

# Greening the Teacher Preparation Curriculum

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## **Abstract**

*Gannon University, located in downtown Erie, Pennsylvania, created a middle level teacher preparation curriculum focused on sustainability. After reviewing the literature about learning, teacher preparation, and barriers to campus greening, the article describes how Education for Sustainable Development (ESD) was integrated into the middle level teacher preparation curriculum. The curriculum engages students in the science, technology, engineering, and mathematics (STEM) disciplines, meets accreditation standards, meets university academic requirements, and has been awarded special designation by the Pennsylvania Department of Education (PDE).*

From federal mandates to produce highly qualified teachers to institutional goals of greening the campus, an array of issues compete for the attention of teacher preparation programs. The U.S. Department of Education advises increased coursework in the science, technology, engineering, and mathematics (STEM) disciplines. Accreditation organizations require that teacher preparation programs demonstrate attainment of specific content standards. State agencies set requirements for teacher certification programs. Community and campus residents apply pressure for sustainable campus development. Facing these varied constituencies and their demands, institutions must choose which concerns can be addressed with the resources available. Faced with these issues, Gannon University decided to investigate the possibility of meeting multiple challenges through curriculum redesign. This article describes how Education for Sustainable Development (ESD) was integrated into the curriculum redesign process, resulting in a model for greening the teacher preparation curriculum.

## **Education for Sustainable Development**

Greening projects are undertaken by institutions of higher education for a range of purposes. Frequently campus greening projects are undertaken to establish sustainable policies and practices, save money, improve learning, and increase efficiency (Net Impact 2009; Rappaport 2008). Unfortunately, although much attention has been given to green buildings, recycling, and environmental awareness activities, it is evident that very little coursework requires students to study sustainability. A focus on education as a means to sustainability, known as ESD, takes greening into the arena of curriculum; few examples of curriculum greening exist outside of the geography, environmental science, and engineering majors (Dyer 2006; Gray-Donald and Selby 2004; Haigh 2005). “The assumption of many SD [sustainable development] projects at universities seems to be that the transition to a greener campus, or one with a smaller ecological footprint, will lead, as it were, organically to a shift in understandings and attitudes”

(Gray-Donald and Selby 2004, 204). At this time, however, the impact of sustainable development projects has not been widely documented and it appears that a new approach to campus greening is necessary.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) recognized the importance of education in developing sustainability initiatives and designated 2005–2014 a Decade of Education for Sustainable Development. The goal of the Decade of ESD is to “integrate the principles, values, and practices of sustainable development into all aspects of education and learning” (UNESCO 2005, 6). During this decade, UNESCO calls upon institutions of higher education to improve basic education, redesign education programs, develop knowledge and awareness, and provide sustainability training (UNESCO 2005, 7). While many institutions have jumped on the greening bandwagon, greening efforts have resulted in the creation of individual environmental courses, not purposefully created green undergraduate programs (Haigh 2005).

Now, halfway through the Decade of ESD, institutions of higher education are beginning to recognize the importance of greening the curriculum in addition to greening buildings and services (Venkataraman 2008). In response to UNESCO’s call for ESD, the American Association of Colleges of Teacher Education (AACTE) prepared an online resource page to support the integration of ESD into the teacher preparation curriculum (“Decade of Education for Sustainable Development,” <http://www.aacte.org/index.php?/Programs/Standards-and-Practice-STEP/decade-of-education-for-sustainable-development.html>). In addition, the Association for Advancement of Sustainability in Higher Education (AASHE) began working with institutions of higher education to implement sustainability initiatives (AASHE n.d.). However, as noted in a *New York Times* article, “it’s one thing to put up a trophy of recycled glass and brick that relies on the sun, the wind or other renewable resources for power. It’s another to build a curriculum—and to get students to look at the world differently—with green buildings as a centerpiece” (Egan 2006, 20). Recognizing the need for curriculum greening outside traditional “green” majors, the Gannon University teacher preparation program decided to create a strand in the middle level teacher preparation curriculum focused on ESD. This was accomplished by purposefully designing a multisection curriculum that promotes experiential learning and uses an environmental problem-solving approach.

## **Moving Teacher Preparation Toward a Pedagogy of Sustainability**

Gannon University, a private, coeducational Catholic university, is a comprehensive Masters L institution situated in downtown Erie, Pennsylvania. Located along Lake Erie, Gannon University has approximately 4,200 students enrolled in associate’s, bachelor’s, master’s, doctoral, and certificate programs. Because Gannon is located in the Lake Erie watershed and grants degrees in environmental science, the Gannon community is acutely aware of the need to focus on sustainability. Students, staff, and

faculty have joined together to create Gannon Goes Green (GGG), an organization focused on campus greening. The GGG organization developed both a vision for campus sustainability and a structure to address funding, purchasing, policies, practices, marketing, awareness and curriculum. In addition to the work of GGG, faculty members in the Environmental Science and Engineering Department have taken steps to develop a minor in sustainability to enhance Education for Sustainable Development (ESD). This, however, approaches only a very narrow portion of the curriculum and the focus remains on students in the sciences. The humanities, including teacher preparation programs, remain untouched by the ESD movement.

