

A Global Classroom for International Sustainability Education

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Sustainability studies put emphasis on social-environmental-technical problems with local manifestations and global impacts. This makes especially poignant the need for educational experiences in which students confront the challenges of crossing cultural, national, and geographical boundaries in a globalized world and understand the historical, epistemological and ethical underpinnings of these diverse cultural conditions. The success criteria to evaluate the educational experiences demanded by the globalization of education, however, are yet to be specified and used in novel educational opportunities. A brief review of international sustainability education options currently available to students reveals a gap between the knowledge students may need to succeed in a globalized world and the opportunities available. Into this landscape, we introduce The Global Classroom, an international collaboration between Leuphana University of Lüneburg in Germany and Arizona State University in the US. The project strives for an interdisciplinary and cross-cultural approach to equipping students with the knowledge, skills, and attitudes required to take on sustainability challenges in international settings. We discuss the structure and organization of the Global Classroom model and share preliminary experiences. The article concludes with a reflection on institutional structures conducive to providing students with the international learning opportunities they may need to tackle sustainability problems in a globalized world.

Keywords: Sustainability Education; International Education; Project- and Problem-Based Learning; Interdisciplinary Education

Introduction

Sustainability challenges, including climate change, loss of biodiversity, poverty, epidemics, and violent conflicts, manifest at specific locations; yet, the underlying causes are linked to other regions, nations, and even the global society. Hence, potential mitigation and solution options require coordinated and collaborative efforts around the world (Van der Leeuw et al., 2012). The coming generations of decision-makers, government agents, entrepreneurs, farmers, engineers, consultants, and others will have to face these challenges while collaborating across local, regional, national, geographical, and cultural boundaries. Collaboration of this extent requires the broad acquisition of specific competence, knowledge, skills, and attitudes, which in return has major implications for teaching and education (de Haan, 2006; Rowe, 2007; Sipos, 2008; Brundiers & Wiek, 2011).

With these new teaching challenges, educators must determine how to best equip students with these trans-boundary competencies. Classroom exercises that present sustainability problems and solution options are an important part of such a competency-focused approach. These classroom exercises, however, lack the cross-cultural and real-world experience that

is critical for developing competencies that account for the local nuances of sustainability problems and solutions. There is a particular need for diverse and rich cross-cultural learning opportunities that simultaneously prepare students for understanding sustainability challenges and build student capacity to develop robust solution options to these challenges.

The success criteria or general learning objectives for such international educational experiences can be summarized as follows. Students need to be capable of working across national, geographical, and cultural boundaries, recognizing the cultural, historical, epistemological and ethical context of perceiving sustainability problems and developing solution options; and drawing on a pool of internationally-sourced solution ideas that can, when adapted, be transferred to different local contexts. Students ought to become:

- Sensitive to cultural differences and their historical origins (general cultural sensitivity).
- Attuned to how sustainability problems *and* potential solutions differ in diverse local contexts (context-specific problem and solution orientation).
- Recognize, distill, adapt, and transfer sustainability knowledge, problem-solving frameworks, concepts, and best prac-

tices to local settings (problem-solving through adaptation and transfer).

- Integrate perceptions, knowledge, and skills across different disciplines and communities of practice in order to comprehensively understand sustainability challenges and their ethical implications and to develop evidence-based solution options (interdisciplinarity).
- Capable of working in teams composed of individuals with diverse cultural backgrounds (cross-cultural teamwork).

In the following, we briefly review international sustainability education options that are currently available to students and summarize the strengths and weaknesses of these education options. Against this review background, we present the concept and structure of the Global Classroom, an international collaboration between Leuphana University of Lüneburg in Germany and Arizona State University in the US. The Global Classroom offers cross-cultural and interdisciplinary educational experiences with the intent to equip students with the knowledge, skills, and attitudes required to take on sustainability challenges in international settings. We conclude the article with a discussion of institutional structures best suited to provide students with such international learning opportunities.

The article offers a tangible example of how to provide international educational opportunities in line with the general criteria for advanced sustainability education. We hope the article provides a valuable source of inspiration for other universities to initiate similar efforts or expand ongoing ones.

International Opportunities for Sustainability Education

Universities are in the process of recognizing the need for shifting and transforming established structures and practices in research, teaching, and operations in order to meet the sustainability challenges of the 21st century (Ferrer-Balas et al., 2008; Whitmer et al., 2010; Wiek et al., 2011b; Lang & Wiek, 2012). One important domain of this transformation is the emergence of international educational programs in sustainability. We first review the current state of international sustainability education opportunities through the lens of 17 international programs featured by the Association for the Advancement of Sustainability in Higher Education (AASHE). AASHE is a support network for educational organizations to advance sustainability in teaching, research, and operations. AASHE maintains a list of sustainability study abroad programs offered by various organizations across the US¹. We limit our review to academic institutions (as opposed to including other organizations) providing undergraduates with sustainability study abroad opportunities. While not comprehensive, the selected 17 programs present a robust spectrum of opportunities currently available to students in the US. We reviewed these programs based on the information available on the web (we did not request further information, conduct interviews, etc.). For the purpose of this review, we sought only information easily and readily accessible to students landing on the program page.

