

# Sustainability Specialization Proposal

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The idea of sustainability has evolved from the pursuit of 'sustainable development'. The most visible roots of sustainable development emerge from the 1987 Brundtland Report, "Our Common Future" which summarized the outcome of the World Commission on Environment and Development formed in 1983. The commission sought to address growing concern "about the accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development." Sustainability addresses wholeness and balance among a) social equity, b) economic vitality, and c) ecological integrity in order to "*meet the needs of the present without compromising the ability of future generations to meet their own needs*" (World Commission on Environment and Development 1987).

In the two decades since the report the idea of sustainability has evolved, deepened and engaged civil society, the business sector, and government from local to global levels. The emergence of employment web sites dedicated to jobs in sustainability mark the rapid growth of career opportunities. Programs of study around sustainability continue to emerge with European universities initiating efforts to transcend disciplinary focus and develop programs and degrees that address this more holistic approach of study. Throughout the U.S. a number of colleges and universities offer programs and degrees in sustainability (University of Michigan, Colorado State, Aquinas College, Duke, Portland State University, University of Massachusetts, University of Minnesota, University of New Mexico, University of Texas etc.). In fact, Arizona State opens the first 'school' of sustainability in the fall of 2007 providing undergraduate, masters, and doctorate degrees in sustainability. Additionally MSU holds a membership in the Association for the Advancement of Sustainability in Higher Education (AASHE), a membership-based association of colleges and universities working to advance sustainability in higher education in the US and Canada. AASHE sponsors the Sustainability Across the Curriculum Leadership Workshop series. The growth in sustainability across campuses led to the development of the Higher Education Associations Sustainability Consortium (HEASC). Interest in sustainability also led to development of a peer-reviewed publication, the *International Journal of Sustainability in Higher Education*.

In response to requests from MSU students who seek to gain more visible sustainability skills that also appear on their transcripts, we propose the development of a specialization in sustainability open to all undergraduates at Michigan State University. A team of faculty and students has been working for more than a year to conceptualize and develop a program that will provide graduates of the specialization with needed competencies for success. This specialization offers a unique competency-driven approach rather than relying solely on credits or courses. Therefore the specialization requires that students provide evidence of their proficiency in

specified competencies through a learning portfolio built from curricular, co-curricular, and extra-curricular experiences.

Sustainability requires wholeness and balance among a) social equity, b) economic vitality, c) ecological integrity and d) aesthetic understanding in order to “*meet the needs of the present without compromising the ability of future generations to meet their own needs*” (World Commission on Environment and Development 1987). We believe that in order to achieve these outcomes students should achieve proficiency in 1) critical thinking, 2) systems thinking, 3) personal awareness and development (knowledge of self) and 4) civic engagement, as well as the above mentioned social, economic, ecological, and aesthetic dimensions. In order to optimize learning, students will engage in direct experiences that expose them to the social, economic, environmental and civic processes involved in sustainability by making sense of it in practical and personal ways. As such, the many co-curricular activities that MSU students seek out during their tenure will be practice fields for developing these competencies.

Aligning with this model of education including extra-curricular and inter/intra-personal development we would ideally like to see the sustainability specialization develop into a Living-Learning community. As a residential initiative we envision a union of academics and operations whereby students study the place where they live. This “hidden curriculum” of sustainability at our institution is ripe for undergraduate research projects (many currently being funded by the VP for Finance and Operations) and community engagement. We also see great promise in housing sustainability specialization students in a shared residence hall, possibly with other connected specializations in a hub model. We would encourage living-learning environments beyond the typical freshman-sophomore range through shared living in off-campus housing that might be facilitated by the program.

During the past 200 years, humans have come to be a major altering force on the life support systems of the planet. This requires graduates to be able, as educator Parker Palmer writes, “to think the world together”. The complexity that engulfs us requires an integrative and purposeful look at the whole in the company of many, making it imperative for graduates to master the classical disciplines such as ethics, economics, ecology or civics, in addition to the transdisciplinary attributes of sustainability. Graduates will be expected to demonstrate an ability to use a systems approach to connect the many facets of complex issues, use critical thinking to weigh and evaluate choices, and connect personal choices with community and global consequences.

