

# CUR Focus

## Up the Pyramid, Around the Loop—Action Research Cultivates Sustainability Scholars to Green the Campus

We live in a time of ecological crisis. Major ecosystems on Earth are in decline, our climate is warming dangerously, and the species causing all of the concern—*Homo sapiens*—will grow in global population from about 7 billion today to 9 billion by the middle of this century (Ash et al. 2005). The situation can be frightening to contemplate, but we try to keep the upbeat words of Paul Hawken in mind. “What a great time to be born,” he says, in the 2007 documentary *The 11th Hour*. “What a great time to be alive. This generation gets to completely change this world” (Conners et al. 2007).

We are committed to helping prepare the generation now in college to begin making the profound social and technological changes that will enable humans to realize a truly sustainable world. College and university campuses—with their human populations, their mixture of built and natural environments, their systems for energy, water, food, and transportation—are microcosms of society. This makes campuses excellent laboratories for learning how to live more lightly, gracefully, and justly on the planet.

Per its mission statement, George Mason University is “committed to creating a more just, free and prosperous world” (George Mason 2013). We are convinced that our university, with its rich intellectual resources, its proximity to the nation’s capital, and its global scope, is also well positioned to produce future sustainability leaders. We are passionate about helping George Mason to fully realize its potential to educate students to help advance sustainability.

To this end, we created and co-direct George Mason’s minor in sustainability studies, launched in 2009; we also collaborated on development of the university’s bachelor’s program in environmental and sustainability studies, launched in 2010. One of us is the lead instructor for Sustainable World, the 200-level introductory course for both the major and the minor. One of us is the lead instructor for Sustainability in Action, the 400-level capstone course for both programs. The aim of our curriculum is to foster students’ development as student scholars in general and “action” researchers in particular within the emerging integrative field of sustainability studies.

The development of our undergraduate sustainability programs has coincided with George Mason’s adoption of a Quality Enhancement Plan (QEP) focused on greatly expand-

ing opportunities for undergraduate research across the university (OSCAR QEP 2011). With the support of a three-year curriculum development grant from the Office of Student Scholarship, Creative Activities, and Research (OSCAR), we have integrated undergraduate research in sustainability studies into our curriculum. This article details how we use the program’s bookend courses, the introductory Sustainable World and capstone Sustainability in Action courses, to scaffold students’ ascent of OSCAR’s three-level scholarly pyramid—discovery, inquiry, and creation of scholarship—shown in Figure 1. This graphic summarizes overall goals for each level of the pyramid, based on the Students as Scholars master rubric (OSCAR Rubric 2011).

We also describe our learning loop model, which provides students in the introductory course with opportunities to learn about design and execution of university-funded, campus action research projects directly from students who have completed the capstone. Reciprocally, project ideas from the introductory course are passed forward for potential implementation by subsequent capstone students.

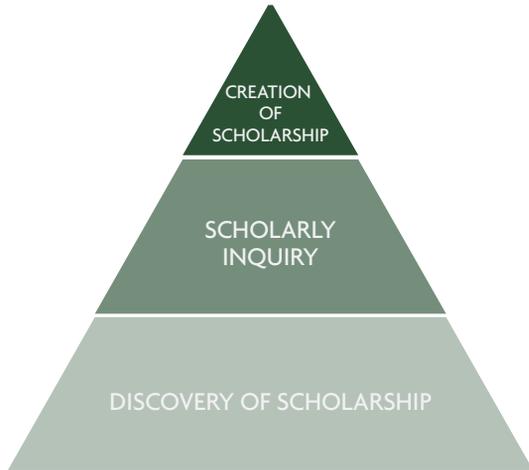
### Toward a Sustainable World

The Students as Scholars (SaS) master rubric lists six desired student learning outcomes at the basic, discovery level (OSCAR Rubric 2011). The Sustainable World course focuses on five of these, adapted to our discipline:

- A. Distinguish between personal beliefs and evidence.
- B. Articulate how sustainability scholarship influences society.
- C. Evaluate the credibility of source information.
- D. Understand research methods used in sustainability studies.
- E. Understand how knowledge is transmitted within sustainability studies, from sustainability studies to other disciplines, and to the public.

