Strategies for Incorporating Sustainability into the Curriculum

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ABSTRACT

Six strategies are outlined for incorporating sustainability or green concepts into curriculum and assessment. The first is to create an organization-wide assessment rubric targeting a green outcome. The second strategy discusses development of a new green program. Next, a green program outcome can be added to an existing program. Strategy four is to create a course to augment an existing program or use as a stand-alone offering. The next strategy is to analyze course level competencies and build learning modules for green competencies. Finally, performance standards for competency assessment can be modified to incorporate sustainability into courses. Sample processes are listed along with curriculum examples.

STRATEGIES FOR INCORPORATING SUSTAINABILITY INTO THE CURRICULUM

Strategies to incorporate sustainability into the curriculum are as diverse as higher education institutions themselves. "Some institutions have been able to embrace sustainability as a core principle," while others focus on developing graduate programs for sustainability professionals says Rowland (as cited in Johnston, 2013). While Rowland argues there should not be a "single pathway to success … in developing and implementing the sustainability education curriculum," this paper intends to highlight practical strategies for educators to consider when modifying or developing a curriculum. It argues for a consistent process to build and capture data about the effectiveness of sustainable curriculum activities and/or assessments. Analyzing examples from practitioners and referencing actual curriculum projects and deliverables, this paper uncovers six methods in which colleges are integrating sustainability into the curriculum. For the purposes of this paper, the terms "sustainability" and "green" are used interchangeably.

WHAT IS CURRICULUM?

Promoting sustainability through curriculum design involves articulating what students will take away from a learning experience and connecting this outcome to some kind of assessment. Curriculum developers use systematic, consistent frameworks to organize learning outcomes, activities, and assessment tasks. The curriculum products include a syllabus, course outline, and learning modules with associated assessment tasks. These documents should be presented to learners upfront—prior to any sustained learning experience—whether it be a credit course, workshop, or seminar. Additionally, after a program and its associated courses are designed, curriculum maps show where program outcomes or other broad core abilities appear across courses. These deliverables are the vehicles by which sustainability is evidenced and communicated to learners and the public.

UPFRONT ANALYSIS

With any sustainability initiative, the outcomes of that initiative must be defined. Results are then reported and compared with what was targeted. Initially this information is gathered through local industry-educator focus groups so outcomes satisfy unique regional needs. Prior to launching a curriculum design, it is ideal to conduct a focus group for a particular occupation, program, or discipline to determine how sustainability impacts that area. The results of the analysis assist in determining a strategy.

STRATEGY 1: CREATE A COLLEGE-WIDE ASSESSMENT RUBRIC

> Increased attention to student learning outcomes has also been facilitated by the greater adoption and use of rubrics. Rubrics are valued because they help faculty and programs identify strengths and weaknesses in learning and they clarify what is expected of students (Kinzie, J., 2011).

The assumption in strategy one is that educators have taken steps at the mission level to 1) identify, 2) verify, and 3) state in performance terms, a college-wide outcome and assessment strategy for sustainability. Colleges create, name, and publicize a green outcome; they use the outcome as a vehicle to bring a larger mission to the frontlines. The hope is that students make connections between specific content competencies and a broader sustainable society. Using a college-wide rubric for assessment equips instructors with a standard instrument that is easily understood. It describes learner performance using measurable terms and marries process to data, as assessment results can be more efficiently aggregated. The first step, if using this approach, is to write a good sustainability outcome.

Guidelines for writing a college-wide outcome:

- Begin with an action verb
- Target a transferable skill that goes beyond the context of a specific course
- Encourage learners to perform at a higher level
- Specify performance standards for reliability and fairness
- List assessment strategies (Clinical evaluation, internship, standardized test, portfolio artifact, etc.)

For example, "apply sustainable practices" is a green core ability infused across programs and courses at Lakeshore Technical College in eastern Wisconsin. Below is a portion of the campus-wide rubric used to assess learner performance of the outcome.