As with many other institutions, this lack of whole-campus involvement with ESD at Gannon University can be attributed to multiple demands competing for resources. In the teacher preparation arena, ESD is only one of many movements, internal and external, vying for attention. Professional organizations such as the AACTE and the National Council of Accreditation of Teacher Education (NCATE) urge teacher preparation programs to redesign for greater impact on PK-12 schools (AACTE n.d.; NCATE 2008). The National Academy of Sciences (NAS) demands more emphasis on science, technology, engineering, and mathematics (STEM) disciplines (Committee on Prospering in the Global Economy of the 21st Century 2007). At the state level, the Pennsylvania Department of Education (PDE), the state accrediting body, changed certification guidelines in 2008 and required teacher preparation programs to create middle level certification programs aligned with specific competencies. Meanwhile, the university developed updated guidelines for Liberal Studies coursework. During the 2008–2009 academic year the Gannon University School of Education accepted the challenge of redesigning the teacher preparation program to address AACTE, NCATE, and NAS recommendations, to meet changing state certification program requirements, and to better support the mission of the institution.

## **Identifying Elements of Effective ESD Programs**

The School of Education curriculum development team envisioned a curriculum that would reflect best practices in middle level teacher preparation and address the myriad issues demanding attention. When describing the middle level curriculum, Caskey (2002) depicts it as “a curriculum that engages students actively in learning or knowledge work: critical thinking; rigorous inquiry; thoughtful reflection; purposeful discourse; collaborative exchange; and systematic application, analysis, synthesis, and evaluation of information” (104). The curriculum development team committed to building a curriculum which embraced these components and those related to effective ESD programs.

Although Creighton wrote about greening the curriculum at Tufts University (1998, 227), there are few other examples of ESD in undergraduate teacher preparation programs. Research from outside the field of teacher preparation reveals that initiatives which actively engage students with sustainability concerns throughout their higher education experience through interdisciplinary coursework have been successful in greening campuses (Creighton 1998; Gray-Donald and Selby 2004). However,

Venkataraman found that there is “still much to be done to find the most effective ways to teach about the environment and impart personal responsibility and action” (2008, 9). In moving toward a pedagogy of sustainability, the curriculum development team decided to create a program that actively engages students with sustainability; enhances engagement with science, technology, engineering, and mathematics (STEM) disciplines; and supports positive changes in both personal behavior and content knowledge through experiential learning. This approach is supported by Cohen’s assertion that ESD can be successful only when students have internalized a sustainable mindset. According to Cohen, “A sustainable mindset is composed of three components. We need to be systems thinkers, academically and practically grounded, and ethically motivated” (2007, 84).

As the curriculum development team considered the design of the middle level teacher preparation program, they also examined *How People Learn (HPL)*, a review of literature on teaching and learning (Bransford, Brown, and Cocking 2000). HPL identified a framework for thinking about the elements of effective instructional programs and identified four elements that impact learning or lack of learning. According to the HPL framework, learning is facilitated when the learning environment attends to individual learners (121), promotes active engagement with disciplinary content (124), provides opportunities for feedback that improves performance (127), and takes place within a community context (132). These principles, along with those proposed by Cohen (2007), were consciously incorporated into the middle level curriculum to create a curriculum that provides optimal environments for learning and promotes a sustainable mindset.

## **ESD in the Middle Level Teacher Preparation Program**

Research has shown that moving toward ESD requires a change in thinking about sustainability and personal behavior, not just an understanding of environmental issues (Cohen 2007; Haigh 2005). To produce this change in thinking and behavior, an approach was needed that taught more than content alone. To develop the approach, a subgroup of the GGG campus organization was invited to participate in designing the middle level curriculum. This steering committee consisted of the GGG co-chair, a professor from the Environmental Science and Engineering department, a professor from the School of Education, a representative from the Office of Corporate and Foundation Relations, and a member from Lake Erie Allegheny Earth Force, a community organization involved with environmental education. After considering several curriculum options, the steering committee agreed to integrate a problem solving approach into the curriculum instead of designing the curriculum around discrete environmental issues. The problem solving approach chosen was the Earth Force Community Action and Problem Solving (CAPS) approach described in “The Six Steps of Earth Force” (Holmes 2004). This approach meets the need described by Cohen (2007) to develop a sustainable mindset by introducing systems thinking into curriculum.

The Earth Force CAPS approach is a six-step process used to help students investigate environmental policy and practice issues. With over fourteen years of experience in serving middle level teachers and students, the Earth Force CAPS program has demonstrated effectiveness in changing the mindset of learners (Meldrum 2007). Earth Force involves students in community action through project-based learning, an approach recommended to improve the effectiveness of instruction (Bransford, Brown, and Cocking 2000). In the first three steps, the Earth Force CAPS approach allows students to select an environmental issue for further study and supports them as they conduct independent research to develop the content knowledge necessary for evaluating policies and practices related to the selected issue. The next two steps require students to identify possible options for addressing the issue and selecting a course of action. Finally, when the issue has been addressed the students reflect on their accomplishment (Holmes 2004). As described in the How People Learn framework, the high degree of learner choice and engagement with disciplinary content are designed to create an effective learning environment (Bransford, Brown, and Cocking 2000).

