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Sustainability: Teaching an Interdisciplinary Threshold Concept through Traditional Lecture and Active Learning

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Sustainability: Teaching an Interdisciplinary Threshold Concept through Traditional Lecture and Active Learning

Abstract
One of the difficulties in teaching global sustainability in the introductory political science classes is the different emphases placed on this concept and the absence of the consensus on where the overall balance between environmental protection, economic development, and social justice should reside. Like many fuzzy concepts with which students struggle, teaching sustainability lends itself to pedagogical examination within the scholarship of threshold concepts. This article investigates students' understanding of sustainability in the seven semesters when the concept of sustainability was introduced via role-playing simulation and compares it with the similar data from a more recent semester when simulation was supplemented with traditional lecture and classroom exercises. Ultimately, our research question is twofold: (1) How do students define a multi-faceted concept like global sustainability and (2) what is the better way to teach it – active learning only or active learning in combination with traditional instruction?

Certaines des difficultés rencontrées quand on enseigne la durabilité mondiale dans des cours de base de sciences politiques sont les divers accents mis sur ces concepts et l'absence de consensus sur la question de savoir où devrait se situer l'équilibre général entre la protection de l'environnement, le développement économique et la justice sociale. Tout comme c'est le cas avec de nombreux concepts flous qui donnent des difficultés aux étudiants, l'enseignement de la durabilité se prête à un examen pédagogique au sein de la recherche sur les concepts de seuil. Cet article se penche sur la manière dont les étudiants ont compris la durabilité pendant les sept semestres au cours desquels le concept de durabilité a été présenté par le biais de simulation de jeux de rôles et il la compare aux données semblables recueillies lors d'un semestre plus récent au cours duquel la simulation a été supplémentée par des cours magistraux traditionnels et des exercices de classe. En fin de compte, notre question de recherche est double : 1) Comment les étudiants définissent-ils un concept qui présente de nombreuses facettes tel que la durabilité mondiale, et 2) Quelle est la meilleure manière de l'enseigner - exclusivement par un apprentissage actif ou par le biais d'un apprentissage actif combiné à une instruction traditionnelle?

Keywords
active learning, mixed pedagogy, global sustainability, general education, threshold concepts, academic bottlenecks

Cover Page Footnote
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Research Puzzle

As the debate about the merits of lecturing in academia rages on in both media and university forums, the newer pedagogical techniques of active learning, collaborative classroom, flipping the classroom, and co-teaching with students are promoted as a more intellectually stimulating alternative to lecturing (Bonwell, n.d.; Broadwater, 2013; Conan, 2012; Eison, 2010; Hanford, 2011; "Is the Lecture Dead?" 2012; Udvari-Solner & Kluth, 2008). The implicit (or often explicit) assumption is that lecturing, the older, venerable form of instruction, is less effective in student retention of information, deeper understanding of concepts, excitement about and ownership of educational experience, and general intellectual development, especially when used alone, rather than as a part of a hybrid pedagogical approach. Perhaps nowhere is lecture presumed to be more antithetical to true learning as when we teach multi-faceted, fuzzy problems that demand novel solutions and deeper understanding. But is traditional instruction, the lecture, completely inappropriate in today's classroom full of multi-dimensional interdisciplinary concepts? Or does it still have a place, perhaps as a supplement to more engaging methods of instruction?

One of the authors of this paper has traditionally taught a concept of global sustainability, which is a complex, multidimensional, interdisciplinary, and controversial concept through the role playing simulation, a technique heralded in the pedagogical literature as a panacea to learning challenges (Bonwell, n.d.; Broadwater, 2013; Conan, 2012; Eison, 2010; Hanford, 2011; "Is the Lecture Dead?" 2012; Udvari-Solner & Kluth, 2008). Students taking a large introductory general education political science class were required to participate in the Global Summit, a course assignment where they were assigned specific roles as part of national delegations (6 people maximum, 36 national delegations maximum, ranging from 11 to 36 country delegations in various semesters the Summits took place). As part of the assignment, students wrote resolutions submitted to the fictional UN Summit on Global Sustainability from a position of their country; they were required to ultimately negotiate and reach consensus on the global solutions to this problem. Students not only submitted the national sustainability resolutions, but also reflected on their experiences after the Summit (in a 3 page reflection paper) and were asked to articulate their country's position on sustainability during the Summit itself through oral debriefing sessions.