Apply Sustainable Practices

Criteria	Beginning	Developing	Accomplished	Mastery
Learner demonstrates awareness of the ecological impact related to his/her chosen area of study	Learner is aware of current environmental issues	Learner identifies which environmental issues are impacted within their chosen area of study	Learner demonstrates how his/her field impacts the environment	Learner identifies sustainable strategies that can decrease his/her industry's impact on the environment
Learner identifies environmental conservation strategies	Learner is aware of areas of environmental concern	Learner identifies conservation strategies to address environmental concerns	Learner demonstrates effective environmental conservation practices	Learner articulates how specific conservation strategies impact our broader environment
Learner identifies how sustainable practices produce a lean work environment	Learner is aware of different sustainable initiatives in his/her work environment	Learner identifies which sustainable initiatives can streamline process within his/her field	Learner demonstrates how sustainable initiatives produce a lean work environment and improve workplace quality or performance	Learner identifies emerging technologies/practices that have the potential to streamline his/her work environment
Learner incorporates sustainable practices (environmental, economic, social, and cultural) during the decision making process	Learner is aware of current environmental issues but often does not incorporate them into his/her decision making process	Learner connects sustainable practices to environmental impact and incorporates them into his/her decision making process	Sustainable practices guide the learner's decision making process in his/her life and workplace	Learner creates a culture of decision-making based on sustainable practices within his/her workplace. Learner models sustainability-based decision making within his/her workplace

Prior to developing the rubric, the college's Director of Curriculum and faculty representatives from each division collected feedback from faculty members using a survey. Employer input was gathered by conducting a focus group. Through this process, the sustainability outcome was added to the existing eight core abilities; the college is currently integrating it throughout programs and courses (Lakeshore Technical College, 2012).

STRATEGY 2: CREATE A NEW GREEN PROGRAM

This strategy may be the most exciting, as new occupations and innovations emerge and colleges scramble to provide cutting-edge programs and certificates.

A recent large scale effort funded by federal dollars in the state of Wisconsin, allowed for development of green programs such as the nation's first *Dairy Grazing Apprenticeship* program that incorporates sustainable farming methods. Apprentices work on farms with a master dairy grazier and take courses at a local technical college plus the University of Wisconsin. A two-year, 4,000-hour program, the apprenticeship combines on-farm learning and classroom instruction (Wisconsin Department of Workforce Development, 2011). Other new program examples include Renewable Electricity Technical Certificate, Sustainable Design Certificate, Energy Sustainability Engineering Technology (Dunham, B., 2011) and Green Business Management Graduate Program (Dudley, C., Marando, M, & McCarthy, J., 2011).

While developing a complete program involves many steps, the general process includes:

1. Conduct project leadership focus group
2. Facilitate occupational analysis
3. Develop program outcomes, performance standards, and assessment strategies
4. Build courses and course competencies
5. Design rollout plan
6. Provide instructor training

Green Industry Technician was recently designed to emphasize sustainability and environmental stewardship—training students in the planning, establishment, and care of public, private, and commercial landscapes (Lightfield, N. & Nickel, R.M., 2010). The program ensures graduates promote sustainable land and water management practices; assess project requirements based on sustainable land management principles; select plants adapted for various applications; create sustainable, environmentally sound landscape design plans; construct landscape design plans; demonstrate safe operation of tools and equipment used in landscape applications; and maintain turf and plants. The curriculum came as a result of an industry need for more green-conscious professionals within landscape design.

