

# **Undergraduate Program Assessment Plan**

## **Department of Geology and Environmental Geosciences**

### **Northern Illinois University**

Since its inception in 1969, the Northern Illinois University Department of Geology and Environmental Geosciences has continuously evolved and remade itself, always with the intent of better meeting the needs of the students it serves. To continue that tradition, the department continually evaluates the goals for its B.S., M.S. and Ph.D. programs, and regularly conducts formal assessments of those programs. This document describes the plan for undergraduate program assessment in the Department of Geology and Environmental Geosciences. As background for that plan, it first reviews some key aspects of the departmental history, and then lists current characteristics of the department that are significant factors in the design, organization and implementation of assessment procedures.

#### Timeline of Departmental Evolution

- |       |   |
|-------|---|
| 1969  | • Departments of Geology and Geography formally created from the previous Department of Earth Sciences                                      |
| 1970s | • programs focus on classic trilogy of geology, geochemistry and geophysics   |
| 1972  | • department creates summer field course in geologic mapping  |
| 1980s | • programs expand their scope to include environmental subjects such as hydrogeology, global climate change, and near-surface geophysics    |
| 1981  | • Ph.D. degree program initiated  |
| 1990s | • programs become increasingly more integrated and cross-disciplinary, with growing emphasis on global phenomena and the whole earth system |
| 1994  | • department creates Secondary School Teacher Certification programs in Physical Science and General Science                                |
| 1997  | • department named changed to Department of Geology and Environmental Geosciences   |
| 2001  | • emphases in Geology, Environmental Geosciences and Earth Science Education created in the B.S. program                                    |

#### Important Characteristics of the Current Department

Assessment procedures in the department continually evolve as the department and its programs improve and change. The assessment methods used to evaluate program quality directly depend on the structure and objectives of the current program. In turn, the structure and objectives of the undergraduate program reflect the present educational and research focus of the department faculty, as well as the demographics and academic and professional needs of the student body. As of 2003, the Department of Geology and Environmental Geosciences has the following important characteristics that significantly affect the operation and assessment of the undergraduate program:

- serves approximately 50 majors
- number of majors has increased roughly 40% in the last five years
- majority of majors are transfer students that arrive at NIU as Juniors
- serves approximately 1200 general education students per semester
- three undergraduate advisors (Colin Booth, Patrick Ervin, Mark Fischer), one for each of the program emphases (Environmental Geoscience, Earth Science Education, Geology)
- assessment of the Earth Science Education emphasis is overseen by the University Committee for Initial Teacher Certification (CITC)
- one departmental assessment coordinator (Paul Stoddard)
- comprise 14 faculty

#### **Departmental Goals for Undergraduate Earth Science Education: Expected Student Outcomes**

The principal goal of the department is to provide an exemplary earth science education to all its students. To more clearly define and help achieve this goal, the department has identified and described eight general areas of knowledge and skill in which all students must develop proficiency. These general areas of knowledge and skill, as well as specific expected student outcomes for each area, are described in detail in a formal departmental goals statement titled: Components of an Exemplary Earth Science Education: Undergraduate Program Objectives and Expected Student Outcomes. This document is attached to this report as Appendix 1.

### Assessment Methods

The department uses a variety of direct and indirect methods to assess student performance. Table 1 below lists and describes each of the various assessment tools, the person(s) responsible for conducting the assessment, and the times at which the assessments are conducted.