The partnership with Lake Erie-Allegheny Earth Force allows the university to incorporate the Earth Force CAPS approach into the curriculum to ensure integrated, coherent, and democratic learning experiences in a real-world setting. As students engage in the Earth Force CAPS program, they develop leadership skills, experience real world collaboration, and make interdisciplinary connections. In addition, it integrates elements of civic engagement and service learning. The Earth Force CAPS approach meets the need for authentic curriculum, a requirement of middle level programs, as it

is co-developed by teachers and students; it is a collaborative effort, a negotiated plan for learning. An authentic curriculum creates and connects learning experiences in the school context to be more like learning and life outside school. It requires the learner to construct knowledge, conduct inquiry and perform tasks that have a purpose beyond simply satisfying the assignment (Caskey 1996). Authentic curriculum systematically arranges for young adolescents to be engaged in rigorous and meaningful knowledge work. (Caskey 2002, 107)

Using the problem solving approach not only allows the curriculum to engage students with authentic problems, it also provides awareness of a variety of sustainability issues and increases the number of teacher candidates engaged in STEM disciplines.

## **Using Curriculum Mapping to Infuse a Pedagogy of Sustainability**

Led by the director of middle level and secondary certification programs, the Gannon University School of Education used curriculum mapping to facilitate the development of the scope and sequence of the middle level teacher preparation program so that it

would meet the competencies required by the state, incorporate the elements of effective instructional programs, and implement best practices in ESD. The curriculum mapping process, as described by Jacobs (1997), allowed the team to (1) visually see the alignment between coursework and accreditation requirements; (2) designate where content is introduced, developed, and mastered; and (3) identify appropriate assessments. The curriculum map, created on a spreadsheet, displayed a matrix of courses, PDE middle level teacher candidate competencies, and assessment tools. The intersections where courses were identified as meeting PDE competencies were coded with the level at which the course addressed the competency. In this way, the matrix visually displayed where competencies were introduced, developed, mastered, and maintained in the teacher preparation program. The curriculum map visually organized a great deal of information and functioned as a cognitive tool for the curriculum team (Shim and Li 2006).

Using the coded curriculum map, team members were able to see gaps and redundancies in the curriculum and make adjustments to ensure that coursework adequately presented opportunities to master the competencies. After the map was examined and each competency had been aligned with a course, a description of the mastery assessment tool for each competency was added to the curriculum map. The finished map included coursework in adolescent development, middle level pedagogical strategies, and assessment, as well as coursework in the humanities and sciences. Once completed, the mapping process allowed the School of Education curriculum team to see the scope and sequence of the coursework in the newly designed middle level teacher preparation programs. Figure 1 shows a condensed version of the curriculum map focusing on the courses used in the ESD strand of the curriculum. The complete program guide sheets can be found online at the Gannon University School of Education website (<http://www.gannon.edu/departamental/education/undergrad.asp>). The curriculum mapping process aligns well with a recommendation that institutions of higher education need to reconfigure programs to infuse a pedagogy of sustainability throughout the curriculum (Cohen 2007).

**Figure 1. Condensed Curriculum Map for the ESD Strand of the Teacher Preparation Curriculum.**

1. Middle Level Education Competencies	Liberal Studies Courses		Professional Core Courses		Key Assessments at Course Level
	Leadership Seminar	Intro to Environmental Science	Concepts/ Methods Science	Student Teaching	
<i>I.H. Professionalism</i>					
Act as positive role models, coaches, and mentors for all young adolescents;	I	D	M	m	Disposition Assessment
Communicate deep content knowledge in subjects taught;	I	I	D	M	Teaching Performance (PDE 430 Form)

Serve on advisory program, co-curricular activities and other programs supporting the curriculum;	I		D, M	m	Disposition Assessment
Uphold professional standards;	I, D	D	M	m	Disposition Assessment
Participate fully in teaming and collaborative grade and building level structures.			I, D	M	Disposition Assessment

**II. C. Science**

**1. Develop, implement and assess and modify curriculum and lessons as evidenced by their ability to:**

e. Use and interpret scientific explanations of the natural world;	I	D	M	m	Project Notebook & Reflection
f. Generate and evaluate scientific evidence and explanations;	I	D	M	m	Project Notebook & Reflection
g. Understand the nature and development of scientific knowledge and participate productively in scientific practices and discourse;	I	D	M	m	Project Notebook & Reflection
h. Implement pedagogy for the concepts that students find most difficult, as well as ways to support their understanding of those concepts;			D	M	Lesson & Unit Plans & Teaching Performance (PDE 430 Form)

**3. Ecology standards – understand and know Pennsylvania’s grade 4-8 Academic Standards for Environment and Ecology including:**

a. Watersheds and wetlands;	I	D, M	m	m	PDE Content Exam, Lesson & Unit Plans, & Teaching Performance (PDE 430 Form)
b. Renewable and non-renewable resources;					
c. Environmental health;					
d. Agriculture and society;					
e. Integrated pest management;					
f. Threatened, endangered and extinct species;					
g. Humans and environment;					
h. Environmental laws and regulations.					

**7. Science and inquiry:**

a. Teach science as a process of inquiry;			I, D	M	Lesson & Unit Plans & Teaching Performance (PDE 430 Form)
b. Illustrate the process of scientific inquiry by having students think critically and logically to make the relationships between evidence and explanations.					