The Summit and all related activities are a key part of the *Global Politics and Society* course, an introductory *International Relations* class that serves as both a general education offering and political science requirement on our campus. The class also satisfies elective requirements for several other programs, including global studies and democracy and justice studies. The majority of students enrolled in this course were not political science majors and the class might serve many of the students as an introduction to international problems, including the quest for global sustainability solutions. Global sustainability is not only one of the major international issues, but it is also a global issue with contested meaning. Mastering its understanding is an important learning outcome for both political science majors and the overall student population. Consequently, substantial time (about 3 weeks out of fourteen total weeks of instruction) is devoted to introducing students to the complexity of global sustainability. Exploring global sustainability comes at the end of the course after students are introduced not only to theories of international relations, but also to global economic issues, human rights, and environmental problems. In essence, global sustainability is a final, integrative concept to teach in the course, precisely because of its challenging nature.

A casual survey of three outputs (resolutions, debriefing notes, and reflection papers) procured during the first seven semesters the class was taught revealed some undeniable patterns. Students seemed to struggle to incorporate all three elements essential for sustainable solutions (environmental, social, and economic ones), opting instead to concentrate on solving environmental problems at the expense of thinking about sustainability in a more holistic fashion. However, traditionally, this concept was introduced through active learning techniques, without students having prior exposure to the material that they were expected to master. In this article, we investigate the differences between students learning the concept of sustainability in semesters with and without a pedagogical intervention. Ultimately, our two research questions are: (1) How do students define a multi-faceted concept like global sustainability?; and (2) What is the better way to teach the concept of global sustainability – active learning only or active learning in combination with traditional instruction? Prior to this investigation, our research proposal was submitted to and approved by the Institutional Review Board, a committee supervising all research involving human subjects.

This article is situated most directly within the literature on teaching concepts with inherent tension and contested meaning (e.g., citizenship, human rights, justice, etc.). Sustainability also approximates an interdisciplinary threshold concept, necessitating the unpacking of academic bottlenecks that prevent more effective student learning and intellectual progression. More importantly, this research adds a new dimension to the on-going debate on the merit of the lecture versus traditional instruction combined with more active learning teaching techniques.

Definitional Uncertainty and Inherent Difficulties in Conveying the Meaning of Sustainability in the Classroom

The difficulty of conveying and teaching sustainability is not accidental. From the very beginning of using this term, there were questions about "precisely what is sustainability, and, specifically, what does it mean for this particular sector, nation, or region" (Goodland, 1995, p. 1) that transcended academia. If environmental sustainability came to signify "life-supporting systems, includ[ing] atmosphere, water, and soil," social sustainability was usually defined as "poverty reduction," "redistribution and sharing," "population stability," and "community solidarity," while economic sustainability is by now commonly referred to as "efficiency of use of goods," "growth," and "equity of distribution" (Goodland, 1995, p. 2). The sub-definitions imply that the three dimensions of sustainability can be treated in isolation when, in actuality, there is considerable overlap among the three. In other words, "a truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity are integrally related to environmental limits imposed by supporting ecosystems" (Agyeman & Evans, 2004, p. 157).

Not only is there an inherent conflict between the three aspects of sustainability, there is also a tension between the global and national (and even local) levels of policy-making processes necessary to comprehensively address this issue. The three issues mentioned above must be framed in both the global terms of building "new, planetary-scale social, [environmental], and economic relationships" and "domestic terms of particular national governments' responsibilities to carry out actual policy proposals" (Miller, 2005, p. 403). But this geographic complexity tends to only compound already existing problems of effectively teaching the interdisciplinary nature of sustainability.

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One of the main struggles in teaching sustainability, therefore, is the different emphases placed on the concept and the absence of the consensus on where the overall balance between environmental protection, economic development, and social justice aspects of sustainability should reside. Rather than an inherently ambiguous outcome, sustainability, if defined properly, is "a paradigm for thinking about a future in which environmental, societal, and economic considerations are *balanced* in the pursuit of development and improved quality of life" (McKeown, 2002, p. 8). This balance, however, varies, depending on the context, and is often individual- or discipline-specific. In balancing economy, environment, and society (or people, planet, and profits, as sustainability is currently understood), how do we ensure that one of these aspects is not overlooked in our teaching, or, more importantly, in student understanding and learning of this concept?