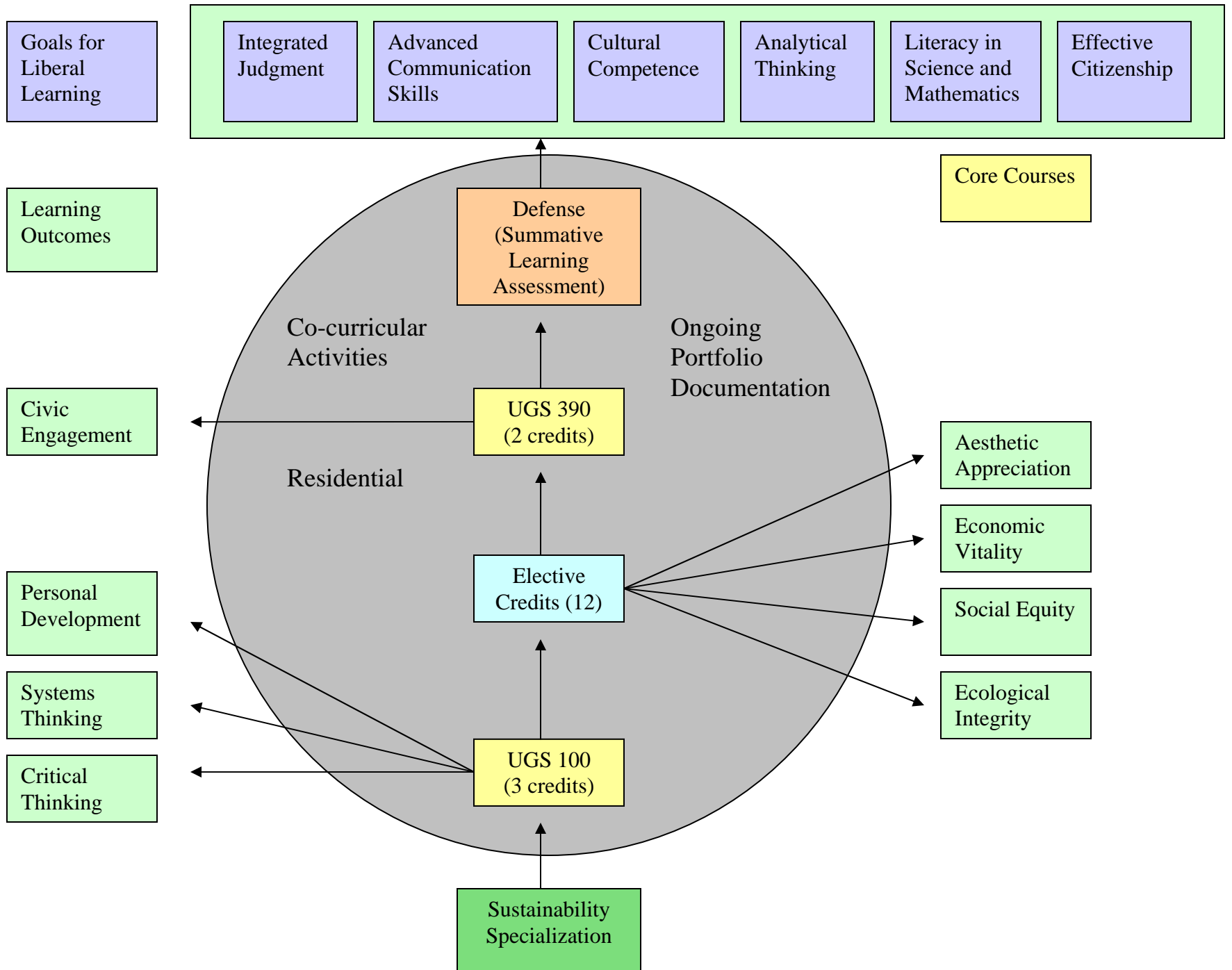
### **The Learning Program**

The program requires students in the specialization to demonstrate learning outcomes in all four sustainability content areas: Ecological Integrity, Economic Vitality, Social Equity, and Aesthetics (see “Competencies” section for more details) as well as learning outcomes in the personal development domain. Students must demonstrate both breadth of knowledge in the four content areas with added depth of knowledge associated with their primary thematic focus (major). Our model illustrates that students can acquire desired competencies and content knowledge through both curricular and extra-curricular avenues. We recognize that creating a (credit-only) specialization as transdisciplinary as sustainability could create a labyrinth too difficult for a student to schedule and complete. Our model acknowledges and rewards

purposeful and reflective learning based upon a combination of disciplinary curriculum and extracurricular experiences. The evaluation of the competencies will rely upon student work demonstrated through both curricular and extracurricular performance AND portfolio presentation.

- Students must first complete UGS 100, Intro to Sustainability (offered Spring Semester), 3-4 credits. With this course they will learn the fundamental principles/theories of sustainability, systems thinking, group process skills, and how to document and assess their learning using a portfolio
- Students will select a specialization advisor from a list of affiliated faculty. They will be required to meet with this advisor at the beginning of every semester to plan competency learning into their semester and review their portfolio progress from the previous semester.
- Students will be required to complete one semester of UGS 390, Applications in Sustainability (offered each semester), 1-2 cr. This is a semester long outreach/engagement/service learning experience approved by their advisor. The student must be prepared to spend at least 6 hours per week engaged in a project associated with their sustainability track.
- Students will be required to present their portfolio to a review panel (3 sustainability advisors) prior to graduation. This review process will be scheduled much like a graduate committee defense. Students who fail this review may request an Extension (ET) to complete requirements in conjunction with University grading policy.
- Require 12 credits associated with 4 core competencies and content areas (IAH, ISS, ISB, ISP count). Requiring a set of credits that are flexible AND requiring a portfolio provides accountability. These other 12 credits could be used for other specializations as well. While we do not require a “double” specialization, we certainly align the sustainability specialization to foster double specializations.