*Key: I = introduce, D = develop, M = master, m = maintain*

In addition, the curriculum map allowed the School of Education to communicate assessment data and request resources from the Office of Institutional Research. It also ensured that the team consciously thought about creating a curriculum that included

engagement with ESD across a series of courses and experiences designed to inculcate a sustainable mindset (Cohen 2007). Through the curriculum mapping process the development team identified a leadership seminar, two environmental science courses, and a teacher preparation course that had elements related to ESD and would provide an opportunity to introduce, develop, master, and maintain a sustainable mindset. Using this interdisciplinary model allows the curriculum to acknowledge that “few real-world problems rest comfortably within individual disciplines” (Haigh 2005, 38) and provide opportunities for students to engage in authentic STEM coursework.

After using curriculum mapping to identify courses and design the scope and sequence of the middle level teacher preparation program, the university applied for approval by the PDE. The approved middle level certification program includes an ESD strand that provides opportunities for teacher candidates to learn, use, teach, and embrace ESD principles in a multisequence of courses. This model, called the LUTE Model, infuses ESD in the teacher preparation curriculum.

## **The LUTE Model: Learn, Use, Teach, Embrace**

Research calls for ESD to be grounded in both academic and practical experience (Bransford, Brown, and Cocking 2000; Cohen 2007). The LUTE model was designed as a multisequence series of courses in which students successively learn a problem-solving approach, apply the problem-solving approach with support, and independently lead an Earth Force project using the problem-solving approach. This tiered approach uses sustainability projects to actively involve students in understanding middle level pedagogy, STEM content areas, and problem solving. This type of interdisciplinary, collaborative approach is supported by research on best practices in teacher preparation and middle school curriculum (Bransford, Brown, and Cocking 2000; Caskey 2002; Duschl, Schweingruber, and Shouse 2007; Waks 2002).

### **Learn It**

The first phase of the LUTE model focuses on helping students learn the Earth Force CAPS process. This phase takes place in a university-required leadership seminar offered during the sophomore year. The course is open to students from other majors and, as required by the university, is offered in conjunction with a course on ethics. The synergy of content in the two courses is designed to encourage creative thinking, discussion, and deep understanding of the Earth Force CAPS process. In addition, although the curriculum design team did not initially require an ethics course, the need to be ethically motivated is described as essential by Cohen (2007). Similarly to the Centre for Excellence in Teaching and Learning described by Dyer, Selby, and Chalkley (2006), the partnership between Lake Erie-Allegheny Earth Force and Gannon University encourages “students to engage critically with key sustainability agendas and their social, ethical, professional and personal implications” (310). The cohort of students enrolled in both classes provides students the opportunity to participate in a learning community, develop academic and social support among peers, and increase a sense of belonging (Arhar and Crowe, 2002; Bransford, Brown, and Cocking 2000).

During the leadership seminar the students learn the six steps of the Earth Force CAPS process, stewardship, and ethical behavior for teachers. The course, co-taught by Gannon School of Education faculty and Earth Force staff, ensures that the students are familiar with all program staff in the ESD strand. The course is required as part of the university's liberal studies coursework. The liberal studies leadership course is required to address leadership as a result of group interaction, the role of ethical reasoning in promoting the well being of humankind, and Catholic social justice teachings. The Earth Force CAPS process addresses all of these components as students examine the campus community for sustainability concerns and work in groups to determine an ethical course of action. While students are not developing pedagogical skills in this phase, they are developing leadership skills and a knowledge base upon which the rest of the LUTE model relies.

### **Use It**

The second phase of the LUTE model requires students enrolled in the middle level teacher preparation program to use the Earth Force CAPS approach to conduct a greening project on campus during their junior year. This experience is part of the Introduction to Environmental Science course required for middle level science majors and is recommended for middle level majors with other content concentrations. Taking this course provides students with both academic content knowledge and practical knowledge, a best practice described by Cohen (2007, 92). In addition, it provides a knowledge-centered environment to facilitate learning (Bransford, Brown, and Cocking 2000).

The greening project embedded in this course requires that students actively engage in the problem solving process to identify and solve a problem on campus. To ensure that the needs of the learners are met the project allows students to investigate potential issues and identify one that they would like to address (Bransford, Brown, and Cocking 2000). This increases student interest in completing the projects and provides them with experience in prioritizing issues, avoiding the problem described by Creighton (1998) in which projects start off full steam ahead but quickly lose pace and veer off track. In addition, it allows students to move theory into action in an environment that is supported by peers and the course professor. Shandas and Messer note that by taking part in stewardship, "community members can begin to reestablish the connection between their actions and the health of the environment" (2008, 416).

This interdisciplinary approach supports the students' understanding of STEM content and middle level curriculum while encouraging students to adopt a sustainable mindset. Students are required to keep electronic project notebooks documenting and reflecting on their learning, a strategy recommended by Cohen (2007) to document the effectiveness of this component in encouraging students to adopt a sustainable mindset. Support for the electronic project notebooks is provided through the Earth Force organization's AmeriCorps Vista position.