There are two course modules in which individual students work with widely used sustainability frameworks to develop discovery-level scholarly skills. The first of these frameworks is ecological footprint analysis (EFA) and the second is life-cycle analysis. Before the SaS-supported course redesign in 2012, engagement with EFA in the introductory course consisted of having students complete an online ecological foot-

**Figure 1. George Mason University’s Three-Level Pyramid for Students as Scholars Learning Outcomes**



<b>Creation of Scholarship</b>
<p><b>At the pinnacle of pyramid, students will:</b></p> <ul style="list-style-type: none"> <li>• Create an original scholarly or creative project.</li> <li>• Communicate knowledge from an original scholarly or creative project.</li> </ul>
<b>Scholarly Inquiry</b>
<p><b>At the middle level of the pyramid students will:</b></p> <ul style="list-style-type: none"> <li>• Articulate a scholarly question, engage in key elements of scholarly process, and situate the concepts, practices, or results of scholarship within a broader context.</li> </ul>
<b>Discovery of Scholarship</b>
<p><b>At the foundational level of the pyramid students will:</b></p> <ul style="list-style-type: none"> <li>• Understand how knowledge is generated and disseminated through scholarship.</li> <li>• Discover how they can engage in the practice of scholarship.</li> </ul>

Source: <http://oscar.gmu.edu/fac-staff/student-learning-outcomes.com>

print “quiz” and then reflect—through an individual writing assignment and group discussion—on what the “quiz” taught them about the planetary impact of their personal lifestyles (Center for Sustainable Economy 2013). The redesigned syllabus adds rigor to the assignment. In addition to completing the quiz, students now read and respond in writing to a scholarly article that details the research methodologies employed by the scholars whose work informed the creation of the original quiz and a subsequent major revision of it (Venetoulis and Talberth 2008). The article also explains how companies and other organizations, municipalities, states, and even countries use EFA to structure their efforts to measure and reduce their ecological impact.

This course module supports students’ development with respect to multiple discovery-level learning outcomes. Information about how EFA is used in the real world helps students see how sustainability scholarship influences society (outcome B). The article goes behind the user-friendly interface of the quiz to show students the complicated quantitative research that transforms the personal information they add to the form into an easy-to-understand result. This look “behind the veil” helps students understand the research methods used in sustainability studies (outcome D). The quiz itself, with its straightforward online interface and clever communication of results. Upon completing the quiz, the student sees how many Earths would be needed if everyone on the planet adopted his or her consumption habits. This gives a clear and concrete example of how knowledge generated by sustainability scholars is transmitted to the public (outcome E).

Few of the students in the 200-level Sustainable World course come to the class with experience in reading and analyzing peer-reviewed scholarly articles. Thus, the instructors use a writing prompt and a mini-lecture to guide students through reading and analyzing the peer-reviewed article on EFA. This effort pays dividends when students turn to the research they must do for a course assignment that challenges them to perform a life-cycle analysis on a consumer item they use regularly. The assignment requires students to research the raw material inputs for this consumer item; to discover where the product is assembled and under what kind of labor conditions; to account for the energy used and pollution created in the manufacture, transport, and use of the item; and to investigate what happens to the item after its useful life ends. Since 2007, students have examined both the environmental and social impacts of hundreds of different consumer items ranging from apples to yo-yos.

This assignment, which counts for 20 percent of the course grade, proceeds in stages. Before submitting the final research essay, students do preliminary research on two potential topics. After they have received the instructor’s feedback and decided on a topic, they submit an outline with an annotated bibliography of all the sources they are using for their research. The annotated bibliography must include at least eight high-quality sources, at least two of which are peer-reviewed articles from scholarly journals.

This assignment also advances students’ development with respect to multiple discovery-level learning outcomes. It engages students directly in sustainability research and thus supports their progress toward understanding the research methods used in sustainability scholarship (outcome D). The use of information obtained from various sources enhances students’ ability to distinguish between personal beliefs and

evidence (outcome A), and careful evaluation of this information, in the annotated bibliography and the essay itself, improves students' ability to evaluate the credibility of the source information (outcome C).