### Sustainability Specialization Map of Relationships



## Specialization Organizational Structure

One of the early questions raised in our deliberations was how does this specialization relate to existing specializations at MSU? Might it be possible to simply orient an existing specialization program towards sustainability? As we explored this further we identified several existing specializations that by subject matter overlapped significantly with our sustainability specialization: Peace and Justice Studies, STEPPs, International Development, and RISE. We met with each specialization leader and discussed how we might fuse our idea for a specialization with an existing one. Ultimately both Peace and Justice and RISE appeared to be the closest matches with the most interest. More recently we have also had conversations with the Bailey Scholars Program, and the new Residential College in Arts and Humanities.

In the spirit that sustainability is about recognizing relationships, we see the structure of the sustainability specialization as a living model of attending to relationships. We envision an evolution of relationships among other specializations that would cross-pollinate and nurture the strengths of each, while inspiring a larger community of learning among them. This could grow into either formal or informal relationships, perhaps emerging as a hub of specializations that share common resources, space, and co-and extracurricular social learning. Sustainability writ large transcends all colleges in their content and therefore does not have a distinguishable disciplinary home. Thus, we believe the specialization should report through the office of the Associate Provost for Undergraduate Education. To this end the specialization competencies have been aligned with the “Outcomes of Liberal Learning” that have evolved from the leadership of the Associate Provost’s office. Further, we believe the time is ripe for MSU to take a leadership role among Land Grant universities to demonstrate the importance of this curriculum and pedagogy in higher education, that more directly connects the academic learning with personal development and engagement with the campus and larger community as a living laboratory. We feel MSU is uniquely situated to develop this model of social learning because of our strong interdisciplinary approaches and the existing sustainability programs that connect the university within and beyond the campus. We therefore recommend that as we launch the new specialization we utilize existing staff to anchor and build the program, while developing a significant cohort of faculty who can provide necessary support in teaching and guiding the work of students.

We are proposing that Geoff Habron, Asso. Prof. Fisheries and Wildlife and Sociology should coordinate and lead the launch of this program with assistance from the Director of Campus Sustainability and the RISE Coordinator. We see strong linkages between these programs and the competency-based approach that the sustainability specialization is offering. We have requested support for a ½ time RA to study the effectiveness of the pedagogy and evaluate student learning outcomes. This positions us to provide one of the first assessments of an undergraduate sustainability program in the literature. Additionally we believe the scholarship of our teaching, learning and engagement must remain front and center to the specialization. Having research support in this area will ensure we continually ask the critical questions of our curricular and learning design and delivery. Finally we seek some means of rewarding faculty involvement in classes, student project guidance, advising, or as judges of student level of competency.

The proposed organization structure will include:

- Program Coordinator - (Habron ½ time)
- Assistant Coordinators- (Link and Thorp ¼ time each)
- Secretary/Administrative assistant (1 FTE)
- Graduate Research Assistant (1/2 time)
- Faculty content and student advisors

Program Coordinator and Assistant Coordinator will be responsible for:

- Teaching: UGS 100, UGS 390
- Advising
- Program Administration
- Identifying engagement opportunities
- Identifying jobs, job shadow, internships

- Portfolio review (along with other SUS faculty)
- Facilitating student research/projects
- Convene sustainability cohort dialogue sessions
- Marketing program

### **Context for Assessment**

The creation of a new specialization provides an opportunity to design a curriculum that incorporates the scholarship of teaching and learning. A solid curriculum should address the structural design as well as the learning environment. The design begins first with the desired learning outcomes and results (Wiggins et al. 1998). Next designers must determine what constitutes acceptable evidence of competency in the outcomes and results. Last, one plans instructional strategies and learning experiences that bring students to these competency levels. The outcomes and design of the specialization appear in the previous sections, but will be integrated in the assessment plan.

