

General Education Assessment Academic Year 2014-2015

The initial General Education Program at SUNY ESF, implemented in 1999, was created as a response to the SUNY Board of Trustees requirement to standardize general education across the SUNY system. The program has evolved both at a system level as well as at the College level and the assessment plan has been reorganized to meet the needs of the College, the new system initiatives, as well as the Middle States criteria.

Assessment of the general education program for 2014-2015 has focused on developing the process for evaluating our general education goals and generating recommendations for making assessment more efficient and informative in coming years.

Process

This past year a committee of faculty reviewed the general education student learning outcomes (SLO's) at the system level, the current college level, as well as those mandated by Middle States. The SLO's (**Appendix I**) were refined to meet these criteria and then rubrics were generated to guide the assessment of student work (**Appendix II**). Student work from a variety of sources were collected, including papers from general education writing courses, exams and laboratory reports from general education mathematics and science classes, and senior-level capstone projects from 6 of 8 departments and programs from across campus. The rubrics were applied and the results tabulated (**Appendix III**). The faculty involved with the initial review met to make recommendations based on the data and have generated this report, which was presented to department chairs, and at each department's faculty meeting for review. It was also presented to the general faculty for review and feedback at a College-wide Governance meeting. In March and April of 2015, the committee plans to refine this report, solicit more recommendations for improving learning gains and to create a plan of action beginning in the fall of 2015.

Student Learning Outcomes

SUNY ESF's general education Student Learning Outcomes (SLO's) are concerned with six areas: (1) Scientific Reasoning; (2) Quantitative Reasoning; (3) Basic Communication Skills; (4) Technological and Information Literacy; (5) Values, Ethics and Diverse Perspectives; and (6) Critical Thinking.

(1) Scientific Reasoning

Students at ESF will be able to: demonstrate an understanding of modern science, the implications of scientific discoveries, apply the scientific method, and to use science to address contemporary problems.

(2) Quantitative Reasoning

Students at SUNY ESF will be able to effectively communicate quantitative information through describing, interpreting, applying, or evaluating problems.

(3) Basic Communication Skills

Students at ESF will demonstrate the ability to formulate and present ideas in both written and oral forms that reflect critical thinking skills; show awareness of audience, context, and purpose; and present a well developed argument using appropriate sources.

(4) Technological and Information Literacy

Students at ESF will be able to use critical thinking skills to determine the information needed to solve a problem, access information using appropriate technologies, and effectively and appropriately use information to accomplish a specific purpose.

(5) Values, Ethics and Diverse Perspectives

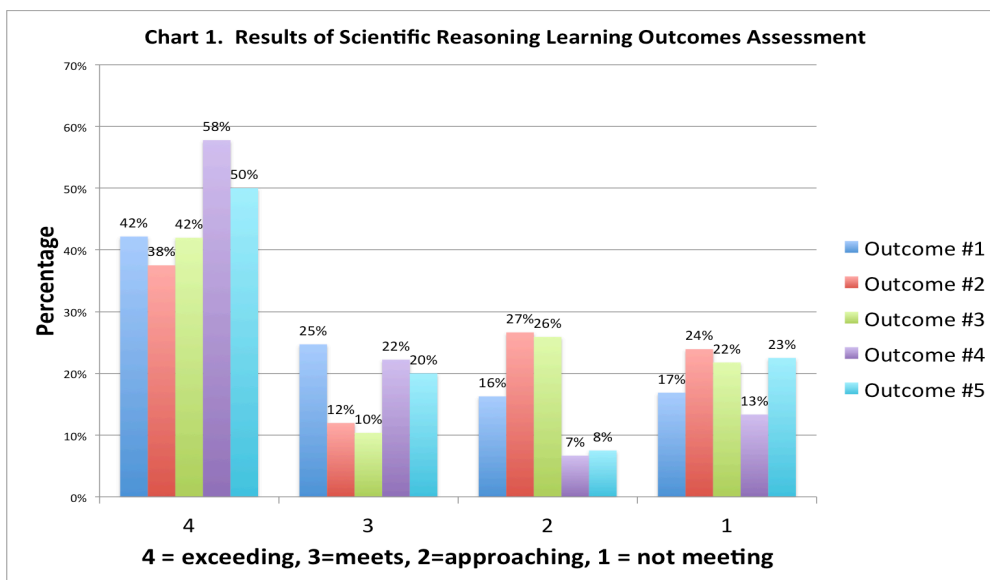
Students at ESF will be able to demonstrate an awareness of diverse cultures and values, recognize ethical issues in contemporary society, and apply ethical concepts in addressing diverse personal, professional, and societal settings.

(6) Critical Thinking

Summary of Assessment of Student Work

(1) Scientific Reasoning

A rubric was used to assess five aspects associated with the broad Scientific Reasoning learning outcome above. Lecture assignments, laboratory papers, exams and capstone papers were used to assess these five outcomes: (i) demonstrate knowledge of the scientific method; (ii) formulate and test hypotheses, (iii) assess credibility and validity of scientific information, (iv) make informed decisions on contemporary issues demanding scientific literacy and (v) analyze and discuss the relationship between scientific discovery and society. For all outcomes we set a target goal of 70% of the student work assessed should meet or exceed expectations. The results of our assessment are shown in **Chart I**.



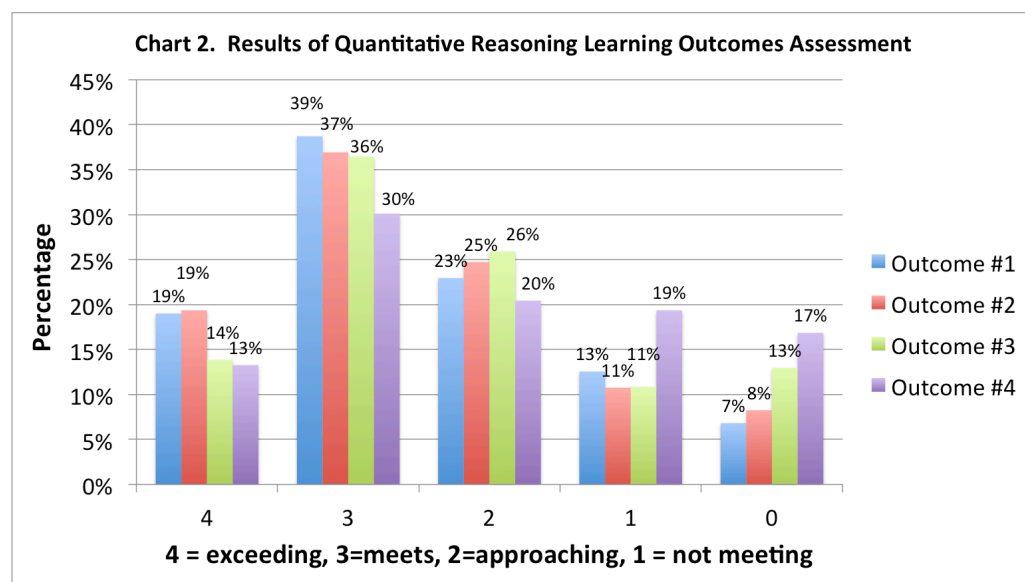
The basic premise of scientific reasoning rests with an understanding of, and the ability to, apply the scientific method. Learning outcomes #1 (demonstrate knowledge of the scientific method) and #2 – (formulate and test hypotheses) directly assess how well our students are achieving our learning outcome goal for the scientific method. For outcome #1, we are approaching the goal of 70% meeting and exceeding but for outcome #2 we are falling short. A large number of the papers used to assess the second outcome were first year papers where students are still learning about experimental design. In capstone courses however, the students show significantly more facility with experimental design and the iterative process associated with the scientific method. Recommendations for improving the outcome here is to introduce experimental design earlier in the curriculum and to ensure that all students have a final capstone experience.