The process used for this project:

1. Conduct needs assessment using local professionals (69 local employers stated an increase in demand for entry-level employees in this area)

2. Write program outcomes, performance standards, and assessment strategies
3. Configure courses
4. Map program outcomes to courses
5. Revise course competencies and performance standards

STRATEGY 3: ADD A SUSTAINABILITY PROGRAM OUTCOME TO AN EXISTING PROGRAM

"More time should be spent embedding green skills training within current curricula, and less energy inventing new programs," reports the Center on Wisconsin Strategy, a think tank out of the University of Wisconsin (White, S. & Walsh, J., 2008). Perhaps the most common approach to addressing sustainability, this method retrofits traditional programs to meet green industry demands and/or state policy initiatives. Because the nature of green jobs involves mostly "middle-skilled workers in traditional occupations," (White, S. & Walsh, J. 2008) the challenge to transform occupations falls squarely on career and technical education programs.

Community and technical colleges have a rich history of preparing the workforce. Designing and modifying curriculum in partnership with local industry is their hallmark. Employers expect to hire technically prepared employees and designing quality program outcomes sets the stage for assessment of proficiency. Program outcomes by definition are field specific skills, attitudes, and abilities to be mastered by learners completing a program, major, or discipline thread. Each program outcome has multiple competencies; mastery of the related competencies should lead to mastery of that program outcome.

Many technical programs offered in two-year colleges, such as welding-fabrication, manufacturing, energy, and electricity, have added new sustainability related program outcomes. These outcomes address lean manufacturing, alternative energy, waste reduction, and greater energy efficient operations. New program outcomes provide instructional designers and faculty the opportunity to thread associated competencies and learning objectives across courses. Students advance through the program by completing assessments that demonstrate achievement of individual competencies or clusters of competencies at the course level. Like competencies, new program outcomes are clarified by performance standards and levels, such as if the outcome is introduced, practiced, or assessed in a given course or series of courses.

The process for adding a new sustainability program outcome to an existing program:

1. Conduct focus group with industry subject matter experts; analyze how sustainability impacts the occupation and future green trends
2. Cluster related topics into broad themes, prioritize if needed
3. Conduct a gap analysis of existing program outcomes
4. Develop an action plan to revise existing program outcomes
5. Write a new program outcome which addresses sustainability
6. Engage faculty and subject matter experts together to review the program outcome and performance criteria

7. Validate proposed program outcome by aligning it with relevant industry standards identified by faculty and subject matter experts
8. Vet drafted program outcome and alignment to industry standards with additional industry experts and area employers
9. Consider validation surveys and analyze data collected; revise as needed
10. Map new program outcome to courses and/or course competencies
11. Finalize the new program outcome and criteria
12. Revise college catalog and website, or wherever curriculum is accessed
13. Revise student learning plans and learning materials
14. Update syllabi and instructor guides

STRATEGY 4: CREATE A GREEN COURSE TO AUGMENT AN EXISTING PROGRAM OR USE AS STAND-ALONE

Out of thousands of institutions in the United States and Canada, Rowland admits, "Only several hundred of them offer their students opportunities to take courses addressing sustainability" (as cited in Johnston, 2013). The need is great.

One example of where this need is being addressed is in heating, venting, and air conditioning programs, where a new course in geothermal heating is added to augment the program. This core course prepares program graduates and heating professionals in the industry to install, troubleshoot, and repair geothermal heating systems. This course builds upon skills learned in previous program courses, but it is also used as a stand-alone course for industry professionals, offering them a chance to master the competencies needed for certification.

STRATEGY 5: CREATE A GREEN LEARNING MODULE

Targeting a smaller chunk of learning, this strategy packages a course-level sustainability outcome with learning activities designed around sustainability content, practice, and application. An assessment rubric is part of the module and targets competency criteria. A re-purposeable, stand-alone module, this chunk can be added to a course or used alone. It ideally includes all learning materials such as handouts, resources, and electronic media.

For example, to address the greening of the trades movement, emerging skills impacting the Electric Utility Line Worker program in Wisconsin were examined. A focus group met to determine necessary outcomes that would later produce 12 modules. Green trends were analyzed in the occupation and new competency modules developed. All modules include a detailed instructor manual, learning outcomes and activities, and an assessment rubric for each competency. A federally funded initiative, upgrading this occupation was a coordinated effort between Wisconsin technical college instructors and skilled lineworkers.

