Updated and Approved ViEWS Departmental Plan for Geosciences

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Department: Geosciences

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Plan includes:
1. Brief statement of departmental goals for incorporating visual expression, writing and speaking into the geosciences undergraduate curriculum.
2. An updated plan for how we have already developed and implemented a curriculum that reflects ViEWS goals based on the plan submitted in December 2004.

_______________________________________________________________________

APPROVAL SIGNATURES

Department Representative: __________________________ Date: ____________

College Dean: __________________________ Date: ____________
ViEWS Goals and Objectives

The Department of Geosciences is committed to supporting the development of robust communications skills for all undergraduate students who major in geosciences such that they are highly competitive communicators upon graduation. As a result of our commitment to a developmental approach in acquiring essential communications skills for geoscience professionals, nearly all of our in-major undergraduate courses include projects and assignments that support a developmental approach to achieving geoscientific communication literacy.

Upon graduation, the vast majority of our undergraduate students will either attend graduate school (the majority of professional geoscientists have master’s degrees) or seek employment. Common employment opportunities include: resource exploration and development, hazards evaluation and mitigation, environmental assessment and cleanup, secondary and college education, and applied or basic exploratory research. These career paths all require a common set of communications skills, hence the justification for a broadly uniform design for achieving geoscientific communication literacy over the course of the major.

In geosciences, as in all sciences, communication is central to the methods and philosophies that are foundational to the enterprise. If a student can write a scientific report, describe scientific research in a presentation, and create explanatory graphics, we can be assured that s/he is learning to reason scientifically. Without a written, spoken, and visual demonstration of these skills, we cannot be assured that s/he has embraced the methods and philosophies that undergird the science. As a result, we appreciate fully the necessity for students to become “communication literate” in the geosciences because in doing so, they also demonstrate that they are geoscientifically literate. Thus, designing a curriculum that builds toward geoscientific communication literacy is not only essential for our graduates, it is also central to our ability to assess the success of our programs in developing geoscientifically literate graduates who can become contributing members of the geoscience community.

ViEWS Plan for Geosciences

A Developmental Approach to ViEWS for Geoscience Majors

In designing a developmental approach to achieving the communication and scientific reasoning skills that are essential for geoscience graduates, the geosciences curriculum committee agreed upon a set of desired learning outcomes for visual expression, writing, and speaking in fall 2004. The creation of three new courses was integral to supporting this approach. These courses effectively frame the scientific communications and reasoning components of our undergraduate curriculum. The first course, Field Methods (GEOS 2444) is an observation-intensive field experience taken by first-year geoscience majors in late spring. In this course, the instructor emphasizes the importance of carefully making and systematically documenting field data as both field notes and sketches and of subsequently revising those notes and sketches into written records and simple graphics. The next course, Fundamentals of Geoscience is a fall term, sophomore-level, communications-intensive course that explores the interconnectedness of the history and philosophy of the geosciences to the common forums for professional geoscientific communication (reports, abstracts, oral presentations, posters and associated graphics). This course communicates procedural knowledge about how to be a geoscientist and sets degree and professional expectations early in the major. Fundamentals of Geoscience is followed by several required and “required but elected” 3000- and 4000-level
courses that form the content core of the major. All of these courses incorporate one to several projects that emphasize writing reports, speaking, or creating visual materials as appropriate to both the course content and the sophistication of the student. During spring term, all graduating seniors enroll in the Senior Seminar, a capstone communication-intensive course that was explicitly designed to follow the scientific research and communication process. Students and their faculty facilitators jointly investigate two problems during the semester, each in a seven-week module. After researching an aspect of that module’s theme, each student summarizes her/his results in a written report and presents it orally using presentation software to create either a slideshow or a poster.

**Embedding Specific ViEWS Outcomes in Geoscience Courses**

As a department, we acknowledge that all geoscience graduates should be able to perform the following specific communication tasks using modern technology:

**Visual:**
A) Create maps illustrating data acquisition and synthesis.
B) Create visual illustrations of experimental or modeling procedures.
C) Create drawings or sketches of field or laboratory observations.
D) Create graphs of data correlation or dependence.
E) Create graphs or charts of geologic variables as a function of distance, depth, or time.
F) Create 2-D (e.g., maps, cross-sections) and 3-D visual interpretations of geologic surface and subsurface properties and processes.