We use a review scheme based on the quality criteria for international sustainability education in a globalized world we explored above. For each program we asked the following questions.

In how far does this program:

- Promote cross-cultural education?

- Address the context-specificity of sustainability problems and potential solutions?
- Offer capacity-building in complex problem-solving (solution orientation)?
- Adopt an interdisciplinary approach to sustainability problems and potential solutions?
- Teach teamwork in cross-cultural settings?

To keep our review cursory, as intended, we reviewed if an element was either “strong,” predominantly “absent,” or “not clear” from available material. We formulated our answers based on keywords and phrases available on program landing pages. In particular, we focused on sentences beginning with phrases like, “The program is designed [...]” or “this program’s goal [...]” or “students will explore [...]” For example, the phrase to provide “students with an opportunity to learn about contemporary and historical issues that impact development and social change in Southern Africa” is deemed a “strong” opportunity for cross-cultural education. The phrase, “This course will examine watershed management and its role in sustainable development,” represents a “strong” solution orientation; use of the word “transdisciplinary” indicated a “strong” interdisciplinary approach. The statement that students will, “cross borders, working collaboratively to solve problems” is deemed evidence of “strong” teamwork in cross-cultural settings (Table 1).

The majority of international sustainability education opportunities we reviewed lasted between one and two months (Table 2).

Our review reveals that a majority of programs (14 of 17) provide students with a cross-cultural educational opportunity (Table 1). The majority of programs available address the context-specificity of sustainability problems and potential solutions (10 of 17); slightly fewer build capacity in complex problem-solving (solution orientation) (8 of 17), or adopt an interdisciplinary approach (8 of 17; 3 additional programs may, but this was “not clear” from available information). Our review reveals a dearth of programs offering students experience to work on cross-cultural teams (1 of 17). Only one program meets all of the presented criteria for international sustainability education opportunities (Table 3).

The Global Classroom Experiment

Into this landscape, we introduce The Global Classroom, an international collaboration between Leuphana University of Lüneburg in Germany and Arizona State University in the US.

Background

During the academic year 2009/2010, an international group of fellows in residence at the Institute for Advanced Studies in Berlin (Wissenschaftskolleg zu Berlin) formed a working group on curriculum reform. These fellows represented a wide range of disciplines (from physics and biology to political science and art history) and geographical regions (US, Europe, India, Israel). The group produced a manifesto and a set of recommendations (see: <http://curriculumreform.org>; Elkana et al., 2010). The central recommendation was to prepare students from the beginning of their studies to understand and deal with real-life problems at a global scale and to understand contextual (geographical, cultural) dimensions of knowledge.

Based on these discussions, the group began to explore the

¹Available at: <http://www.aashe.org/about/aashe-mission-vision-goals>

Table 1. International sustainability education opportunities featured by the Association for the Advancement of Sustainability in Higher Education (AASHE).

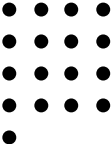
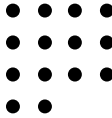
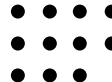
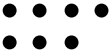
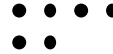

