

Sustainability Education at the Community College:
Implications for Policy and Practice

by

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ABSTRACT

Sustainability is a relatively new topic that has transcended traditional disciplinary boundaries. Since faculty members have been trained in traditional disciplines, developing curriculum for and teaching sustainability presents both a great opportunity and a challenge. In order to embrace sustainability education and develop and implement new curriculum, faculty members have to expend a large amount of effort and time. Moreover, faculty members require support and help of professional development programs. All these issues and problems demonstrate a need for this research study.

The purpose of this study was to analyze the processes and procedures used by a small sample of faculty members of Greenville Community College District (GCCD) to integrate sustainability into the curriculum and classroom. The diffusion of innovation was identified as the conceptual framework, and qualitative case study methodology was used. The findings revealed three major themes why faculty members were interested in sustainability education: love of nature, inherent nature of their discipline, and commitment to issues of equity. The findings revealed that sustainability is taught using pedagogical tools such as experiential learning, problem-based learning, inquiry-based learning, and a heavy focus on research. As lesson plans were developed, appropriate assessment tools were created.

The participants interviewed identified several barriers for teaching interdisciplinary courses, among which time constraints and increase in workload emerged as common themes. The study found that strategies for helping mainstream faculty members embrace sustainability education were time, rewards, recognition, support and encouragement, motivation of students, and creating a network of early adopters as mentors.

DEDICATION

I am dedicating this dissertation to my entire family.

I am dedicating this dissertation first and foremost to my husband, Professor B.L. Ramakrishna; you have always believed in me, pushed me and encouraged me to reach for the goal of completing my doctoral degree. You are the reason I exist and you are the love of my life; I would not have accomplished this degree without you.

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Chapter 1

Introduction

We stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny. We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace. Towards this end, it is imperative that we, the peoples of Earth, declare our responsibility to one another, to the greater community of life, and to future generations (United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2000).

Many critical challenges and issues are facing our society today, such as climate change, high cost and lack of energy sources, declining economy, and natural and man-made disasters of gigantic proportions combined with a worldwide increase in population. The key environmental challenges facing our society today are a mandate to change the way we live. As a global society, we need to strive for a world where all people are treated equally and have equal opportunities. We need to strive for a world where there are adequate resources for all and the basic needs of people are met. We need to strive for a world where all people are treated with respect and dignity. We need to think globally and strive to make life more equitable. Global inequity is mainly attributed to people in certain parts of the world who are on a trend of over-consumption; whereas, in other places in the world, there is a dire need for basic necessities such as food, water and shelter. An approach to solving the inequities in the world

identified and supported by the United Nations is sustainable development.

Sustainability is defined by the United Nations as “to improve the quality of life for all people, not just for our generation but for future generations too (Brundtland, 1987, p. 43).” With the mindset of Mahatma Gandhi’s quote, “Be the change you wish to see,” we need to inspire our future generations to lead the charge to find solutions to the multitude of problems facing us today (Gandhi, 1927). It is the students in today’s higher education institutions who will become future leaders to solve the world’s problems. Hence, it is imperative that we teach the basic values of sustainability to our students.

The United Nations has designated the years from 2005 to 2015 as the decade of education for sustainable development (United Nations Education, Scientific and Cultural Organization, 2005). According to (Cortesi, 2003), “Higher education institutions bear a profound, moral responsibility to increase the awareness, knowledge, skills, and values needed to create a just and sustainable future. Higher education plays a critical but often overlooked role in making this vision a reality” (p. 17). The American Association of Community Colleges (AACC) states that amongst higher education institutions, community colleges play a major role because they are responsible for educating 45% of undergraduates nationwide (American Association of Community Colleges, 2008; Ashburn, 2006, p.B1).

Community colleges serve a two-fold function; they either help prepare students for the workforce or they help students go through the educational pipeline from high school to four-year colleges and universities. Since the community college's central role and sole focus is education, innovation is encouraged and supported in the classroom. In 2004, the board of directors of the AACC passed a resolution in support of the United Nations decade of education for sustainable development (Rowe, 2005; AACC, 2007).

Community colleges across the country have taken a leadership role in sustainability education. In order to promote sustainability education at the GCCD, a Sustainability Instructional Council (IC) was created in 2009. The instructional council decided on what course prefixes were a part of sustainability, the hiring qualifications for faculty members, and the course competencies of the different sustainability courses. Initially, when the instructional council was formed there were nineteen diverse disciplines that had self-identified as being a part of the instructional council. A total of 24 faculty members initially served on the instruction council. The interdisciplinary nature of sustainability made it challenging to develop, offer and teach courses in this topic. Hence, national organizations such as the AACC have promoted sustainability education with new initiatives.