The Community Sustainability Project introduces students to the sustainability-related action research that will become the focus of their capstone experience in the Sustainability in Action course. This group assignment challenges student teams to diagnose a sustainability-related need on campus and propose a project to effectively address that need. Projects may focus on infrastructure improvement or promoting behavioral change. The teams develop their proposals using the application template for the Patriot Green Fund (PGF), George Mason's annually renewed \$100,000 fund to support sustainability-related infrastructure improvement and research projects on campus. Through researching and developing the proposal, team members continue to develop skills with building evidence-based arguments (outcome A), while also evaluating the credibility of researched information (outcome C) and understanding the research methods used in sustainability studies (outcome D) in the specific context of greening the campus. Project teams receive quantitative scores and qualitative feedback from peers and instructors on their written proposals and their oral presentations of proposals to the class. Thus, each student in the class gets one opportunity to collaboratively produce a peer-reviewed and faculty-reviewed proposal, as well as multiple opportunities to critically evaluate proposals produced by their peers.

An essay question on the final course portfolio assignment asks each student to recommend one project (other than his or her own project) for approval by the Patriot Green Fund and to justify this recommendation. The essay prompt directs students to address not only practical matters such as feasibility, cost versus benefit, and potential impact of the project they recommend for funding, but also to articulate how the project demonstrates mastery of discovery-level learning outcomes related to understanding the research methods used in sustainability scholarship (outcome D) and sustainability scholarship's influence on society (outcome B).

This explicit integration of discovery-level learning outcomes into a prompt for the final portfolio essay is emblematic of how learning outcomes are assessed in this course. Our assumption is that the best way to foster students' progress toward mastery of these outcomes is to engage them directly with the outcomes as regularly as possible. We post the outcomes on the syllabus and discuss them at length at the first class meeting. We highlight which outcomes will be emphasized as part of the description for each assignment. In nearly every class meeting, we conclude our discussion of class texts

by asking students to analyze the texts as research artifacts and determine what kinds of sustainability research informs them. The final essay prompt described above echoes an essay prompt from the midterm exam that challenges students to interpret a critical learning experience from the first half of the course in terms of how this experience helped them advance toward mastery of one of the discovery-level learning outcomes. We believe this approach encourages students not only to develop foundational scholarly skills to apply in the capstone course, but also to begin identifying themselves as sustainability-studies scholars.

### Sustainability in Action

The capstone Sustainability in Action course aims for students to transfer theory they discovered in the introductory Sustainable World class and other courses into practice in pursuit of sustainability goals. Students' real-world, sustainability-related projects originally addressed target communities' needs or problems. However, we found this broad, community project-based approach insufficient to develop both the practical skills and reflective learning practices deemed vital for emerging sustainability practitioners. We recognized the need for a more rigorous and systematic approach to learning by doing. Our university's Quality Enhancement Plan catalyzed this revision.

Acting as reflective practitioners, students in this course ascend from scholarly inquiry (SI) into the creation of scholarship (CS) levels of the SaS pyramid. Adapted to our sustainability and action focus, this involves the following five learning outcomes:

- A. Articulate and refine an action research question to address a priority sustainability challenge. (SI)
- B. Gather evidence appropriate to the question. (SI)
- C. Situate this action research within a broader sustainability context. (SI)
- D. Perform and present action research to peers, professors, and future cohorts, using appropriate scholarly conventions. (SI and CS)
- E. Demonstrate awareness of broader sustainability implications of action research discoveries. (CS)

We realize these objectives through concurrent action research projects, reflective discourse, and peer assists via service learning. Without distinctly assessing them, the curriculum also implicitly addresses remaining SaS master-rubric learning outcomes at the SI level ("Follow ethical principles.") and CS level ("Justify that project intends to be

engaging and novel...” and “Take responsibility for executing the project.”)