Academic Institution	Appalachian State University (informally)	Arizona State University	Augsburg College	Daemen College	East Carolina University	Portland State University	University of California at Davis	University of California at Davis
Program name	Sustainability and Sustainable Development Education Initiative	Study Abroad in Australia: Human Dimensions of Sustainability	Social Change and Development in Southern Africa	Consortium for North American Sustainability	Study Abroad in International Sustainability	CIEE Rio de Janeiro Environment & Sustainability Studies	Sustainable Cities of Northern Europe	Sustainable Ecuador—From the Andes to the Amazon
Program goals excerpt	“To improve the quality of undergraduate and graduate education with a focus on sustainable development through the exchange of curricula and language acquisition, faculty and staff, students and cultural experiences.”	“This transdisciplinary program draws on a very wide range of fields...to explore human dimensions of sustainability—past, present and future”	“Provides students with an opportunity to learn about contemporary and historical issues that impact development and social change in Southern Africa and the efforts to address such issues”	“Participate in experiential learning at local organizations and agencies. -Cross borders, working collaboratively to solve problems.”	“Examine the natural, history and environmental conservation of North Queensland, Australia...The course integrates Australian land and marine management policies with cultural and historical practices of the Aboriginal clans which occupy each of these areas.”	“Through rigorous coursework and complementary field experiences, you’ll enhance your knowledge of contemporary environmental and sustainability issues (social, economical, and environmental) from a local, national, and global perspective.”	“This course examines the features, systems and designs for sustainable cities ranging from transit, bike and ped circulation to renewable energy systems to waste management and urban planning and design. Relying on lectures, field trips, guest speakers, design and planning problems, and reading-the-city exercises, the course shows what lessons can be taken from Europe back to US cities.”	Examine “the historical development and current situation of Ecuador’s indigenous peoples, with special emphasis on issues of environmental sustainability. Using lectures, seminar discussions and fieldwork, the course underscores the impact that economic and political factors have on the process of indigenous cultural adaptation.”
Program duration	appx. 1 semester	appx. 3 weeks	appx. 1.5 months	1 semester to 1 year	appx. 1 month	1 semester	appx. 1 month	appx. 1 month
Promotes cross-cultural education	strength	strength	strength	strength	absence	strength	strength	strength
Addresses the context-specificity of sustainability problems and potential solutions	absence	absence	strength	strength	strength	strength	strength	absence
Has a solution orientation	absence	absence	strength	strength	absence	absence	strength	absence
Adopts an interdisciplinary approach to sustainability problems and potential solutions	not clear	strength	strength	strength	strength	not clear	absence	absence
Teaches teamwork in cross-cultural settings	absence	absence	absence	strength	absence	absence	absence	absence

Academic Institution	University of California at Davis	University of Georgia	University of Minnesota	University of Minnesota	University of Minnesota	Virginia Polytechnic Institute and State University	Virginia Polytechnic Institute and State University	Virginia Polytechnic Institute and State University	Virginia Polytechnic Institute and State University
Program name	Sustainable Energy Technologies	Brazil Student Exchange Program in Forest, Wetland and Natural Resources	Watershed Management in Sustainable Development	Sustainable Food Chains	Sustainable Development	Brazil Project	Russia Project	China Project	South Africa Project
Program goals excerpt	“The program is designed so that students will learn cutting-edge energy technologies as well as the history, traditions and culture of Korea.”	“The program’s goal is to prepare you for a future in the natural resources, forestry, and agricultural sciences that is highly globally interconnected.”	“This course will examine watershed management and its role in sustainable development in the Ecuadorian Highlands.”	“Designed to introduce American students to the history, culture, political history, sociology, civilization and language of the country.”	“Students will learn the synergies and tension between economic, social and environmental impacts—positive and negative. The focus is developing a critical understanding of the principles of sustainability for business and society, as well as how organizations can maximize benefits associated with the demand for sustainable development”	“Balancing rapidly expanding global demand and consumption for Brazilian produced goods with increasing pressure on Brazil’s land base and resources ... Our goal in this GSI Brazil Project will be to explore some of these complexities and the solutions different organizations are developing to respond.”	“Our goal is to better understand how effective public-private partnerships can help address these challenges and successfully accomplish international environmental sustainability goals. In particular, we will examine the opportunities and constraints for improving infrastructure systems in Russia, especially related to land use, waste and water management in and around urban areas.”	“To better understand sustainability challenges facing the region, and to explore strategies being developed to address these challenges.”	“We will explore ... the urban-rural interface, managing for global environmental change, migration and health, green infrastructure and settlement planning, and biodiversity conservation in the only country that contains an entire floral kingdom. We will meet with government officials, academics, practitioners, and activists ... Participants will work as a team to produce a report and other products of value to local and international partners.”
Program duration	appx. 1 month	1 to 2 semesters	appx. 1 month	appx. 1 month	2 weeks	hybrid (2 months with two weeks travel)	hybrid (2 months with two weeks travel)	2 weeks	hybrid (2 months with two weeks travel)
Promotes cross-cultural education	strength	absence	absence	strength	strength	strength	strength	strength	strength
Addresses the context-specificity of sustainability problems and potential solutions	absence	absence	strength	absence	absence	strength	strength	strength	strength
Has a solution orientation	absence	absence	strength	absence	absence	strength	strength	strength	strength
Adopts an interdisciplinary approach to sustainability problems and potential solutions	absence	absence	absence	absence	not clear	strength	strength	strength	strength
Teaches teamwork in cross-cultural settings	absence	absence	absence	absence	absence	absence	absence	absence	absence

Table 2.
Duration of the reviewed international programs.

Program duration	1 - 2 semesters	1 - 2 months	1 - 3 weeks
Number of programs	4	7	3

Table 3.
Narrowing of the opportunity space for students in international sustainability education as more quality criteria are applied.

