Department: Science, Mathematics, and Technology Education (SMATE)

Program Assessment Plan

I. Assessment committee
The Science Education faculty members serve as an assessment committee of the whole to develop and execute a plan to assess the impact of our programs on our students and to use assessment data to improve our programs. Assessment activities will be reported to university stakeholders on the program website.

II. Assessment strategy
Our programs are assessed at four levels. Each level is defined by a set of specific outcomes or objectives to be assessed. These levels are designed to correspond with each other so that the more specific outcomes near the bottom of the hierarchy directly relate to one or more outcome from the level above it. The four levels are:

1. **Mission Statement**: The overall broad goal/vision.
2. **Program Objectives**: Objectives we expect our students to meet 3-5 years after graduation.
3. **Program Outcomes**: Outcomes that we expect our students to meet on graduation.
4. **Course Outcomes**: Outcomes that we expect our students to meet in specific courses.

Each section below summarizes the outcomes/objectives at each level, as well as a plan to assess each set of outcomes/objectives. This document concludes with a description of how assessment data is used to improve the program at all levels.

III. Mission statement
To be a national model of effective recruiting and preparation of the highest quality future elementary and secondary mathematics and science teachers. We will participate in research and dissemination of new knowledge in mathematics and science education reform to the university and K-12 communities, and serve as a valuable resource to the university and broader community to improve mathematics and science teaching and learning.
IV. Program objectives: Alumni

Our Alumni will:

1. Effectively teach all of their students as demonstrated by individual student performance.
2. Demonstrate deep content knowledge of science necessary for effective teaching.
3. Demonstrate deep pedagogical content knowledge in science.
4. Demonstrate the capacity to continuously improve their science instruction through collaboration with their peers analyzing their student’s learning as represented by their work.
5. Engage in ongoing professional growth as science educators.
6. Assume leadership roles in their buildings and districts.

Assessment. We will survey a sample of our graduates periodically to assess the program objectives. This self-report data will be supplemented by analysis of student learning measured with the state assessments.

SMATE has collected significant data over the past seven years through our NSF grant funded work that demonstrates the success of our graduates in meeting the program objectives.

V. Program Objectives: BA/Ed.

Future Elementary School Teacher Graduates from our B.A.Ed program will:

1. Understand the basic scientific concepts at a depth necessary to teach effectively, including:
   a. The transformation and transfer of matter and energy in physical, Earth and living systems.
   b. Fundamental concepts of force, motion, and interactions.
   c. Fundamental processes in Earth systems.
   d. Fundamental processes in living systems.
2. Understand the nature of scientific inquiry.
3. Understand the principals and values of the scientific enterprise.
4. Understand their own science learning.
5. Develop a beginning understanding of pedagogical content knowledge in science.
6. Develop knowledge and capacity to use assessment for learning.
7. Develop a beginning capacity to differentiate science instruction so that all students have the opportunity to learn.
8. Develop the belief that effective science learning in the elementary grades is critical for all students.
9. Develop the confidence that they can effectively teach science to all of their students.
10. Develop the understanding that collaboration with peers around evidence of their student’s learning is critical to improving their instruction.
11. Develop knowledge of and facility with using resources, tools, and materials to plan and implement effective science instruction.

Future Middle and High School Teacher Graduates from our B.A.Ed program will:

1. Understand the fundamental concepts and principals of the disciplines they will be teaching. (Biology, Chemistry, Earth and Space Science, and/or Physics)
2. Understand the nature of scientific inquiry.
3. Understand the principals and values of the scientific enterprise.
4. Develop a beginning understanding of pedagogical content knowledge in science.
5. Develop knowledge and capacity to use assessment for learning.
6. Develop a beginning capacity to differentiate science instruction so all students have the opportunity to learn.
7. Develop the belief that effective science learning in the elementary grades is critical for all students.
8. Develop the confidence that they can effectively teach science to all of their students.
9. Develop the understanding that collaboration with peers around evidence of their student’s learning is critical to improving their instruction.
10. Develop knowledge of and facility with using resources, tools, and materials to plan and implement effective science instruction.

Assessment. The main source of data at this level comes from assessment items at the course level. Each course outcome for the science content courses for future elementary teacher candidates, developed and delivered in SMATE, links to a specific program outcome. These courses are also taught at our partner two-year colleges (Everett CC, Skagit Valley College, Whatcom CC). We collect common data for those classes to feed into the analysis that is used in making course modifications. Assessment data from the teaching methods and practicum courses also link to program outcomes. For future middle and high school teachers, course grades from science content courses are used to judge content knowledge.

