

A multidisciplinary team-teaching approach to sustainable business education

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ABSTRACT

Sustainability has been identified as one of the most pressing challenges for business and society. However, research shows that sustainability topics are still not given sufficient attention in higher education, particularly in the undergraduate business curriculum. This paper offers a template for an interdisciplinary, team-taught undergraduate sustainability course for a holistic understanding of sustainability issues in management education.

Keywords: sustainability, social aspects of business education, team-teaching, interdisciplinary teaching, undergraduate pedagogy

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INTRODUCTION

Sustainable development, or “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987), has been recognized as one of the greatest challenges facing businesses, governments, and communities. Yet, sustainability issues still remain an uncharted territory in higher education. Benn and Dunphy (2009) note that business schools lag behind corporations and government entities in their interest in sustainability issues. This is a concern considering that sustainable development is imperative for future business leaders.

While the recent debate within the academic community as to how sustainability issues should be incorporated into the curriculum in business schools has sparked a stampede to offer degree programs and courses centered on sustainability topics at the graduate level (Banerjee, 2004; Springett, 2005; Thomas, 2005), a similar effort in undergraduate education is lacking to a great extent. Further, the lack of consensus as to what a sustainability curriculum should entail (Christensen et al. 2007) might be problematic for a comprehensive and systematic sustainability education in the long run. As research points out, sustainable development is indeed a complex, multisystem issue (Bradbury, 2003; Starik & Rands, 1995) with social, economic, and political implications (Gladwin et al. 1995) that requires the collaboration of multiple stakeholders (Roome, 1998). Yet, the dominance of disciplinary (Blewitt 2004) that structures most educational institutions appears to present a challenge to teaching sustainability in a holistic manner. Benn and Dunphy (2009, 277), for example, note the “observed resistance in business schools to the interdisciplinary and systems-based underpinnings of sustainability” (Roome, 2005; Springett & Kearins, 2001). The authors further state that despite the multidisciplinary nature of the topic, “in practice these areas of study are marginalized from the core curriculum (Mah, Hunting, & Tilbury, 2006), seen as specialized areas of study and as unrelated to the core or real interests of business.”

Research suggests that a multidisciplinary approach to sustainability education is lacking, particularly in the undergraduate business curriculum. As such, this paper seeks to address this gap by offering business faculty a template of a multidisciplinary and team-taught undergraduate course on sustainability. More specifically, this paper describes a seminar, Sustainability of Business, designed as part of the Betty F. Elliott Initiative for Academic Excellence,¹ which was launched in early 2010 by the College of Business at the University of Michigan-Dearborn as a campus-wide exploration of critical business issues. Given the multifaceted nature of the topic, it seemed that a team-teaching approach would be most appropriate for a holistic exploration of sustainability issues. As a result, four College of Business (hereon COB) faculty initiated a committee and reached out to four other faculty from the Colleges of Engineering and Arts, Sciences, and Letters to form an interdisciplinary team that would design and deliver the seminar. The rest of this paper describes the eight course modules, each offering a different disciplinary perspective of sustainability, as well as course development procedures including the organization of the course content, development of the learning objectives, and enrollment.

COURSE DEVELOPMENT

The topic of sustainability was recognized by COB faculty as one of the most critical and timely issues facing businesses. A sustainable society can be visualized as economically vibrant,

¹ The authors wish to thank the Elliott family for the generous support making this paper possible.

environmentally sound, and socially just, now and into the future. Businesses realize that tougher regulations, increasing operational costs, and higher customer expectations are driving them to adopt sustainable business practices. As such, the aim of the Sustainability in Business seminar was to foster an in-depth exploration of sustainable business practices to engage and prepare both future business and thought leaders on sustainability topics. The seminar sought to offer an integrated curriculum that works in a multidisciplinary approach across various fields and perspectives. The underlying philosophy was that a sustainable business system is complex and needs to be evaluated from a systems perspective at the intersection of socio-environmental-technological-business-economic problems as depicted in Figure 1. The faculty felt that unless one looks at the problem from all these dimensions in an integrated fashion, sustainability issues would not be comprehensively understood. See Figure 1 (Appendix).

In order to foster such a holistic view of sustainability and support the seminar, related efforts were organized throughout the year to deepen the campus' and community's understanding of how the practice of sustainability impacts businesses. These efforts included funded scholarly research by faculty and doctoral students, a student-led sustainability week, and a public lecture series.

Initially, four faculty from the COB, due to personal interest in the subject matter, were recruited to design and teach the course. One of the four was selected as the Project Coordinator. Because this course was intended to offer a multidisciplinary perspective on sustainability, four faculty from outside the College, namely, from biology, engineering, social entrepreneurship, and architecture were recruited to join the COB team. The eight faculty met over eleven months to plan the course and develop curriculum. The key issues discussed in the meetings included developing a mutual perspective on sustainability as it pertains to business, course prerequisites, scheduling of the class, course description, learning objectives, exam and project design, order of modules, grading issues, homework assignments, and online Blackboard course content development. In addition, a website was developed to promote the Elliott Initiative and this course.

ENROLLMENT

The course was advertised to students through the Advising and Student Services office. Additionally, interest in sustainability was promoted through the website dedicated to the Elliot Initiative and a panel discussion held in the semester before the course was offered. The panel, "Sustainability in Manufacturing," explored how manufacturing companies are adapting to the impact of various dimensions of sustainability in the product-life-cycle and the supply chain while remaining competitive and maintaining operational excellence. Also, a student-led 'sustainability week' was held the semester before the course was offered to stimulate student interest in the topic. This week included a multitude of activities and speakers including presentations on sustainable campus purchasing, local farming, and green products.

