p>Students will possess a knowledge and understanding of the geologic record of terrestrial and oceanic Earth processes and of life on Earth at a level consistent with teaching the broad range of these subjects to general students and a subset of these subjects to students focusing on the study of Earth Science.</p>	<p>Same as above.</p>	<p>1. In 2006, the graduate committee did not identify weaknesses in this Intended Outcome.</p> <p>2. In 2006, there have been no problems with teaching assistant activities of graduate students.</p> <p>3. In 2006, no problems with this Intended Outcome were brought to the attention of the Faculty Retreat.</p>	<p>No action required at this time, but we will continue to evaluate this item.</p>



Educational Outcomes by Graduation	Assessment Method and Criteria	Summary of Results	Use of Results
<p>Students will have the ability to use an appropriate set of state-of-the-art quantitative and analytical techniques in the conduct of their research.</p>	<p>Students prepare and submit two scientific manuscripts to internationally recognized peer-reviewed journals. These manuscripts describe the use of quantitative and analytical methods used by the student. External peer-review is the most rigorous assessment available in science. Reviewers are aware of the state of the art in research methodology. Success in publication is indicative of the proper use of research methods.</p>	<p>This assessment tool was initiated for students starting the PhD program in 2002. Since then 54 manuscripts have been submitted by PhD students. Of these 34 have been accepted for publication, 7 are currently in review, and 8 have been declined.</p>	<p>No action required at this time, but we will continue to evaluate this item.</p>
<p>Students will demonstrate significant skills in scientific communication, both written and oral, the ability to read and comprehend the scientific literature, and understanding of the importance of the scientific literature as a foundation for their research activities, and the ability to write and publish the results of their research in the peer-reviewed literature.</p>	<ol style="list-style-type: none"> 1. Students are required to make an annual oral presentation to the students and faculty on the progress and results of their research. Their presentation is reviewed by those attending and the comments are used collectively for the assessment of our program. The faculty receives immediate feedback on the degree to which students possess skills in oral scientific presentation. 2. Second year students prepare two written research proposals. These are reviewed by a faculty committee, and then presented and orally defended before the committee. Through this process, faculty receive continuing feedback on the level of student performance in communication skills. 3. Students prepare and submit two scientific manuscripts to internationally recognized peer-reviewed journals. External peer-review is the most rigorous assessment available in science. 	<ol style="list-style-type: none"> 1. This evaluation tool has been in place since 2002. Faculty and students indicate that student communication skills are strong and improving. Both groups have noted that the presentations would be more effective if more faculty attended regularly. 2. Faculty assessment of the written proposals and the oral defenses indicates that the quality of communication skills of our students is improving. 3. This assessment tool was initiated for students starting the PhD program in 2002. Since then 56 manuscripts have been submitted by PhD students. Of these 36 have been accepted for publication, 7 are currently in review, and 8 have been declined. 	<p>During the 2006 Faculty Retreat, department faculty discussed the importance of scientific publication and revised the PhD requirements to require three submitted manuscripts. This change will take effect for incoming students in 2006.</p>

Creation Date: 2008-07-25

Report :

Academic Program: BA degree program in Earth Science

Prepared by: Dale Sawyer

1. OUTCOME:

i) Students should possess a basic understanding of the structure of the Earth and the processes which formed and have modified the Earth throughout its history. This understanding should be adequate to support the incorporation of Earth science knowledge into the study and practice of a field other than Earth Science.

2. METHODS:

i) We will begin conducting exit interviews with BA graduates.

3. RESULTS:

i) Our most recent BA graduate completed our program in 2005.

ii) We currently have one BA student, who is expected to graduate in 2010.

4. CONCLUSIONS:

i) We do not have any results yet.

5. ACTION PLAN:

i) We designed our BA program for students interested in Earth Science but not planning a career in the field. We will monitor the content of similar programs offered by peer institutions.

6. FOLLOW UP EVALUATION:

i) The undergraduate advisor will meet with our current BA student annually.

Creation Date: 2008-07-25

Report :

Academic Program: BS degree program in Earth Science

Prepared by: Dale Sawyer

1. OUTCOME:

- i) Students will possess basic familiarity with the scientific literature, and basic skills in the oral and written communication of scientific results.
- ii) Students will have a core of basic technical skills (laboratory, field observation and measurement, and computation)

2. METHODS:

- i) BS students are encouraged to engage in research projects with faculty at Rice and/or to participate in summer research opportunities with faculty at other institutions. During these activities they become involved in cutting edge science projects exposing them to state-of-the-art research techniques and ideas.
- ii) We plan to begin conducting interviews with these students after they complete research programs of this type. In this way we expect to discover what they have learned and what they have produced.
- iii) We will determine how many and which experiences lead to scientific presentations and scientific publications by the students.

3. RESULTS:

- i) During the past 2 years, about 80% of our BS students have participated in research with faculty at Rice or elsewhere.
- ii) In most cases, these experiences have led to the presentation of talks or posters at national and international scientific meetings.
- iii) In about 25% of cases these experiences have led to the submission of scientific manuscripts.
- iv) In every case, the students have described learning to use modern research techniques in the laboratory, the field, and/or using computation. The students consider the experience positive.