Table 1. Assessment Tools and Procedures

<b>Assessment Tools</b>	<b>Description of Method</b>	<b>Frequency of Assessment</b>	<b>Person(s) Responsible</b>
Core Course GEOL 320 Environments and Life through Time	Instructor(s) completes a summary report detailing student performances. This report characterizes performance in the class, and serves as a baseline for students entering the major.	Annually, at the end of the fall semester.	course instructor(s)
Core Course GEOL 325 Solid Earth Composition	Instructor(s) completes a summary report detailing student performances. This report characterizes performance in the class, and serves as a baseline for students entering the major.	Annually, at the end of the fall semester.	course instructor(s)
Core Course GEOL 330 Global Cycles	Instructor(s) completes a summary report detailing student performances. This report will not only characterize performance in the class, but also assess how well students were prepared upon entering the class.	Annually, at the end of the spring semester.	course instructor(s)
Core Course GEOL 335 Structure and Dynamics of the Earth	Instructor(s) completes a summary report detailing student performances. This report will not only characterize performance in the class, but also assess how well students were prepared upon entering the class.	Annually, at the end of the spring semester.	course instructor(s)
Capstone Course GEOL 477 Field Methods in Environmental Geosciences	Instructor(s) of GEOL 477 complete a summary report detailing overall student performances. This report should strive to identify key areas of weakness, and will serve as a baseline to characterize the knowledge and skill level of students graduating as majors.	End of every summer term.	course instructor(s)
Capstone Course GEOL 478/479 Geological Field Techniques	Instructor(s) of GEOL 478/479 complete a summary report detailing overall student performances. This report should strive to identify key areas of weakness, and will serve as a baseline to characterize the knowledge and skill level of students graduating as majors.	End of every summer term.	course instructor(s)
Alumni Surveys	Alumni are provided the opportunity to comment on the quality of education, advising, and career counseling they received in the department. They are also able to comment on facilities, faculty, and any other aspect they deem important.	Conducted one, five and nine years after graduation, to coincide with university alumni surveys.	Department Assessment Coordinator
Employer Surveys	Employers of program graduates are asked to evaluate the quality of communication, scientific and technical skills and knowledge displayed by recent program graduates.	Conducted two years after graduation	Department Assessment Coordinator

Table 2 on the following page lists each assessment method currently used by the Department of Geology and Environmental Geosciences, and identifies which expected student outcomes are addressed by each method. Copies of the alumni survey and employer survey currently used by the department are provided in Appendix 2.

### **Departmental Assessment Structure and Processes**

The two charts in Appendix 3 schematically illustrate the structure of the department, its programs, and how and when assessment is carried out in the department. The first chart outlines the basic subdivisions of the department's undergraduate and graduate programs, lists the expected outcomes for each subdivision, and identifies which individuals, committees or panels are involved with assessment of each part of the program. The second chart identifies the three phases of assessment conducted in the department: data collection, data analysis, and program response. Under each of these phases are listed the assessment activities that take place, who is involved with that activity, and when each activity takes place.

Table 2. Correlation of Assessment Methods and Expected Student Outcomes

Expected Student Outcomes	Assessment Method								
	Core Course GEOL 320	Core Course GEOL 325	Core Course GEOL 330	Core Course GEOL 335	Capstone Course GEOL 477	Capstone Course GEOL 478/479	Best Practices	Alumni Survey	Employer Survey
Earth Materials									
Earth Features									
Earth Processes									
Interpreting the Geologic Record									
Data Collection, Evaluation and Manipulation									
Communication									
Scientific Analysis									
Societal Significance of Geoscience									

Note that the expected student outcomes listed here represent categories of more specific outcomes. Details of each category, including the specific student outcomes for each category, are described in Appendix 1.

## **Appendix 1**

### **Undergraduate Program Goals Statement**

Department of Geology and Environmental Geosciences  
Northern Illinois University

## Geology and Environmental Geosciences

### **Components of an Exemplary Earth Science Education: Undergraduate Program Objectives and Expected Student Outcomes**

Undergraduate Majors in the Department of Geology and Environmental Geosciences are expected to demonstrate a broad variety of skills and knowledge throughout their progress through the program and when they matriculate. For purposes of assessment, and to ensure that students have a clear understanding of what is expected of them throughout the program, the Department of Geology and Environmental Geosciences divides these skills and knowledge into eight basic categories we refer to as “Components of an Exemplary Earth Science Education.” This document defines those components and describes some of the key expected student outcomes for each component. The objective of the program is to ensure all students receive training in, and demonstrate proficiency in each of the following eight basic categories of earth science skills and knowledge:

#### 1. Earth Materials

Earth comprises many different materials whose formation, composition and distribution are intimately associated with one another. A wide variety of Earth processes and features may be diagnosed by the presence or absence of these materials. Students will be able to identify, describe, compare, and contrast rocks, minerals, sediments, and soils. Additionally, they will be able to describe the distribution of these materials on Earth and describe their formation.