This question is all the more pressing in the political context. In the era of mass skepticism about, if not outright resistance to, sustainability and stalled political momentum on both national and global levels, how do we prepare informed citizens, ready and willing to engage in social change in the absence of political will on the part of both elites and mass public, one of the aspirational goals of our education?

Relevant Pedagogical Literature

Like many other fuzzy concepts with which many students struggle, teaching global sustainability lends itself to pedagogical examination within the scholarship of threshold concepts and disciplinary bottlenecks (Fouberg, 2013; Mayer & Land, 2003; Morgan, 2012; Wimshurst, 2011), with one important caveat: that it is, of course, an interdisciplinary concept. This fact also contributes to challenges in instilling a complete and thorough understanding of this multidimensional concept among students. This strand of scholarship suggests that students will invariably be confounded when thinking about sustainability beyond the most simplistic and reductive approaches. Yet mastering threshold concepts is essential in student learning, due to the transformative (leading to a significant shift in student perceptions) and the integrative (exposing the previously hidden interrelatedness) nature of any such concept (Mayer & Land, 2003, pp. 3-4).

The problem with student comprehension of threshold concepts usually arises from their counterintuitive, alien, or incoherent nature (Mayer & Land, 2003). In the case of sustainability, the latter situation, in which individual elements are in themselves easily conveyed, but might be lacking one overarching organizing principle, might be at play.

Bottleneck problems (Middendorf, Pace, Shopkow, & Diaz, 2007) are related to threshold concepts and also bring to our attention significant barriers to student learning as a continuous *process* rather than a one-time mastering of particular concepts. Even though the bottleneck research so far concentrated on problems endemic to the discipline of history, it can be easily applied to other fields, including interdisciplinary training. In particular, the inability to link specific (environmental, economic, and social) details to a broader context might be one of the bottlenecks experienced by students learning about sustainability.

Indeed, previous studies already identified sustainability as a threshold concept and suggested active learning techniques to teach it. Video diaries, for instance, were found to be successful in fostering transformative, integrative, and irreversible knowledge of sustainability among participants in a British travel course to rural Uganda (Roberts, 2011). The teaching

modality that the instructor employs to introduce students to sustainability involves role-playing simulation, one of the most popular offerings in the active learning repertoire.

Extant research demonstrated that while lecture results in better achieving mastery of content, alternative teaching methods, including problem-based learning and simulations, create deeper understanding and retention of material (Bligh, 2000; Bok, 2006; Dods, 1997; Polich & Goodell, 2007a; Polich & Goodell, 2007b; Sutherland & Bonwell, 1996). The overwhelming consensus in the literature seems to be that lecture "is not highly effective to help students accomplish [complex] student learning outcomes" and that "in studies measuring information retention after a course, transfer of knowledge in new situations, problem solving, thinking, attitude change and motivation, active learning was always more effective than pure lecture as a teaching technique" (Center for Instructional Technology, n.d.; Hake, 1998). Other studies have indicated that active learning also fosters intrinsic motivation to learn, which can spur action far beyond the classroom (Benware & Deci, 1984). Even those studies which did not find significant differences between active and passive learning with regard to student performance still reported that students' perceptions of the active learning method were more positive, indicating that active learning rooted in peer interaction can at least improve student attitudes towards learning and reduce the burden of facilitation that normally falls upon the instructor (Haidet, Morgan, O'Malley, Moran, & Richards, 2004; Wingfield & Black, 2010).

Given the criticisms of lecturing and exultation of active learning techniques, especially in conveying complex, multi-dimensional, interdisciplinary bottleneck concepts and solving problems, the Global Summit on Sustainability would appear to be an ideal approach to take in a course about global politics and sustainability. But is it? Our article presents evidence on the most effective ways to utilize active learning techniques, like role-playing simulations, in teaching sustainability and suggests rehabilitation of lecture as an important element of instruction. Since simulations are an acknowledged signature pedagogy in political science (Bernstein, 2012), this investigation also contributes to discussions of disciplinary signature pedagogies' effectiveness (or ineffectiveness) in conveying complexities of social and political phenomena.