An effort was made to enroll students from a variety of majors in the COB. Because the requirements of most of the majors allow for very few elective courses, the faculty team sought approval from COB faculty to allow the course to count toward required credit for the majors. As a result of these efforts, nineteen students enrolled in the course.

ORGANIZATION OF COURSE CONTENT

The course content was organized into eight learning modules. The learning modules covered were environmental economic systems, socio economic systems, socio-business perspectives, marketing perspectives, supply chain management systems, technology and energy systems, management information systems, and financial perspectives. Each module was delivered in one or two three-hour sessions.

On the first day of class, the seminar faculty team delivered a brief presentation to introduce each module to the students. Beginning with this first class, faculty made explicit the relationships among the course modules to engage the students in an inter-disciplinary learning experience. These relationships were also highlighted in the organization of the syllabus. The most apparent aspect of sustainability, namely, environmental economics was delivered first, followed by socio-economic, socio-business, marketing, supply chain, technology and energy, finance, and green IT aspects of sustainability such that the students could build up knowledge of the topic.

To instill sustainability awareness in students, an electronic course pack was provided through an online course site developed using Blackboard. This site contained the syllabus, the course project, readings and class notes for each module. Students were also asked to upload their project drafts for faculty review and were provided feedback through Blackboard. The majority of the course communication was carried out through the Blackboard course site.

LEARNING OBJECTIVES

The course was organized around eight learning objectives with the goal of capturing an objective per module. The course objectives include applying and understanding : 1) environmental economics; 2) the importance of socio-economic systems and triple bottom-line; 3) the role of corporations' business performance on society; 4) sustainability as it relates to marketing strategies and consumer perception of firms' sustainable marketing initiatives; 5) the management of efficient supply chains to meet targeted levels of sustainability; 6) modes of energy production and their effectiveness in sustainable energy generation; 7) the effect of sustainable computing on organizational outcomes; and 8) the role of sustainability in achieving the objectives of a firm and the impact of sustainability on the valuation and financial performance of a firm.

TERM PROJECT

In addition to lectures, one of the centerpieces of learning for the course was a team project. The goal of the project was to evaluate and benchmark sustainability performance of an organization with industry standards. Student teams also proposed recommendations for sustainability improvement. The firms for the project were identified by a member of the faculty team with strong industry contacts.

A brief outline of the six projects offered by five industry partners who participated in the initiative is as follows: 1) Comerica Bank – Reviewing sustainability in the banking and financial services sector and how this bank is incorporating sustainability in its day-to-day operations; 2) Dow Chemical Company – Reviewing interdependence among various economic issues of sustainability at the company's business operations; 3) Dow Chemical Company –

Understanding the application of sustainability principles to transparency and public accessibility issues in the marketing function; 4) Ford Motor Company – Reviewing how the company is dealing with sustainability issues in its corporate business model; 5) Nichols, Inc. – Investigating how this distributor of consumer goods has embraced sustainability principles by integrating it in its corporate business philosophy; 6) Smith Group – Reviewing how this architectural firm is incorporating sustainability in offering architectural and interior design services to its clientele.

In order to oversee the term-projects effectively, two faculty were assigned to each project team. Students worked closely with the assigned faculty and designated company representatives to carry out interviews with company executives, an extensive review of the companies' sustainability reports, and a literature review. Students produced a paper and a presentation based on their analysis. The assigned faculty graded that student team's work. Each paper was also assessed by the entire teaching team and final project grades were assigned based on consensus of the faculty team.

Students presented the projects during a special event attended by the Dean, faculty, and industry partners. The event was intended to celebrate the conclusion of the seminar and facilitate networking through a dinner served before the presentations.

EXAMS AND GRADING

In addition to the term project, students took two exams. Each exam covered four modules. The green IT module was planned to be on the final exam but was cancelled due to faculty illness. The faculty responsible for each module wrote essay and multiple-choice questions for the covered material. The grading of the exams was carried out by the faculty responsible for each module. The project coordinator later compiled the grades. Final compilation of the course grade was determined during a meeting attended by all faculty teaching the course.

COURSE MODULES

A description of the eight course modules follows. Resources for each module are listed in Appendix A.

Environmental Economic Systems

The module on Environmental Economic Systems examines how the understanding of sustainability is key to balancing environmental trends (e.g., population increase) with the needs of the human society (e.g., access to safe food and water) and the global economy. This module included two lectures along with in-class discussions of two assigned readings of prominent research articles (Hardin, 1968; Vorosmarty et al., 2010) that have helped to shape the study of environmental economics.

At the beginning of the module, the method of scientific inquiry was used to answer the question "What is sustainability?" After a lengthy discussion of the different interpretations of what sustainability represents, the traditional triple-bottom line definition of sustainability was reviewed. At this point, the distinction was drawn between the disciplines of ecological economics, a field of environmental study by ecologists, and environmental economics, a field of environmental study led by economists. Two major issues studied in environmental economics

were then identified: 1) the use of natural resources, such as oil, minerals, and forests by human activities; and 2) the reduction or minimization of pollution caused by such actions. Students read “The Tragedy of the Commons” (Hardin, 1968), which was a seminal article that argued that treating the environment as a commons, or publicly owned resource, inexorably resulted in over-exploitation and degradation of the earth’s natural resources, since individual benefit from resource-use exceeds an individual’s share of the resulting loss of the resource.

In order to avoid such non-sustainable use of resources, the argument was made that humans must first identify and quantify the direct costs and indirect costs (ie. externalities) versus the benefits associated with any natural resource consumption. Students debated who should pay for externalities. While most agreed that society in general must bear some of these costs, students unanimously felt that the producers (corporations) were obliged to bear the majority. However, before assigning the burden of costs, a major challenge of any cost-benefit analysis is determining what natural resources are actually worth.