In terms of the learning environment, the National Academies' Division of Behavioral and Social Sciences and Education (Bransford et al. 2000) summarized the key factors in generating curricula that lead to valuable learning experiences: "an alternative metaphor for curriculum is to help students develop interconnected pathways within a discipline so that they "learn their way around it and not lose sight of where they are" (Bransford et al. 2000:153). Poor curriculum design produces knowledge and skills that are disconnected rather than organized into coherent wholes." (Bransford et al. 2000:138). In order to succeed a curriculum should include components that are learner-centered, assessment-centered, knowledge-centered, and community-centered. Learner-centered environments provide opportunities for students to construct their own meanings based upon their previous understanding, beliefs and cultural practices. The teacher then provides bridging activities that lead from the student's past to new understanding. Such bridging activities should engage students in cognitive conflict that generates multiple viewpoints. Learner-centered environments shift the emphasis from teacher to learner and from teaching to learning (Barr and Tagg 1995). Curricula and institutions embedded in this learning paradigm can generate a "hot cognitive economy" by utilizing the following best practices:

- support students in pursuing their own goals
- require frequent student performances
- frequent and ongoing feedback
- assure a long time horizon for learning
- provide for stable communities of practice
- aligns all of its activities around the mission of producing student learning (Tagg 2003)

Knowledge-centered learning environments focus more on building understanding and sense making than memorizing facts. These environments help students acquire concepts but also learn the procedures of a discipline. Taking a problem-based approach provides more natural learning situations for students where they can "explore, explain, extend, and evaluate their progress. Ideas are best introduced when students see a need or a reason for their use—this helps them see relevant uses of knowledge to make sense of what they are learning" (Bransford et al. 2000:139). Helping students make sense of their learning requires frequent and ongoing feedback and assessment (Tagg 2003; Bransford et al. 2000). Assessment-centered environments provide frequent and ongoing feedback in order to expose students' thinking and understanding in a variety of modes. Ideally assessment should encompass "declarative ("knowing that"), procedural ("knowing how"), schematic ("knowing why"), and strategic ("knowing when certain knowledge applies, where it applies, and how it applies") (Shavelson and Huang 2003). New developments in the science of learning suggest the importance of establishing community-centered environments in fostering learning. Many opportunities exist for addressing the many dimensions of community "including the classroom as a community, the school as a community, and the degree to which students, teachers, and administrators feel connected to the larger community of homes, businesses, states, the nation, and even the world (Bransford et al. 2000:144-145).

Unfortunately, "while instructional practices have shifted from behavioral perspectives toward social constructivist paradigms, the ways in which we assess student learning have lagged behind, thereby creating a disconnect between

learning and assessment” (Morrone et al. 2004). To breach the disconnect curricula must weave together the triple helix of learning, pedagogy and assessment.

Guidelines for assessment include:

1. assessment of personal, social, and civic abilities as well as cognitive ones
2. real dialogue and greater agreement on the content of assessments
3. recognition that what we test and make public will greatly influence what is taught and what is learned
4. clarity in the debate about what to assess through the use of a conceptual framework
5. multiple and varied assessments
6. meaningful feedback on assessment results to all stakeholders of the institution including
7. students, faculty, administrators, legislators and others who support the work of the institution. (Shavelson and Huang 2003).

## **Specialization Assessment Plan**

Thus the evaluation strategy aligns with the four components suggested by Bransford et al. (2000):

- Learner-centered: learning plans
- Assessment-centered: e-portfolio, sustainability scenario exercises
- Knowledge-centered: core and elective competency-based
- Community-centered: applied project

We provide a range of assessment opportunities throughout a student's tenure in the program (Tagg 2003). Each opportunity requires differing resource (e.g. time, money, people, etc.) availability in terms of the kind of evidence and the participants who will provide judgment.

- a. Existing MSU assessment mechanisms
  - i. Course assignments, grades, SIRS forms
- b. Sustainability portfolio
  - i. Students develop learning plan upon entering, take courses and other experiences, work on portfolio throughout, turn in and make presentation last semester
  - ii. Electronic portfolios include core courses, elective courses, co-curricular, extra-curricular evidence. MSU is adopting the e-portfolio system through ANGEL.
- c. Sustainability scenario options
  - i. Have students address an applied sustainability scenario at the beginning and end of their time at MSU
  - ii. Utilize community as sources of scenarios or projects. Businesses, non-profits, municipalities could submit ideas for students to ponder. Students would then present evidence to community entity requesting input. For example, since the cities of Lansing and East Lansing have signed the national Mayor's Climate Change Initiative, students could help with implementation ideas. A capital area Business Alliance of Local Living Economies is forming and could also provide a source for the students to develop meaningful projects and thinking.
- d. Project could be anything (essay, poem, dance, PowerPoint, painting, sculpture, etc) that "demonstrates" sustainability thinking/being in practice. One of the four thematic sustainability areas and core competencies will be chosen and demonstrated through the final presentation.
- e. Public presentation
- f. Opportunities in curriculum to "practice"/try out ideas
  - i. These opportunities would help students toward their final project or capstone or portfolio