Number of programs evaluated	Number of programs promoting cross-cultural education	Number of programs promoting cross-cultural education AND addressing context specificity	Number of programs promoting cross-cultural education AND addressing context specificity AND having a solution orientation	Number of programs promoting cross-cultural education AND addressing context specificity AND having a solution orientation AND adopting an interdisciplinary approach	Number of programs promoting cross-cultural education AND addressing context specificity AND having a solution orientation AND adopting an interdisciplinary approach AND teaching cross-cultural teamwork
					
17	14	11	7	6	1

possibility of an educational pilot that would allow pursuing these recommendations. Of the institutions represented in this group, Arizona State University (ASU) and Leuphana University of Lüneburg (LUL) provided the best opportunity to conduct a pilot project. Both universities had recently begun a process of radical transformation that challenged traditional conceptions of research and education (Crow, 2010; Lang & Wiek, 2012), similar to other universities around the world (Ferrer-Balas et al., 2008); professional relationships (student exchange, co-teaching, joint supervision, etc.) already existed among faculty and students from both institutions; and both institutions were willing to facilitate and support a pilot in global education for continuation and expansion, beyond a one-off experiment.

A new group emerged from these initial discussions that was tasked to develop the Global Classroom as an integrated joint program between ASU and LUL for 12 credit hours (US) or 30 credit points (Germany) that would run over 3 semesters and initially involve three overlapping cohorts of 40 students each (20 from each institution). With this idea, the group successfully approached the Stiftung Mercator for funding. Through a series of virtual and in-person meetings involving faculty members, post-docs and teaching assistants from both institutions, we developed an integrated curriculum and a technology platform for start in January 2013.

Basic Features

The initial Global Classroom focuses on one topic—Sustainable Cities—and approaches it from a variety of perspectives, including sustainability studies, sociology, social geography, history, history and philosophy of science and medicine, environmental ethics, and economics. The background of the first cohort of students is equally diverse. Applying the principles of the curriculum reform manifesto as well as similar efforts in re-conceptualizing sustainability education (Wiek et al., 2011b), the Global Classroom is built on a hands-on, collabora-

tive research model that is inquiry-based, problem-driven, context-sensitive and solution-oriented. By combining interdisciplinary liberal arts approaches based on historical, epistemological, ethical and sociological analyses with a problem- and solution-oriented sustainability science research educational model, the Global Classroom uses virtual technologies to educate students on ways to engage and contextualize complex sustainability problems. The Global Classroom adopts methodology and computational tools developed in other educational projects to facilitate teaching and learning. These include the Embryo Project (<http://embryo.asu.edu>), which developed workflows and manuals for peer review, writing and publishing based on modular research projects; system thinking approaches to sustainability challenges; mapping methodologies inspired by urban sociology; walking methods developed in the fields of urban studies, photography, and sociology; and a Problem- and Project-Based Learning (PPBL) approach developed in the School of Sustainability at ASU (Wiek et al., 2013). The Global Classroom is built on the understanding that when we deal with problems in isolation, without recognition of broader context and cause, we fail to generate effective, lasting solutions. Our educational institutions have a long record of successfully training topical experts with narrowly constrained skill sets. The Global Classroom draws off of these critical basic knowledge foundations. But where current educational institutions seek only to better understand urban systems, the Global Classroom builds capacity for generating knowledge that sustainability change-makers—be they researchers, practitioners, or general citizens—can use to advance urban sustainability in addition to gaining a broader contextual understanding of these issues.

To equip students with the knowledge and tools they need to systematically engage urban sustainability challenges and drive toward positive change, the Global Classroom pairs an inquiry-based mode of researching and experiencing the city with a sustainability competency approach to education. Furthermore, the Global Classroom provides students with the skills to

analyze the historical, epistemological and ethical foundations of these problems. A competency framework provides a “converging set of key competencies that can guide the design of programs and courses in sustainability, teaching and learning evaluations” (Wiek et al., 2011a). The key competency framework proposes five domains of knowledge and skill as critical to sustainability science research and education: systems thinking, anticipatory thinking, normative thinking, strategic thinking, and interpersonal skills (ibid.). **Table 4** illustrates how learning outcomes of the Global Classroom map onto key competencies.

The Global Classroom is designed and taught by an international team of faculty and graduate students, drawing on diverse disciplinary backgrounds from sustainability to biology to philosophy to environmental ethics, promoting an interdisciplinary approach. The Global Classroom engages in the first cohort 22 ASU undergraduate students and 20 LUL undergraduate students of diverse disciplinary backgrounds from art, psychology, biology, sustainability, and others.