### **Teach It**

The third phase in the LUTE model requires students to implement the Earth Force CAPS approach during the senior-year Concepts and Methods of Science course,

which includes a pre-student teaching experience. This course helps to build teacher candidate knowledge of science content and pedagogy and is connected to a teaching practicum in a fourth- to eighth-grade classroom or after-school program. The practicum experience requires teacher candidates to facilitate Earth Force projects during the teaching practicum. The experience of teaching the Earth Force CAPS process is designed to help teacher candidates implement their knowledge of adolescent development, integrated curriculum, and effective learning environments. In addition, because Lake Erie-Allegheny Earth Force has partners in the schools around the city and the surrounding county, the partnership enabled the university to support the teacher candidates' experiences with the Earth Force CAPS approach as they implement it with middle school students. During this phase of the LUTE model, the partnership with Earth Force is critical in finding placements and supporting use of the Earth Force CAPS in middle level classrooms (Shandas and Messer 2008).

The Lake Erie-Allegheny Earth Force organization also provides project support by working with students to create electronic project portfolios using web technology such as blogs and wikis. In this phase, Lake Erie-Allegheny Earth Force staff members meet monthly with the teacher candidates to assess project progress and provide support. This requirement lends itself to expanding the concepts of stewardship and sustainable living beyond the classroom to the campus and community. This is very much in line with the repercussions for curriculum discussed by Gray-Donald and Selby (2004):

The implications of a pedagogy of sustainability are that learning should spill out of the classroom and into the campus and community. The interlinking of curriculum, campus and community enables students to become engaged in action learning in multiple arenas, with the classroom housing: initial sharing and framings of the theoretical and personal understandings, subsequent dialogue and reflection on actual experiences “in the field,” a revisiting of theory in the light of what emerges, and the consequent informing of further action learning plans. (207)

To further support the practicum component of the Teach It phase, Gannon University has partnered with the Erie Metropolitan Transit Authority to allow students to ride the city buses for free with a student identification card. This allows the students to travel to and from practicum placements in the urban area without cost. It also provides students with a model of sustainable practice through the use of mass transportation.

## **Embrace It**

The final phase of the LUTE model expects students to embrace the idea of sustainable living and begin to adopt sustainable practices in their own lives. In this stage, students are able to take additional environmental science coursework in sustainability, volunteer in an Earth Force after-school program, or use the Earth Force CAPS approach during the student teaching semester or beyond. In addition, a study of teacher preparation programs revealed that students who experienced collaboration

during their preparation and found it to be beneficial were individuals who used a variety of teaching activities in their own practice (Brouwer and Korthagen 2005). Therefore, teacher candidates who have engaged with the LUTE coursework are expected to perform successfully in the student teaching semester and embrace the nature of interdisciplinary, learner-centered teaching and learning.

As noted by Cohen (2007), the adoption of a sustainable mindset will require institutions to track their students in the world beyond campus to evaluate the impact of the greening of the curriculum. All will require, however, that Institutional Research engage in dialogue and collaboration with many others in the institution, especially faculty, students, and alumni who are testing the value of their educations in the world beyond the campus. Through our partnership with the Lake Erie-Allegheny Earth Force organization, we are able to continue to support teachers who wish to use the Earth Force CAPS approach in their own classrooms. Initially, the institution will track graduates for three years after graduation to support their use of ESD in middle level classrooms and engage them in surveys and interviews to document the impact of the LUTE curriculum.

## **Addressing Obstacles to Success**

The Gannon programs were developed with an eye toward recognizing and minimizing challenges in the design and development of campus greening initiatives. A review of literature revealed four types of obstacles to successful campus greening programs: investing in infrastructure, improving education about sustainability, changing behaviors, and implementing ongoing assessment.

### **Investing in Infrastructure**

One obstacle to campus greening is financial in nature. This barrier exists when universities fail to invest in infrastructure (Rappaport 2008, 11) by neglecting to finance data collection and storage, communication about greening initiatives, hiring staff dedicated to greening initiatives, and the development evaluation tools (Creighton 1998; Dahle and Neumayer 2001; Haigh 2005; Rappaport 2008). Although the lack of financing for infrastructure can be attributed, in part, to the time between initiative implementation and evidence of effectiveness (Dahle and Neumayer 2001; Creighton 1998), it can also be attributed to a lack of commitment and conviction of administrators (Creighton 1998). In order to ensure the awareness and commitment of administration by developing and communicating a vision for campus sustainability, a group of students, staff, and faculty joined together to establish Gannon Goes Green (GGG). Group membership included student representatives from the student government association, student environmental clubs, and the activities programming board. Faculty members from all academic departments were invited to participate and many did so as their schedules allowed. In addition, staff members from the offices of service learning, finance, and facilities management also participated in the group. Although leadership for this effort was initially shared by students, faculty, and staff, there are now two co-chairs, one representing administrative staff and one representing faculty.

The vision for GGG is to serve as a recommending body for cost effective environmental innovation, use of green technologies where appropriate, and implementation of green academic and institutional policies. To support the vision, a unit plan for organizational structure, goals, and funding was prepared and presented to the university administration. By approving the unit plan and supporting the GGG unit plan, goals, and funding needs, the administration has clearly demonstrated a commitment to investing in the organizational infrastructure. The administration has also demonstrated support by providing assistance from the institutional research, grants, and finance departments to the School of Education as outside funding is sought to purchase materials and equipment, fund data collection and storage, provide staffing for the greening initiatives, and develop evaluation tools for the LUTE curriculum. In addition, the Dean of the College of Humanities, Education, and Social Sciences dedicated a room in the School of Education suite as a math and science laboratory. This room is equipped with wireless technology, laboratory space, and a locked equipment storage room. The administrative commitment also includes budgeting for the purchase of startup equipment for the courses in the LUTE curriculum.