**Written:**
G) Write a project proposal.
H) Produce a written (including visual) record of field, laboratory, or computer work.
I) Produce a technical report (data and analysis) of a field, laboratory, computer, or library project.
J) Write a professional abstract for a scientific presentation.
K) Produce a professional report (including synthesis and interpretation) of a field, laboratory, computer, and/or library project.

**Spoken:**
L) Present a scientific review, including personal assessment, to colleagues using presentation software (slides or poster).
M) Present a professional report to a scientific audience using presentation software (slides or poster).
N) Present a report containing scientific information and conclusions to a general audience using presentation software (slides or poster).

**Curricular Inventory of Courses with Projects that Build Toward Desired ViEWS Outcomes**

Table 1 lists courses that are required for a geoscience major in the order in which students commonly take them. Each course contributes to a student’s development toward the desired communications outcomes in different ways to produce a balanced curriculum (as indicated by a letter which corresponds to the scientific communications outcomes in the list above). The status of the evaluator (faculty, GTA or both) is also indicated. The table was updated in spring 2007 by faculty teaching the courses.
Table 1. Required Courses for a Geosciences Major

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Year</th>
<th>Visual</th>
<th>Written</th>
<th>Spoken</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOS 2444</td>
<td>(Field Observations)</td>
<td>freshman</td>
<td>A, C, D, E, F (faculty, GTA)</td>
<td>H, I (faculty, GTA)</td>
<td>L (faculty)</td>
</tr>
<tr>
<td>GEOS 1005</td>
<td>(Fundamentals)</td>
<td>sophomore</td>
<td>B, D (faculty)</td>
<td>G, J, K (faculty)</td>
<td>L, N (faculty)</td>
</tr>
<tr>
<td>GEOS 3404</td>
<td>(Structural Geology)</td>
<td>sophomore</td>
<td>A, C, D, E, F (faculty, GTA)</td>
<td>H, I, K (faculty, GTA)</td>
<td></td>
</tr>
<tr>
<td>GEOS 3504</td>
<td>(Mineralogy)</td>
<td>sophomore</td>
<td>B, C, D (faculty, GTA)</td>
<td>H, I, K (faculty, GTA)</td>
<td></td>
</tr>
<tr>
<td>GEOS 3104</td>
<td>(Geophysics)</td>
<td>sophomore</td>
<td>A, B, D, E, F (faculty, GTA)</td>
<td>H, I (GTA)</td>
<td></td>
</tr>
<tr>
<td>GEOS 3704</td>
<td>(Igneous and Metamorphic)</td>
<td>sophomore</td>
<td>C, D (faculty, GTA)</td>
<td>H, I (faculty, GTA)</td>
<td></td>
</tr>
<tr>
<td>GEOS 3204</td>
<td>(Sedimentology – Stratigraphy)</td>
<td>junior</td>
<td>A, C, E, F (faculty, GTA)</td>
<td>H, I, K (faculty, GTA)</td>
<td></td>
</tr>
<tr>
<td>GEOS 3604</td>
<td>(Paleontology)</td>
<td>junior</td>
<td>C, E (faculty, GTA)</td>
<td>H, I, K (faculty, GTA)</td>
<td></td>
</tr>
<tr>
<td>4-6 elective 3000- and 4000-level courses</td>
<td>junior-senior</td>
<td>visual required in all courses</td>
<td>written required in some courses</td>
<td>oral required in a few courses</td>
<td></td>
</tr>
<tr>
<td>GEOS 4024</td>
<td>(Capstone Senior Seminar)</td>
<td>senior</td>
<td>synthesis using visual expression (faculty)</td>
<td>G, I, J, K (faculty)</td>
<td>L, M (faculty)</td>
</tr>
</tbody>
</table>

Visual communication is so fundamental to the geosciences that students in every course use and create graphics. Scientific reports are required in nearly all courses as well. Oral communication is required at the introductory and capstone levels, and in several of the 4000-level elective courses.

Faculty are responsible for all grading of the lecture component of the course (including all formal written and oral presentations), and are directly involved in either grading or supervising GTA grading of laboratory work, including written lab reports. Visual communication is a routine component of both lecture and laboratory, and is graded by both faculty and GTA. GTAs typically grade written lab and field notes and reports.