The AACC created a "Sustainability Education and Economic Development" (SEED) Center whose charge was to help community

colleges lead in sustainability by providing access to promising practices and curriculum to teach sustainability (AACC, 2010). Additionally, colleges and universities nationwide jointly created a professional organization called the “Association for the Advancement of Sustainability in Higher Education” (AASHE) for promoting sustainability in higher education (Association of Sustainability in Higher Education, 2006). Furthermore, the National Wildlife Federation (NWF) collected and analyzed the data on the trends and new developments in sustainable practices in colleges and universities (National Wildlife Federation, 2008).

A survey of 1,068 colleges and universities was conducted by NWF to determine the value of sustainability education and sustainable campus operations in the United States higher education sector and how these values were put into practice (NWF, 2008). The findings of this NWF campus report indicated that there was a decline in the curricular offerings of sustainability and environmental course offerings from 2001 to 2008.

The NWF campus report (NWF, 2008, p.5) further stated

There is a widening gap between where American higher education actually is on teaching sustainability and where it should be. It serves as a warning. If we are unable to bridge the gap there could be dire consequences. But with greater focus on making the transition and given adequate human and financial resources, we can bring academia up to speed and help shape a brighter and more sustainable future.

Table 1 illustrates the results of surveys conducted between 2001 and 2008 for academic trends.

Table 1
*Academic Trends in Sustainability education**

Academic Trends	2001	2008
	Grade C	Grade C-
Educating students on the basics of sustainability or earth's natural systems during various academic course offerings	26–33% schools reported this activity	20–25% schools reported this activity
	Grade B	Grade C+
Support faculty professional development programs on environmental or sustainability topics	46–53 % schools reported this activity	34–39 % schools reported this activity
	8%	4%
Students take at least one course related to sustainability or the environment	schools reported this activity	schools reported this activity

*NWF, 2008.

Even though there are programs such as the SEED and AASHE that help increase the utilization of concepts of sustainability in the classroom, there is a need to transform sustainability education in community colleges in terms of depth and breadth of knowledge delivery (AACC, 2010).

Statement of Problem

Sustainability is interdisciplinary in nature and transcends traditional disciplinary boundaries such as social sciences, humanities, natural sciences, physical sciences and architecture (Orr, 2005). Teaching new interdisciplinary topics such as sustainability can be a struggle for many faculty members since they are trained in traditional disciplines. It is

challenging for faculty members to develop the curricula in order to teach new courses in the interdisciplinary subject of sustainability. Additionally, incorporation of innovative pedagogy in the classroom takes time and effort. Adding sustainability to an existing curriculum can lead to issues of depth of coverage versus the breadth of coverage. Faculty members are faced with the dilemma of how to integrate sustainability in the curriculum with focus on in-depth knowledge. In addition, professional development programs are needed to help community college faculty members incorporate sustainability in the classroom.

Purpose of Study

The purpose of this study was to analyze the processes and procedures used by a small sample of faculty members of the GCCD to integrate sustainability into the curriculum and classroom.

This research study primarily focused on how a sample of GCCD faculty members developed curricula on sustainability. The study delved into the ways in which faculty members incorporated sustainability in the classroom with innovative pedagogy. This study determined which professional development programs were most useful to the faculty members. This study also examined the factors that supported or impeded faculty members in implementing sustainability across their respective curriculum.

Conceptual Framework

GCCD faculty members have adopted many innovative teaching and learning programs such as informational technology, collaborative learning, and service learning. Successful implementation of innovative pedagogy and programs in the college classrooms are correlated to the faculty members' "buy-in" and adoption of the innovation. Through in-depth literature reviews on critical campus issues, the conceptual framework for the study was identified as the diffusion of an innovation.

Rogers (1983) identified the classic diffusion model for the adoption of any new innovation. Rogers has also identified the following five categories in the lifecycle of an innovation: innovators, early adopters, early majority, late majority and laggards (Rogers, 2003). According to Rogers (2003, p.67),

A social system is a kind of collective learning system in which the experiences of the earlier adopters of an innovation, transmitted through interpersonal networks, determine the rate of adoption of their followers. Such learning by doing in a social system can, of course, take a negative turn if the innovation is not efficacious in solving a problem.

This theoretical model has been tested by myriad applications from introducing innovation into global markets to innovation in higher education (Rogers, 2003).