### **Improving Education about Sustainability**

Researchers suggest that critical components in changing behaviors include increasing awareness of sustainable development issues through education (Dahle and Neumayer 2001; Creighton 1998). The LUTE model addresses awareness throughout a multisequence of courses developed in response to the research showing that disjointed awareness activities, such as flyers, tables, and lectures, are not effective in promoting sustainable change in student behavior (Dahle and Neumayer 2001). The LUTE model addresses awareness by engaging students in examining the campus environment for potential sustainability issues and taking action to improve sustainability. This was particularly important in the urban setting, where green policies and practices are not obvious to the student body (Dahle and Neumayer 2001). The LUTE coursework scaffolds student engagement in the process, providing support to the teacher candidates as they internalize the Earth Force CAPS process and engage in both campus projects and middle school Earth Force CAPS projects. This approach ensures that students are educated about their impact on the campus community, K-12 school community, and surrounding urban areas and have the skills necessary to make changes (Creighton 1998).

As an urban campus, the Gannon University physical plant is not separate from the city in which it resides. Instead, campus buildings span several blocks and are scattered amid government offices, churches, and apartments. In many cases the students, who are largely commuters, lack a feeling of connection to the university (Dahle and Neumayer 2001). To address this obstacle, the curriculum team developed a learning community for middle level majors that focuses on developing stewardship during the sophomore-year leadership and ethical responsibility courses. Research shows that “students who participate in learning communities develop an educational citizenship (an understanding of mutual interdependence), academic and social support from their peers, increased learning and more engagement in learning, a sense of

belonging, and intellectual development” (Arhar and Crowe 2002, 215). The use of a learning community allows the students to engage with academic content while learning an environmental problem solving process and engaging in discussion about stewardship, thus strengthening the connection of the commuter population to the urban environment.

## **Changing Behaviors**

Another type of obstacle involves changing behavior to adopt a sustainable mindset and demonstrate that mindset through personal action. In order to help students adopt a sustainable lifestyle, it appears that thinking about lifestyle choices must be changed (Cohen 2007; Haigh 2005; Rappaport 2008). According to Creighton, this is “one of the most challenging components of campus greening” (1998, 273). Some researchers attribute the difficulty to cultural norms (Creighton 1998; Dahle and Neumayer 2001; Rappaport 2008). Some researchers (Creighton 1998; Dahle and Neumayer 2001) describe the current culture as one of apathy toward sustainability issues, while others disagree and cite the enthusiasm of students as a strength in developing ESD (Rappaport 2008). To make a shift toward sustainability in individuals and in institutional culture, Dahle and Neumayer (2001) suggest that students be involved in data collection, analysis, and decision making. The Gannon University School of Education built the ESD strand into the curriculum with a focus on student involvement in these tasks through coursework matched to PDE competencies and institutional learning outcomes. In this way, the greening of the curriculum institutionalizes a culture of sustainability and is well positioned to facilitate change in individual teacher candidates as well.

## **Implementing Ongoing Assessment**

The final obstacle to campus greening is related to assessment issues (Creighton 1998; Rappaport 2009; Thompson and Creighton 2007). Researchers agree that it is important to evaluate progress but point out that data collection, analysis, and reporting is time consuming and may be discouraging (Creighton 1998; Thompson and Creighton 2007). Gannon University recognized the need for a coherent assessment plan during the development of the middle level teacher preparation program and planned for frequent progress reporting using multiple measures. Assessment measures for PDE teacher candidates were indicated on the curriculum map and communicated in course syllabi. As part of the LUTE curriculum, teacher candidates are required to communicate progress weekly when engaged in greening projects. To document project status the students use electronic project notebooks developed using online collaboration tools such as blogs and wikis. This component allows the university and Earth Force staff to comment on progress and encourage continuation. In addition, it allows communication between project leaders so that issues that cannot be addressed in one semester can be revisited in future semesters without repeating the initial research. This approach is designed to reduce frustration and improve continuation of projects when progress is slow and enthusiasm has waned.

In addition to assessment of students at the course level, institutional measures are used to assess the success of the LUTE model. As noted by researchers, “Indicators

should measure the important things. Select indicators for a specific purpose and measure progress toward identified goals in a way that is relevant, available, and understandable” (Thompson and Creighton 2007, 49). Because the coursework is presented over a series of courses in a multise­mester approach, the designers wanted a multitiered approach to program assessment to provide ongoing and consistent reporting (Rappaport 2008; Thompson and Creighton 2007). This allowed for both formative and summative assessment of the program, as recommended by the literature on assessment-centered environments (Bransford, Cocking, and Brown 2000). The assessments will gather information recommended by researchers and examine sustainable mindset, disciplinary knowledge, and changes in the sustainability rating of the university (Cohen 2007; Thompson and Creighton 2007).