Learning Outcome #3 was somewhat disappointing, with only 52% of our students meeting or exceeding the standard set. It was discussed by the committee and the recommendation was that an after the fact assessment for this outcome may not be the best way to understand where our students on this topic. Rather, we think course instructors should be provided with specific things to look for and to analyze their papers for this individually. This outcome requires specific topical knowledge and therefore is best evaluated by the capstone instructors.

The results of 80% and 70% for outcomes #4 (making informed decisions on contemporary issues) and #5 (analyze and discuss the relationship between scientific discover and society) indicated that our students generally are meeting the standard we have set. However, the student work that was collected was specific to these outcomes, a question on a final exam for a general education chemistry course was used, and that question specifically asked for the students to compare and contrast and express an opinion on a societal topic.

(2) Quantitative Reasoning

A rubric was used to assess four aspects associated with the broad Quantitative Reasoning learning outcome above. Lecture assignments, laboratory papers, exams and capstone papers were used to assess these four outcomes. The data can be found in **Chart 2**.



The results of 58% proficiency, for first outcome of identifying and describing quantitative information in any context, is a little low. This is basic quantitative reasoning skill, and we would expect that 80% of students would be able to exemplify this outcome at an average level. This outcome may need to be split into distinct outcomes in order to better identify what students are having difficulty identifying or describing. The problems that identified this learning outcome were poor indicators, and they seemed to have been more focused on the more difficult portion of this outcome. The proportions of symbolic, visual, and numerical problems selected were not equal, and this may have skewed the results. However, the biggest factor looking at the data was that most of the problems that were targeted for assessment attempted to capture all of the learning outcomes, and this in itself was faulty. This becomes evident when we look only at capstones and senior papers, the percentage increases to 72% of students at least meeting outcome one. With this consideration, the 58% is low but understandable considering the metrics.

The data indicates that 56% of the samples surveyed were at least meeting outcome 2; Interpret quantitative information and draw inferences from them. Considering only questions that were more directly designed to measure this outcome (i.e. exam questions), then the data indicates that 70% would be at least meeting this outcome.

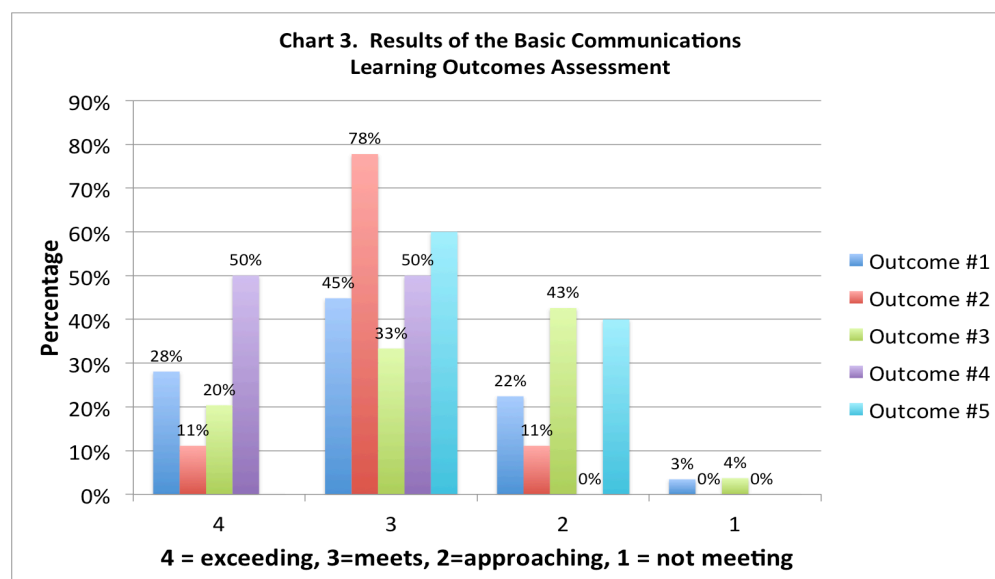
The most disappointing result was what the data says about objective three, “Apply and Analyze problems with acquired quantitative reasoning and skills.” The data indicates that 50% of students were meeting or exceeding objective for the articles that we looked at. This percentage did not vary much from exam questions to capstones or senior thesis. Ideally 75% of the students should be able to exemplify that they are at least meeting this objective. I suspect that with a better data set this percentage is much higher and closer to the 75% target. Nonetheless, it is disappointing that with senior papers and capstones alone only showed 52% were exemplifying that they were meeting this objective.

The data collected indicates that 43% were meeting or exceeding the fourth objective of “Synthesize and Evaluate problems within a specific discipline using quantitative reasoning.” This is considered a high level skill where students are able to break down quantitative information and rebuild it using higher level quantitative tools to be able to support or arrive at a conclusion, and this occurs within a specific discipline. This objective is ideal, and we do not expect all students to be proficient in exemplifying this objective. However, this objective is the ideal aspiration and we think it would be wrong to omit it. With that said, we would expect that half of the qualifying articles examined would display this level of quantitative fluency. This objective should ideally be found in a capstone, senior project, or a comprehensive project, the problem is that not all such articles require such an analysis, and might be difficult to measure consistently. The data shows that 43% is meeting this objective when we consider only capstones, and this is satisfying as it is close to the 50% target. On the flip side, the data shows that 70 % are meeting or exceeding this objective based solely on exam questions, however this type of high level objective is not appropriately measured in such a context.

(3) Basic Communication Skills

A rubric was used to assess five aspects associated with the broad Basic Communication Skills learning outcome above. Lecture assignments, laboratory papers, exams and capstone papers were used to assess these five outcomes. The data can be found in **Chart 3**.

The results gathered concerning Learning Outcome #1 (produce writing that clearly communicates ideas reflective of critical thinking skills) show that our students are meeting our expectation of being able to produce writing illustrative of their critical thinking skills, that is grammatical correct and well developed. 72% of our students are meeting or exceeding the standard for this outcome. The data that was used included both student work from writing classes where the emphasis is on the writing process as well as senior year capstone courses where writing is used as a tool to bring research and experimental design work to the forefront.



Learning Outcome #2 is actually quite low, only 14% of our students are meeting or exceeding our expectations, however, this is most likely a direct reflection of not being able to measure this outcome from finished work. If, however, only the student work that illustrates fluency in writing is analyzed, we notice that the numbers increase dramatically. This is a good example of where the general education committee will need to provide the faculty members with a rubric and have them assess their student's work as it is being produced. This is what might be considered an "at the time" assessment, final work shows the result of the process but not the fluency of engaging with the process.