To illustrate cost-benefit analysis, two case studies of human resource use were discussed. The first case study about the collapse of the Polynesian society of Easter Island was used to demonstrate a real-world example of the potentially catastrophic consequences of non-sustainable human use of resources. The case shows that when the Polynesians deforested the island through overharvesting of its trees, their economy, along with societal norms collapsed. The indigenous people had to resort to warfare with other tribes for food and even cannibalism to survive. The second case study, an examination of the transition from traditional, non-sustainable forestry practices to sustainable forest use, was used to show that sustainability is a reachable goal, even for a large-scale commercial enterprise.

By the end of this module, students realized that sustainability must address societal and economic needs while recognizing environmental limitations and realities. Further, students realized that the environment has existed without humans in the past, and could exist in a future world devoid of humans, unless humans properly value and take actions to conserve it.

Socio-Economic Systems

This module exposed students to the social and environmental consequences of economic development (i.e., industrialization and urbanization). The primary learning objective for this module was to make students aware of how and why sustainability is anchored in the triple bottom-line concepts of economic growth, social program, and environmental stewardship. As such, the module was organized around these three concepts.

The class discussion started with the role of economic growth in social prosperity and development. Standard topics traditionally covered in business schools such as the role of technological innovations in economic growth, efficiency in the utilization of resources, market uncertainty, and the objective of maximizing return on shareholder investment were acknowledged. This module emphasized the importance of a firm’s social and environmental responsibilities in addition to the traditional profit-maximization goal. Social responsibilities included the creation of a diverse work force, allowing collective bargaining through unionization, and respecting the rights of all stakeholders. The need for firms to take the lead in promoting civic duties that promote a clean environment formed the basis of the lecture on the concept of environmental stewardship. The need for biodiversity and emission reduction in business operations was emphasized.

Practical steps for helping companies adopt sustainability related practices to offer green products and services to consumers were demonstrated. These techniques were directly utilized by student-led teams in the industry related term projects for this course. Class discussions were amplified with readings and examples of sustainable firms across a wide spectrum of industries such as chemicals, industrial cleaning products, landscaping, and architecture.

Socio-Business Perspectives

This module aimed to provide an overview of a socio-business system and to help students understand how a business can make a social impact in its community while making a profit. The module was organized around two teaching objectives: understanding the basic tenants of social entrepreneurship and assessing an enterprise's impact on stakeholders, the community, and the environment.

Prior to class, students were asked to write and submit online their definition of social entrepreneurship in 300 words. The class session started with a discussion of the definition of social entrepreneurship. Students were engaged and provided a variety of responses. The class then transitioned to a lecture on the theory of social entrepreneurship and students watched two videos, one on the company Get Fresh Detroit (www.getfreshdetroit.com) and the other on Embrace (www.embraceglobal.org).

After the videos, the class began another lecture and discussion on Dr. Ted London's Impact Assessment Framework, a tool used to assess an enterprise's overall impacts on stakeholders, the community, and the environment. Students then applied this framework to the Get Fresh Detroit business plan.

The last half of the class was devoted to analyzing the case study, "Ecotact: Bringing Sanitation to the Base of the Pyramid?" The students were placed into their project teams to apply the lecture from the first half of the class to Ecotact, a company that develops and manufactures public toilets and showers to address the growing environmental sanitation issues in Africa. Student teams were challenged to assess Ecotact's impacts and to make a decision of whether or not to invest in the organization as a social enterprise. The class wrapped up with student teams presenting their analyses and positions to the rest of the class.

Marketing Perspectives

The marketing module focused on the strategic use of three of the marketing mix elements (i.e., product, promotion, and price). The fourth P, place, was covered in the Supply Chain Management Systems module. A latent goal of the module was to offer students a consumer-oriented perspective of sustainability. The underlying idea was that sustainability issues concern all; students can contribute toward the solution by minimizing their carbon footprint and making more informed consumption choices. Secondly, students (as future businesspeople) were asked to take on a consumer viewpoint to evaluate certain green products (e.g., Ford Think, a discontinued electric car) to understand that meeting consumer expectations is vital for the success of sustainable products. The reading assignments were accordingly chosen to reflect both the producers' and consumers' views on sustainability.

The module was delivered over two lectures. The first lecture emphasized how marketers can help develop sustainable solutions by using the 4P's, while the second lecture involved a presentation on challenges of marketing sustainable technologies by a local inventor and

entrepreneur, founder of NRG Dynamix. The guest lecture was centered on NRG Dynamix's latest invention Hydraulic Hybrid Power Train and how the company marketed this technology to various manufacturers and the U. S. Army. Students appreciated the opportunity to meet with an entrepreneur and hear his experiences firsthand.

More specifically, the first lecture included discussion of concepts such as planned obsolescence, upcycling, cradle-to-cradle design, and collaborative consumption. Students were provided several examples of sustainable solutions applied in the industry. For instance, the cradle-to-cradle (C2C) design concept was stressed with examples from Herman Miller chairs manufactured according to C2C principles. A video of Terracycle, a student start-up specializing in upcycling was shown. The video was supplemented with information from the Terracycle case. Examples of services and collaborative consumption included several popular networking websites focused on borrowing and renting (see Appendix A).

Different types of promotional claims were discussed to address how marketers can educate consumers about the environmental benefits of their products. This discussion drew from the promotional tactics introduced in *Sustainable Marketing* (1999). Examples from industry (e. g. , Xerox's cartridge recycling program and resin-based, non-toxic inks, Starbucks's Shared Planet program, and Seventh Generation's iPhone apps) were provided to illustrate how companies employ various promotional claims to educate their customers about the environmental benefits of their offerings. Also discussed were different promotional appeals and their effectiveness. While discussing the emotional appeals, students watched a provocative campaign by 10:10UK, an environmentalist group advocating carbon emission reductions. The students discussed if the threatening messages used in the campaign would convince consumers to reduce their carbon footprint. Next, the students worked on a group exercise based on a reading assignment. Students were asked to match the promotional appeals discussed with different consumer segments identified in the MIT Sloan article (Ginsberg & Bloom, 2004).