#### 2. Earth Features

Surface and internal Earth processes act on Earth materials to create Earth features that range in size from microscopic to global (e.g., rivers, deltas, faults, moraines, karst, sedimentary bedding structures, the Earth’s magnetic field, the sea floor, volcanoes, Earth’s internal structure, tectonic foliation). Students will be able to recognize and describe specific modern and ancient Earth features, and be able to explain how they are formed and modified by the interactions of various Earth processes.

#### 3. Earth Processes

Earth is continually modified by the combined actions of countless processes. Students will be able to discuss the fundamental physical, chemical, and biological processes that operate in and on the Earth system. They will be able to explain the interconnections among various earth processes, describe how processes acting together can create specific geological environments, and reconstruct how Earth processes have evolved and varied in significance over geological time.

#### 4. Interpretation of the Geologic Record

Earth history is derived from collective scientific observations and interpretations of the geologic record. The geologic record is held within Earth materials and features whose composition and distribution may vary over space and time. Students will be able to describe the basic history of the solar system, discuss the earth system, including the geologic time scale, the evolution of life, long-term changes in global climate, major transgression and regression events, and the configuration of tectonic plates during key intervals of geologic time. Students will also be able to explain linkages between the causes and effects of major Earth events, and reconstruct Earth processes or environments from evidence identified in the geologic record.

#### 5. Collection, Evaluation, and Manipulation of Data

Scientific inquiry and interpretation relies on accurate collection and evaluation of observational and experimental data. Interpretations are only as good as the data that support them, and scientists must strive to maintain excellence in collecting and handling data. Consequently, students must be able to accurately collect and synthesize field and laboratory observations or data. They must be able to assess the data quality, recognize sources of data error and bias, and demonstrate basic proficiency with computer programs used to organize, manipulate, analyze and present data.

## 6. Communication

The successful advance and use of scientific knowledge and understanding requires effective communication, not only amongst scientists, but also amongst scientists, governments, educators, and the public. To ensure that graduates of the program are effective communicators, students will be able to conduct literature research, summarize the work of others, write technical summaries of research, prepare public presentations, and explain technical information to general audiences, including primary and secondary school students and teachers.

## 7. Scientific Analysis

Scientific analysis is higher-order critical thinking and creative reasoning that requires students to apply their knowledge and skills in novel ways. Students who can effectively perform this critical thinking will be able to devise original research plans, formulate testable scientific hypotheses, develop multiple working hypotheses to interpret scientific data and observations, assess the quality and accuracy of scientific reporting in the modern media, and assess the approach and results of their own research, as well as the research of others.

## 8. Societal Significance of Geoscience

Geoscientists have long been at the forefront of the battle for environmental preservation and for the safe, efficient and logical exploitation of Earth's natural resources. To continue this tradition, and to assist in producing an environmentally conscientious public, students will be able to recognize, describe and explain short- and long-term environmental issues and risks faced by humans and induced by human activities. In addition, they will be able to explain the ways that geoscience contributes to society, including natural hazard assessment, water and mineral resource management, energy resource exploration and utilization, waste management, environmental protection, environmental and climate change, and education.

## **Selected Bibliography**

Heath, C.P.M., 2003, Geological, geophysical, and other technical and soft skills needed by geoscientists employed in the North American petroleum industry: American Association of Petroleum Geologists Bulletin, v. 87, no. 9, p. 1395-1410.

Santi, P.M. and Higgins, J.D., 2005, Preparing geologists for careers in engineering geology and hydrogeology: Journal of Geoscience Education, v. 53, n. 5, p. 513-521.