Learning Outcome #3 was also disappointing. One of the most important aspects of good writing is the ability to interpret and use others work to enhance and support your writing. The fact that only half of the student work that was reviewed is showing evidence of this indicates that more work needs to be done with students on how to use citations. A recommendation to the faculty from this committee includes having students write additional annotated bibliographies and categorizing their references as pro and con arguments and then writing why it is a pro or con argument with respect to their work.

The 100%, meeting and exceeding result for Learning Outcome #4 is misleading, it like Outcome #2 was nearly impossible to assess from the student work that the committee collected. Of the papers collected only 6% showed meeting and exceeding in this category but almost all of them were missing this aspect it was unclear to the committee if that was because it was part of the assignment and the student failed to demonstrate it or that it was never a part of the assignment and therefore the document was inappropriate for assessing this outcome. This is another "at the time" assessment

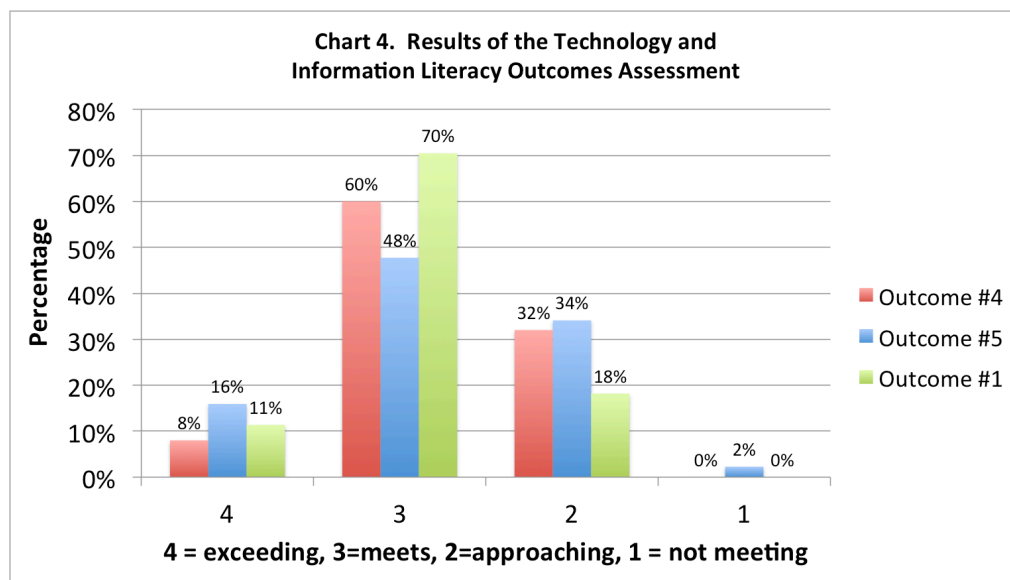
that will need to have faculty input directly about their students. The committee plans to provide students with rubrics for general education assessment and to train them on how to assess oral presentations for the purpose of general education (not course assessment) assessment.

Peer review is another example of an “at the time” assessment, little if any of the materials collected had any evidence of peer review.

In summary, learning outcome #1 and #3 were successfully assessed through this process and the students are meeting standards set for outcome #1 and for outcome #3 the committee will solicit feedback from the Writing and Capstone instructors about how to improve citation use in writing arguments. For Outcomes #2, #4 and #5, a rubric will be developed and provided to faculty teaching those courses so that “at the time” assessment can be made and used as a living contribution to general education assessment.

(4) Technological and Information Literacy

A rubric was used to assess three aspects associated with the broad Technological and Information Literacy learning outcome above. Lecture assignments, laboratory papers, exams and capstone papers were used to assess these three outcomes. The data can be found in **Chart 4**.



Assessment of Learning Outcome #1 – Use critical thinking skills to determine the nature and extent of the information needed to solve a problem – indicates that our students have the skills to determine what information they need to find to solve a problem. The capstone papers showed clear evidence of being able to find citations that backed up their work and that they were able to identify clear questions and find the information necessary to begin investigating those questions. Capstone projects were ideal for evaluating this outcome as many departments ask students to write a proposal and then to write their final paper in the form of a research paper or project report.

The committee identified outcome #2 as important at the beginning of the process but once the review of student work started, it became evident that this was not something that could be evaluated from finished work. The only materials available to the reviewers were finished documents after the

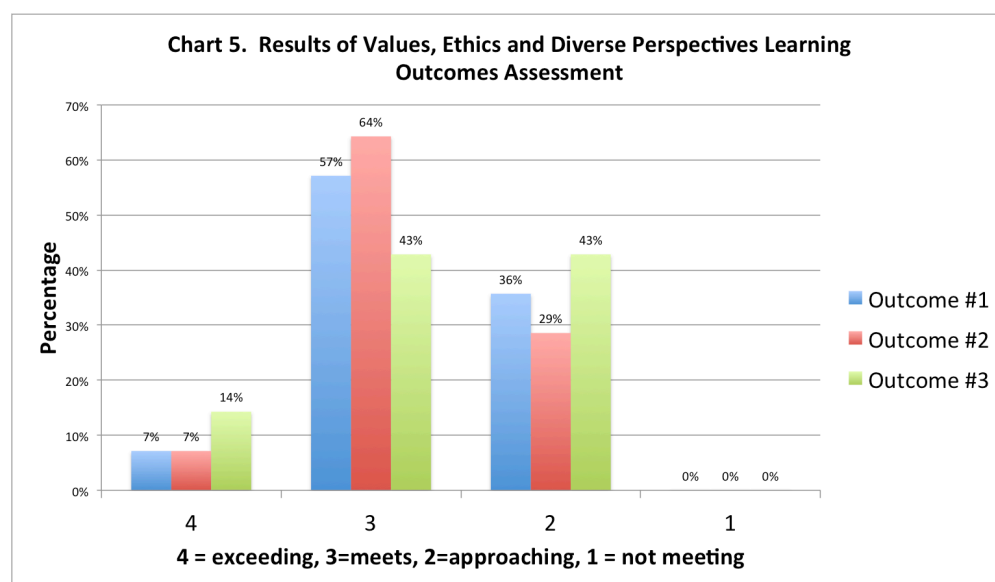
technologies were used to find the citations and background materials. There was no way to evaluate what the students used to find the materials. This was another “at the time” assessment that the committee thinks would be best evaluated by the course instructor or through the Library Literacy courses that are offered: ESF 200 Information Literacy. The committee plans to create a rubric for this and to provide it to our ESF 200 faculty and ask them to complete it each year and submit the data to the committee for inclusion in the assessment process.

Prior to commencing review of student work, the committee did not pay careful attention to Outcomes that were overlapping between subject areas. This inefficiency will be addressed next fall when in the next iteration of general education assessment. As a result, this team of reviewers did not evaluate Outcome #3.

The results for outcome #3 and #4, while lower than our target at 68% and 64% respectively, were assessed and the student work showed clear evidence of effective use of information and proper citation. As indicated in basic communication assessment, students continue to need practice using sources effectively to support their arguments. It is heartening to note that while there are subtle differences in the rubric used to assess Outcome #4 here and Outcome #3 for basic communication, the results were close. Therefore, addressing this on two fronts is likely to increase the success rate of our students in the future.