Students also discussed how the price element of the marketing mix might factor in consumers' adoption of sustainable products. Most students expressed that sustainable products are more expensive than comparable offerings and consumers are discouraged by the higher price tag. Next, students elaborated on why non-sustainable offerings were affordable and many attributed low cost of production to unethical business practices (e. g. , sweatshop labor), pollution inducing manufacturing practices, or toxic ingredients. Most students agreed that it would be necessary to educate the consumer on the 'true costs' of products by exposing the poor manufacturing practices of non-sustainable businesses. The module introduced two sustainable pricing tactics: life pricing and take-back pricing. Energy Star appliances and Home Depot's Eco Options were discussed as examples of life pricing. The section on pricing centered on the Price chapter of the *Sustainable Marketing* (1999) book.

Supply Chain Management Systems

This module centered on supply chain sustainability issues (i.e., rationale, forms, design, performance metrics, and adoption). First, students were introduced to the functioning of a traditional supply chain design based on a cradle-to-grave philosophy, in which primary activities were planning, sourcing, making, and delivering. Next, they were introduced to a sustainable supply chain model, which includes reuse/remake/recycle activities. A significant portion of discussion was devoted to evaluating this paradigm change in supply chain thinking.

More specifically, three sustainability issues were discussed at length: (1) closing the loop: cradle-to-cradle, (2) environment friendly or green, and (3) re-manufacturing.

Clearly, the importance of sustainability issues is reflected in recognizing their influence and impact very early in the design stage of the product-life-cycle. The influence of demand and supply of natural resource drivers such as steel, aluminum, copper, oil and other minerals by emerging countries, namely India, China and Brazil; global environmental rules and regulations adopted by international conventions and treaties among various nations and regions of the world; end-of-life (ELV) vehicle directives for Original Equipment Manufacturers (OEMs) in the automotive industry; waste electrical and electronic equipment (WEEE) directives in the electronic industry; and restrictions on the use of certain hazardous substances directive (RoHS) were among many topics discussed. Considerations in designing reverse logistics involving remanufacturing, reuse, recycling and repair issues subject to ecological, legislative and economics constraints encountered by businesses were debated. Examples of green supply chains in automotive, medical, and healthcare industries were introduced.

The format of this module was lecture utilizing PowerPoint presentations, assigned readings from published literature, and examples compiled by the instructor from published case studies in trade and academic journals. In addition to students' knowledge on core concepts their abilities to relate sustainability issues in supply chains for products and/or services that they have encountered as a consumer were assessed.

Technology and Energy Systems

The Technology and Energy Systems module offered technical background related to sustainability. It introduced students to key modes of energy production and discussed their effectiveness with regard to sustainable energy generation. The class discussion honed in on basic concepts and global trends related to sustainable energy generation and consumption. Topics covered included climate change, resource limitations, modes of sustainable energy production, and the comparative sustainability of different modes of energy. The lectures were organized around two main topics: (1) energy production and consumption projections and (2) the rationale for sustainable energy.

Students were briefly introduced to the laws of thermodynamics and energy efficiency. The limitations these laws impose on energy generation efficiency were also discussed. Next, the class elaborated on examples of energy transfer. Finally, the efficiency of devices for energy generation and transfer were provided with examples.

The discussion in this section was on usage, availability, and effects of energy. Global trends and projections related to energy production and consumption from 1970 to 2020 were shared. This was broken down into per capita energy consumption growth. Environmental effects of fossil energy on global climate change were highlighted, and it was surmised that the current energy generation model based on fossil fuels is not sustainable. Students debated alternative, sustainable forms of energy and discussed the business value of each. Nuclear fission and fusion, hydropower, biomass, geothermal, wind, and solar were among the forms of sustainable energy discussed. For each of these alternatives, the source, advantages, disadvantages, estimated costs, risks, and environmental impacts were analyzed.

The module was presented in lecture format using a PowerPoint presentation. Students were tested on concepts such as sources of energy, units of power, methods for conversion of energy, energy efficiency, and renewable methods of energy production.

Management Information Systems

The management information systems module was designed as part of the course but was not delivered during the term because of instructor illness. The plans for the module are, therefore, discussed here. The concept of green IT was introduced through a discussion of a mini-case on the impact to the environment of Google searches. Two articles with very different analyses of the impact (Research Reveals, 2009; Holzle, 2009) were read in class. Students discussed the articles in small groups and were asked to consider the implications of the energy-intensive nature of data centers for business managers. Students were also asked to assess the likelihood that people would abstain from Google searches if they took the environmental effects into account and to consider the implications of this for business organizations and society.

The analysis of the Google search case was followed by a short lecture on the goals of Green IT. This discussion focused on the twin objectives of maximizing energy efficiency during the acquisition and operations of IT assets and disposing of used computing equipment in an environmentally sound fashion. Students were asked to consider these goals in the context of current approaches to computing with a focus on cloud computing and applications that are familiar to students from a variety of backgrounds such as Facebook and YouTube. Students were asked to consider the storage intensive nature of these and other business applications in a discussion of the Green IT implications of these approaches to computing.