Research Design

To understand the most effective means of teaching and learning about one such complex problem, we looked at students' definitions of sustainability (as captured in resolutions, reflection papers, and debriefing notes) in the seven semesters when students were charged with writing a resolution on sustainable development for their country as part of their Summit participation (active learning only); we compared these definitions with the data collected post our intervention in which the lecture preceded the active learning. Our intervention was a lesson plan/lecture that explained the tension in and complexity of the meaning of sustainability and emphasized its three dimensions. Traditionally, students were given minimal formal instruction on sustainability beyond the textbook treatment of this problem, a short introduction of the three Es (economy, environment, and equity) framework to analyze it, and a couple of suggested (but not required) readings prior to the Summit. The last time the course was taught (Spring 2013), a new component was incorporated to test the hypothesis that students will perform better if given more deliberate explanations and examples of sustainability in the format of traditional lecture supplementing already existing active learning elements, than by engaging in active learning techniques alone.

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Specifically, after giving brief examples of how unbridled economic development, especially outsourcing, irrevocably changes natural landscapes, contributes to public health issues (that detract from overall development), and creates only short-term economic solutions both globally and locally, we described the theoretical tension inherent in the concept of sustainable development and then introduced students to the heuristic device of the sustainability triangle. Next, we applied the sustainability triangle to particular real world policy initiatives, ranging from the global, to the national and to the local. At the end of the lesson, we asked the national groups (each made up of 6 students) to think about the repertoire of possible sustainable solutions for their assigned countries by working with the heuristic device of the sustainability triangle. Table 1 provides a breakdown of these lecture elements, including the timeline for each element and our sources.

Table 1
Breakdown of Lecture Elements

Topic	Timeline (minutes)	Resource
Negative consequences of unbridled economic activity	10	Global (The Hour, 2007) and local (reintroduction of native plants on campus) examples
Theoretical tension in sustainable development	10	Beckerman, 2002; Hardin, 1968; Rolston, 1996
Introduction of heuristic device of sustainability triangle	5	Tilbury, 2008
Application of sustainability triangle to global, national, and local policy initiatives	15	Global: UN Sustainable Development Goals (Independent Research Forum on a Post-2015 Sustainable Development Agenda, 2013; United Nations Department of Economic and Social Affairs, 2012); National: Socially Sustainable Finland (Ministry of Social Affairs and Health of the Republic of Finland, 2010); Local: Sustainable Green Bay (Sustainable Green Bay, 2013)
In-class assignment asking national teams to determine sustainable solutions for their assigned countries using the triangle	30	
Conclusion of lecture	5	

Data and Methods

Qualitative and quantitative analyses of student reflections, reports, and other classroom documents are widely used to access if the hypothesized learning outcomes have been met (Creswell, 2013; Patton, 2002). Accordingly, through quantitative and qualitative content analysis of the three Summit-related outputs (resolutions, debriefing notes, and reflection papers), we were able to see dominant patterns of defining/thinking about sustainability in classes which were charged with creating resolutions and finding sustainable solutions on their own versus a class that would receive the specific sustainability lecture (see above) to better prepare students to apply the concept in the context of a role-playing simulation. We suspected that students would be better able to think about national and global sustainability if they study and apply the concept as part of a classroom exercise. But even if our intervention proved unsuccessful, the first part of our research question is significant in its own right. At the time when universities promote sustainability and include it as a major goal in their mission statements, we need a better understanding of where students stand on this issue and what might be barriers to their full comprehension of this complex problem.

Our actual data used to analyze pre-intervention definitions of sustainability consisted of (1) student reaction papers submitted during the seven semesters pre intervention (540 total) and one semester following the intervention (68 total); (2) debriefing notes from five semesters pre- and one post-intervention; and (3) national resolutions from the seven semesters prior (200 total) and one semester following the pedagogical intervention (12 total). The imbalance between the pre- and post-intervention data points to a potential limitation of this study, since the one semester during which we collected data for a hybrid pedagogical approach might just be an aberration. Theoretically, more data analyzing student outputs following our proposed intervention could potentially alter the results.