American Geological Institute, National Center of Earth Science Education, 1991, Earth Science Education for the 21<sup>st</sup> Century: A Planning Guide

## **Appendix 2**

### **Alumni and Employer Surveys**

Department of Geology and Environmental Geosciences  
Northern Illinois University



**Alumni Survey**  
Department of Geology and Environmental Geosciences  
Northern Illinois University

This survey is an important component of the continual review and assessment of programs and student preparation in the Department of Geology and Environmental Geosciences. Please take some time and answer each of the questions and return your responses to the department. Your thoughtful and candid responses will be appreciated.

Date: \_\_\_\_\_

**PLEASE TELL US ABOUT YOURSELF**

What year did you graduate from NIU? \_\_\_\_\_

What degree(s) did you earn at NIU (circle)?                      B.S.                      M.S.                      Ph.D.

If you graduated with a B.S. degree, what was your Emphasis (circle one)?

Geology                      Environmental Geoscience                      Earth Science Education

What is your present occupation? \_\_\_\_\_

Does it utilize your geological training? \_\_\_\_\_

To which of the following U.S. Census groups do you belong (circle one):

Asian                      Black                      Hispanic                      Native American                      White                      Other

Gender (circle one):      Female                      Male

**PLEASE TELL US YOUR VIEWS REGARDING THE EDUCATION YOU RECEIVED IN THE  
DEPARTMENT OF GEOLOGY & ENVIRONMENTAL GEOSCIENCES**

	Agree Strongly	Agree Slightly	Disagree Slightly	Disagree Strongly
1. The structure and requirements of the geology program provided me with a well-integrated education.	1	2	3	4
2. The following courses in the geology major can be considered essential				
a. GEOL 320 Environments and Life through Time	1	2	3	4
a. GEOL 325 Solid Earth Composition	1	2	3	4
a. GEOL 330 Environments and Life through Time	1	2	3	4
a. GEOL 335 Dynamics and Structure of the Earth	1	2	3	4
3. The elective courses in my degree program gave me a broad understanding of the discipline.	1	2	3	4
4. The required courses in mathematics, chemistry and physics are important to an understanding of earth science as a discipline.	1	2	3	4
5. The courses in the major offered credit appropriate to the level of effort required.	1	2	3	4
6. The overall quality of course content in the department was good.	1	2	3	4

	Agree Strongly	Agree Slightly	Disagree Slightly	Disagree Strongly
8. My program of study proved to be challenging and stimulating.	1	2	3	4
9. Departmental course requirements for my degree provided sufficient breadth to help me adjust to changes in my profession.	1	2	3	4
10. The overall quality of career/graduate school advisement I received in the department was good.	1	2	3	4
11. The overall quality of program planning and advisement I received in the department was good.	1	2	3	4
12. My Earth Science training provided me with an in-depth understanding of the discipline.	1	2	3	4
13. Overall, the courses I took in the department provided sufficient opportunities for developing my writing skills.	1	2	3	4
14. Overall, the courses I took in the department provided sufficient opportunities for developing my public speaking and presentation skills.	1	2	3	4
15. Overall, the courses I took for my degree provided sufficient opportunities for developing my field and laboratory skills.	1	2	3	4
16. I am satisfied with my knowledge of the subject matter covered in courses taught in the department.	1	2	3	4
17. If I had the decision to make over again, I would select Earth Science as my discipline.	1	2	3	4
18. The quality of Earth Science education I received compares favorably with that received by the people with whom I work, but who attended other universities.	1	2	3	4
19. The attitude of faculty in the department was <b>not</b> influenced by my gender.	1	2	3	4
20. The attitude of faculty in the department was <b>not</b> influenced by my race.	1	2	3	4
21. Overall, the attitude of faculty in the department was positive and helpful.	1	2	3	4
22. As a result of my education at NIU, I am satisfied with my ability to apply the knowledge obtained in my degree program for purposes of defining and solving problems.	1	2	3	4
23. As a result of my education at NIU, I am confident in my ability to find scientific information on my own, interpret it, and apply my findings.	1	2	3	4
24. Departmental facilities, including space, field, laboratory equipment and computers, were adequate to support my studies.	1	2	3	4
25. My experiences in the department have significantly improved my appreciation of the role of geoscience in important societal and public policy issues.	1	2	3	4

**Please use the space below and the back of this survey to add any additional comments.**

**Employer Survey**  
Department of Geology and Environmental Geosciences  
Northern Illinois University

This survey is an important component of the continual review and assessment of programs and student preparation in the Department of Geology and Environmental Geosciences. Please take some time and answer each of the questions and return your responses to the department. Your thoughtful and candid responses will be appreciated.