Four approaches to Green IT were then discussed: (1) increasing the product lifecycle, (2) optimizing use of hardware, (3) reducing power consumption, and (4) recycling. During the discussion of product lifecycles students read and discussed an article on the lifecycle of cell phones (Mitchell, 2010). During a small group discussion session students addressed questions about the relatively short lifecycle of cell phones and the willingness of users to keep their smart phones for a longer period of time in order to reduce the environmental impact of these devices. Students read an article on Yahoo's green data center (Niccolai, 2010) during the discussion of optimizing the use of hardware. This article was used to introduce the concept of PUE (Power Usage Effectiveness), a measure of the energy efficiency of data centers. An article on recycling e-waste in developing countries ("E-Waste, 2010) was used to facilitate a small group discussion on recycling computing equipment.

Financial Perspectives

The Financial Perspectives module took the approach of evaluating the practice of sustainability as a business decision in light of value maximization objective of firms. This module was composed of two parts: conceptual/philosophical foundation of financial perspectives on the business of sustainability and analysis of greenhouse gas (GHG) as a sustainability issue.

The first lecture focused on the Enlightened Long-Term Firm Value Maximization Objective (Jensen, 2001), which accounts for stakeholders' interests including the practice of sustainability. The findings of two surveys on European and North American chief finance officers' perspectives on environmental sustainability were reviewed. Students learned from the surveys that consumers and the community (public reputation) are key drivers to practicing sustainability and that business decisions are made in the context of the objective of enlightened value maximization. Students were also introduced to the Iceberg Balance Sheet framework that could help address the challenges faced by practitioners in measuring the non-financial

performance of sustainability. To emphasize this fundamental topic, empirical studies that found positive impacts of practicing sustainability on the valuation and stock returns of U. S. companies were also discussed.

The second lecture focused on the analysis of GHG emission. First, students learned about the background of this global (environmental) sustainability issue. Then, two major approaches to manage this problem were discussed: (1) tax incentives and penalties and (2) the Cap and Trade mechanism in the context of governmental regulations in a global setting. In regards to tax incentives and penalties, the highlights of the various tax policies adopted in the U. S. in the last decade that intended to mitigate the GHG problem were reviewed. The Cap and Trade mechanism was examined in detail by studying the experiences of participating countries in the Kyoto Protocol, the non-U.S. global collaborative efforts to manage GHG, and the introduction of The American Clean Energy and Security Act (ACESA; Waxman-Markey Act) of 2009. Also closely examined were the three components of the Cap and Trade mechanism, namely, carbon trading and the carbon derivatives market, carbon allowance/credit, and carbon offset. The module concluded with a numerical exercise on the evaluation of a project that involves carbon emission, and the various approaches to managing the related GHG emission problem.

STUDENT SURVEY RESULTS

A survey was conducted of students taking the class at the end of the semester. Students were asked to rate their experience on a variety of dimensions and provide comments about the course. Results of the student ratings of the course are presented in Tables 1 and 2 (Appendix). The items in Table 1 measured students' knowledge about sustainability before and after taking the course. Students responded to four questions on a scale of 1 to 7, where 1 indicates 'a little' and 7 indicates 'a lot'. The mean response for each item is shown in the table.

The results show that students knew little about sustainability before taking the course and their knowledge of sustainability issues increased as a result of the course. Students found the course project helpful in improving their understanding of sustainability as it pertains to business situations.

The items in Table 2 measured student attitudes about the team-teaching approach and the seminar. Students were asked to respond on a scale of 1 to 7, where 1 indicates 'strongly disagree' and 7 indicates 'strongly agree'. The mean response for each item is shown in the table. Although the students expressed some reservations about the team-taught nature of the course, they were somewhat positive about recommending the course to a friend.

Students were also asked six open-ended questions designed to elicit feedback the strengths and weaknesses of the course, ways to improve the course, the team-teaching approach, and the effect of the course on their attitudes and behaviors related to sustainability.

Strengths of the Course

The first open-ended question "In your opinion, what were the strengths of the course?" generated interesting comments from the students about the multidisciplinary nature of the course, the quality of the lectures, and the relationships with companies fostered through the course project. Some of the comments about the multidisciplinary nature of the course are presented below:

*Multidisciplinary approach was interesting.
The varied disciplines added a lot to the course.
The different perspectives by the many professors. That gave us a diverse experience. Dynamic learning.
I really enjoyed getting different points of view on sustainability.*

Some of the comments about the lectures are presented below:
*The passion of most of the lectures.
Most lectures were very interesting.
Every professor had thorough knowledge of their topics.
Much information covered and well organized lectures.*

Some of the comments about relationships with companies fostered through the term project are presented below:

*Having a company contacted and setup for the project.
Setting up the companies for group project & setting up contact.*

Weaknesses of the Course

Another open-ended question, “In your opinion, what were the weaknesses of the course?” yielded comments about the broad scope of the topics covered and the need for more clarification regarding exams and the term project. Students also perceived that the coordination among the faculty teaching the course could be improved. Some of the comments about the variety of the topics are presented below:

*It was great to hear the different focuses, but having so many professors and so many subjects unfortunately only allows us to skim the surface of the issue, and doesn't hardwire the idea of sustainability as much as it should.
One weakness was that we had a lot of info to process.*

Some of the comments regarding the need for clarification on exams and term project include:

*Exams & format were very vague on what to expect.
Some areas were left vague & more info would have helped in those areas.
Direction on project was vague.*

Some of the comments regarding coordination among the faculty include:

*A little unorganized
The incohesive nature.
Course was somewhat disorganized.*

Ways to Improve the Course

Students were also asked to respond to the question: “How could the course be improved?” Students felt that the project requirements and information on exam material should be more specific. They also noted that the course could cover fewer diverse topics with more depth of coverage. Lastly, they favored fewer reading assignments.

Some of the comments regarding clarifications on exams and project included:

Define the report much better.

Define exams better

More direction.

Student comments on the diversity of topics are presented below:

Less [sic] professors (more classes) and more in depth lecture topics.