## **Elaboration of Assessment Plan**

Echoing the Bransford et al (2000) report the sustainability organization Second Nature advocates pedagogical strategies that address the content of learning, the context of learning, the process of education, and partnerships with local and regional communities (Cortese 2005). Additionally, they add the importance of linking the institutional practice of sustainability. The approach stresses the importance of ensuring “the same lateral rigor across, as the vertical rigor within the disciplines” as well as reflecting interdisciplinary systems thinking (Filho 2002; Blewitt et al 2004). Most importantly it emphasizes active, experiential, inquiry-based learning (Scholz et al. 2006; Steiner and Laws 2006) using real-world problems “to make human/environment interdependence, values and ethics a seamless and central part of teaching of all the disciplines, rather than isolated as a special course or module in programs for specialists” (Filho 2002). Demonstrating practical applications of sustainability provides the best approach to reach out to those who do not understand or resist the concept (Filho 2002). This can be accomplished by providing students with “multiple exposures to the sustainability paradigm throughout their education” (Rowe 2002:85). However, “more longitudinal studies are needed to see what approaches and combinations of approaches best encourage graduates to be proactive change agents for sustainability concepts. Research is also needed on what types of teaching are most effective. Research assessing what professional development is most effective would also be very helpful to higher education institutions” (Rowe 2002:93).

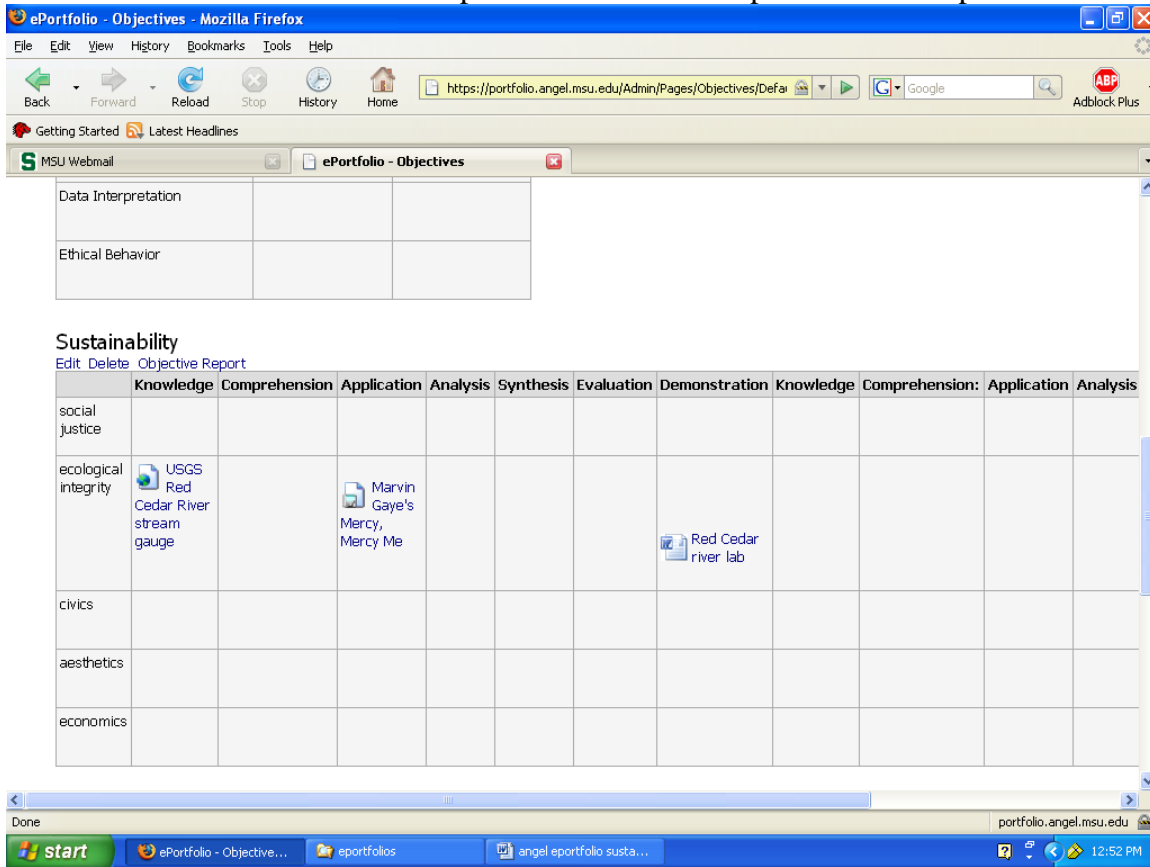
Despite the growth of sustainability programs nationwide, a lack of program assessment appears in the literature. However, our assessment strategy does build on the work of the Earth Sustainability course series at Virginia Tech in developing a longitudinal approach that captures changes in both content but also student personal development (Bekken and Marie 2007). Virginia Tech incorporated The Learning Partnerships Model (Baxter Magolda, 2004) “founded on three principles by which faculty support students during their journey: (1) validate each student’s capacity to know, (2) situate learning in the student’s experience, and (3) create a partnership in which the participants mutually construct meaning” (Bekken and Marie 2007:57). “In effect, the pedagogical design of assignments, class meetings, and out-of-class activities must both support and challenge students by valuing their experience and learning skills but also by providing them with the impetus and support to progress to more complex, comprehensive, and adequate modes of learning and thinking. Thus, the learning goals, content, and pedagogy must concomitantly reassure students yet express high expectations of their becoming increasingly responsible for their learning” (Bekken and Marie 2007:57).