According to Cohen (2007), it is important that the institution track data on the effectiveness of the ESD curriculum in promoting a sustainable mindset. To assess the change in attitudes associated with adopting a sustainable mindset, the program will use a modified version of the Earth Force program evaluation tool (Earth Force 2004). This instrument has been used for more than a decade in K-12 education and has documented improvement in civic responsibility among middle school students who have engaged with the Earth Force CAPS approach (Meldrum 2007). This instrument will be applied as a pre-assessment and post-assessment for each course in the multise­mester sequence. In addition to the pre- and post-assessments, students will be interviewed post-graduation to examine the impact of the ESD component of the teacher preparation curriculum. The recent graduates will also be tracked by the Earth Force organization to provide follow-up project support during their first three years of teaching.

For assessment of disciplinary knowledge, the Student Assessment of Learning Gains instrument (SALG) will be used to gather pre- and post-curriculum quantitative data (<http://www.salgsite.org>). The SALG instrument assessment results provide the ability to evaluate the impact of the training and make changes for future semesters. In addition, student knowledge of content and middle level curriculum will be assessed in a two-fold manner. First, content knowledge will be assessed using the standardized tests required by the PDE. Second, teacher candidates will be required to present a project portfolio during the pre-student teaching semester and a teaching portfolio during the student teaching semester. The portfolio evaluations will document understanding of adolescent development and middle level pedagogy.

To assess the impact of the LUTE curriculum on the campus environment, the Sustainability Tracking, Assessment and Rating System (STARS) will be used. This instrument assesses Gannon’s progress in meeting long-term objectives for environmental sustainability. The STARS tool, developed by the Association for Advancement of Sustainability in Higher Education, evaluates sustainability in the institutional areas of academics, research, operations, and administration (<http://stars.aashe.org/>).

## **Implementing and Evaluating ESD in Teacher Preparation**

To evaluate the success of campus greening programs, Creighton (1998) suggests that programs must become part of how the institution works. Using this criterion, the greening of the middle level has been successful, as it is now integral to the middle level teacher preparation curriculum, has a structure for collecting assessment data, and has a formalized plan for evaluation. Creighton also suggests that a successful program has university commitment and support. The evidence of success on this measure is the willingness of the institution to provide both human and monetary resources. These resources have supported staff as they sought approval for new courses and syllabi as well as in applying for grants to improve curriculum and laboratory resources. Another criterion of success, according to Creighton (1998), is the willingness of individuals to be champions for campus greening initiatives. As evidence of success in using this criterion, Gannon can show that the School of Education faculty and steering committee members who participated in the creation of the green curriculum have continued to be active in campus greening initiatives and curriculum greening, especially in the humanities and teacher preparation arenas. Finally, Creighton (1998) posits that success is directly related to understanding the basic principles of environmental protection. The greening of the teacher preparation curriculum has ensured that expertise in basic principles of environmental protection is being developed in both students and faculty as they attend conferences, participate in partnerships, and apply for grant monies to support research.

In addition to meeting the criteria for success outlined by Creighton (1998), the newly designed middle level teacher preparation curriculum was reviewed by the PDE and approved for implementation beginning in the fall 2009 semester. In recognition of the high quality of the program, the state designated specific areas of the program as “a Promising Model or Innovative Practice” (private correspondence from Terry Barnaby, Director, Bureau of School Leadership and Teacher Quality, PDE [June 3, 2009]). Areas receiving the special designation include the emphasis on adolescent development and assessment as well as alignment with key state academic standards and assessment anchors throughout multiple courses in the program. The PDE also recognized the collaboration among faculty members and faculty expertise in middle level and disciplinary content areas. The field experience and student teaching sequence also received special designation with specific recognition for collaboration with field placement sites to provide high quality experiential opportunities to put theory into practice. Finally, the initiatives designed to support new teachers after graduation were also recognized by the state with special designation.

### **Conclusion**

Gannon University is currently seeking grant funding to support the continuing improvement of both curriculum and resources. At the time of this writing, the Gannon University middle level teacher preparation program has just enrolled its first students and is beginning to work on data collection. The enrollment in this program has

already increased the number of students engaged in STEM content through the new STEM-related middle level curriculum enhancements. In addition, students in the middle level teacher preparation program are already volunteering with after-school Earth Force programs in urban K-12 schools. With active enrollment and participation in the curriculum greening initiatives, the program is off to a healthy start.

Data will be collected on measures related to the attainment of institutional goals, environmental indexes, and teaching performance. As data is collected, assessments will be evaluated and additional information about performance will be published. To successfully replicate the LUTE component of the teacher preparation curriculum, institutions wishing to green the teacher preparation curriculum should consider engaging in the curriculum mapping and community building activities described in this article.

## References

American Association of Colleges of Teacher Education (AACTE). n.d. STEP assessment project: Linking preservice measures to evidence of student learning. <http://www.aacte.org/index.php?/Programs/Standards-and-Practice-STEP/step-assessment-project.html> (accessed August 1, 2009).

Arhar, J. M., and A. R. Crowe. 2002. Cohorts in middle level teacher preparation: Transformational possibilities and complexities. In *Middle school curriculum, instruction, and assessment*, ed. V. A. Anfara Jr. and S. L. Stacki, 211–231. Greenwich: Information Age Publishing.

Association for the Advancement of Sustainability in Higher Education (AASHE). n.d. About AASHE. <http://www.aashe.org/about/about.php> (accessed August 1, 2009).

Bransford, J. D., A. L. Brown, and R. R. Cocking, eds. 2000. *How people learn: Brain, mind, experience, and school*. Washington: National Academies Press.