Try to be less general with the topic, either by covering less [sic] topics, or using less introduction.

Less [sic] professors.

The Team-Teaching Approach

Another item on the survey asked students to respond to the following question: “This course was team-taught by eight professors. Please comment on the team-teaching approach used in the course.” Feedback about the team-teaching approach was mixed. Some students had favorable perceptions of this approach, while others noted problems. A few students were sensitive to both the strengths and weaknesses of this approach.

Students commented favorably on the knowledgeable professors and the interesting material. Some of the comments about the strengths of the team-teaching approach are presented below:

Liked how knowledgeable each professor was on each topic.

I liked it a lot. It made the course more interesting.

It was great to hear the experience of each professor.

Gave a dynamic learning environment.

All great professors and very knowledgeable. They were all a pleasure to be with.

I enjoyed the different points of view.

Some students noted issues with organization and coordination of elements of the course. Some of the comments on the weaknesses of the team-teaching approach are presented below:

The team-teaching felt less like a team and more like visiting professors that have no clue what is covered in other modules.

Disliked it overall, it was somewhat disorganized.

A few students were sensitive to both the weaknesses and the strengths of the team-teaching approach.

It was well organized for a first try at something the COB has never done before.

Would like less [sic] professors and a more detailed expectation of each of their requirements.

Difficult to switch between thoughts on exams. Prof's in this class were pretty impressive.

Effect on Student Attitudes

The survey also asked students to answer the following question: “In what ways has this course affected your attitudes about sustainability?” Overall, students indicated that their awareness of sustainability improved as shown in the comments below:

I have really grown to appreciate the value of sustainability and how it affects our daily lives.

Better understanding, appreciation and awareness.

It broadened my view & increased my passion towards it.

It has opened my eyes to the possibility of using it in my future career.

Some students expressed increased awareness about their role in contributing to a sustainable environment.

It has opened my eyes and from a consumer perspective. I am beginning to evaluate companies.

I recognize opportunities to contribute as well as the market for it.

Effect on Student Behavior

Lastly, students were asked: “In what ways has this course affected your behavior with respect to sustainability?” The students reported favorably on this question, expressing that increased awareness about sustainability issues improved their motivation either to seek employment in organizations that prioritize sustainability or to change their consumption behavior. Student comments are presented below:

It's encouraged me to seek employment with a company that makes sustainability a priority.

In the finance world, there are few people who consider the money that can be saved through considering sustainable options – I can now know about those before going in to any corporation. Thank you!

I plan on trying to be sustainable in all aspects of my daily life in an effort to make a difference in the world.

I am starting more green efforts in my own home.

CONCLUSION

The faculty felt that teaching this course was a professionally and personally enriching experience. While it was at first a challenge to work with colleagues from other disciplines, teaching this course proved to be a learning experience for all involved. Most importantly, it was gratifying to find through the survey that the faculty were able to make a difference, however small that might be. The authors encourage others to seek opportunities to work with interdisciplinary colleagues on similar initiatives.

REFERENCES

- Banerjee, S. B. (2004). Teaching sustainability: A critical perspective. In C. Galea (Ed.), *Teaching business sustainability* (34-47). Sheffield, UK : Greenleaf.
- Benn, S. , & Dunphy, D. (2009). Action research as an approach to integrating sustainability into MBA programs: An exploratory study. *Journal of Management Education*, 33(3), 276-295.
- Blewitt, J. & Cullingford, C. (2002). *The sustainability curriculum: The challenge for higher education*. Wiltshire: Cromwell Press.
- Bradbury, H. (2003). Sustaining inner and outer worlds: A whole-systems approach to developing sustainable business practices in management. *Journal of Management Education*, 27(2), 172-187.
- Christensen, L. , Jones, E. P. , Hartman, L. P. , Hoffman, W. H. , & Carrier, J. (2007). Ethics, CSR, and sustainability education in the *Financial Times* top 50 global business schools: Baseline data and future research directions. *Journal of Business Ethics*, 73(4), 347-368.
- E-Waste: Crude recycling methods used in developing countries contaminate air, water and soil, researchers say. (September 20, 2010). www.sciencedaily.com/releases/2010/03/100322073534.htm, accessed August 16, 2011.
- Fuller, D. A. (1999), *Sustainable Marketing*. Thousand Oaks, CA: Sage Publications, 1-43.
- Ginsberg, J. M. & Bloom, P. N. (2004). Choosing the right green marketing strategy. *MIT Sloan Management Review*, 46, 79-84.
- Gladwin, T. N. , Krause, T. -S. , Kennelly, J. J. (1995). Beyond eco-efficiency: Towards socially sustainable business. *Sustainable Development*, 3, 35-43.
- Hardin, G. (1968). The tragedy of the commons. *Science*, 162, 1243-1248.
- Holzle, U. (January 11, 2009). Powering a Google search. The Official Google Blog. googleblog.blogspot.com/2009/01/powering-google-search.html, accessed August 16, 2011.
- Jensen, M. (2001). Value maximization, stakeholder theory, and the corporate objective function. *Journal of Applied Corporate Finance*, 14(3), 8-21.
- Mah, J. , Hunting, S. A. , & Tilbury, D. (2006). Education about and for sustainability in Australian business schools: Business schools project-stage 2. A report prepared by the Australian Research Institute in Education for Sustainability for the Australian Government Department of the Environment and Heritage, Canberra. Summary retrieved October 20, 2011, from www.aries.mq.edu.au/publications_2006.htm.
- Mitchell, R. L. (November 18, 2010). Smart phone, dumb contracts. Computerworld Blogs. blogs.computerworld.com/17382/smart_phones, accessed August 16, 2011.
- Niccolai, J. (September 20, 2010). Yahoo opens 'chicken coop' green data center. Computerworld. www.cio.com.au/article/361397/yahoo_opens_chicken_coop_green_data_center/, accessed August 16, 2011.
- Research reveals environmental impact of Google search. (January 12, 2009). www.foxnews.com/story/0,2933,479127,00.html, accessed August 16, 2011.
- Roome, N. (ed.). (1998). *Sustainable strategies for industries*. Washington, DC: Island.
- Roome, N. (2005). Teaching sustainability in a global MBA: Insights from the OneMBA. *Business Strategy and the Environment*, 14, 160-171.
- Springett, D. (2005). Education for sustainability in the business studies curriculum: A call for a critical agenda. *Business Strategy and Environment*, 14, 146-159.