Previous studies of the balanced approach to sustainability education employed content analysis, looking specifically for students' references to environmental values, sensible use of nature, welfare and public health, democracy and political participation, equality and multiculturalism, global problems, and economic development and prosperity (Johannesson, Norddahl, Oskarsdottir, Palsdottir, & Petursdottir, 2011). These dimensions of the concept of sustainability were likewise used in our assessment of students' understanding and internalizing of sustainability as a balanced concept. Accordingly, when content-analyzing country resolutions, we looked at the following terms mentioned in the resolutions to codify particular documents as containing environmental, economic, or social aspects of sustainability (see Table 2).

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Table 2
Examples of Environmental, Economic, and Social Elements in Country Resolutions

Environmental	Economic	Social
Global climate change	Economic aid	Women's rights
Greenhouse gas reduction	Free trade	Children's rights
International environmental regulation	Free market	Indigenous people's rights
Local EPA	Global market	Global equality
Acid rain	Cap and trade	Religious freedom
Deforestation	Multinational corporations	Ethnic equality
Alternative/renewable/clean/green energy	Infrastructure development	LGBT rights
Biofuels	Rural development	Right/access to health care
Resource/energy conservation	Financial stability	Infectious diseases
Environmental rehabilitation	Technical assistance	Combating corruption
Water conservation	General economic development	Solving refuge crisis
Water management		Human trafficking
General pollution reduction		Access to clean water
Waste management		Food security
Biodiversity		Eradication of poverty
Endangered species		Sustainable population growth
Mining regulations		Educational cooperation
Coastal preservations		Literacy
		Internet access
		Access to education (including higher education)
		Environmental awareness

When analyzing individual student reflection papers, we looked for evidence that students understood and could intelligently discuss sustainability as a combination of economic, environmental, and social solutions. The environmental, economic, and social aspects of sustainability might manifest themselves in student papers in the form of the following textual indicators (see Table 3).

Table 3
Examples of Environmental, Economic, and Social Elements in Student Reaction Papers

Environmental	Economic	Social
Pollution	Job creation	Public health
Global climate change	Investment	Poverty reduction
Species extinction	Corporations	Human rights
Biodiversity	Economic development	Gender equality
Air and water purity	Industry	Protection of minority rights
Conservation	Agriculture	Community values
Natural resource management	Green jobs	Diversity
Environmental laws	Green GDP	Improved education
	Smart growth	Emphasis on social services
	Bottom-up development	Communal stewardship
	Prosperity	Absence of discrimination
		Cultural rights
		Religious freedom
		Citizenship

To capture international versus national levels of sustainability, we assessed the student usage of the textual indicators, including "global," "international," "universal," "conventions," and "treaties," as opposed to "national," "local," "regional," "particular," "country-specific," "laws," "policies," etc.

By looking for the overall balance of the use of these indicators in experimental (post-intervention) and control (pre-intervention) groups' reflection papers and resolutions (quantitative content analysis), we were able to better understand the exact extent of the

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difficulties students had in mastering the interdisciplinary concept of sustainability and flesh out the differences in pedagogy. Finally, debriefing notes contained edited summaries of student responses to the prompt "how did your country define and approach sustainability?" Qualitative in nature, this data was used to supplement results of quantitative content analysis of country resolutions and student reflection papers.

Resolution Analysis

This part of our data analysis relied on group output as a unit of analysis. Rather than looking at individual student understanding and mastering of the concept of sustainability prior to and after our intervention, we examined national resolutions, produced by 5-6 student teams, working as a country delegation. This, together with debriefing notes (also aggregated by country, rather than individuals), gave us the first approximation to the extent of the learning bottleneck (understanding the threshold interdisciplinary concept) we were trying to correct.

During the seven semesters prior to the Spring 2013 semester when the pedagogical intervention took place, students were consistent in favoring environmental aspects of sustainability in their resolutions at the expense of economic and especially social dimensions. The following table shows the percentage of resolutions for each semester that included economic, environmental, and social aspects of sustainability, as well as the percentage of resolutions for each semester that included all three aspects of sustainability (see Table 4).