To address a shared concern about unsustainability today, student teams proceed through a full iteration of action research: They (1) undertake a study and plan, (2) take action, (3) collect and analyze evidence on the impact of their actions, (4) reflect on findings, and (5) propose potential follow-up research. At an orientation during the previous semester, students brainstorm about contemporary challenges to realizing sustainability and set priorities for those they might address. They then form teams by selecting which challenge each student would like to focus on addressing over the following 15-week semester. Over the break before that next semester begins, these teams develop initial statements of the problem to present to the class, for example:

- “We use too much paper on campus.”
- “Our recycling rates on campus are pathetic.”
- “Commuters to campus underuse transportation alternatives to driving solo.”
- “Local schools don’t practice or teach kids about sustainability.”
- “Some of our peers may be homeless.”

During the first few sessions of the semester, students refine their problem statements in order form a question for their action research (outcome A). They gather evidence (outcome B), research and measure the extent of the problem, and diagnose root causes before formulating a set of options to help address those causes. Where pertinent, we also introduce the action research reports and proposals to the Patriot Green Fund submitted by previous cohorts of students in order to inform the teams’ selection of an appropriate option for action.

The teams’ research questions are then articulated and refined using feedback from the professor and from students’ peers. Their aim is to frame each question in terms of the action they deem most viable to pursue over the remainder of the semester. The problem of wasting paper, for example, was addressed through conducting research on the question: “How would charging more for two single-sided printed sheets than for one double-sided sheet affect the amount of paper used in computer labs?” Students examined this question through interviews with staff at peer institutions, followed by coordination with our university’s printing services department to change the pricing structure, and then compare subsequent to historical usage data.

After the specific research proposal is developed, teams submit monthly progress reports (complete with feedback from

their professor and peers), pursue their action research projects, collect and compare post-action data with baseline data, and finally (outcome D) report on their findings, conclusions, and proposed follow-up research in written and oral formats at an end-of-semester symposium. Throughout the process, each of these products is evaluated by and discussed with both faculty members and peer evaluators—along with an occasional guest alumna or alumnus—all using a common rubric both to assess and to frame feedback. For instance, achieving competency in the research proposal is contingent, in part, upon fully demonstrating to evaluators that the team’s “Action research question [is] focused, manageable and appropriately addresses key aspects of a priority sustainability challenge.” If this is not achieved, evaluators can explain, for example, that the question’s scope is too large to address within the time constraints of a single semester. In this fashion, teams’ progress toward the desired student-learning outcomes is regularly assessed in a social-learning context, with feedback informing both skills development and inevitable mid-course corrections.

Parallel to the action research process, students as “action-eers” pursue up to 50 hours of self-directed service learning to promote sustainability around campus and in their own communities. Building upon the 25 hours of service learning they perform in the Sustainable World course, students may elect to tend to an organic garden on campus, participate in a shoreline trash cleanup, plan an Earth Week event, support food bank distributions or energy-efficiency improvements for low-income neighbors, or myriad other pertinent activities. Action research teams also solicit their peers to support delivery of each other’s projects (outcome D). Students even organize “work days” when the whole class collaborates on some off-campus sustainability activity. One such effort removed scores of illegally dumped tires from a nearby backwoods pond, for example. These varied activities provide students with a broader base of experience with which to understand the context (outcome C) and interpret the implications (outcome E) of their own action research.

Ongoing reflective discussions throughout the course foster a culture of active and collaborative learning as students become sustainability practitioners. Logs and journal entries that capture accomplishments and lessons from service learning are regularly shared and discussed in class. We also use reflective discourse to provide a broader context (outcome C) for understanding and interpreting the implications (outcome E) of students’ action research. The professor presents a series of interactive lectures based on John C. Dernbach and colleagues’ *Acting as if Tomorrow Matters: Accelerating the Transition to Sustainability* (2012). The text starts with the well-documented premise that Americans have known for a generation what we need to do to achieve sustainability, and

yet we have made only “modest progress towards an increasingly distant goal” (p. 127).

Students discuss how their daily actions and their action research relate to overcoming the daunting obstacles this text presents. Meanwhile, student teams regularly lead and facilitate class discussions about passages from the Northwest Earth Institute’s *Choices for Sustainable Living* (2012) on topics such as food, transportation, and consumption. These passages challenge students to reflect deeply on how their daily choices and behaviors can contribute to or imperil progress toward a more sustainable world. This reflection culminates with a final writing assignment in which students write and, if they choose, share in class an editorial that captures the broader sustainability lessons and implications they derived from their action research, service learning, and reflective discourse over the course of the semester (outcome E).