The Virginia Tech team utilized student responses to two exercises to generate formative and summative assessment as students progressed through their four course sequence. “At the beginning of fall semester 2004, we gave students two exercises: one in which they were asked to define the term *sustainability* and state what they wanted to see sustained and the second in which they were asked to envision the future based on four worldview-driven stories of what it might look like (Costanza, 2000) These two short written exercises allowed us to simultaneously assess students’ knowledge base and epistemological development” (Bekken and Marie 2007:63). These exercises illustrate the importance of using applied case studies to foster the critical thinking necessary to address sustainability (Scholz et al. 2006). In addition to these exercises, students completed end of term reflections on the course assignments whereby they critiqued their assignments based upon their cumulative learning at the end of the semester. To assess the student work, the Virginia Tech team utilized criteria based on the four dimensions of self-authorship that focus on student development: how the students conceptualize complexity and authority, whether they recognize fundamental assumptions and arguments, and how they apply or transfer disciplinary knowledge beyond disciplinary boundaries.

To enable assessment over a long time horizon (Tagg 2003) and across multiple modalities, we center assessment on the use of portfolios (MSU Faculty and Organizational Development; Slater). The specialization aims to work with the MSU e-portfolio project to develop a matrix that enables students to upload work that addresses the various competencies of the specialization, including those that align with MSU’s undergraduate outcomes of liberal learning. Our program builds on the efforts of Indiana University Purdue University Indianapolis (IUPUI), as described in Morrone et al. (2004) as well as in the presentation provided in a 2006 Lilly Seminar (<http://www1.provost.msu.edu/facdev/LillySeminar/pastsem.asp>).

A learning matrix comprised of the key outcomes and competencies comprises the structure of the learning portfolio whereby students provide authentic evidence that satisfy the requirements. Such evidence can emerge from

core class assignments, elective class assignments, internships, projects or students own inquiry. We provide an example of the e-portfolio process that illustrates how a student can post evidence for the Ecological Integrity component using Bloom’s Taxonomy for the various levels of proficiency. Each piece of evidence can represent multiple facets of the sustainability specialization. In this case a website that provides real-time and historical data about the Red Cedar River on campus demonstrates that the student can find indicators of ecological integrity. This also addresses liberal learning outcomes of Literacy in Science and Mathematics. Lyrics from a popular song demonstrate that a student can integrate aesthetics to understand the meaning of ecological integrity in society. This also addresses liberal learning outcomes of Cultural Competence. Lastly, a student provides a report from a class lab exercise from an elective to provide evidence that they can design a study and collect information on ecological integrity. This also addresses liberal learning outcomes of Literacy in Science and Mathematics, Advanced Communication and Analytical Thinking. Additionally students will need to provide a reflective statement that describes how the evidence demonstrates a particular level of competence with respect to the outcomes.



Sustainability faculty can then assess the submitted materials and assign a score based on the specialization rubric containing the various outcomes and competencies (see Sustainability Specialization Map figure). Faculty can view student progress by viewing a summary of student submission progress for each area:

https://portfolio.angel.msu.edu - Attached Artifacts - Mozilla Firefox

Artifact type: All

**Attached Artifact Summary**  
Artifact type: All

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	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Demonstration								
social justice Total: 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ecological integrity Total: 3	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0
civics Total: 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
aesthetics Total: 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
economics Total: 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Our portfolio format provides consistency with the triple helix metaphor since “how students have been taught and what they have learned is captured not only through the assessment of tasks that demonstrate meaningful application of knowledge and skills of their learning (authentic assessment), but perhaps more importantly through reflection on their learning” (Morrone et al. 2004).

### **Sustainability Competencies**

The design of the competency model below includes both personal development competencies that are non-discipline specific, as well as sustainability content areas that are more closely aligned with disciplinary and interdisciplinary learning.