*Materials that Encourage Continuity in the Communications Curriculum*

To foster a cohesive communications curriculum throughout the geosciences major, we have encouraged faculty to use the same written evaluation rubric and two communication reference texts for all written, spoken and visual work. When students enroll in *Geoscience Fundamentals* in the fall of their sophomore year, they purchase three texts—two of which explore conventions for scientific writing (Penrose and Katz, 2004) and speaking/visual expression (Orchard et al., 2000). All faculty have copies of Penrose and Katz (2004) and are
encouraged to refer students to this source to guide their written work. In the capstone Senior Seminar, students are once again explicitly directed to Penrose and Katz (2004) and Orchard and others (2000) as guides to inform their writing, graphics creation, and public speaking.

Similarly, a scientific writing rubric (attached) is introduced in Geoscience Fundamentals that is used to guide student writing and peer review in that course. This same rubric has been shared with all geoscience faculty so that it can be incorporated into all student written project evaluations beginning fall 2007. Our goal is to use this rubric repeatedly throughout the major so that students become adept at both self- and peer-evaluation of writing. As students adopt the characteristics of good scientific writing outlined in the rubric, they will become more adept at recognizing good scientific writing in others and will be better prepared to critically self-evaluate their own written work.

Assessment of ViEWS Plan in Achieving Desired Communications Outcomes

In order to track whether the Geosciences ViEWS curriculum is significantly increasing communication and scientific reasoning literacy, we need to follow student progress over time. Currently, we think that this can be done most effectively by using an agreed upon evaluation rubric for formal written projects in all GEOS courses and by requiring that students keep an electronic portfolio of ViEWS materials including evaluations and self-reflections throughout their undergraduate program.

Electronic Portfolios of a Student’s ViEWS Materials

Beginning in fall 2007, all geosciences majors will begin keeping an electronic portfolio of materials generated from formal communications projects that build toward the desired ViEWS outcomes listed on page 3. In spring 2007, Barbara Bekken will work with the Learning Technologies group to build a goals-based matrix into e-portfolio that supports the desired ViEWS outcomes. At the beginning of fall 2007, faculty will participate in a workshop that introduces them to how to use e-portfolio for evaluating student work and how to guide students in evaluating their own work using a rubric. We will also require that students archive their work so that it can be made available to assess their development toward geoscientific communication literacy.

Using a Writing Rubric

Incorporating a single scientific writing rubric (attached) as a guide to good writing throughout a student’s undergraduate experience is essential to encourage student engagement in evaluation and in systematizing evaluation of student writing between faculty and over time. We also want to encourage that students transfer the responsibility for evaluation from the faculty member to themselves as they become familiar with the characteristics good scientific writing. By using a single rubric, we hope to foster a process wherein students learn to engage in more meaningful student- and peer-evaluation of written materials prior to submission.

Assessing Student Progress toward ViEWS Outcomes

In early spring of each year beginning in 2008, select members of the Geosciences Curriculum Committee will request access to student e-portfolios to determine whether faculty and students are using e-portfolio as planned. These committee members will also assess to what degree students are making progress toward the desired ViEWS outcomes by spot-checking
posted samples of their work with associated faculty and self-evaluations. At that time, any concerns regarding student progress will be directed to the student’s advisor. As we assess student work in the spring of 2009 and again in 2010 we will determine whether bringing in outside evaluators is necessary.