We encourage capstone students, as emerging sustainability scholars, to directly assess the course’s effectiveness in delivering its intended Students as Scholars’ learning outcomes. In particular, the first anonymous course evaluations following SaS updates in 2012 assessed the degree to which students (n=13) agreed that the capstone course had met each of its five SaS outcomes. On a scale of one (strongly disagree) to five (strongly agree), five was the most common response for the perceived achievement of each learning outcome, as well as the median for outcomes A, C, and E. Scores for each of those three outcomes averaged between 4.5 and 4.6. By contrast, median scores for B and D were both four, with means of 4.4 and 4.3, respectively. Some students merely agreed (27 out of 65 responses) or remained neutral (4 of 65), though none disagreed, that each outcome was met. By contrast, most students strongly agreed (34 of 65 responses) that all five SaS learning outcomes had been met. Students articulated that the course was good (median rating: four out of five) and the teaching excellent (median of five). The next cohort of students is twice as large (n=26). This increase bodes well for subsequent statistical analyses and, more broadly, for the popularity and potential of our sustainability studies programs.

A common critique in students’ assessments, however, was that there was too much work for a four-credit course. Nine students indicated that they had put a “very high” amount of effort into the course, three said they had put in a high amount, and only one noted moderate effort. Several also indicated that either assignments should be scaled back or else the course increased to six credits to match their effort. As a result, we are considering how to refine the delivery of a four-credit course (e.g., reducing the maximum service learning time from 50 to 40 hours) without compromising commitment to our learning outcomes.

## The Learning Loop

Students in our sustainability major and minor scale the pyramid of scholarship, with skills developed in the introductory course preparing them to execute action research in the capstone course. Students in the introductory Sustainable World class discover sustainability scholarship and then design research proposals that, if funded, can be pursued in the capstone Sustainability in Action course, either as action research or as service learning.

The capstone students, in turn, assess the effectiveness of students’ proposals from the Sustainable World course and their own social innovation ideas for addressing priority sustainability challenges at the campus and community levels. These “actioneers” then create novel sustainability scholarship as they progress in their action research and service learning. Their reports of results, impacts, and lessons learned are ultimately conveyed to beneficiaries and the next cohort of student researchers.

Thus, this learning loop model brings program alumni back to the introductory course to share their action research results and experiences as they pass along project ideas and teach the next wave of students the best practices for their future work as sustainability practitioners.

## Conclusions

The two courses we have described jointly promote our students’ development up the pyramid of SaS research skills. Students learn to examine and evaluate sustainability scholarship, then formulate and refine research questions, attending to ethical principles in the inquiry process, project implementation, and assessment. They also build confidence in their own ability to plan and collaborate on action-oriented scholarship that is critical to advancing the emerging field of sustainability studies.

Students generally appreciate the practicality of action research in pursuit of sustainability and value the real-world impact of their research. One student wrote that the Sustainable World course “allowed me to assess my impact on the world” and also provided “options to replace unsustainable practices within my life and that of the people around me.” Another student’s anonymous course evaluation conveyed that the Sustainability in Action course advanced learning when “activities outside [the] classroom got us to work together to support sustainability, building community.”

With our campus as their learning lab, these young scholar-practitioners have successfully created price incentives for double-sided printing across campus; installed a hydroponic prototype in a university greenhouse for peers’ learning and

food production for university dining services; raised awareness about alternative transport, energy efficiency, homelessness and hunger in our community; and even obtained hundreds of signatures on petitions for better recycling and more renewable energy on campus. As we write, teams of students within our major and minor have research applications pending that would fund a food-waste-to-biodiesel converter, install native bird and bat houses to improve animal habitats in campus groves, and finance installation of a green roof on one of our newest LEED-certified buildings.

These contributions are perhaps the most compelling index we have for tracking our students' development as sustainability researchers. Up the pyramid and around the loop, these students are helping green our university while learning the skills they need to realize a more sustainable future.



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