- Springett, D. , & Kearins, K. (2001). Gaining legitimacy? Sustainable development in business school curricula. *Sustainable Development*, 9, 213-221.
- Starik, M. , & Rands, G. (1995). Weaving an integrated web: Multilevel and multisystem perspectives of ecologically sustainable organizations. *Academy of Management Review*, 20(4), 908-935.
- Thomas, T. (2005). Are business students buying it? A theoretical framework for measuring attitudes toward the legitimacy of environmental sustainability. *Business Strategy and Environment*, 14, 186-197.
- Vorosmarty, C. J. , McIntyre, P. B. , Gessner, M. O. , Dudgeon, D. , Pruseivch, A. , Green, P. , Glidden, S. , Bunn, S. E. , Sullivan, C. A. , Reidy Liermann, C. , & Davies, P. M. (2010). Global threats to human water security and river biodiversity. *Nature*, 467, 555-561.
- World Commission on Environment and Development. (1987). *Our common future*. Oxford: UK: Oxford University Press.

APPENDIX A

Recommended Resources for Course Modules

Environmental Economic Systems

- Hardin, G. (1968). The tragedy of the commons. *Science*, 162, 1243-1248.
- Roberts, L. (2011). 9 Billion?. *Science*, 333, 540-544.
- United States Census Bureau. U. S. & World Population Clocks. <http://www.census.gov/main/www/popclock.html>.
- Vorosmarty, C. J. , McIntyre, P. B. , Gessner, M. O. , Dudgeon, D. , Pruseivch, A. , Green, P. , Glidden, S. , Bunn, S. E. , Sullivan, C. A. , Reidy Liermann, C. , & Davies, P. M. (2010). Global threats to human water security and river biodiversity. *Nature*, 467, 555-561.

Socio-Economic Perspectives

- DiPiazza Jr. , S. A. , Kreutzer, I. , Mack, M. , & Zaidi, M. (2010). Vision 2050: A new agenda for business. World Business Council for Sustainable Development, Executive Summary, 1- 6, 37-62.
- Downs, A. (2004). *Still stuck in traffic: Coping with peak-hour traffic congestion*. Washington, D. C. : The Brookings Institute.

Socio-Business Perspectives

- London, T. (2009). Making better investments at the base of the pyramid. *Harvard Business Review*, 87(5), 106+.
- Martin, R. & Osberg, S. (2007). Social entrepreneurship: The case for definition. *Stanford Social Innovation Review*, 5(2), 28-39.
- Trelstad, B. (April 2009). *The nature and type of social investors*. Acumen Fund.

Websites

- Acumenfund.org
Caseatduke.org
Nextbillion.net
Socialedge.org

Marketing Perspectives

Ferdig, M. A. (2007). Sustainability leadership: Co-creating a sustainable future. *Journal of Change Management*, 7, 25-35.

Fuller, D. A. (1999). *Sustainable marketing*. Thousand Oaks, CA: Sage Publications, 1-43.

Ginsberg, J. M. & Bloom, P. N. (2004). Choosing the right green marketing strategy. *MIT Sloan Management Review*, 46, 79-84.

Videos

10:10UK campaign ([www. publicradio. org](http://www.publicradio.org))

Story of stuff ([www. storyofstuff. com/](http://www.storyofstuff.com/))

Terracycle The Beginning Part 1 [www. youtube. com/watch?v=UvWNIH_4gRg&feature=related](http://www.youtube.com/watch?v=UvWNIH_4gRg&feature=related)

Terracycle The Beginning Part 2 [www. youtube. com/watch?v=VU-yUdgNkoQ&feature=related](http://www.youtube.com/watch?v=VU-yUdgNkoQ&feature=related)

The One Story ([http://www. youtube. com/user/1difference#p/u/1/oCzXZLiEmd0](http://www.youtube.com/user/1difference#p/u/1/oCzXZLiEmd0))

Websites

B1g1. com; wearfigs. com; toms. com – one for one business model

groups. neighborrow. com/ - collaborative consumption

[www. footprintnetwork. org/en/index. php/GFN/page/calculators/](http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/) - personal footprint calculator

[www. relayride. com](http://www.relayride.com) - carsharing

[www. snapgoods. com/](http://www.snapgoods.com/) - renting/borrowing

[www. terracycle. net](http://www.terracecycle.net) - upcycle

[www6. homedepot. com/ecoptions/index. html?](http://www6.homedepot.com/ecoptions/index.html?) –shows life time savings of sustainable products

Supply Chain Management Systems

Lee, H. L. (October 2010). Don't tweak your supply chain--Rethink it end to end. *Harvard Business Review*, 88(10), 62-69.

Nidumolu, R. , Prahalad, C. K. , & Ranganaswami, M. R. (September 2009). Why sustainability is now the key driver of innovation. *Harvard Business Review*, 87(9), 56-64.

Rossi, M. , Charon, S. , Wing, G. , & Ewell, J. (2006). Design for the next generation: Incorporating cradle-to-cradle design into Herman Miller products. *Journal of Industrial Ecology*, 10(4), 193-210.