Brouwer, N., and F. Korthagen. 2005. Can teacher education make a difference? *American Educational Research Journal* 42 (1):153–224.

Caskey, M. M. 2002. Authentic curriculum: Strengthening middle level education. In *Middle school curriculum, instruction, and assessment*, ed. V. A. Anfara Jr. and S. L. Stacki, 103–118. Greenwich: Information Age Publishing.

Cohen, B. 2007. Developing educational indicators that will guide students and institutions toward a sustainable future. *New Directions for Institutional Research* 134 (Summer): 83–94.

Committee on Prospering in the Global Economy of the 21st Century. 2007. *Rising above the gathering storm: Energizing and employing America for a brighter economic future*. Washington, D.C.: National Academies Press.

- Creighton, S.H. 1998. *Greening the ivory tower: Improving the environmental track record of universities, colleges, and other institutions*. Cambridge: The MIT Press.
- Dahle, M., and E. Neumayer. 2001. Overcoming barriers to campus greening: A survey among higher educational institutions in London, UK. *International Journal of Sustainability in Higher Education* 2 (2): 139–160.
- Duschl, R. A., H. A. Schweingruber, and A. W. Shouse, eds. 2007. *Taking science to school: Learning and teaching science in grades K-8*. Washington: The National Academies Press.
- Dyer, A., D. Selby, and B. Chalkley. 2006. A centre for excellence in education for sustainable development. *Journal of Geography in Higher Education* 30 (2): 307–312.
- Earth Force. 2004. Quality Rubric. [http://www.earthforce.org/files/574\\_file\\_Quality\\_for\\_Web.doc](http://www.earthforce.org/files/574_file_Quality_for_Web.doc) (accessed May 16, 2010).
- Egan, T. 2006. The greening of America's campuses. *The New York Times* (January 8), online edition. [http://www.nytimes.com/2006/01/08/education/edlife/egan\\_environment.html](http://www.nytimes.com/2006/01/08/education/edlife/egan_environment.html) (accessed July 30, 2009).
- Gray-Donald, J., and D. Selby. 2004. Through the (not so) green door: University campus greening and curriculum change. *Ekistics* 71 (427–429): 203–212.
- Haigh, M. 2005. Greening the university curriculum: Appraising an international movement. *Journal of Geography in Higher Education* 29 (1): 31–48.
- Holmes, A. 2004. The Six Steps of Earth Force. [http://www.earthforce.org/files/553\\_file\\_The\\_Six\\_Steps\\_of\\_Earth\\_Force.pdf](http://www.earthforce.org/files/553_file_The_Six_Steps_of_Earth_Force.pdf) (accessed May 16, 2010).
- Jacobs, H. H. 1997. *Mapping the big picture: Integrating curriculum and assessment K-12*. Alexandria: Association for Supervision and Curriculum Development.
- Meldrum, V. 2007. *Earth Force evaluation: Summary of 2005–2006 evaluation results*. Denver: Earth Force. Available at [http://www.earthforce.org/files/1912\\_file\\_Earth\\_Force\\_2005\\_06\\_Evaluation\\_Summary.pdf](http://www.earthforce.org/files/1912_file_Earth_Force_2005_06_Evaluation_Summary.pdf).
- National Council of Accreditation of Teacher Education (NCATE). n.d. Professional standards for the accreditation of teacher preparation institutions. <http://www.ncate.org/documents/standards/NCATE%20Standards%202008.pdf> (accessed August 1, 2009).
- Net Impact. 2009. *Campus greening resource guide*. San Francisco: Net Impact. [http://netimpact.org/associations/4342/files/CampusGreeningResourceGuide\\_2009.pdf](http://netimpact.org/associations/4342/files/CampusGreeningResourceGuide_2009.pdf) (accessed September 4, 2009).

Rappaport, A. 2008. Campus greening behind the headlines. *Environment* 50 (1): 7–16.

Shandas, V., and W. B. Messer. 2008. Fostering green communities through civic engagement: Community-based environmental stewardship in the Portland area. *Journal of the American Planning Association* 74 (4): 408–414.

Shim, J. E., and Y. Li. 2006. Applications of cognitive tools in the classroom. In *Emerging perspectives on learning, teaching, and technology*, ed. M. Orey (electronic book). [http://projects.coe.uga.edu/epltt/index.php?title=Cognitive\\_Tools\\_in\\_the\\_classroom](http://projects.coe.uga.edu/epltt/index.php?title=Cognitive_Tools_in_the_classroom) (accessed October 1, 2009).

Thompson, G., and S. Creighton. 2007. Metrics and meaning for environmental sustainability. *New Directions for Institutional Research* 134 (Summer): 41–54.

United Nations Educational, Scientific, and Cultural Organization (UNESCO). 2005. *United Nations Decade of Education for Sustainable Development (2005–2014): International implementation scheme*. <http://www.unesco.org/education/desd> (accessed July 30, 2009).

Venkataraman, B. 2008. Why environmental education? *Environment* 50 (5): 8–11.

Waks, L. J. 2002. Exploratory education in a society of knowledge and risk. In *Middle School Curriculum, Instruction, and Assessment*, ed. V. A. Anfara Jr. and S. L. Stacki, 23–40. Greenwich: Information Age Publishing.

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