(5) Values, Ethics and Diverse Perspectives

A rubric was used to assess three aspects associated with the broad Values, Ethics and Diverse Perspectives learning outcome above. Lecture assignments, laboratory papers, exams and capstone papers were used to assess these three outcomes. The data can be found **Chart 5**.



The committee was actually quite surprised by the scores on the outcomes for this SLO. Generally, this has not been something that College’s general education courses have had time to emphasize and going into the review there was general concern that it would be missing from our student work altogether. The use of capstone courses however illustrates that through professional development seminars and upper-level courses where students work closely with faculty members and

professionals in the community, they are being exposed to the ethics within their fields and perhaps in society. They are then incorporating them into their senior projects and synthesis/capstone papers. In many departments there has also been a movement toward lower-level courses on professional ethics.

Moving forward, the committee is excited by the opportunities being presented by the revision of the undergraduate program through the strategic planning process to be more intentional about creating opportunities for our students to engage more directly with different cultures and with the philosophy of science and history. Intentionality in the design of these experiences will result in better outcomes in the very near future. Some of the current ideas on the table include, increased community engagement through service learning, emphasis on a travel experience (semester away US or Abroad) and a more focused general education program where sets of core courses discuss some of the biggest societal and environmental questions of the day.

(6) Critical Thinking

Each of the individual areas assess above have critical thinking student learning outcomes and these have not yet been correlated at this time.

Recommendations based upon data collected

- Analyze data over a three year period
- Collect materials in electronic format
- Require the use of an e-portfolio
- Create spreadsheets for faculty to evaluate items that are best done by the instructor
 - Use of databases to find references (Library courses)
 - Interpretation of reference materials (instructor of capstone courses)
- Provide feedback to faculty about student learning outcomes so that they can better incorporate the material into their courses.
- Create a cohesive general education program that runs through all four years
- Require all majors to do capstone experiences
- Create a group responsible for overseeing and creating the general education program
 - Could be a sub-committee of the faculty Governance committees, Instructional Quality and Academic Standards and/or Curriculum
 - Could be a division like ES

Respectfully submitted on behalf of the committee by Kelley J. Donaghy, Committee Chair

Committee Members

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APPENDIX I.

General Education Student Learning Outcomes

1. Scientific Reasoning
2. Quantitative Reasoning
3. Basic Communication Skills
4. Technological and Information Literacy
5. Values, Ethics and Diverse Perspectives

General Education Scientific Reasoning Student Learning Outcomes

Students at ESF will be able to demonstrate an understanding of modern science, the implications of scientific discoveries, be able to apply the scientific method and to use science to address contemporary problems.

ESF Scientific Reasoning Learning Outcomes	Products and Sampling Plan: What products will be sampled for assessment and when.	Analysis: What do we do to maintain or improve?
1. Demonstrate knowledge of the scientific method.	Lecture Assignments and Exam and Quiz Questions - from the general education science courses	
2. Formulate and test hypotheses	Laboratory reports from the general education science courses.	
3. Assess credibility and validity of scientific information***	Lab reports and Capstone papers - evaluate citations; Analytical writing unit from EWP 190 courses.	
4. Make informed decisions on contemporary issues demanding scientific literacy***	Final Exam Questions from General Chemistry I; Final Lab report in General Chemistry II; General Biology assignments on current events related to scientific discoveries; capstone papers from all majors that have capstones	
5. Analyze and discuss the relationship between scientific discovery and society		

***Critical Thinking Student Learning Outcome

Quantitative Reasoning Student Learning Outcomes

At SUNY ESF, we have two sets of learning outcomes that we need to consider. The SUNY general education mathematics requirements, and the institutions learning outcomes involving quantitative reasoning. The SUNY general education mathematics requirements (shown below) are a subset of the institution's Quantitative Reasoning learning outcomes.

ESF's Quantitative Reasoning Learning Outcomes	Products and Sampling Plan: What products will be sampled for assessment	Analysis: What do we do to maintain or improve? (every 3rd year)
Students will be able to:		
Identify and Describe quantitative information symbolically, visually, numerically or verbally.	Exams , Projects, Labs, Fieldwork	
Interpret quantitative information and draw inferences from them.	Exams , Projects, Labs, Fieldwork	
Apply and Analyze problems with acquired quantitative reasoning and skills.	Exams , Projects, Labs, Fieldwork	
Synthesize and Evaluate problems within a specific discipline using quantitative reasoning.	Exams , Projects, Labs, Fieldwork	

Basic Communication Outcomes

ESF's Basic Communication Learning Outcomes	Products and Sampling Plan: What products will be sampled for assessment?	Analysis: What do we do to maintain or improve? (every 3rd year)
Students will be able to:		
1. Produce writing that clearly communicates ideas reflective of critical thinking skills.	Research papers/ portfolios (random sample of 40) from Research Writing & Humanities (EWP 290) or... Senior Synthesis capstone projects (random sample of 40) representative of various majors	
2. Demonstrate fluency in a writing process.	Research papers/ portfolios (random sample of 40) from Research Writing & Humanities (EWP 290) or... Senior Synthesis capstone projects (random sample of 40) representative of various majors	
3. Demonstrate the ability to integrate relevant sources when composing an argument.	Research papers/ portfolios (random sample of 40) from Research Writing & Humanities (EWP 290) or... Senior Synthesis capstone projects (random sample of 40) representative of various majors	
4. Demonstrate the ability to prepare and present an oral presentation.	Senior Synthesis capstone presentations (random sample of 40) representative of various majors	
5. Demonstrate the ability to evaluate and provide meaningful feedback on own and others work.	Senior Synthesis capstone presentations (random sample of 40) representative of various majors	

General Education Technological and Information Literacy Student Learning Outcomes

Students at ESF will be able to demonstrate an awareness of diverse cultures and values, recognize ethical issues in contemporary society, and apply ethical concepts in addressing diverse personal, professional and societal settings.

ESF Scientific Reasoning Learning Outcomes	Products and Sampling Plan: What products will be sampled for assessment and when.	Analysis: What do we do to maintain or improve?
1. Use critical thinking skills to determine the nature and extent of the information needed to solve a problem.	Senior Synthesis or Capstone Projects	
2. Effectively and efficiently access needed information using appropriate technologies.	Senior Synthesis or Capstone Projects	
3. Critically evaluate information and credibility of its sources.***	Senior Synthesis or Capstone Projects	
4. Effectively use information to accomplish a specific purpose.	Senior Synthesis or Capstone Projects	
5. Ethically and legally access and use information		

***Critical Thinking Student Learning Outcome

Values, Ethics and Diverse Perspectives Student Learning Outcomes

<p>ESF's Values, Ethics, & Diverse Perspectives Learning Outcomes</p>	<p>Products and Sampling Plan: What products will b sampled for assessment</p>	<p>Analysis: What do we do to maintain or Improve? (every 3rd year)</p>
<p>Demonstrate awareness and recognition of diverse cultures and ways of thinking and knowing</p>	<p>Capstone projects, Senior Synthesis projects (random sample of 40) representative of various majors</p>	
<p>Demonstrate recognition of ethical issues throughout society.</p>	<p>Capstone projects, Senior Synthesis projects (random sample of 40) representative of various majors</p>	
<p>Apply ethical concepts to diverse personal, professional or societal settings.</p>	<p>Capstone projects, Senior Synthesis projects (random sample of 40) representative of various majors</p>	

APPENDIX II.