Date: \_\_\_\_\_

**PLEASE TELL US ABOUT YOUR BUSINESS**

Business Name: \_\_\_\_\_

Primary Business Activities: \_\_\_\_\_

\_\_\_\_\_

Number of Employees (circle one)

fewer than 10      10-20      20-50      50-75      75-100      more than 100

**PLEASE TELL US ABOUT YOUR EMPLOYEES THAT ARE ALUMNI OF THE DEPARTMENT OF GEOLOGY AND ENVIRONMENTAL GEOSCIENCES**

How many of your employees are graduates of our department? \_\_\_\_\_

What NIU degree(s) do these employees have from our department? (circle each, and list the number of individuals that hold each type of degree)?

B.S.      M.S.      Ph.D.      \_\_\_\_\_

How long has each of these individuals been employed by your business? \_\_\_\_\_

What are the primary responsibilities of these employees? \_\_\_\_\_

\_\_\_\_\_

**PLEASE TELL US YOUR VIEWS REGARDING THE EDUCATION AND PROFESSIONAL PREPARATION OF YOUR NIU ALUMNI IN THE GEOLOGY & ENVIRONMENTAL GEOSCIENCES DEPARTMENT**

(circle the appropriate number for each question)

	Not Relevant	Agree Strongly	Agree Slightly	Disagree Slightly	Disagree Strongly
1. My employees demonstrate a high level of knowledge of the earth sciences.	0	1	2	3	4
2. My employees demonstrate a high level of proficiency in their understanding and use of chemistry.	0	1	2	3	4
3. My employees demonstrate a high level of proficiency in their understanding and use of mathematics.	0	1	2	3	4
4. My employees have excellent public speaking and presentation skills.	0	1	2	3	4
5. My employees have excellent writing skills.	0	1	2	3	4

	Not Relevant	Agree Strongly	Agree Slightly	Disagree Slightly	Disagree Strongly
6. My employees demonstrate excellent field and laboratory skills.	0	1	2	3	4
7. My employees demonstrate a high level of proficiency with computers, software and other technologies required to do their job.	0	1	2	3	4
8. My employees can easily develop new ideas and techniques for solving complex problems.	0	1	2	3	4
9. My employees conduct quality background research for a project, making sure they thoroughly understand relevant governmental, social, scientific and business issues.	0	1	2	3	4
10. My employees can easily adapt to new professional responsibilities.	0	1	2	3	4
11. My employees can think and act independently.	0	1	2	3	4
12. The NIU Geology and Environmental Geoscience alumni whom I employ were equally as well-prepared as employees who graduated from other universities, and who perform similar tasks.	0	1	2	3	4
13. The presence of NIU Geology and Environmental Geoscience Department alumni in my business has increased my respect for, and confidence in the value of their NIU Undergraduate Degree.	0	1	2	3	4
14. An NIU Geology and Environmental Geoscience degree is an asset in the marketplace.	0	1	2	3	4

Please use the space below and the back of this survey to add any additional comments. We sincerely appreciate any suggestions or guidance you can provide that will help us better prepare our graduates for their professional careers.

### **Appendix 3**

#### **Departmental Assessment Structure Chart and Undergraduate Assessment Processes Chart**

Department of Geology and Environmental Geosciences  
Northern Illinois University

**Departmental Assessment Structure  
Geology and Environmental Geosciences**  
overseen by departmental assessment coordinator  
[Mark Fischer]

**Undergraduate students**  
program and curricular issues  
overseen by undergraduate committee  
[Melissa Lenczewski, chair]

**Graduate students**  
program and curricular issues  
overseen by graduate committee  
[Jim Walker, chair]

**General Education**

**Majors**

**M.S. and Ph.D.**  
graduate Director  
[Jim Walker]

**Expected Outcomes**

**Scientific Method**

- identify the steps in the scientific method
- apply steps in the scientific method to problem solving