The students both in Germany and in the United States start with an open exploration of their cities. From the beginning, they work in international teams on collaborative projects that get refined over the course of the three semesters. The research projects include a focus on context-specific sustainability challenges, using problem- and project-based learning approaches (Steinemann & Asce, 2003; Thomas, 2009; Yasin & Rahman, 2011; Wiek et al., 2013) but also emphasize the various contextual factors needed to fully comprehend the issues. For example, in Phoenix, students have the opportunity to focus on water resource management, urban sprawl, or urban heat island; in Lüneburg, students have the opportunity to focus on sustainability-oriented business development, energy transitions,

and urban-rural development tensions. In both cases, students will also investigate the larger cultural context and historical constraints for all these issues. Student research teams are expected to investigate not just urban sustainability challenges, but also potential solutions, focusing on lessons to be learned from sustainability advancements in Phoenix, and Lüneburg, and around the world.

Active exploration of the cities is complemented by discussion and instruction in background knowledge on cities, sustainability, history, ethics, etc. To this end, online-material is provided for discussion in the joint transatlantic sessions enabled by the use of Vydio® technology. Other electronic teaching and communication platforms, such as social media and discussion forums, accompany in-class presentations and discussions. Funding from Stiftung Mercator allows for two exchange visits to the partner university by each cohort. During the first visit, students refine, defend, and plan their group research projects; during the second one they finish up and present their findings in an open event.

Modular Design

The Global Classroom curriculum on urban sustainability unfolds over three semesters spanning three core stages combining problem-based and solution-oriented sustainability approaches with perspectives from history and philosophy of science as well as ethics (**Figure 1**). Each student’s resident cities, Phoenix and Lüneburg, frame case studies for urban challenges.

Each of the six modules engage students through a suite of diverse content, context, and methodologies framed, augmented, and achieved through teamwork, stakeholder engagement, and

Table 4. Linking learning outcomes of the global classroom to sustainability key competencies.

<i>Systems thinking</i>	<i>Anticipatory thinking</i>	<i>Normative thinking</i>	<i>Strategic thinking</i>
Analyze complex feedbacks among cross-sector and cross-scale urban sustainability challenges, like land-use change and energy consumption, as well as path dependencies that constrain directions of development in society, as with transportation infrastructure.	Create and craft plausible sustainability visions (desirable future states), for example a vision of healthy and livable urban communities.	Evaluate implications of and trade-offs among different conceptions of the city, different motivations for development, and alternative visions of the future; assess how different worldviews shape the reality of a city.	Develop strategies to support change in different societal contexts, for example a strategy for initiating and maintaining urban agriculture.
<i>Interpersonal skills</i>			
Engage, motivate, collaborate with peers, decision-makers, stakeholders, and the public.			

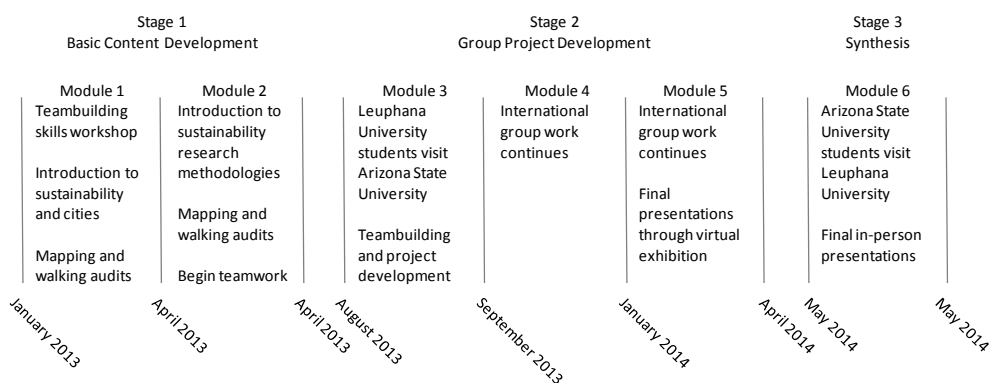


Figure 1. Working model for the stages and modules of the Global Classroom.

international collaboration.

Content

The content component of each module becomes the entry point for student engagement with sustainability problems. By building systemic understanding of urban sustainability challenges and pushing students to grapple with the potential outcomes of different societal trajectories and evaluate the implications of these trajectories, the content component empowers students with a nuanced, holistic appreciation for the complexity of the urban environment.

Students review the broad history of urban development; learn about current urbanization challenges related to population growth, social and demographic change, land-use land-cover change, water and energy systems, decision making, and infrastructure decay; encounter visions of sustainable cities and successful responses to urban challenges; and develop an understanding of how change happens in cities. When synthesized and framed in a problem-based and solution oriented context, the knowledge developed in the content section provides a foundation for place-based, student-driven research on solution development. In addition, students will also further explore the historical origins and ethical challenges behind all these sustainability solutions.