Rubrics Used for Assessing Student Learning Outcomes

1. Scientific Reasoning
2. Quantitative Reasoning
3. Basic Communication Skills
4. Technological and Information Literacy
5. Values, Ethics and Diverse Perspectives

Scientific Reasoning Student Learning Outcomes

Students should be able to:	Exceeding (4)	Meeting (3)	Approaching (2)	Not Meeting (1)
Learning Outcome #1 Demonstrate Knowledge of the Scientific Method	Papers show a clear introduction based on observation, a hypothesis, methods section on the experiment to be done, a results and discussion section that is well thought out and based on collected data and a possible future work section	Papers have introduction, hypothesis, methods, results and discussion section, but it is less well written, the results and the data do not match or at least seem less well understood. No more than one missing component.	Several components are missing, the data collected seems weak or missing and the results and discussion section do not discuss the data collected.	Paper does not have a clear outline that would indicate that the scientific method was used in the development of the ideas.
Learning Outcome #2 Formulate and test hypotheses	Hypothesis is clearly spelled out and the introduction and experimental design are clear. Data is collected that support or deny the hypothesis.	Hypothesis is spelled out, the experimental design is flawed or at least not as well developed. Data is collected that support or deny the hypothesis	Either the hypothesis is missing, the experimental design is flawed. Data is collected but it is not able to support or deny the hypothesis	No hypothesis, experimental design is unclear, data is not collected or it not relevant to the rest of the paper
Learning Outcome #3 Assess credibility and validity of scientific information	References are present and discussed critically in the text. A variety of reference materials are used (primary, secondary) and are referenced accurately.	References are present and may be discussed critically in text. Less variety in reference materials used and the style of referencing may not be uniform	Very few references are present but not discussed critically. Only websites are used as references and the style of the references are not uniform.	No references.
Learning Outcome #4 Make informed decisions on contemporary issues demanding scientific literacy	Students are able to express an opinion about a prompt that includes a contemporary issue (fracking, energy, biodiversity, sustainability). They can write pros and cons and then based on their arguments, they express a well supported opinion.	Students are able to express an opinion about a prompt that includes a contemporary issue (fracking, energy, biodiversity, sustainability). Their opinion however is not well supported and they do not have a set of pros and cons	Students express an opinion about a prompt that includes a contemporary issue (fracking, energy, biodiversity, sustainability) but there is no supporting evidence presented.	Opinion is yes or no, no clear understanding of the problem expressed in the prompt.
Learning Outcome #5 Analyze and discuss the relationship between scientific discovery and society	Clear Connections are made between the history and philosophy of science and their impact on society. For example: ethics and the tuskegee experiments or vaccinations or the rise of technology.	Connections are made between the history and philosophy of science and their impact on society, discussion is in much less depth. For example: ethics and the tuskegee experiments or vaccinations or the rise of technology.	Weak Connections are made between the history and philosophy of science and their impact on society, discussion has no depth. No examples are given.	No connections are made, no examples are given and no attempt to provide any details is made.

Quantitative Reasoning Student Learning Outcomes and Rubrics

Student's should be able to:	EXCEEDING (4)	MEETING (3)	APPROACHING (2)	NOT MEETING (1)
<p>Interpret: <i>Ability to explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i></p>	<p>Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information. <i>For example, accurately explains the trend data shown in a graph and makes reasonable predictions regarding what the data suggest about future events.</i></p>	<p>Provides accurate explanations of information presented in mathematical forms. <i>For instance, accurately explains the trend data shown in a graph.</i></p>	<p>Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units. <i>For instance, accurately explains trend data shown in a graph, but may miscalculate the slope of the trend line.</i></p>	<p>Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means. <i>For example, attempts to explain the trend data shown in a graph, but will frequently misinterpret the nature of that trend, perhaps by confusing positive and negative trends.</i></p>
<p>Identify and Describe: <i>Ability to convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)</i></p>	<p>Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.</p>	<p>Competently converts relevant information into an appropriate and desired mathematical portrayal.</p>	<p>Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.</p>	<p>Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.</p>
<p>Application / Analysis: <i>Ability to make judgments and draw appropriate conclusions based on the quantitative analysis of data, while recognizing the limits of this analysis</i></p>	<p>Uses the quantitative analysis of data as the basis for deep and thoughtful judgments, drawing insightful, carefully qualified conclusions from this work.</p>	<p>Uses the quantitative analysis of data as the basis for competent judgments, drawing reasonable and appropriately qualified conclusions from this work.</p>	<p>Uses the quantitative analysis of data as the basis for workmanlike (without inspiration or nuance, ordinary) judgments, drawing plausible conclusions from this work.</p>	<p>Uses the quantitative analysis of data as the basis for tentative, basic judgments, although is hesitant or uncertain about drawing conclusions from this work.</p>
<p>Assume and Evaluate: <i>Ability to make and evaluate important assumptions in estimation, modeling, and data analysis</i></p>	<p>Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate. Shows awareness that confidence in final conclusions is limited by the accuracy of the assumptions.</p>	<p>Explicitly describes assumptions and provides compelling rationale for why assumptions are appropriate.</p>	<p>Explicitly describes assumptions.</p>	<p>Attempts to describe assumptions.</p>
	<p>Calculations are successful and comprehensive to solve the problem and elegantly stated.</p>	<p>Calculations are successful and comprehensive to solve the problem</p>	<p>Calculations attempted are either unsuccessful or represent only a portion of the calculations required to comprehensively solve the problem.</p>	<p>Calculations are unsuccessful and not comprehensive to solve the problem.</p>
<p>Synthesize: <i>Expressing quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)</i></p>	<p>Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.</p>	<p>Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.</p>	<p>Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.</p>	<p>Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as "many," "few," "increasing," "small," and the like in place of actual quantities.)</p>