4. CONCLUSIONS:

- i) We believe that this is a strong record of research involvement among undergraduate students.
- ii) Most of our BS graduates go on to good graduate schools, and we attribute much of their success in admission to the research they do as undergraduates.

5. ACTION PLAN:

- i) We will continue to encourage our BS students to do research, present their results at major scientific meetings, and to submit manuscripts to high quality journals.
- ii) Faculty, particularly the undergraduate advisors, will seek out undergraduate research programs outside of Rice and bring them to the attention of our BS students.

6. FOLLOW UP EVALUATION:

- i) We will keep track of the fraction of undergraduate students engaging in research.
- ii) We will summarize the post-research interviews to identify ways to improve the undergraduate research experience.
- iii) We will keep track of presentations and publications resulting from undergraduate student research.

Submitted By : alan
Email : alan@rice.edu
Department : Natural Sciences
Report Type : Academic and Co-curricular

Program : MS in Earth Science

School/Unit :

Degree :

Creation Date : 2008-04-18

Modify Date : 2008-04-18

Report :

Academic Program: MS degree program in Earth Science

Prepared by: Dale Sawyer, Julia Morgan

1. OUTCOME: Students will possess the skills in scientific communication, in both written and oral forms, so as to demonstrate their ability to present information clearly, logically, and critically. They will demonstrate their ability to read and comprehend scientific literature in their field of research.

2. METHODS:

i) Students are required to make an annual oral presentation to the students and faculty on the progress and results of their scientific research. Beginning academic year 2001-2002, a seminar course, ESCI 404, was developed as a forum for student presentations, overseen by a faculty facilitator. Audience members submitted evaluation and comment forms reviewed by the facilitator and provided to the student speaker. The facilitator also provided a more complete and constructive written review of each presentation for the student speaker. Review comments were used collectively for the assessment of students' abilities to communicate and convey their research results. Faculty received immediate feedback on the degree to which students possessed skills in oral scientific presentation and had appropriate knowledge of the scientific basis of their research.

ii) Second year students prepare a written research proposal. This proposal is reviewed by a faculty committee, and then presented and orally defended by the student before the committee. Throughout this process, faculty receive continuing feedback on the skill level of students in communication, and assess the student's scientific background to pursue independent research.

iii) Students are encouraged to prepare and submit at least one first-author scientific manuscript to an internationally recognized peer-reviewed journal. External peer-review is the most rigorous assessment available in science.

3. RESULTS:

i) The seminar evaluation tool has been in place since 2002. Review of faculty and student evaluations showed that student oral communication skills were strong and improving. The practice gained by these department presentations is credited with improving the professionalism of the students, and their presentations at national and international scientific meetings. However, both students and faculty noted that the presentations would be more effective if more faculty members attended the presentations regularly, and if the seminar series were better integrated into departmental activities.

ii) Faculty assessment of the written proposals and the oral defenses indicated that the quality of communication skills of our students was improving. The proposal defenses became more rigorous, and thus effective in guiding the student's research plans.

iii) The peer-reviewed publication assessment tool was initiated for students starting the MS program in 2002. Between 2002 and 2006, 20 manuscripts were submitted by MS students. Of these 14 were accepted for publication, 1 was declined, and 5 are currently in review. These results demonstrate a high level of student communication skills, but only a fraction of MS students submitted their research for publication.

4. CONCLUSIONS:

i) Recently, several faculty, and also students, suggested changes in the format of student presentations, specifically by integrating faculty, senior researcher, and student presentations into a single, year-long departmental seminar forum, now organized by a student facilitator but still with faculty oversight.

ii) During the 2006 Department of Earth Science Faculty Retreat, department faculty discussed the importance of scientific publication as a means of communication, and concerns were raised about the relatively small number of MS graduates whose research work resulted in scientific publication. We concluded that all quality research should be published and that we should try to increase the fraction of MS student work that was published. We also felt that preparing a scientific manuscript was the best way to help students learn written communication skills.

5. ACTION PLAN:

i) The new year-long seminar format was initiated in 2006-2007, and appears to have increased student, researcher staff, and faculty attendance at talks. It has also resulted in an improved level of scientific discourse within the department.

ii) All faculty are strongly encouraged to attend the student presentations regularly.

iii) The Faculty decided to require (rather than recommend) that MS candidates submit one manuscript, approved by their faculty advisor, to a recognized scientific journal. This manuscript would then form the primary content of their MS thesis. This new rule became effective for MS students matriculating in Fall 2006.

6. FOLLOW UP EVALUATION: The first students for whom the new seminar and publication rules apply will graduate beginning Spring 2008, at which point we can begin to evaluate the effectiveness of the new rules. Student presentation skills will be evaluated by the number and quality of professional talks that they give at national and international meetings, and during interviews with potential employers. Evaluation of publications as a means of communication will be based on the percentage of students submitting manuscripts, and the fraction of submitted manuscripts that become published papers.