**Mathematics**

- read and interpret graphs
- estimate uncertainties
- perform simple arithmetic and trigonometric calculations

**Assessment Overseen by**

- General Education Assessment Coordinator

**Geology**

undergraduate advisor  
[Mark Fischer]

**Environmental  
Geosciences**

undergraduate advisor  
[Melissa Lenczewski]

**Earth Science  
Education**

undergraduate advisor  
[Kathy Kitts]

**Expected Outcomes**

Earth Materials  
Earth Features  
Earth Processes  
Interpreting the Geologic Record  
Data Collection, Evaluation and Manipulation  
Communication  
Scientific Analysis  
Societal Significance of Geoscience

**Assessment Overseen by**

- Departmental Assessment Coordinator
- Department Assessment Panel

**Expected Outcomes**

Undergraduate majors pursuing the Earth Science Education Emphasis must meet a variety of State, Federal and discipline-specific Professional standards that are not outlined in the department assessment plan. Details of these standards, expected student outcomes, and other procedures for conducting the assessment of Teacher Certification students are described in the Earth Science Teacher Education Assessment Plan.

**Assessment Overseen by**

- emphasis Advisor
- CITC
- CITC Research and Assessment Committee

**Expected Outcomes**

Communication  
Data Collection, Evaluation and Manipulation  
Scientific Analysis  
Societal Significance of Geoscience  
Specialized Geoscience Knowledge

**Assessment Overseen by**

- Graduate Program Director

# Key Activities in the Undergraduate Program Assessment Process Geology and Environmental Geosciences

## Phases of the Assessment Process

assessment data collection phase	assessment data analysis phase	program response phase
<div>                     GEOL 320 <i>each fall</i>                      assessment report                      example assessment instruments                      example student work                 </div>	<div>                     Department Assessment Coordinator reviews and summarizes:                      • general education assessment data                      • alumni survey responses                      • employer survey responses                      • course assessment reports <i>each summer</i> </div>	<div>                     Department Assessment Meeting <i>each summer</i>                      Department Assessment Coordinator                      • reviews program status                      • identifies program strengths and weaknesses                      • recommends programmatic changes                      • recommends changes in program assessment process                 </div>
<div>                     GEOL 325 <i>each fall</i>                      assessment report                      example assessment instruments                      example student work                 </div>		
<div>                     GEOL 330 <i>each spring</i>                      assessment report                      example assessment instruments                      example student work                 </div>	<div>                     Department Assessment Panel reviews, summarizes and provides comments on:                      • assessment instruments used in courses                      • example student work <i>each summer</i> </div>	<div>                     Department Assessment Panel                      • recommends changes in assessment tools used in courses                      • comments on quality and appropriateness of student work in key assessment courses                 </div>
<div>                     GEOL 335 <i>each spring</i>                      assessment report                      example assessment instruments                      example student work                 </div>	<div>                     Earth Science Education Emphasis Advisor reviews and summarizes:                      • collected assessment data                      • comments of related CLAS faculty                      • comments of CITC Research and Assessment committee <i>each summer</i> </div>	<div>                     Earth Science Education Emphasis Advisor                      • summarizes assessment processes in this emphasis                      • summarizes results of assessment data analysis for this emphasis                      • recommends changes in this program emphasis                      • recommends changes in emphasis assessment processes                 </div>
<div>                     GEOL 477 <i>each summer</i>                      assessment report                      example assessment instruments                      example student work                 </div>		<div>                     Departmental Faculty                      • collectively decides how to change program                      • collectively decides how to change assessment procedures                 </div>
<div>                     GEOL 478/479 <i>each summer</i>                      assessment report                      example assessment instruments                      example student work                 </div>		
<div>                     Alumni Survey <i>1, 5, and 9 years</i> </div>		
<div>                     Employer Survey <i>2 years after graduation</i> </div>		
<div>                     General Education Courses <i>each summer</i>                      embedded test questions                      course evaluations                 </div>		