Table 4
Results of Content Analysis of Country Resolutions

Semester	Economic	Environmental	Social	All Three Aspects
Pre-Intervention				
Fall 2008	93%	96%	79%	65%
Spring 2009	79%	76%	57%	38%
Fall 2009	50%	92%	67%	33%
Spring 2010	73%	97%	89%	65%
Fall 2010	97%	94%	81%	75%
Spring 2011	69%	100%	74%	63%
Spring 2012	90%	90%	100%	90%
Post- Intervention				
Spring 2013	100%	100%	89%	89%

Viewed from a slightly different perspective, students always grappled with the multidimensionality of sustainability as expressed in resolutions. The higher percentage of country delegations capable of more complex thinking about sustainability in later semesters might reflect better understanding of the problem on the part of the instructors and better prodding of students to think about all three dimensions. However, even with increased awareness of the bottleneck issue, the rate of success, traditionally, fluctuated between 33% and 65% of country delegations being successful in practicing sustainability as a complex, multidimensional interdisciplinary concept with the exception of one semester (Spring 2012),

when the class size was significantly smaller, the smallest in the entire sample, including the post-intervention semester.

We hypothesized that the number of students mastering the sustainability concept will increase following the pedagogical intervention. In fact, the number of resolutions that contained both economic and environmental clauses reached 100%, while 89% of national delegations acknowledged the important of equity issues. This suggests that the human rights dimension of sustainability still proved the most challenging for students to fully comprehend. While the post-intervention numbers moved in the expected direction and are definitely among the best ones we ever had, more can be done with educating students about social aspects of sustainability.

Analysis of Individual Reflection Papers

The different unit of analysis allowed us to not only understand the class trends, but also look for the gender differences in learning about sustainability. Gender did not appear to have a consistent impact on this particular learning, with both men and women defining sustainability in mostly environmental terms (with an exception of two semesters). Yet, individual level of analysis only further confirms that not all students were able to master sustainability as a multidimensional, interdisciplinary concept. Table 5 shows the percentage of reflection papers for each semester that discussed economic, environmental, and social aspects of sustainability and the gender breakdown for each, as well as the percentage of reflection papers that discussed sustainability as a global versus a national phenomenon.

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Table 5
Results of Content Analysis of Student Resolutions

	Economic (%)			Environmental (%)			Social (%)			Global (%)	National (%)
Semester	All Papers	Male	Female	All Papers	Male	Female	All Papers	Male	Female		
Pre-Intervention											
Fall 2008	72	85	59	59	60	55	46	50	41	93	49
Spring 2009	40	69	75	73	42	39	53	52	50	83	34
Fall 2009	46	61	43	66	64	67	54	39	51	85	62
Spring 2010	44	65	41	75	71	85	63	61	45	92	34
Fall 2010	48	59	41	71	74	70	56	53	53	91	40
Spring 2011	58	75	63	74	53	75	70	62	78	82	26
Spring 2012	56	62	48	63	66	62	80	83	76	91	35
Post-Intervention											
Spring 2013	43	44	42	73	73	73	57	49	69	81	39

Analysis of pre-intervention reflection papers reveals that students struggled with defining and discussing sustainability in all seven semesters we did not introduce the material prior to the active learning exercise. At best (during Spring 2010 semester), only 77% of students even mentioned it in the assignment, and at worst, half of the class failed to meaningfully address this concept (Spring 2009). The percent of students who were able to address all three elements of sustainability and see both national and global levels was considerably lower. In all but two semesters (Fall 2008 and Spring 2012), students felt more comfortable reducing sustainability to environmental dimensions (60-70% range on average) and seeing it as global phenomenon (82%-93% range). Gender differences were not as pronounced as we suspected with men and women about equally likely to discuss sustainability (average gender differences in this category were 2-3%). Both men and women were more likely to concentrate on environmental issues while thinking about sustainability.