Context: The “Local” Case Study

Just as an individual brings his/her own experience to bear on an issue and uses his/her experience as a medium of exchange in dialogue with his/her peers, the context component, here urban sustainability issues in Phoenix and in Lüneburg, will be the medium of engagement and exchange for Global Classroom students. By challenging students to apply their competency-based approach to conceive of specific urban sustainability problems in Phoenix and in Lüneburg, the context component equips students with place-based issues on which to engage their international peers. By collaborating across cities as different as Phoenix and Lüneburg students cultivate an appreciation for the diversity of urban sustainability challenges and solutions. Through engaging specific place-based challenges and learning about different problems shared or unique to different cities and cultures around the world, students bring richer perspectives to problem conceptualization and solution-oriented research.

Research Methodology

Throughout each module, instructors cultivate an appreciation of exploring knowledge gaps. They discuss different types of knowledge generated by different types of research and how to apply different methods of knowledge generation when undertaking solution-oriented sustainability research. Furthermore, they will also convey to students how to critically evaluate, reflect and problematize these solutions and their constraints in light of historical, epistemological, and ethical considerations. Students obtain a broad methodological skill set to perform solution-oriented sustainability research. In addition to learning the importance of a dialectic approach to critical engagement, students are being introduced to problem analysis, sustainability visioning, and transition strategy development methods.

Teamwork

The complexity and diversity of sustainability challenges

calls for a collaborative approach to problem and solution research. Students in the Global Classroom tackle sustainability research challenges in international and interdisciplinary teams to prepare them for this reality. By supplementing knowledge cultivation with professional skills development, including project management, team document organization, meeting facilitation, conflict resolution, and virtual collaboration, the Global Classroom provides students with an experience base on which to draw for future professional work and research.

International Collaboration and Virtual Teamwork

The majority of sustainability challenges have global causes and implications. The Global Classroom experience is designed to address problems of this scope by having students study local problems and then engage with international peers to develop a richer understanding of how global problems manifest differently (and similarly) in other local contexts. The Global Classroom allows students to explore not just different cities, but also cultures. Students develop an appreciation for diverse values and perceptions influence sustainability challenges and solutions. By providing coaching support and virtual platforms for international communication, the Global Classroom builds student capacity for cross-cultural collaboration, a critical ingredient for interacting successfully in a globally interconnected world. The Global Classroom project pursues the goals of international education as a hybrid course that takes advantage of new media, technology, and learning theory. In addition, students gain first-hand experience with cutting-edge tools in video communication, online course environments, and online project presentation. Collaborative virtual group workspaces for participants and an online course environment that houses supporting course resources complete the Global Classroom learning environment.

Initial Experience with the Global Classroom

In light of our review of international sustainability education opportunities, we find the Global Classroom enriches the options available in the landscape of international sustainability education. Below, we discuss the ability of this model to deliver on quality criteria for international sustainability education; we present our plan for formative and summative assessments of student performance and program learning objectives; and we delve into the challenges (expected and experienced) of implementing the program, as well as strategies for coping with experienced challenges.

Continuous Assessment

To succeed in addressing sustainability challenges in a globalized world, students need to be capable of working across cultures, recognize cultural contexts, and draw upon a pool of internationally-applied ideas that can, when adapted, be transferred to different local contexts. The Global Classroom project provides various opportunities to acquire these capabilities through international education.

Global Classroom students work in international team on diverse place-based sustainability challenges in Phoenix and Lüneburg. As they shape their research, students are constantly challenged to combine the perspectives of international team members. In this way, students gain first-hand experience with cross-cultural teamwork and the different norms, perspectives,

and approaches of their peers. Additionally, students and instructors draw on diverse epistemological backgrounds to craft research questions—teams composed of students from the arts, psychology, biology, sustainability and other programs are being coached by instructors to tackle urban sustainability issues that do not recognize disciplinary boundaries. Student teams not only delve into sustainability problems, but are also encouraged to research potential solutions—drawing from German, US, and international expertise across disciplines. This includes recognizing, distilling, transferring, and adapting sustainability knowledge, problem-solving frameworks, concepts, and best practices to local settings.

For continuous improvement, we are instituting a range of formative assessments to help us evaluate student learning and course effectiveness. One of our approaches to evaluating effectiveness is through the sustainability key competencies framework (Wiek et al., 2011a). Adopting the competencies framework allows for a comprehensive set of proxies for many of the quality criteria of international sustainability education outlined above (Table 5). For example, practice in cross-cultural teamwork develops interpersonal skills; synthesizing interdisciplinary perspectives to tackle an urban sustainability problem builds capacity in systems think about complex webs of influence among, say, infrastructure and political power.