We have developed an exit interview for our graduating general science majors to assess the quality of the SMATE academic programs and connections to the broader teacher preparation program and disciplinary programs. The interviews will begin in Spring 2010. Results of the interviews will be discussed by the faculty each fall to respond to common feedback and trends that may appear over time.
VI. Course Outcomes

See appendix A for a full set of course outcomes. All faculty members are required to list the relevant course outcomes on the syllabi for the classes they teach each quarter. Faculty members meet each year to discuss possible course changes suggested by the data/evidence collected during the previous year. Common course outcomes, syllabi, and assessments are used for all the courses taught at SMATE.

Assessment. Pre- and post-test results for the content courses are used to assess student achievement of disciplinary knowledge. In the teaching methods courses students write a final reflective essay which is scored against a common rubric. In the elementary practicum course students make a final presentation of evidence of their students’ learning based on results of their planned classroom assessments.

This evidence is used by the faculty members that teach the respective courses to propose revisions to the courses. New course elements include assessments designed to measure their effectiveness at achieving their stated purpose. This evidence becomes part of the next year’s review.

VII. Use of Assessment Data

The director of SMATE will summarize the data in an annual internal report. Faculty meetings will be devoted to identifying weaknesses revealed by the data at each assessment level. The group will then determine 1-3 priorities for improvement based on those data and will begin to discuss: a) possible improvements that can be made, and b) additional data that need to be collected to further illuminate the problem. In response to these discussions, the faculty will develop and implement a plan for making improvements and collecting additional data.
APPENDIX A: SMATE COURSE OUTCOMES

In each course listed below, students will:

**SCED 201: Matter and Energy in Physical Systems**
1. Understand the nature of physical interactions, how they are responsible for the transfer and transformation of energy and the basic concepts of force and motion;
2. Understand the concept of the conservation of energy and its use in explaining phenomena;
3. Develop a deep understanding of physics ideas that can be used to explain interesting phenomena, and are included in the elementary school science curriculum;
4. Practice and develop an understanding of how knowledge is developed within a scientific community: that doing science involves using evidence and creative thinking, that knowledge is established through collaboration and consensus, and that science knowledge can change over time;
5. Appreciate the thinking of elementary students while they engage in scientific inquiry, and to make connections with your own learning of physics; and
6. Become more aware of how their own physics ideas change and develop over time, and how the structure of the learning environment and curriculum facilitate these changes.

**SCED 202: Matter and Energy in Earth Systems**
1. Understand how the transfer of heat from the interior of the Earth toward the surface causes slow changes in the position of the Earth’s plates (e.g., formations of mountains and ocean basins) and relatively rapid changes at the surface (e.g., volcanic eruptions and earthquakes);
2. Understand that physical evidence, such as fossils, relationships between rock units, and radioisotopic dating, provide evidence for the Earth’s evolution and development;
3. Understand how energy interactions and changes are fundamental in explaining the dynamics of living organisms, the earth and the universe;
4. Develop a deep understanding of geologic ideas that can be used to explain natural phenomena, and that are included in the elementary school science curriculum;
5. Practice and develop an understanding of how knowledge is developed within a scientific community: that doing science involves using evidence and creative thinking, that knowledge is established through collaboration and consensus, and that science knowledge can change over time;
6. Become more aware of how their own geologic ideas change and develop over time, and how the structure of the learning environment and curriculum facilitate these changes.

**SCED 203: Matter and Energy in Living Systems**
1. Describe how energy and matter are acquired by and transferred through living organisms;
2. Describe how an ecosystem is structured according to flows of matter and energy;
3. Understand how the flow of energy and matter influences the evolution of living organisms;
4. Understand that science and common sense use similar thought processes (logic);
5. Make detailed observations and descriptions of patterns;
6. Formulate hypotheses and predictions;
7. Identify and control variables;
8. Conduct precise and accurate measurements;
9. Read and interpret scientific data presented graphically;
10. Learn about your own and your peers’ science learning.

SCED 294: Investigative Science
1. Understanding of what matter is composed of and how it behaves;
2. Understand the small particle model of matter;
3. Understanding of how scientific knowledge is generated and used, and begin to fathom its power as well as its limitations;
4. Be able to ask and answer a simple scientific question by conducting a scientific inquiry.

SCED 370 Science and Society
1. Understand basic models for how scientific knowledge is generated and gains reliability.
2. Explore and understand how science is used to inform a variety of issues having significant global importance such as: proliferation of nuclear weapons, the possibility of global climate change, energy resources, the AIDS crisis, deforestation, large-scale extinction of species, availability of potable water, depletion of the ozone layer, energy usage and the population crisis.
3. Compare and contrast science and pseudo-science.