Moore (1991) adapted Roger's diffusion model into the field of "marketing of high technology products" using the following classification: early market, mainstream market and late market. Moore introduced the idea that there is a chasm between the early adopters of an innovation to

when the majority of people accepts the innovation. According to Moore, if an innovation fails to cross the gap or chasm between the early adopters and mainstream, then the innovation will never succeed in reaching the majority of the stakeholders invested in the high technology markets.

Geoghegan (1994) reiterated Roger's and Moore's findings by applying the diffusion model to the "use of instructional technology in the academic world." With the advent of computers more than thirty years ago, instructional technology (IT) was touted as the next big revolution to affect teaching and learning in the college classroom. Geoghegan discovered that there was a gap between adoption of the IT by a few faculty members who were early adopters and the majority of mainstream faculty members. Geoghegan also discovered that failure to use IT by mainstream faculty members resulted in failure of the IT penetrating the curriculum in terms of both breadth and depth of use. The theoretical framework of the diffusion model was applied to integration of sustainability into the classroom.

There are some fundamental differences between instructional technology and sustainability: IT is a pedagogical tool whereas sustainability is an integrated topic. In spite of the differences, Terry Calhoun of the Society for College and University Planning pointed out that the trend in adoption of IT is similar to the lag in adoption of sustainability in the classroom (as cited in Carlson, 2008). Ten years ago, the administrators in campuses were trying to get the faculty members to

adopt new innovative IT in the classroom. Faculty members that saw rewards in teaching and learning eventually crossed the chasm in the adoption of the new technologies. Professors are presently ahead of the administrators and Calhoun has predicted that sustainability adoption might follow a similar trend. (as cited in Carlson, 2008).

Research Questions

The primary research question was: “What are the processes and procedures used by the GCCD faculty members to make sustainability part of the curriculum and the classroom?” This study specifically focused on the following subsidiary research questions:

1. How do the GCCD faculty members develop sustainability curriculum in order to incorporate it into the classroom?
2. How do the GCCD faculty members develop innovative pedagogy in their teaching and learning of sustainability in the classroom?
3. Which professional development programs were most useful to the faculty members for incorporating sustainability in the classroom?
4. What are some factors that support or impede GCCD faculty members as they endeavor to incorporate sustainability in the classroom?

Assumptions of the Study

As the researcher, I worked under the assumption that sustainability education is an important aspect of a student's course of study. Pronouns such as I, me, my, and myself are used to represent the researcher in order to create a dialogic environment in a personalized setting. Moreover, I am a faculty member at the same community college district in which the research study was conducted and could have brought a prosustainability education bias into the study.

This assumption was based on the following factors:

Sustainability naturally lends itself to contextual learning. Students can relate their classroom experiences to their real life experiences in their neighborhood and in their world.

Students learn better with active learning approaches in the classroom. The very nature of sustainability education lends itself to active learning strategies with respect to using real life examples and experiential learning.

Traditionally education is very compartmentalized and there are different silos holding the different disciplines apart such as different perspectives and approaches to the topic and differences in culture, policies, funding etc. However, sustainability education is holistic and interdisciplinary in nature. Hence it leads to breaking down the walls and barriers separating traditional disciplines.

Faculty members are interested in teaching sustainability since they are interested in the topic and feel the importance of teaching critical issues in sustainability.

Students should become well aware that the United States comprises only 5% of the world's population and yet uses 25% of the world's resources. The assumptions that natural resources are infinite and inexhaustible are false and sustainable education can educate and empower students to bring about change in perspectives.

The Rogers diffusion model will fit this study.

Limitations of the Study

Due to financial and time constraints, this study was limited to a small sample of faculty members from a large community college district in the United States. This study focused on eight full time faculty members that attended a professional development event organized by the Greenville Center for Learning and Instruction (GCLI). The faculty members were purposely chosen from different colleges within the GCCD system in order to add diversity to the sample. Since the study was limited to eight faculty members that have adopted sustainability in their curriculum, a prosustainability bias might have been introduced into the research. In order to minimize the prosustainability bias, one faculty member who was not actively involved in sustainability education was chosen for the study.

This study is an interpretation of the perspectives, ideas, and feelings of a small sample of faculty members through the lens of the researcher. According to Ahern (1999), it is not possible for a qualitative researcher to be totally objective as absolute objectivity is not humanly possible. The perceptions of the researcher affect the qualitative study and subjectivity of the researcher can be a weakness in the study (Merriam, 1998). Gaps in this research might continue until a broad based study with multiple researchers can be conducted to minimize the subjective nature of the qualitative research.