Student Learning Outcomes Basic Communication

Outcome #1				
Students will be able to produce college-level writing that clearly communicates ideas through skills of observation, summary, synthesis, and analysis, reflective of critical thinking skills.				
	Not Meeting (1)	Approaching (2)	Meeting (3)	Exceeding (4)
Thesis/Focusing Claim	Writer fails to present a controlling purpose or thesis; consequently it is difficult or impossible to identify the central idea. No evidence reflective of critical thinking.	Writer presents a wandering, vague, or unfocused controlling idea or thesis with little complexity reflective of critical thinking.	Writer presents an identifiable and focused controlling idea or thesis with some complexity reflective of critical thinking.	Writer presents an easily identifiable, focused, controlling idea or thesis with significant complexity reflective of critical thinking.
Organization and Development	Writer moves from an unsatisfactory introduction to an unsatisfying ending, thus conveying the sense that much of what has been presented is unresolved.	Writer moves awkwardly from a weak introduction to an unsatisfactory conclusion. Basic paragraphing exists, but often fails to support or even recognize a central idea, and the use of evidence and examples is inadequate. Sentence and paragraph transitions are often unclear, awkward, indirect, and/or illogical.	Writer moves coherently and logically from a satisfying introduction to a solid conclusion. Paragraphs fit within this structure and present examples and evidence to support the ideas presented. For the most part, sentences are well constructed and transitions are sound—though the sequence of ideas may occasionally be awkward.	Writer moves logically and coherently and from an engaging introduction to a well-demonstrated conclusion. Paragraphs fit within this structure coherently and present pertinent examples and evidence to support central and subsidiary ideas. Sentence structure displays sophistication and variety; transitions add to the logical development of the topic.
Evidence	Writer rarely or never presents examples and/or evidence to support ideas. Writer is inconsistent with citations or does not cite sources at all. Evidence of critical thinking about sourcework is absent.	Writer infrequently draws on, presents, and/or contextualizes examples and evidence to support ideas. Writer is inconsistent with citations. Minimal evidence of critical thinking about sourcework.	Writer generally draws on, presents, and contextualizes examples and evidence to support ideas, using appropriate citations, with some inconsistency. Some evidence of critical thinking about sourcework.	Writer draws on, presents, and contextualizes pertinent examples and evidence to support ideas, using appropriate citations. Significant evidence of critical thinking about sourcework.
Rhetorical Considerations	Tone, diction, and word choice are not appropriate for the subject or audience.	Tone and diction are often inconsistent and/or inappropriate for the subject or audience.	Writing exhibits some degree of control over the tone and diction appropriate for the subject or audience. Writing demonstrates consistent use of important conventions particular to a specific discipline and/or writing task(s), including organization, content, presentation, and stylistic choices.	Writing exhibits a solid command of word variety and a tone and diction appropriate for the subject or audience. Writing demonstrates detailed attention to and successful execution of a wide range of conventions particular to a specific discipline and/or writing task(s) including organization, content, presentation, formatting, and stylistic choices.
(Attention to Audience, Context, Purpose)	Writing rarely or never follows a consistent system for basic organization and presentation appropriate to a specific discipline and/or writing task(s).	Writing sometimes follows expectations appropriate to a specific discipline and/or writing task(s) for basic organization, content, and presentation.		
Mechanics	Mechanics (grammar, punctuation, spelling and documentation) disrupt reading and often obscure meaning.	Mechanics (grammar, punctuation, spelling and documentation) are not well executed and may, at times, obscure meaning.	The writing exhibits some degree of control over the tone and diction appropriate for the subject and its implied audience.	Mechanics (grammar, punctuation, spelling and documentation) are error free.

Some details adapted from the Association of American Colleges and Universities (AACU)

Student Learning Outcomes Basic Communication

Outcome #2				
Students will be able to demonstrate fluency in a writing process that includes drafting; revising; editing; peer and instructor feedback; and self-evaluation.				
	Not Meeting (1)	Approaching (2)	Meeting (3)	Exceeding (4)
Revision of Content, Focus, Structure	Writer demonstrates a lack of ability to revise at the level of content or structure. Either changes do not improve these features or are focused almost solely on mechanics.	Writer demonstrates a lack of ability to revise in any substantial way. Whatever revision has been done has not been sufficient to improve the content, focus, structure, clarity, and coherence of an earlier draft. Such revision may be limited to sections of the writing rather than to the work as a whole.	Writer demonstrates the ability to revise by refining the content, sharpening the focus, and improving structure, clarity, and coherence. Refining content may include clearer presentation of evidence, shifting of emphasis to foreground the most relevant material, providing improved transitions that keep the focus evident, and reworking the introduction or conclusion as well as rewriting individual sentences.	Writer demonstrates clear evidence of revision by altering content and approach, reorganizing material, and/or clarifying and strengthening the coherence of ideas. Revisions may include addition of new material; deletion of unhelpful material; substitution of more relevant material for less relevant material; strengthening of transitions, introductions, and conclusions; and rewriting of individual sentences.
Editing for Sentence-Level Correctness (Mechanics)	Mechanics (grammar, punctuation, spelling and documentation, if needed) are problematic and make it difficult or impossible to understand meaning.	Mechanics (grammar, punctuation, spelling and documentation, if needed) have problems and sometimes impede meaning.	Mechanics (grammar, punctuation, spelling and documentation, if needed) are mostly accurate and rarely impede meaning.	Mechanics (grammar, punctuation, spelling and documentation, if needed) of the final revision are nearly flawless.

Some details adapted from the Association of American Colleges and Universities (AACU)

Outcome #3				
Students will be able to demonstrate the ability to locate, evaluate, and effectively integrate a range of relevant sources when composing an argument.				
	Not meeting (1)	Approaching (2)	Meeting (3)	Exceeding (4)
Identification and Selection of Appropriate Sources	Writer works with a very limited selection of sources, resulting in a polarized and/or shallow perspective on the topic. Sources neither satisfactorily support nor advance the argument.	Writer works with a limited selection of sources representing narrow perspectives on the topic. Sources somewhat support and advance the argument.	Writer works with a few sources representing a few perspectives on the topic. Sources generally support and advance the argument.	Writer works with a carefully selected range of relevant sources representing multiple perspectives on the topic, resulting in a rich researched argument. Sources clearly support and advance the argument.
Integration of Sources to Support Argument	Writer does not engage with researched texts. The writer demonstrates an inability to make decisions about when or where to quote, paraphrase, or summarize sources' ideas or information. The writer does not smoothly integrate source material, and does not provide signal phrases. The writer never, or only weakly, analyzes or challenges perspectives of the sources.	Writer works begins to engage with researched texts, but shows limited fluency in making decisions about when or where to quote, paraphrase, or summarize sources' ideas or information. The writer does not consistently integrate source material, and sometimes lacks signal phrases. The writer only minimally analyzes and/or challenges perspectives of the sources.	Writer works closely with researched texts and generally makes good decisions about when and where to quote, paraphrase, or summarize sources' ideas or information. The writer generally integrates source material smoothly, and uses signal phrases when appropriate. The writer shows evidence of analyzing and/or challenging perspectives of the sources.	Writer works closely with researched texts and makes adept and appropriate decisions about when and where to quote, paraphrase, or summarize sources' ideas or information. The writer consistently integrates source material seamlessly, and always uses signal phrases when appropriate. The writer clearly analyzes and/or challenges perspectives of the sources in a thoughtful, thorough manner.