Upon completion of this assignment in May 2013, following the pedagogical intervention, we observed a marked improvement in hypothesized direction, with 85% of students explicitly mentioning sustainability, our highest percentage to date. Students even specifically referenced parts of our lesson plan and credited it with helping them understand the "holistic nature" of sustainability, exemplified in the following excerpt from a student reflection paper:

> Prior to the Summit, I had a vague idea of what sustainability was. The class period where we were shown the video with the questions for sustainability helped me to understand the concept more clearly. Sustainability focuses not only on the environment, but also social conditions, equity, as well as the economy. In creating our resolution, our team had to consider all those different factors, and develop one holistic solution. It was enlightening to do this, because it showed how each part of the sustainability triangle was linked to the others.

Students of both genders were able to master this concept equally well (the rate of success was identical – 85% for both men and women in class). Yet, despite our best efforts, both male and female students still felt more comfortable with environmental aspects of sustainability (73% of all reflection papers). And sustainability was again defined mostly as a global phenomenon (81% of papers), a finding consistent with the pre-intervention semesters.

Analysis of Debriefing Notes

Our final data come in the form of transcribed verbal responses by select members of country delegations about their countries' understanding of sustainability during the Summit itself. Unlike previous sections, here we rely on debriefing notes from five, not seven semesters of running the Summits. We report the most commonly mentioned themes that emerged after all debriefing notes were collected. Like the previous types of data, debriefing notes confirm our hypothesis that students are more likely to see sustainability as a one-dimensional, mostly environmental, concept.

In Fall 2009, the most common answer about the meaning of sustainability predictably centered around "ensuring a healthy *global environment*" by pursuing one of the following: "reducing green-house gasses and emissions," "using bio-fuels and renewable energy," "controlling emissions," and "protecting water resources and ensuring clean water supplies." The

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second most common answer included discussions of social dimensions, including "equality and support amongst nations," "giving all countries a voice," "promoting human rights," and "education and fighting poverty." Clearly, economic dimensions were totally ignored.

In the Spring 2010 semester, we again observed that students struggled to answer the question about the meaning of sustainability. The majority of definitions of global sustainability dealt with the environment and highlighted various environmental problems and solutions. In particular, "water quality," "air quality," "deforestation," and "energy sources" were common issues that the interviewed students singled out. The economic and social themes were articulated much less frequently and much less strongly. Just a few students contended that sustainability meant economic stability and, surprisingly, independence. The social dimension was mentioned even less frequently, defined mostly as "human rights issues," most notably "prevention of human trafficking."

In the Fall 2010 semester, once again an environmental theme predominated in student answers, with respondents raising the following issues in particular: "greenhouse gases," "reduction of carbon emissions," "access to water," "renewable energy sources," "water shortages," "clean air," and "conservation of resources." Social dimensions were second in prominence ("diversity," "education," "access to health care," "AIDS epidemic," "reduction of poverty," "human rights," especially "prevention of human trafficking") with economic concerns a distant third ("technology," "prosperity").

Consistent with other semesters, in Spring 2011, students again privileged environmental aspects of sustainability, discussing "water sanitation," "air quality," "reduction of emissions," "nuclear energy," "alternative energy," "reduction of pollution," and "clean energies." Economic issues were second in popularity that semester, visible in discussions of "trade," "water-based commerce," "diversification of economy," "fiscal responsibility," and "sustainable food industry." Social issues, in contrast to previous semesters, were not at all popular with just four countries even mentioning "human rights."

Finally, in the Spring 2012 Summit, the environment was predictably once again the most dominant theme, highlighted by students' use of such familiar terms as "clean water," "solar power," "clean energy sources," "water preservation," "forest conservation," and "carbon emissions reduction." Economic and social concerns were of secondary (but equal) importance with students commenting on "human rights" and "job creation" in particular. Interestingly, three country representatives were able to articulate the vision of sustainability as a balance between all three elements of sustainability and give concrete examples of such comprehensive solutions (US, Germany, and Indonesia country delegations).