References Cited


Attachments: Writing Rubric, Sample Checksheet
<table>
<thead>
<tr>
<th>Grade</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>The hypotheses are clearly stated and logically supported by evidence. The arguments are effectively related to each other. The thesis/hypothesis is clear and well-supported. The introduction accurately represents information from the hypotheses/methods. The development of ideas is effective and relevant. The thesis/hypothesis is appropriately supported with evidence. The argument is supported by evidence. The conclusion is supported by the evidence. The citation style is appropriate to the genre. The format is consistent with the task or instructions. Few (&lt;4) mechanical errors (spelling, grammar).</td>
</tr>
<tr>
<td>4</td>
<td>The hypotheses are appropriately developed, but could be better developed. The arguments are mostly effective in supporting each other. The thesis/hypothesis is clear, but could be more succinct. The introduction accurately represents information from the hypotheses/methods. The development of ideas is effective and relevant. The thesis/hypothesis is appropriately supported with evidence. The argument is supported by evidence. The conclusion is supported by the evidence. The citation style is acceptable to the genre. The format is largely consistent with the task or instructions. Many (4-7) mechanical errors (spelling, grammar).</td>
</tr>
<tr>
<td>3</td>
<td>The hypotheses are not entirely clear or effective in supporting each other. The thesis/hypothesis is close to being clear, but could be more developed. The introduction inaccurately represents information from the hypotheses/methods. The development of ideas is ineffective. The thesis/hypothesis is not appropriately supported with evidence. The argument is not supported by evidence. The conclusion is not supported by the evidence. The citation style is acceptable to the genre. The format is largely consistent with the task or instructions. Significant additional evidence needed to support the argument.</td>
</tr>
<tr>
<td>2</td>
<td>The hypotheses are not properly developed, and the arguments are ineffective in supporting each other. The thesis/hypothesis is inappropriately located. The introduction inaccurately represents information from the hypotheses/methods. The development of ideas is ineffective. The thesis/hypothesis is not appropriately supported with evidence. The argument is not supported by evidence. The conclusion is not supported by the evidence. The citation style is acceptable to the genre. The format is largely consistent with the task or instructions. Many (&gt; 7) mechanical errors (spelling, grammar).</td>
</tr>
<tr>
<td>1</td>
<td>The hypotheses are not properly developed, and the arguments are ineffective in supporting each other. The thesis/hypothesis is inappropriately located. The introduction inaccurately represents information from the hypotheses/methods. The development of ideas is ineffective. The thesis/hypothesis is not appropriately supported with evidence. The argument is not supported by evidence. The conclusion is not supported by the evidence. The citation style is acceptable to the genre. The format is largely appropriate to the task or instructions. Many (&gt; 7) mechanical errors (spelling, grammar).</td>
</tr>
</tbody>
</table>

**Evaluation Rubric for Writing that Reports Findings using Scientific Methods**

- **Focus**
  - **A** Paper: Clearly states the hypotheses/applies appropriate scientific methods/appropriately develops sections that support each other and argument in introduction supported by discussion.
  - **B** Paper: Supports each other, argument in introduction is supported by discussion.
  - **C** Paper: Arguments present but not supported, or unrelated. Largely ineffective in supporting each other.
  - **D** Paper: Assertions and evidence are tangential to thesis.
  - **F** Paper: Ineffective transitions, lack of development/toward competency.

- **Organization**
  - **A** Paper: организации is orderly, logical flow of ideas is consistent with hypotheses/methods.
  - **B** Paper: somewhat orderly, logical flow of ideas.
  - **C** Paper: Lacks ideas, Headings/sub-headings used improperly.
  - **D** Paper: Abrupt transitions, headings/sub-headings used incorrectly.
  - **F** Paper: No headings used.

- **Thesis/Hypothesis**
  - **A** Paper: thesis/hypothesis statement well-supported by evidence.
  - **B** Paper: Thesis/hypothesis close to being clear but could be more developed.
  - **C** Paper: Thesis/hypothesis statement not located as appropriate.
  - **D** Paper: Thesis/hypothesis close to being clear, but could be better developed.
  - **F** Paper: Thesis/hypothesis not clear.

- **Argument/Evidence**
  - **B** Paper: Argument mostly supports thesis, but could be better developed.
  - **C** Paper: Argument only partially developed, or tangential to thesis.
  - **D** Paper: Argument present but not supported, or unrelated.
  - **F** Paper: Ineffective, inappropriate.

- **Supporting Material**
  - **A** Paper: Material is well-developed, and fully supports the argument.
  - **B** Paper: Material partially supports the argument.
  - **C** Paper: Significant additional evidence needed to support the argument.
  - **D** Paper: Evidence not developed, or tangential to thesis.
  - **F** Paper: No evidence.

- **Citation Style**
  - **A** Paper: Citation style appropriate to genre.
  - **B** Paper: Citation format marginally acceptable to genre.
  - **C** Paper: Citation format acceptable to genre.
  - **D** Paper: Citation format marginally acceptable to genre.
  - **F** Paper: Citation style inappropriate to genre.

- **Format**
  - **A** Paper: Format consistent with the task or instructions, few (<4) mechanical errors.
  - **B** Paper: Format largely consistent with the task or instructions, many (4-7) mechanical errors.
  - **C** Paper: Format largely inappropriate to the task or instructions, many (> 7) mechanical errors.
  - **D** Paper: Format does not demonstrate proficiency, pervasive use of Standard English (spelling, grammar). Many (> 7) mechanical errors.
  - **F** Paper: Format does not demonstrate proficiency, pervasive use of Standard English (spelling, grammar). Many (> 7) mechanical errors.