Some details adapted from the Association of American Colleges and Universities (AACU)

Student Learning Outcomes Basic Communication

Outcome #4				
Students will be able to demonstrate the ability to prepare and present an oral presentation with attention to audience, context, and purpose.				
	Not meeting (1)	Approaching (2)	Meeting (3)	Exceeding (4)
Content	Central message is unclear and undeveloped. Insufficient supporting details (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) greatly reduces presenter's credibility. Consideration of audience, context, and purpose is absent.	Central message is basic and not memorable. Minimal use of supporting details (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) somewhat reduces presenter's credibility. Consideration of audience, context, and purpose is somewhat apparent.	Central message is clear and consistent with the supporting material. Supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) make appropriate reference to information or analysis that generally establishes the presenter's credibility/authority on the topic. Consideration of audience, context, and purpose is apparent.	Central message is compelling (precisely stated, appropriately repeated, memorable, and strongly supported.) A variety of types of supporting materials (explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities) significantly support the presentation. Consideration of audience, context, and purpose is very apparent.
Organization	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is not observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is intermittently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable within the presentation.	Organizational pattern (specific introduction and conclusion, sequenced material within the body, and transitions) is clearly and consistently observable and is skillful and makes the content of the presentation cohesive.
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) detract from the understandability of the presentation, and speaker appears uncomfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation understandable, and speaker appears tentative.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable.	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling, and speaker appears polished and confident.

Some details adapted from the Association of American Colleges and Universities (AACU)

Outcome #5				
Students will be able to demonstrate the ability to evaluate and provide meaningful feedback on presentations delivered by other students (peer evaluations) and by themselves (self-evaluations).				
	Not meeting (1)	Approaching (2)	Meeting (3)	Exceeding (4)
Evaluation of Others	Student provides little or no constructive feedback with respect to evaluation criteria (re: introduction, body, conclusion, style) when responding to presentations by peers.	Student provides minimal constructive feedback with respect to evaluation criteria (re: introduction, body, conclusion, style) when responding to presentations by peers.	Student provides thorough and thoughtful constructive feedback with respect to evaluation criteria (re: introduction, body, conclusion, style) when responding to presentations by peers.	Student provides rich constructive feedback with respect to evaluation criteria (re: introduction, body, conclusion, style) when responding to presentations by peers.
Self-Evaluation	Student provides little or no detail with respect to evaluation criteria (re: introduction, body, conclusion, style) when conducting self-evaluation.	Student provides minimal detail with respect to evaluation criteria (re: introduction, body, conclusion, style) when conducting self-evaluation.	Student provides thorough and thoughtful detail with respect to evaluation criteria (re: introduction, body, conclusion, style) when conducting self-evaluation.	Student provides rich detail with respect to evaluation criteria (re: introduction, body, conclusion, style) when conducting self-evaluation.

Technology and Information Literacy Rubric for Assessing Student Learning Outcomes

Criteria	Not meeting (1)	Approaching (2)	Meeting (3)	Exceeding (4)
Uses critical thinking skills to determine nature and extent of information needed to solve a problem.	Fails to identify a research question, key concepts, or idea of extent and depth of information needed. Little or no evidence of critical thinking skills.	Identifies an unfocused, unclear, or partial research question; some key concepts; and incomplete idea of extent and depth of information needed. Minimal evidence of critical thinking skills.	Identifies a clear and complete research question, a sufficient number of key concepts; and acceptable idea of extent and depth of information needed. Some evidence of critical thinking skills.	Identifies focused, clear, and complete research question; many key concepts; and clear idea of extent and depth of information needed. Strong evidence of critical thinking skills.
Effectively and efficiently accesses needed information using appropriate technologies.	Fails to retrieve relevant sources of information to fulfill the information need. Ignores appropriate technology, search tools, and methods.	Retrieves sources that generally lack relevance, quality, and balance. Primarily uses inappropriate technology, search methods, and tools.	Retrieves a sufficient number of relevant sources of information that fulfill the information need using appropriate technology, search tools, and methods.	Retrieves a variety of relevant sources of information that directly fulfill the information need using appropriate technology, search tools, and methods.
Critically evaluates information & credibility of its sources.	Fails to evaluate information from a limited number of questionable sources.	Mostly ignores or superficially evaluates information from some questionable sources.	Evaluates and analyzes information from a sufficient number of sources. Evaluation is sufficient.	Critically evaluates and analyzes information and its many and diverse sources. Evaluation is consistent and thoughtful.
Effectively uses information to accomplish a specific purpose.	Does not use relevant information. Fails to accomplish intended purpose. Does not draw conclusions. Fails to effectively communicate ideas.	Uses incomplete information and only partially accomplishes intended purpose. Draws incomplete conclusions. Inconsistently communicates ideas.	Uses appropriate information to accomplish purpose. Draws relevant conclusions. Synthesizes information from a sufficient number of sources. Effectively communicates ideas.	Demonstrates understanding of breadth and depth of research. Synthesizes and integrates information from a variety of sources. Draws meaningful conclusions. Clearly communicates ideas.
Ethically & Legally Accesses and Uses Information	Does not properly incorporate the ideas of others into assignment. Does not cite sources or copies sources without crediting authors.	Inconsistently incorporates the ideas of others into work. Incomplete citations.	Accurately builds on and incorporates the ideas of others into assignment. Correctly cites sources.	Consistently, thoughtfully, and accurately builds on and incorporates the ideas of others into assignment. Consistently and correctly cites sources.

Some details adapted from the Association of American Colleges and Universities (AACU)

Values, Ethics and Diverse Perspectives Rubric

Students should be able to:	Exceeding (4)	Meeting (3)	Approaching (2)	Not Meeting (1)
Demonstrate awareness and recognition of diverse cultures and values	Analyzes, adapts, or applies understanding of multiple worldviews, experiences, and power structures incorporating multicultural perspectives to address significant global problems	Identifies and describes experiences of others in historical and/or diverse contemporary contexts, demonstrating openness to varied cultures and worldviews	Identifies and describes experiences of others in narrow or stereotypical contexts, demonstrating limited understanding or openness to varied cultures and worldviews	Is not able to identify or describe distinctions between other cultures or worldviews, either in historical terms or in contemporary contexts
Demonstrate an awareness and recognition of ethics as a set of behavioral guidelines for individuals, environmental professionals, and society at large	Discusses and analyzes core ethical beliefs and origins with depth and clarity in unfamiliar contexts as well as those applicable to common issues facing individuals and environmental professionals	Clearly articulates core ethical beliefs and their origins in settings typically applicable to common issues facing individuals and environmental professionals	occasionally able to identify and describe ethical behaviors and their origins applicable to common issues facing individuals and environmental professionals	unable to identify or articulate ethical responses to common issues facing individuals and environmental professionals
Apply ethical concepts and perspectives within the context of addressing problems in diverse personal, professional, or societal settings	Adapts and applies the experiences of others in historical or contemporary contexts, applying multiple cultural perspectives and worldviews, suggesting ethical interventions or solutions to significant global problems.	Considers the experiences of others as an integral part of identifying ethical responses to problems in historical or contemporary contexts, with demonstrated openness to varied cultures and worldviews.	Occasionally considers the experiences of others when applying ethical principles to problems, applying a limited degree of openness to varied cultures and worldviews.	Does not consider ethics in problem solving or decision making, or applies only a limited, parochial worldview, regardless of context

APPENDIX III.