	<b>Sustainability Specialization Competency Dimensions</b>	
<b>Personal Development Domain</b>		Meets MSU Liberal Learning Goals:
<b><u>Self Authorship</u></b> Competency 1.0 The graduate will describe their personal development.	Learning Objectives Students will: <ul style="list-style-type: none"> <li>• 1.1 Describe one’s self and relationship to the larger community</li> <li>• 1.2 Articulate personal worldview to include: ontology, epistemology, axiology,</li> <li>• 1.3 Articulate personal life goals and a plan for achieving these goals</li> <li>• 1.4 Describe personal moral/ethical framework and contrast with at least one theory of human moral development</li> <li>• 1.5 Practice self-reflection</li> <li>• 1.6 Practice self-evaluation</li> <li>• 1.7 Describe the role of the physical self in living and learning</li> </ul>	Integrated Judgment
<b><u>Critical Thinking</u></b> Competency 2.0 The graduate will think critically about sustainability.	Learning Objectives Students will: <ul style="list-style-type: none"> <li>• 2.1 Compare and contrast their personal ethical framework for global sustainability with a differing ethical framework</li> <li>• 2.2 Make decisions based on an ethical framework</li> <li>• 2.3 Identify divergent perspectives for an issue of sustainability</li> <li>• 2.4 Explain the limits and uncertainty in scientific knowledge relating to sustainability</li> <li>• 2.5 Critique various modes/paradigms of inquiry</li> <li>• 2.6 Identify assumptions and biases in knowledge construction</li> </ul>	Analytical Thinking
<b><u>Civic Engagement</u></b> Competency 3.0 The graduate is an engaged global citizen.	Learning Objectives Students will: <ul style="list-style-type: none"> <li>• 3.1 Analyze the roles of small group process</li> <li>• 3.2 Practice intentionally small group decision making</li> <li>• 3.3 Provide examples of various roles of</li> </ul>	Effective Citizenship and Cultural Competence

	<p>engaged and citizens at the local and national level</p> <ul style="list-style-type: none"> <li>• 3.4 Identify the core democratic principles.</li> <li>• 3.5 Justify how intellectual diversity contributes to civil society</li> <li>• 3.6 Justify how cultural diversity contributes to civil society</li> <li>• 3.7 Justify how social diversity contributes to civil society</li> <li>• 3.8 Practice dialogue and consensus building with a diverse group</li> </ul>	
<p><b><u>Systems Thinking</u></b> Competency 4.0 The graduate thinks systemically.</p>	<p>Learning Objectives Students will:</p> <ul style="list-style-type: none"> <li>• 4.1 Define and bound a biological or physical system</li> <li>• 4.2 Define and bound a social system</li> <li>• 4.3 Define and bound a system that has ecological, economic, social and aesthetic elements</li> <li>• 4.4 Identify relationships among structures and processes of a system</li> <li>• 4.5 Identify leverage points in a system</li> <li>• 4.6 Model a balancing loop related to sustainability</li> <li>• 4.7 Model a reinforcing loop related to sustainability</li> </ul>	Analytical Thinking
<b>Sustainability Content Areas-Breadth Domain</b>		
<p><b><u>Social Equity</u></b> Competency 5.0 The graduate will explain how social equity contributes to global sustainability</p>	<p>Objectives Students will:</p> <ul style="list-style-type: none"> <li>• 5.1 Identify key concepts of social development (access to economic resources, food, education, energy, health care, water, sanitation, human rights and other appropriate key concepts)</li> <li>• 5.2 Describe examples of historically significant issues of social justice..</li> <li>• 5.3 Describe examples of current social justice issues related to sustainability.</li> <li>• 5.4 Explain at least two theories of power</li> <li>• 5.5 Explain the significance of power and its relationship a to sustainability</li> <li>• 5.6 Describe a theory of justice</li> </ul>	Cultural Competence

<p><b><u>Economic Vitality</u></b>  Competency 6.0  The graduate will explain how economic vitality contributes to sustainability</p>	<p>Objectives  Students will:</p> <ul style="list-style-type: none"> <li>• 6.1 Identify opportunity costs and trade-offs as related to sustainability</li> <li>• 6.2 Identify life-cycle costs, benefits, and externalities</li> </ul>	<p>Literacy in Science and Mathematics</p>
<p><b><u>Ecological Integrity</u></b>  Competency 7.0  The graduate employs ecological principles that contribute to sustainability</p>	<p>Objectives  Students will:</p> <ul style="list-style-type: none"> <li>• 7.1 Describe the long-term consequences of human activity on ecosystems</li> <li>• 7.2 Explain with scientific data the proposition that the majority of the Earth's ecosystems are degrading</li> <li>• 7.3 Explain using scientific data how we are exceeding the carrying capacity of the planet</li> </ul>	<p>Literacy in Science and Mathematics</p>
<p><b><u>Aesthetics</u></b>  Competency 8.0  The graduate employs principles of aesthetics to contribute to sustainability.</p>	<p>Students will:</p> <ul style="list-style-type: none"> <li>• 8.1 Recognize the principles of balance, symmetry, harmony and order</li> <li>• 8.2 Explain what makes for enduring art or beauty</li> <li>• 8.3 Defend a personal appreciation of something beautiful and how it supports global sustainability</li> </ul>	<p>Integrated Judgment</p>