Sustainability Competencies for Utility Workers (Wisconsin Department of Workforce Development, 2011)

1. Adhere to safely rules for renewable distributed generation systems
2. Compare the various forms of renewable distributed generation
3. Identify the proper equipment connections used in renewable distributed generation installations
4. Acquire appreciation for the rules and regulations pertaining to renewable distributed generation
5. Summarize the impact renewable distributed generation has on distribution operations
6. Apply metering skills to renewable distributed generation systems
7. Explain how renewable distributed power automation equipment and control systems work
8. Summarize how using recycled power/utility poles impacts utilities
9. Explain the benefits from using hybrid trucks and utility vehicles
10. Summarize smart grid technologies and residential local area networks
11. Evaluate the use of new generation environmentally friendly oils
12. Communicate green energy trends to the public

The 12 new learning modules are stand-alone, or they can be associated with safety, metering, electrical codes, and a number of other program design components.

STRATEGY 6: CONTEXTUALIZE PERFORMANCE STANDARDS IN EXISTING COURSES

Faculty members have always been conscientious of trends impacting their programs; many have already included sustainability principles in their classrooms, whether formally or informally. In 2011, Seneca College reported, "58 percent of the faculty had already started the process of incorporating sustainability into the curriculum, while 23 percent were considering it." This same report indicates that faculty "wanted to do something but did not know how" (Dudley, C. Marando, M., & McCarthy, J., 2011). Adding new performance standards or contextualizing existing ones is a course-specific strategy which encourages the blending of technical or competency-based assessment with assessment of broader, transferable skills such as those related to sustainability or other core abilities.

Using this strategy, learners are evaluated based on observed sustainability performance. Criteria for "what it looks like to be green" are embedded into assessment; students demonstrate application of the criteria, which in turn determines their grade. In the design of an assessment instrument, such as a rubric, competency criteria are contextualized to include practices such as recycling and waste minimization. This brings sustainability into day-to-day activities, while original content is retained. Besides direct observation of sustainability practices, faculty may also design complimentary learning activities that support achievement of the competency and related performance standards. This gives students an opportunity to practice and self-assess prior to final assessment.

Examples of contextualized performance standards:

[Competency] (learner performs a process or procedure)	Competency: Prepare main entrée
• [existing criteria] • Analyze process to determine where waste occurs • Follow established procedures for minimizing waste • Consider waste generated • Select sustainable resources when available • Use natural resources (air, water, energy) responsibly • Apply the reduce, reuse, recycle philosophy • Make efficient use of energy • Consider the ability to buy local • Avoid excess packaging • Recycle unused or used materials • Use non-toxic materials	• [existing criteria] • Purchase food in a manner to reduce excess packaging • Dispose of non-useable food in compost • Purchase foods from local providers to minimize energy used for transportation and shipping • Maximize use of raw food resources and minimize the use of processed foods • Minimize refrigeration and food storage expenses to reduce energy consumption • Plan for just-in-time delivery of perishable goods

The strategy to revise performance standards on a course-by-course basis, however, is problematic. When gathering quality data about student achievement, inconsistencies make it difficult to examine performance beyond one instance of a course. Adopting a common course outline with embedded and consistent green performance standards would improve data collection efforts across multiple courses. Without consistent standards, gains across courses, programs, and departments would be difficult to measure.

Leaders in education have always been nimble in responding to trends that impact learner success. As sustainability continues to be a talking point and way of life, the instructor-learner relationship is fertile ground for application of these essential skills—skills that transcend content-specific competencies. This unique relationship is where learners apply, and instructors observe, "sustainability-in-action" in the context of a variety of disciplines. Creating a thoughtful, aligned, and relevant curriculum is the first step to ensure these principles are being implemented.

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