1. Descriptive project title
   Growing science and sustainability teachers: using hydroponics and vermicomposting in pre-service teacher education

2. Faculty name(s)
   Cindy Fabbri

3. Faculty classification (Regular or Adjunct)
   Regular

4. Email address
   cfabbri@alaska.edu

5. Academic department
   School of Education

6. Course # and Title
   ED 479/688 Science Methods & Curriculum Development

7. Sustainability focus (Choose one or more from this list or create your own)
   d. Waste Management
   f. Food Systems
   g. Education and Curriculum
   h. Social Sustainability

8. Summary of Sustainability Enhancement

   a. Provide a brief summary of the proposed course improvements and how they will enhance education of sustainability, as defined above, at UAF.

   This funding will be used to purchase both hydroponic growing equipment and a worm-based composting (vermicomposting) system for use in the classroom. The hydroponics equipment will be used, with the preservice teachers in the science methods class, to model how to conduct real-world research projects in the classroom. Possible research projects will focus on food security in Alaska (i.e. growing food in the classroom) and/or on the role of plants in improving indoor air quality.

   This project will enhance sustainability education at UAF by increasing student teachers’ knowledge of sustainability concepts. The project looks to give the student teachers sufficient background knowledge of sustainability and sustainability issues so that they could feel comfortable integrating these concepts in their future classrooms. This project also looks to provide an experience with inquiry-based learning so that these students are then able to use this teaching strategy in their future classrooms.
The worm composting system will also be set-up in the classroom. This will be used to teach concepts associated with important science concepts (i.e. change, decomposition, cycles) and sustainability concepts (i.e. waste management). This piece, set-up next to the hydroponic equipment, provides a visible and tangible experience for students to think about growth and decay and the movement of energy and matter in systems.

The equipment will be set up in a classroom in the Old University Park Building. This classroom is a dedicated space for the teacher education program so equipment will be able to stay in that space year-round and the room is locked by keypad. Only the education faculty can unlock the room - so the equipment will be safe.

b. Summarize previous sustainability education in any of your previous courses.

My ED 479/688 class currently incorporates some basic aspects of sustainability into class discussions (further description in 9d below). I also taught LAS/NRM 493 Water in the Environment and Society and NRM 370 Watershed Management and both of these classes used sustainability and systems frameworks as conceptual foundations for the courses.

9. Details of Course Improvement

Keep in mind that the students fund the Sustainability Fee, so we have the responsibility to spend money efficiently, responsibly, and in a way that benefits students.

a. Describe the course.
ED 479/688 Science Methods & Curriculum Development is a capstone type course. Students in their final “internship year” of the teacher preparation program enroll in this methods course. Amongst other things, the course looks to model how these future teachers can use active, inquiry-based methods to facilitate learning in their future science classroom.

b. How will you better incorporate the theme of sustainability into your course?
This project will not only allow me to talk about sustainability but it will allow me to engage the students in hands on investigative experiences on important sustainability issues (food security, air quality, and waste disposal).

c. Define specific goals and expected long and short-term benefits to the student body and/or UAF campus.

I would expect that the student teachers participating in this learning experience would have the following learning outcomes.
Students will:

- Be able to define sustainability;
- Understand the three main components of sustainability (social, ecological, economic);
- Be familiar with Education for Sustainable Development (ESD) as articulated in the work associated with the UN Decade for ESD;
- Recognize that sustainability is a concept that is present in documents that inform how and what they teach (i.e. Alaska Natural Resource & Environmental Literacy Plan, national science standards);
- Understand that sustainability can be taught in concert with disciplines they are already teaching in the K-6 setting (social studies, science, math, language arts);
- Become familiar with lessons and methods that can be used to teach about sustainability in the K-6 classroom;
- Practice skills of inquiry by participating in in-class lessons that model best practice for teaching science;
- Discuss how science and sustainability are relevant and appropriate for the K-6 classroom;
- Gain deeper understanding of sustainable food systems by discussing food security in Alaska and by growing food products in the classroom;
- Gain a deeper understanding of the role that plants play in cleaning the air and discussing how plants help improve indoor air quality;
- Understand growth, decay and cycling;
- Consider the role of K-12 schools in building sustainable communities; and
- Gain knowledge, skills, abilities, and confidence to be able to teach these concepts in their future classrooms.

A further benefit to the campus, along with the academic aspect, relates to the waste management. This classroom is used regularly and classes are frequently scheduled for three-hour blocks. These long class sessions mean students are always eating in this room. Access to a worm-composting bin will keep at least a little bit of food waste out of the trash. Perhaps an arrangement could also be made so that the compost produced goes to the UAF community gardens.

Another benefit of this effort is that this project provides a test case to pilot how well vermicomposting works on campus. Results from this pilot could inform if and how vermicomposting might be expanded on campus. Increasing composting efforts on campus could certainly have long-term benefits for waste managements and in producing compost for the campus gardens, trees, and flowers. Vermicomposting provides a way that composting in this northern climate may be more feasible but it needs to be tested on campus to better understand if and how it is manageable.

d. How do the course improvements build upon existing course syllabi?
This past year I incorporated some introductory aspects of sustainability education into the course (i.e. Education for Sustainable Development (ESD), Alaska Natural Resource
& Environmental Literacy Plan) so that these pre-service teachers could gain some familiarity with sustainability and understand how it aligns with other subjects (i.e. science) that they are required to teach.