<b>Sustainability Content Areas-Depth Domain</b>		
<b><u>Social Equity</u></b> Competency 5.0	Objectives Students will: <ul style="list-style-type: none"> <li>• 5.7 Identify local, national and international institutions with the mission of improving social equity</li> <li>• 5.8 Explain the social consequences, and responses to natural resource use and distribution.</li> <li>• 5.9 Explain the relationships between technology, environment, and social equity</li> <li>• 5.10 Compare and contrast the quality of life of in developing and industrialized societies</li> </ul>	Cultural competence and Effective Citizenship
<b><u>Economic Viability</u></b> Competency 6.0	Objectives Students will: <ul style="list-style-type: none"> <li>• 6.3 Describe the application of various economic theories to evaluate resource management and policy options</li> <li>• 6.4 Explain the interaction of private and public goods and externalities in how markets function</li> <li>• 6.5 Propose methods to incorporate principles of sustainability in business practice (profitability, full cost accounting, purchasing, operations, finance, performance measures and other appropriate principles)</li> </ul>	Analytical Thinking, Literacy in Science and Mathematics, Integrated Judgment
<b><u>Ecological Integrity</u></b> Competency 7.0	Objectives Students will: <ul style="list-style-type: none"> <li>• 7.4 Identify connections of matter and energy between living and non-living systems</li> <li>• 7.5 Describe the transformation of matter and energy between living and non-living systems</li> <li>• 7.6 Compare and contrast the principles articulated in the Rio Declaration, Brundtland Report and Earth Charter</li> </ul>	Analytical Thinking, Literacy in Science and Mathematics
<b><u>Aesthetics</u></b> Competency 8.0	Objectives Students will:	Integrated Judgment

	<ul style="list-style-type: none"><li>• 8.4 Critically appraise a work of art</li><li>• 8.5 Construct a sustainability project integrating aesthetic appreciation as a component.</li><li>• 8.6 Explain questions and statements artists make about global sustainability with their work</li></ul>	
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### Suggested Courses Aligned with Core Competency Domains

#### Social Equity

Elective courses with no (or minimal) pre-requisites	Elective courses with pre-requisites
ANP 201 Sociocultural Diversity FW 211 Gender and Environmental Issues GEO 151 Cultural Geography ISS 215 Social Differentiation and Inequality ISS 225 Power, Authority, and Exchange ISS 310 People and Environment or env-society equivalent - SOC/ANTH/GEO ISS 315 Global Diversity and Interdependence/ PHL 200 Introduction to Philosophy SOC 215 Race and Ethnicity SOC 330 Social Stratification SOC 368 Science, Technology and Society SOC 452 Environment and Society	ANP 321 Anthropology of Social Movements ANP 330 Race, Ethnicity and Nation ANP 430 Culture, Resources, Power ANP 431 Gender, Environment and Development ANP 436 Globalization and Justice PHL 353 Peace and Justice Studies

#### Ecological Integrity

Elective courses with no (or minimal) pre-requisites	Elective courses with pre-requisites
BS 110 Organisms and Populations ENT 205 Pest, Society and Environment FOR 220 Forests and the Global Environment FW 203 Resource Ecology GLG 201 The Dynamic Earth GEO 206 Physical Geography ISB 201 Insects, Globalization, and Sustainability* ISP 203A Understanding Earth: Global Change ISP 203B Understanding Earth: Natural Hazards and the Environment ISP 217 Water and the Environment ISP 221 Earth Environment and Energy* LBS 144 Biology I: Organismal Biology	FOR 404 Forest and Agricultural Ecology FW 364 Ecological Problem Solving FW 444 Conservation Biology ZOL 355 Ecology

#### Aesthetic Understanding

Elective courses with no (or minimal) pre-requisites	Elective courses with pre-requisites
IAH 206 Self, Society, and Technology IAH 231A Themes and Issues: Human Values and the Arts and Humanities IAH 231B Themes and Issues: Moral Issues and the Arts and Humanities IAH 241E Creative Arts and Humanities:	PHL 345 Aesthetics

The Creative Process WRA 110 Writing: Science and Technology WRA 341 Writing Nature and the Nature of Writing	
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### **Economic Vitality**

<b>Elective courses with no (or minimal) pre-requisites</b>	<b>Elective courses with pre-requisites</b>
EC 201 Introduction to Microeconomics EC 202 Introduction to Macroeconomics	EC 310 Economics of Developing Countries EEP 255 Ecological Economics EEP 320 Environmental Economics EEP 405 Corporate Environmental Management FOR 464 Natural Resource Economics and Social Science RD 460 Natural Resource Economics

A student may petition the Coordinator of the Sustainability Specialization to allow for any class not on this list to be substituted for one that is. In these cases the final decision is left to the Coordinator, and students should always seek approval before enrolling in the class.

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