We are evaluating the development of student competencies through pre-, interim-, and post-assessments that will be coded, with standards of inter-rater reliability, at the conclusion of the first cohort. In addition, we conduct periodic student-student, student-instructor, and instructor-instructor reviews to allow for ongoing formative assessment of the structural aspects of the Global Classroom itself (e.g., effectiveness of virtual platforms, relevance of content, availability of instructor support, sources of conflict, course strengths and areas of improvement, etc.).

Challenges

At times, the vision of the Global Classroom runs up against the reality of university logistics, virtual collaboration, and other challenges. Below, we explore a few of these challenges we have encountered and coping strategies we have adopted as the program develops.

Time Zones and University Logistics

In conducting a three semester long collaboration, as opposed to shorter international courses as exhibited in many of the international sustainability education options, two logistical challenges arise. The first challenge occurs at the micro-level: the day-to-day issues of communicating with partners across an 8-hour time difference. Time zones present a two-fold challenge related to when classes can be held (either far earlier than normal for one institution or far later for another), and when faculty can find time to collaborate and plan for classroom and program activities. E-mail, video conferencing services, and the cloud-based software packages each present important tools for the Global Classroom to span the international dateline and communicate synchronously and asynchronously. As we discuss later, however, such technological solutions come with their own issues.

The second challenge occurs at the macro-level: the week-to-week, month-to-month, and semester-to-semester issues of teaching a course simultaneously at two universities with significantly different semester calendars. Semester start- and end-dates, and holiday schedules perforate Global Classroom calendars. But these challenges also offer opportunities as they enable us to take advantage of non-overlapping semesters to organize exchange visits to Phoenix and Lüneburg, respectively.

Table 5. Exemplary use of sustainability key competencies as indicators for meeting criteria of international sustainability education opportunities.

	Promote cross-cultural education	Address the context-specificity of sustainability problems and potential solutions	Have a solution orientation	Adopt an interdisciplinary approach to sustainability problems and potential solutions	Teach teamwork in cross-cultural settings
Systems thinking	Differences in urban decision-making contexts leading to different physical landscapes.	Recognition of how local factors contribute to diversity urban sustainability challenges and solutions.		Incorporation of diverse knowledge domains to urban sustainability research questions.	
Anticipatory thinking	Consideration of diverse perspectives to avoid conflict.	Consideration of context when analyzing urban problems or solutions.		Consideration of how different disciplinary approaches may or may not fully address research questions.	Consideration of diverse perspectives to avoid conflict.
Normative thinking	Consideration of diverse perspectives to avoid conflict.	Not privileging certain cultural contexts over others.	Consideration of winners and losers when researching potential sustainability solutions.	Not privileging certain ways of knowing over others.	Consideration of diverse strengths and supports perspectives to avoid conflict.
Strategic thinking	Leverage cultural diversity to research and test suite of potential sustainability solutions.	Leverage cultural diversity to research and test suite of potential sustainability solutions.	Appropriate, translate, and adapt knowledge of local contexts in problem-solving efforts.	Leverage disciplinary diversity to more fully address research questions or test sustainability solutions.	Cultivate dynamic that draws on teammate strengths and supports team and individual development.
Interpersonal skills	Navigation of local contexts and multi-cultural team dynamics.	Navigation of local contexts and multi-cultural team dynamics.	Navigation of local contexts and multi-cultural team dynamics.	Ability to bridge disciplines in team settings and in public communication.	Navigation of local contexts, cultural, and disciplinary perspectives.

Virtual Collaboration

Virtual collaboration is not a full substitute for in-person interactions, despite our best efforts. Indeed, hundreds of e-mails and dozens of hours of video chats could not compensate for several transatlantic visits that were necessary to plan and consolidate the syllabus and course organization. In general, planning challenges require a lot of good will, trust, flexibility, and understanding in order to come up with feasible and acceptable solutions, sometimes last minute. Therefore, we are still seeking and exploring additional strategies for successful virtual collaboration.

Beyond these more intangible issues of virtual collaboration are the invariable rules of using technologies in the classroom. If you need to use it, and your entire meeting revolves around the need of a technology to work correctly, it will fail sometimes (we have empirical evidence). Institutional technology support (technician), patient students, and good-humored instructors are instrumental in surmounting such technical hiccups.