Data, Analysis and Recommendations Table for Student Learning Outcomes

1. Scientific Reasoning
2. Quantitative Reasoning
3. Basic Communication Skills
4. Technological and Information Literacy
5. Values, Ethics and Diverse Perspectives

General Education Review Results

	Learning Outcomes	Products Evaluated	Goal of students Meeting and Exceeding	Total Papers (all)	Papers evaluated by Rubric	Rubric Analysis (Meeting or Exceeding)	Analysis	Recommendations
Scientific Reasoning	1. Demonstrate knowledge of the scientific method.	Capstone papers. Lecture Assignments and Exam and Quiz Questions - from the general education science courses	70%	229	226	67%	Some of the work evaluated here, were proposals were results and discussion is appropriately missing, so they were scored slightly lower.	Ask all majors to consider introducing experimental design earlier in the curriculum and to require that all students write a capstone paper either individually or as a part of a project team.
	2. Formulate and test hypotheses	Capstone Papers. Laboratory reports from the general education science courses.	70%	229	186	49%	Capstone papers generally showed good evidence of this, some of the data points here were done using general biology I course data and as such the expectation should be lower for this level.	
	3. Assess credibility and validity of scientific information***	Capstone Papers. Lab reports and Capstone papers - evaluate citations	70%	229	192	52%	Used General Biology data at this level 70% meeting and exceeding might be too high.	This was difficult for the reviewers to assess as it required knowledge of the field in many cases. Provide rubric to course and capstone instructors.
	4. Make informed decisions on contemporary issues demanding scientific literacy***	Final Exam Questions from General Chemistry I; Final Lab report in General Chemistry II; General Biology assignments on current events related to scientific discoveries; capstone papers from	70%	229	89	80%	Data was only taken from one exam question on the general chemistry I final. Therefore the 80% rating is misleading.	Integrated general education courses that are focused on contemporary issues and that provided a global view of a problem would significantly increase our understanding of the true student success on these standards.
	5. Analyze and discuss the relationship between scientific discovery and society	FCH 150 Final Exam Questions	70%	229	41	70%	The sample size here is small, out of the 229 papers that were collected only 41 of them included anything that fit this standard.	

General Education Review Results

	Learning Outcomes	Products Evaluated	Goal of students Meeting and Exceeding	Total Papers (all)	Papers evaluated by Rubric	Rubric Analysis (Meeting or Exceeding)	Analysis	Recommendations
Quantitative Reasoning	1. Identify and Describe quantitative information symbolically, visually, numerically or verbally.	Exams , Projects, Labs, Fieldwork	70%	279	279	58%		Choose both a high, mid and low level problems for assessment
	2. Interpret quantitative information and draw inferences from them.	Exams , Projects, Labs, Fieldwork	70%	279	279	56%		
	3. Apply and Analyze problems with acquired quantitative reasoning and skills.	Exams , Projects, Labs, Fieldwork	70%	332	332	50%		Ask general education courses to submit final exam questions for review and ask capstone instructors to have students include calculations in their appendices.
	4. Synthesize and Evaluate problems within a specific discipline using quantitative reasoning.	Exams , Projects, Labs, Fieldwork	70%	279	279	43%		This expectation may be too high and so we need a lower expectation here.

General Education Review Results

	Learning Outcomes	Products Evaluated	Goal of students Meeting and Exceeding	Total Papers (all)	Papers evaluated by Rubric	Rubric Analysis (Meeting or Exceeding)	Analysis	Recommendations
Communication	1. Produce writing that clearly communicates ideas reflective of critical thinking skills.	Research Papers from General Education Courses, senior synthesis and capstone papers.	70%	58	57	73%	Goal Met	Collect papers electronically, word or searchable PDF format for greater efficiency in the review process.
	2. Demonstrate fluency in a writing process.	Research Papers from General Education Courses, senior synthesis and capstone papers.	70%	58	9	89%	Data here is misleading of the 58 papers collected only 9 showed evidence of the process used.	At the time assessment, committee needs to provide course instructors with rubrics to assess this throughout courses. Any course that has a writing assignment could contribute to this set of data.
	3. Demonstrate the ability to integrate relevant sources when composing an argument.	Research Papers from General Education Courses, senior synthesis and capstone papers.	70%	58	54	54%	This was expected to be better for capstones than for lower-level writing courses, this was not observed.	Students need practice in writing annotated bibliographies and illustrating how sources can help support or contrast with the points being made in the paper.
	4. Demonstrate the ability to prepare and present an oral presentation.	Research Papers from General Education Courses, senior synthesis and capstone papers.	70%	58	4	0%	insufficient data this year to do this	"At the time" assessment, committee needs to provide course instructors with rubrics to assess this at the time of the presentation. The annual Spotlight on Research could also be used for this analysis.
	5. Demonstrate the ability to evaluate and provide meaningful feedback on own and others work.	Research Papers from General Education Courses, senior synthesis and capstone papers.	70%	58	5	60%	insufficient data this year to do this	

General Education Review Results

	Learning Outcomes	Products Evaluated	Goal of students Meeting and Exceeding	Total Papers (all)	Papers evaluated by Rubric	Rubric Analysis (Meeting or Exceeding)	Analysis	Recommendations
Technology and Information Literacy	1. Use critical thinking skills to determine the nature and extent of the information needed to solve a problem.	Senior Synthesis or Capstone Projects	70%	44	44	82%		
	2. Effectively and efficiently access needed information using appropriate technologies.	Senior Synthesis or Capstone Projects	70%	44	0	0%	Unable to assess this aspect from finished projects. This needs to happen "at the time" of the action by course instructors.	ESF 200 may be a good vehicle for assessing this. Our library faculty could be provided with a rubric and asked to assess this throughout their courses and provide that information to the committee to include in the overall general education assessment.
	4. Effectively use information to accomplish a specific purpose	Senior Synthesis or Capstone Projects	70%	44	25	68%	Use of software solutions that are appropriate to the discipline to solve discipline specific problems.	
	5. Ethically and legally access and use information	Senior Synthesis or Capstone Projects	70%	58	48	64%	The committee felt that this was the "academic integrity" question, did they reference or cite appropriately.	We could also use the number of academic integrity violations that happen on an annual basis surrounding incorrect citation for this outcome in addition to the final papers.

General Education Review Results

	Learning Outcomes	Products Evaluated	Goal of students Meeting and Exceeding	Total Papers (all)	Papers evaluated by Rubric	Rubric Analysis (Meeting or Exceeding)	Analysis	Recommendations
Values, Ethics and Diverse Perspectives	1. Demonstrate awareness and recognition of diverse cultures and ways of thinking and knowing	Capstone projects, Senior Synthesis projects (random sample of 40) representative of various majors	70%	30	14	64%	Sample sizes were almost too small to be able to say more than some of our students are being exposed to this outcome.	General Education course sequences that ensure that every student is exposed to diversity and an opportunity to engage with different cultures (US or abroad).
	2. Demonstrate recognition of ethical issues throughout society.	Capstone projects, Senior Synthesis projects (random sample of 40) representative of various majors	70%	30	14	71%	Sample sizes were almost too small to be able to say more than some of our students are being exposed to this outcome.	Increase community engagement, offer courses in professional ethics and training, design a program with intentionality toward societal issues.
	3. Apply ethical concepts to diverse personal, professional or societal settings.	Capstone projects, Senior Synthesis projects (random sample of 40) representative of various majors	70%	30	14	57%	Sample sizes were almost too small to be able to say more than some of our students are being exposed to this outcome.	