RIPE Report : 2008-07-25
Prepared by: Dale Sawyer

7. ACTUALIZED PLAN:

i) We have continued the year-long seminar format as described above.

ii) We have encouraged faculty to attend student seminars.

iii) We have changed the MS degree rules to require submission of one manuscript to a recognized scientific journal.

8. EVALUATION:

i) We are pleased with the student seminar program. Faculty attendance is up.

ii) Three MS students graduated in May 2008. All submitted manuscripts for publication. They have not yet moved through the review and editing process, so we do not yet know if they will be published.

iii) Seven MS students made a total of nine scientific presentations this year. These were students at all levels of the program.

9. CONTINUED ACTION PLAN:

i) We think that these programs are working well. We will continue to monitor publications and scientific presentations.

10. PROCESS:

We see the increase in MS student publication as a real improvement and there are signs that we are building a "publication culture" among our graduate students.

Creation Date: 2008-07-25

Report :

Academic Program: PhD degree program in Earth Science

Prepared by: Dale Sawyer

1. OUTCOME: Students will possess the skills in scientific communication, in both written and oral forms, so as to demonstrate their ability to present information clearly, logically, and critically. They will demonstrate their ability to read and comprehend scientific literature in their field of research.

2. METHODS:

i) PhD Students are required to make an annual oral presentation to the students and faculty on the progress and results of their scientific research. Beginning academic year 2001-2002, a seminar course, ESCI 404, was developed as a forum for student presentations, overseen by a faculty facilitator.

Audience members submitted evaluation and comment forms reviewed by the facilitator and provided to the student speaker. The facilitator also provided a more complete and constructive written review of each presentation for the student speaker. Review comments were used collectively for the assessment of students' abilities to communicate and convey their research results. Faculty received immediate feedback on the degree to which students possessed skills in oral scientific presentation and had appropriate knowledge of the scientific basis of their research.

ii) Second year PhD students prepare two written research proposals. The first proposal may be prepared in collaboration with the student's faculty advisor. The second proposal is prepared by the student without significant interaction with the advisor or other faculty members. The later is designed to demonstrate the students ability to prepare a well thought out and written document without faculty assistance. Both proposals are reviewed by a faculty committee, and then presented and orally defended by the student before the committee. Throughout this process, faculty receive continuing feedback on the skill level of students in communication, and assess the student's scientific background to pursue PhD level independent research.

iii) PhD Students are now required to prepare and submit at least three first-author scientific manuscripts to internationally recognized peer-reviewed journals. External peer-review is the most rigorous assessment available in science.

3. RESULTS:

i) The seminar evaluation tool has been in place since 2002. Review of faculty and student evaluations showed that student oral communication skills were strong and improving. The practice gained by these department presentations is credited with improving the professionalism of the students, and their presentations at national and international scientific meetings. However, both students and faculty noted that the presentations would be more effective if more faculty members attended the presentations regularly, and if the seminar series were better integrated into departmental activities.

ii) Faculty assessment of the written proposals and the oral defenses indicate that the quality of communication skills of our students is improving. The proposal defenses have become more rigorous, and thus effective in guiding the student's research plans.

iii) The peer-reviewed publication assessment tool was initiated for students starting the PhD program in 2006. Since then, 29 manuscripts were submitted and 36 presentations were given by 23 PhD students (includes students at all levels in program). These results demonstrate a high level of student communication skills.

4. CONCLUSIONS:

i) Recently, several faculty, and also students, suggested changes in the format of student seminar presentations, specifically by integrating faculty, senior researcher, and student presentations into a single, year-long departmental seminar forum, now organized by a student facilitator but still with faculty oversight.

ii) During the 2007 Department of Earth Science Faculty Retreat, department faculty discussed the record of submission of scientific manuscripts by PhD students in the department. We conclude that requiring publication as a condition for completing a PhD is working very well. The faculty have noted that there is an increasing "culture of publication" among our students.

5. ACTION PLAN:

- i) The new year-long seminar format was initiated in 2006-2007, and appears to have increased student, researcher staff, and faculty attendance at talks. It has also resulted in an improved level of scientific discourse within the department.
- ii) All faculty are strongly encouraged to attend the student presentations regularly. The students are beginning to remind their advisors to attend student talks. We take this as a sign of a healthy academic culture.
- iii) The Faculty decided to maintain the requirement to publish for the PhD students. We discussed a model of encouraging students to submit a manuscript in years 3, 4, and 5. We hope that this will keep them from waiting until they plan to graduate before finishing any manuscripts.
- iv) We plan to develop a more accurate system for recording publication and presentation activity by our students.

6. FOLLOW UP EVALUATION: The first PhD students for whom the new seminar and required publication rules apply will graduate beginning Spring 2008, at which point we can begin to evaluate the effectiveness of the new rules. Student presentation skills will be evaluated by the number and quality of professional talks that they give at national and international meetings. Evaluation of publications as a means of communication will be based on the percentage of students submitting manuscripts, and the fraction of submitted manuscripts that become published papers.