Technology and Energy Systems

Kreith, F. , & Goswami, D. Y. (2007). *Handbook of energy efficiency and renewable energy*. New York: CRC Press.

Management Information Systems

Baroudi, C. , Hill, J. , Reinhold, A. , & Senxian, J. (2009). *Green IT for dummies*. Hoboken, NJ: Wiley Publishing, Inc.

E-Waste: Crude recycling methods used in developing countries contaminate air, water and soil, researchers say. (September 20, 2010). [www. sciencedaily. com/releases/2010/03/100322073534. htm](http://www.sciencedaily.com/releases/2010/03/100322073534.htm) , accessed August 16, 2011.

- Holzle, U. (January 11, 2009). Powering a Google search. *The Official Google Blog*. googleblog.blogspot.com/2009/01/powering-google-search.html, accessed August 16, 2011.
- Lamb, J. (2009). *The greening of IT: How companies can make a difference for the environment*. Upper Saddle River, NJ: IBM Press.
- Mitchell, R. L. (November 18, 2010). Smart phone, dumb contracts. *Computerworld Blogs*. blogs.computerworld.com/17382/smart_phones, accessed August 16, 2011.
- Molla, A. , Pittayachawan, S. , & Corbitt, B. (2009). Green IT diffusion: An international comparison. *Green IT Working Paper Series, Paper No. 1*. <http://greenit.bf.rmit.edu.au/index.php/working-papers.html>.
- Molla, A. , Deng, H. , & Corbitt, B. (2010). IT for green: A framework for assessing the capability of the IT industry. *Green IT Working Paper Series, Paper 5/2010*. greenit.bf.rmit.edu.au/index.php/working-papers.html.
- Niccolai, J. (September 20, 2010). Yahoo opens 'chicken coop' green data center. *Computerworld*. www.cio.com.au/article/361397/yahoo_opens_chicken_coop_green_data_center/, accessed August 16, 2011.
- Research reveals environmental impact of Google search. (January 12, 2009). www.foxnews.com/story/0,2933,479127,00.html , accessed August 16, 2011.
- Sorensen, S. (2010). *The sustainable network: The accidental answer for a troubled planet*. Cambridge: O'Reilly Media, Inc.

Financial Perspectives

- Dereall, J. , Guenster, N. , Bauer, R. , & Koedijk, K. (2005). The eco-efficiency premium puzzle. *Financial Analysts Journal*, 61(2), 51-63.
- Is finance going green?. (2007). CFO Perspectives on Climate Change and Environmental Sustainability. *CFO Research Services and ABN-AMRO*. www.cfo.com/whitepapers/index.cfm/download/10716223.
- Jensen, M. (2001). Value maximization, stakeholder theory, and the corporate objective function. *Journal of Applied Corporate Finance*, 14(3), 8-21.
- Lo, S. & Sheu, H. (2007). Is corporate sustainability a value-increasing strategy for business?. *Corporate Governance*, 15(2), 345-358.
- The role of finance in environmental sustainability efforts. (2008). *CFO Research Services and Jones Lang LaSalle*. www.cfo.com/whitepapers/index.cfm/download/13010943.

Websites

cfo.com
motherjones.com/
secure.cfo.com/whitepapers/index.cfm/download/11878243
www.ftse.com/Indices/FTSE_Environmental_Markets_Index_Series/index.jsp
www.justmeans.com/
www.msci.com/products/esg
www.sustainability-index.com
www.unpri.org/

FIGURE 1
Sustainable business systems

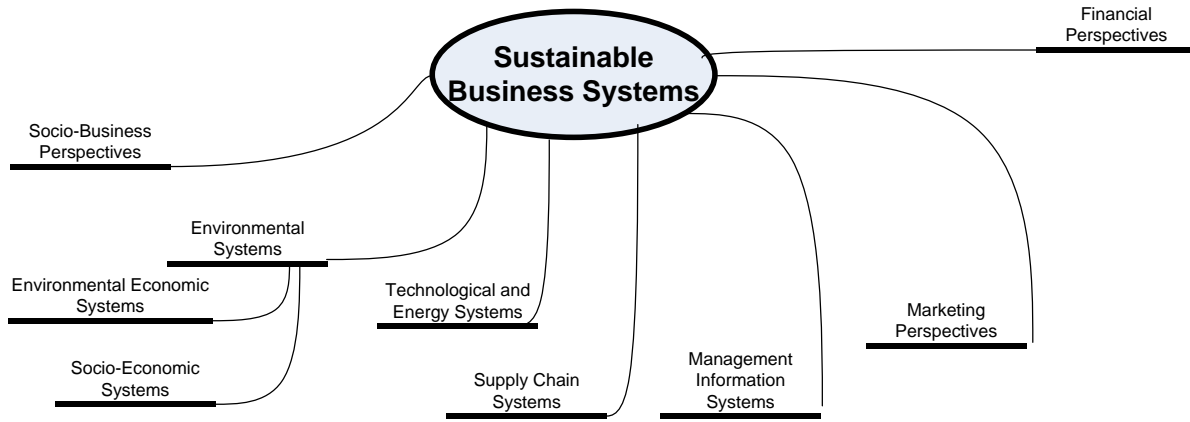


TABLE 1
Student Ratings of the Course

Survey Item	Mean Response
How much did you know about the business of sustainability before taking this course?	2.29
How much do you know about the business of sustainability after taking this course?	5.82
How much would you say your knowledge of sustainability improved as a result of taking this course?	6.06
How helpful was the course project in improving your understanding of the business of sustainability?	5.71

TABLE 2
Student Recommendations of the Course

Survey Item	Mean Response
I would recommend this course to a friend.	4.82
I would consider taking another team-taught course on a different topic.	4.06