SCED 480 Science Methods and Curriculum for the Elementary School
1. Demonstrate dispositions to teach science;
2. Understand the nature of science and its importance in science instruction, how scientific inquiry is important and useful to understanding nature and participation in society;
3. Understand and implement strategies to ensure that all students learn;
4. Understand how students learn science and how to design appropriate learning environments;
5. Develop understanding of how content, learning and pedagogy are related in science learning;
6. Understand and develop assessments that support and document student understanding;

SCED 481 Fundamentals of Teaching Science
1. Develop an understanding of the nature of science;
2. Become familiar with current research on how people learn;
3. Become acquainted with the Washington State Science Standards and the National Science Education Standards and their roles; and
4. Become familiar with documents on reformed science teaching.
SCED 490 Laboratory/Field Experience in Elementary Science
1. Adapt an assigned research-based curriculum to create a coherent science unit;
2. Demonstrate knowledge of a variety of methods found to be effective in the teaching of science.
3. Develop an authentic classroom assessment strategy appropriate to the science topic and grade level.
4. Progress in understanding and performance as excellent science teachers.

SCED 491 Methods in Secondary Education for Science Teachers
1. Develop an understanding of the national and state standards for science education;
2. Design or adapt and test a sequence of science lessons appropriate to address those standards in the secondary classroom;
3. Gain practical experience with teaching and learning science through inquiry methods;
4. Gain a deeper understanding of assessing for student understanding in science;
5. Begin to become collaborative professional science educators.
Closing the Loop Examples: 2010 SMATE

**SMATE Mission:** To be a national model of effective recruiting and preparation of the highest quality future elementary and secondary mathematics and science teachers. We will participate in research and dissemination of new knowledge in mathematics and science education reform to the university and K-12 communities, and serve as a valuable resource to the university and broader community to improve mathematics and science teaching and learning.

**Student Outcome Assessed:**
SCED 202, Develop a deep understanding of geologic ideas that can be used to explain natural phenomena, and that are included in the elementary school science curriculum;
SCED 203, Understand how the flow of energy and matter influences the evolution of living organisms;
SCED 490, Demonstrate knowledge of a variety of methods found to be effective in the teaching of science.

<table>
<thead>
<tr>
<th>Outcome Assessment Activities</th>
<th>Results</th>
<th>Program Improvements Made on the Basis of Assessment Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre- and post-content and attitude assessments for SCED 202, and 203</td>
<td>The result are contained in the following URLs. <a href="http://www.ncosp.wwu.edu/content_assessment/results/">http://www.ncosp.wwu.edu/content_assessment/results/</a>, <a href="http://www.ncosp.wwu.edu/class_survey/results/">http://www.ncosp.wwu.edu/class_survey/results/</a></td>
<td>The courses are revised each year, based on data and student feedback, by a team consisting of the faculty and six NSF supported master teachers. The biology course is being further developed as part of an NSF CCLI grant through Cal State Chico.</td>
</tr>
<tr>
<td>Outcome Assessment Activities</td>
<td>Results</td>
<td>Program Improvements Made on the Basis of Assessment Results</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Annual Review of SCED 490 based on student learning commentaries and feedback                | Students were overwhelmed by the lesson study aspect of the course. There were not enough days to have sufficient training on this, and as a result, the quality of student work was poor. Their analysis of student learning in the K-5 classroom using a lesson study protocol was shallow. Lesson plans and evaluations of students by their cooperating teachers show that student work needs significant improvement. | SCED 490 Revisions for Fall quarter 2010 (First Draft)  
Based on results from 2009-2010, class will be scaled back to 18 students to allow time for observations and feedback.  
Course Outcomes (same as before, but with modification of assessments)  
1. Effective Science Teaching  
a. Adaptation of research-based curriculum (assessed by lesson plans)  
b. Instructional Strategies (assessed by lesson plans, lesson implementation, lesson reflection)  
c. Assessment (assessed by SLE final presentation, uses pre-, formative-, and post-assessment data, and by individual lesson reflections)  
2. Professional Growth (assessed by reflection papers, self assessment on lesson plans, peer HPL reflection on lessons, and participation)  
Woodring Standard 5: pre-service teacher collect K-6 data/analyze and inform instruction  
1. Formative assessment  
2. Pre/post. Pre-service teacher must decide what is appropriate & take responsibility  
Lesson plan changes  
1. Learning goal, assessment, & objectives due from lead teacher two days prior to lesson (but not instructional plan). Sced 490 instructor gives feedback  
2. Full lesson plan due from lead teacher to cooperating teacher when cooperating teacher wants it  
3. Full lesson plan and reflection due from lead teacher to 490 instructor by day after lesson  
4. Reflection from supporting teachers – two reflections from each pre-service teacher per quarter (one for each peer), based on HPL (initial ideas, conceptual framework, metacognition)  
Grading (100 pts)  
1. Attendance (10%).  
2. Participation (5%).  
3. Lesson plans/implementation/reflections (40%).  
4. Reflection essays (15%).  
5. Student Learning Evidence (15%)  
6. Collaboration (5%)  
7. Classroom teacher evaluation (10%) |