Our most convincing proof that the combination of traditional instruction and active learning exercise works best in helping students understand the complexity of sustainability comes from debriefing notes in the semester in which the pedagogical intervention took place. Out of twelve representatives, nine (or 75%) were able to incorporate all three Es of sustainability in their on-the-spot discussions. The other three delegations were still capable to at least recognize two dimensions of our concept (two delegates mentioned a combination of environmental and social aspects and one mentioned environmental and economic ones). Among environmental textual indicators, "deforestation," "air pollution," "adherence to Kyoto Protocol," "quality of air," "clean water," "soil degradation," "renewable energy," and "waste management" were used the most often, while "trade," "exports and imports," "education of labor force," "green jobs," "moving away from mining," and "green technologies" again denoted economic aspects of sustainability. Indicators like "equitable human rights," "women rights,"

"indigenous people's rights," "closing the gap between rural and urban areas, between poor and wealthy," "equity," "equitable distribution of resources," "better medical care," and "better education for all" signaled social dimensions of sustainability.

Despite occasional success in teasing out a comprehensive, balanced vision of sustainability in semesters utilizing only active learning exercise, we observed patterns consistent with our hypothesized findings in all three types of assignments. Many, although not all, students charged with finding sustainability solutions through participating in the active learning exercise failed to master this interdisciplinary, multidimensional threshold concept. The rate of success improves however when the active learning teaching modality is supplemented with traditional instruction.

Conclusions

As expected, without proper explanation of global sustainability's complexities and tensions, students tried to reduce its meaning to mostly environmental themes, with social aspects of sustainability making some inroads into student thinking. Regardless of the type of analyzed data, students overwhelmingly came from the general education class thinking about sustainability not as a multidimensional concept, but as, at best, a bi-dimensional one, with environmental and social aspects predominating. Our findings confirm that sustainability is indeed a threshold concept that requires unpacking existing bottlenecks to facilitate effective student learning and deliberate pedagogical strategies to correct some of the identified barriers.

Our students are hardly unique in their struggles with understanding sustainability as a combination of environmental, economic, and social concerns and solutions. Indeed, we might have tapped into a larger societal problem. While the academic community made an intellectual transition from reducing sustainability to pure environmentalism to a more complex understanding, the general public and even policy makers continue to lag behind. Tellingly, a 2006 survey of sustainability offices in medium and large size US cities revealed that "there is little evidence that cities are connecting sustainability to equity and social justice issues," choosing to be "ecologically sensitive" and "economically sound" but not necessarily "socially just" (Saha & Paterson, 2008, p. 21 and p. 28).

Originally, our solution to this problem on a university campus was to engage students in the role-playing simulations of real global decision-making on sustainability. As it turned out, active learning, exemplified by the Global Summit, if unaccompanied by substantive instruction, has its limitations, even if it encourages students to be creative, think outside the box, and develop other important skills and competencies (Levintova, Johnson, Scheberle, & Vonck, 2011). However, with a simple adjustment in which a more traditional lecture instruction is included alongside the active learning process, the Summit can serve as a useful tool for mastering a threshold concept with resonance and implications beyond college campuses.

In essence, even introductory general education classes can be good incubators of social change. By meaningfully engaging students in real world situations and giving them the appropriate academic skills and tools, we ultimately help universities achieve their goals beyond mere declarations on websites. Even more importantly, we might contribute to a political paradigm shift beyond the academe. The final point is all the more important, since "citizens' political attitudes are linked with their governments' sustainability activities" (Saha, 2009 as cited in Wang, Hawkins, Lebredo, & Berman, 2012, p. 844).

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Yet, our analysis reveals continuing limitations of ever more deliberate and multi-modal teaching of global sustainability. While the combination of lecture and active learning instruction did increase the rate of mastery of this concept, its holistic nature still eludes some students, who continue to assign different weights to the three Es of sustainability, with environmental issues being clearly the weightiest. Our findings suggest that the sustainability pyramid as conceived by students is not a perfect equidistant triangle; rather, environmental perspectives predominate. This might be a generational effect of concentrating on environmental problems and solutions at the expense of human rights and economic issues as practiced in contemporary American secondary education and popular culture broadly defined. Or it might just be human nature that compels students to rectify a certain cognitive dissonance and reduce complexity to simple, clear-cut definitions. These obstacles nonetheless should not deter educators from trying to teach sustainability. Even the passing knowledge of its complexity acquired in one general education political science class can serve as a foundation in subsequent upper-division classes on environmental politics and policy, where the balance between the three Es might finally be restored for all students.

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