A deficit in this class was the fact that I really was not able to model how they could integrate science and sustainability in the classroom. I was unable to demonstrate how they could facilitate lessons that incorporate best practice in science education (i.e. inquiry and investigation) with concepts of sustainability. This project looks enhance this aspect of the course by acquiring equipment that will allow me to teach for and about sustainability.

e. How will you measure the success of your course improvements?

I plan to use a student assessment of learning gains and learning methods to analyze students’ perceptions of what they learned and how they learned it. I will analyze these assessments to evaluate how well the project achieved its objectives and to determine if I could refine the implementation methods to make it more effective in future iterations of the class.

10. Implementation plan a. Present an implementation plan in a table similar to this example table:

<table>
<thead>
<tr>
<th>Date</th>
<th>What will be done</th>
<th>Responsible Person</th>
<th>Funds Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov-Dec 2014</td>
<td>Purchase and set-up equipment</td>
<td>PI</td>
<td>RISE Funding to purchase equipment and School of Education funds PI salary</td>
</tr>
<tr>
<td>Dec 2014</td>
<td>Start seeds, as necessary</td>
<td>PI</td>
<td>NA</td>
</tr>
<tr>
<td>Jan-April 2015</td>
<td>Use the equipment in the course</td>
<td>PI</td>
<td>RISE funding to purchase any maintenance materials (i.e. fertilizer, light bulbs)</td>
</tr>
<tr>
<td>April 2015</td>
<td>Administer the student assessment of learning gains</td>
<td>PI</td>
<td>NA</td>
</tr>
<tr>
<td>Summer or Fall 2015</td>
<td>Analyze results of the assessment and refine the course</td>
<td>PI</td>
<td>NA</td>
</tr>
</tbody>
</table>
## 11. Budget Table

<table>
<thead>
<tr>
<th>Item</th>
<th>Supplier</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Worm Factory</td>
<td>Holm Town Nursery</td>
<td>2</td>
<td>5-tray unit</td>
<td>$120</td>
<td>$240</td>
</tr>
<tr>
<td>2. Extra trays</td>
<td>Holm Town Nursery</td>
<td>4</td>
<td>2 trays per pack</td>
<td>$20</td>
<td>$40</td>
</tr>
<tr>
<td>3. Worms</td>
<td>Holm Town Nursery</td>
<td>2</td>
<td>1000 count</td>
<td>$40</td>
<td>$80</td>
</tr>
<tr>
<td>4. Worm Factory Refill Kits</td>
<td>Holm Town Nursery</td>
<td>8</td>
<td>1 package</td>
<td>$30</td>
<td>$240</td>
</tr>
<tr>
<td>5. Megagarden or other hydroponic system as advised</td>
<td>Holm Town Nursery</td>
<td>2</td>
<td>1 unit</td>
<td>$150</td>
<td>$300</td>
</tr>
<tr>
<td>6. Organic Fertilizers</td>
<td>Holm Town Nursery</td>
<td>5</td>
<td>Bottles</td>
<td>$20</td>
<td>$100</td>
</tr>
<tr>
<td>7. Grow Lamps</td>
<td>Holm Town Nursery</td>
<td>1</td>
<td>Per lamp</td>
<td>$300</td>
<td>$300</td>
</tr>
<tr>
<td>8. Grow Bulbs</td>
<td>Holm Town Nursery</td>
<td>2</td>
<td>Per bulb</td>
<td>$160</td>
<td>$160</td>
</tr>
<tr>
<td>9. Plants</td>
<td>Holm Town Nursery</td>
<td>20</td>
<td>Per plant (small)</td>
<td>$7</td>
<td>$140</td>
</tr>
<tr>
<td>10. Grow Stand</td>
<td>Local home building supply store</td>
<td>1</td>
<td>1 rack</td>
<td>$200</td>
<td>$200</td>
</tr>
<tr>
<td>11. Maintenance Supplies</td>
<td>Holm Town Nursery</td>
<td>Unknown</td>
<td>Misc.</td>
<td>$200</td>
<td>$200</td>
</tr>
<tr>
<td>12. Total Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$2000</td>
</tr>
</tbody>
</table>
12. **Budget justification:**
Please explain line items in your proposed budget table if more detail is appropriate.

The items 1-4 in the budget are required equipment and supplies required to set-up and maintain a worm compost system. Items 5-11 are equipment and supplies required to set-up and maintain classroom hydroponic system. These costs reflect best estimates available at this time. Holm Town Nursery has indicated that they will need to special order some items for this project.

Note: This funding will be coupled with a small mini-grant ($500) from Alaska Science Teacher’s Association that will also be used to purchase hydroponic equipment (i.e. 2 megagarden hydroponic systems and some of the associated supplies). This will allow for a total purchase of four small, independent hydroponic systems and makes small group projects (4-6 learners/group) possible within the larger class.