Cross-Disciplinary and Cross-Cultural Collaboration

The Global Classroom seeks to equip students with tools and experiences on working in interdisciplinary, cross-cultural teams. The same applies to the instructors. We often experience first-hand the need for patience, broad perspectives, and flexibility when it comes to attempting to globalize the educational landscape. Different epistemological perspectives manifest in the approaches we take to planning Global Classroom activities. Tensions are often palpable between those with more process-driven, meticulous approaches vs. those with a more “creative” attitude, for instance, when developing proposals, work plans, and course material. These tensions, when not addressed, can lead to frustration and reluctance to fully engage in continuous deliberation and collaboration. If not addressed early, this could lead to resentment capable of undermining the entire Global Classroom effort. In response, we are learning to practice the very process checks we teach to our students about successful international collaboration; listen to colleague-perspectives, respect the work being done, question assumptions about differences in approaches, and communicate questions appropriately, and institute regular assessment of team interactions. So far we have been successful.

Conclusion

This article started out with quality criteria for international educational experiences to prepare students for confronting sustainability challenges crossing cultural, national, and geographical boundaries. With these criteria in hand, we reviewed student opportunities in international sustainability education. Our rough appraisal found that only one of seventeen programs reviewed fulfill all of the criteria. The Global Classroom Experiment was presented with its program inspiration, design, approach, and ability to deliver on the compiled criteria. Finally, we reviewed the challenges of designing a program that we find fulfills the quality criteria of international sustainability educational experiences.

The Global Classroom is but one program between two institutions supported by a generous external grant. While we find our model of international collaboration valuable, its scope is limited. True transformation of the landscape of international sustainability education will require more substantial change at

the level of academic institutions. Such changes would necessarily affect administration, faculty, and students in different, yet interconnected ways.

Administration needs to work closely to navigate the challenges of potentially incompatible semester and vacation schedules, as well as establishing incentive structures for faculty, post-docs, and research and teaching assistants to tackle these challenges. In addition, finding ways to leverage institutional resources for sufficient virtual collaboration and technological support, as well as intermittent travel funding, is essential. With institutional support, we can imagine generic global classroom teams securing outside funding of site visits, but only with the demonstrated institutional support for other facets of the classroom experience as we have experienced from Arizona State and Leuphana universities.

Faculty need to develop skills in international collaboration and project management. In addition, faculty with valuable disciplinary perspectives but relatively untrained in working on interdisciplinary teams needs to learn to navigate the tension of such worldview-challenging experiences. Although at first difficult, we expect the benefits of such work to far exceed the costs, opening up new streams for fruitful research, travel, and educational opportunities for faculty and students alike.

Students need to develop exceptional flexibility as Global Classroom-like programs come online. At a most basic level, the majority of the students may never have experienced challenges to their worldviews. In addition, those participating in the class must be prepared to manage heavy workloads that may fall at odd-times in their conventional semester as accommodations are made to pair university schedules. Students also need to be flexible regarding out-of-class working hours, as international peers may not be easily reached during conventional work times (e.g., the evening hours for one set of students may be the class hours for another). Where international travel is involved, faculty and administration need to coach students on how to secure outside funding (to ensure that all who are interested have access to these international experiences), as well as on proper travel etiquette.

All parties involved need to adopt to and integrate the promising practices of virtual educational technologies. From in-class video conferencing to out-of class times, emails, and workflows, all parties will likely need to cultivate patience and skill in navigating the online world. These forays into virtual spaces, however, allows universities to tap into the growing body of resources available to online education efforts. A fully global classroom can take advantage of “flipped classroom” models (Strayer, 2007) in which students are free to interact with lesson content outside of the class and instructors are free to use class time to engage students on the nuances of cross-cultural perspectives, collaboration and knowledge translational and adaptation. In addition, such a “flipped” model would also secure valuable and scarce time in which students know they will be able to work together on joint projects, using the paradigm of problem- and project-based learning (Steinmann & Asce, 2003; Wiek et al., 2013).

A critical step to internationalizing sustainability education is to establish the standards vital to ensuring quality student experiences. The Global Classroom can serve as a real-world laboratory for consolidating such standards and practices. Additional “meta research” along a clearly structured research design is required to evaluate, generalize, and transfer the insights gained. While more detailed studies need to be done, our

review demonstrates the distance to go in closing the gap between the knowledge, skills, and perspectives students need to, and the opportunities they have to hone these skills in international sustainability education. Future global classrooms will also need to press the envelope of cross-cultural fluency. Our Germany-US collaboration looks much different than, say, a US-China or Germany-South Africa collaboration might. Should our institutions choose to advance the ideas embodied by the Global Classroom model, multiple and diverse partnerships will be required to encourage broad-based cultural exchanges. The suite of institutions providing student opportunities in international sustainability education, universities, like Arizona State University, Leuphana University of Lüneburg, and those reviewed in this article, will play a critical role in providing students with the international learning opportunities they need to tackle sustainability problems in a globalized world.

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