Significance of Study

There is a minimal quantity of literature on sustainability in higher education. This research study adds to the scholarly body of knowledge on sustainability education and to the literature on the diffusion of innovations of a content area. It is critical to infuse sustainability in community college from a faculty development perspective. Community colleges play a critical role in educating the leaders of tomorrow and hence the significance of this study. Community colleges primarily serve “the community” and sustainable practices at the campuses can impact the community at large.

Definition of Key Terms

The key terms pertinent to this study are defined below:

1. *Change agent.* A change agent is an enthusiastic innovator trying to bring about change or innovation in the workplace or academic institution (Rowe, 2005).
2. *Classroom.* A classroom refers to a traditional classroom with face-to-face interaction.
3. *Diffusion.* Diffusion is a process in which innovation brings about a change in the practices of an institution (Rogers, 1983).
4. *Education for sustainable development (ESD).* ESD includes educating a population that is both literate about the knowledge of sustainability and at the same time is engaged in finding solutions to the issues. This is a term coined by the United Nations to define broad based educational goals such as access to basic universal education geared towards sustainability education. Education for sustainable development is often interchanged with terms such as sustainability education. Education for sustainable development leads to the learning of the skills, the ideals, and knowledge for living sustainably (World Summit on Sustainable Development, 2002).
5. *Faculty members.* Faculty members refer to full time tenure-track faculty members. They are also called residential faculty members.
6. *Full time student equivalency (FTSE).* Calculation of the FTSE is performed with a formula that multiplies the number of

students enrolled in each class by the course credit hours, then divides that number by 15 (the number of credits considered a full-time student in a term). FTSE includes all the students enrolled in full semester and short term classes in session on the 45th day.

7. *Greenville center for learning and instruction (GCLI)*. The GCLI is part of the GCCD system and promotes programs that focus on student success such as effective teaching and learning pedagogy, technology innovation, and the scholarship of teaching and learning.
8. *Innovation*. Innovation “is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” (Rogers, 2003, p. 12).
9. *Instructional council (IC)*. Faculty working in a common disciplinary area from the individual colleges join together to work on courses and programs, They are responsible for development of courses, set the course competencies and course outlines and make broad-based curricular decisions. The general purpose of each IC is to improve communication and coordination among faculty working in common discipline areas.
10. *Professional development programs*. Many faculty development programs such as “dialog days and *Learnshops*” are offered on

“incorporation of sustainability in the classroom” in a traditional face to face setting.

11. *Residential faculty*. Residential faculty refers to full time tenure-track faculty members.
12. *Sustainability*. Sustainability means to improve the quality of life of all people at present and for future generations (Brundtland, 1987).
13. *Sustainable development*. Sustainable development means to meet the needs of the present generation without compromising the needs of the future generations (Brundtland, 1987).
14. *Sustainability Pedagogy*. Sustainable pedagogy means the process of teaching and learning sustainability.
15. *Sustainability Tracking Assessment and Rating System (STARS)*. The program is a transparent self reporting framework for colleges and universities to assess the different aspects of the campus from education and research to campus operations and administration.
16. *Triple bottom line of sustainability*. The triple bottom line stands for improving the quality of life through social, economic and environmental means (United Nations Education, Science and Cultural Organization, 1997).

Methodology

This study was designed as a qualitative case study in order to study the research questions. Yin (2009) stated that the case study method is a suitable methodology for intensely studying a phenomenon in a holistic manner in order to make meaningful interpretations in a real life context. In this research on sustainability education at the community colleges, semistructured interviews along with a short survey, course documents, and Blackboard sites of at least five GCCD faculty members were conducted. According to Creswell (2008) a case study design explores the phenomena in a bounded system.

A bounded system involves a case study bound by time and place and could be a program, an event, an activity or an individual (Creswell, 2008). In this study, the bounded system was the sustainability education at the GCCD and the “unit of analysis” was the faculty members chosen for the study. It is “the unit of analysis, not the topic of investigation, that characterizes a case study” (Merriam, 2009, p. 41). Purposeful sampling technique was used to identify the faculty members for the study.

Choosing the sample population in a purposeful manner can yield maximum insight and understanding about the phenomenon (Merriam, 2009). The faculty members were chosen in a purposeful manner from a subset of faculty members that attended a professional development workshop called the dialog day or the Learnshop on incorporating sustainability in the classroom. Based on the purpose of the study, the conceptual framework, and the research questions, a guide for the

interview questions was drafted for the semistructured interviews. Data analysis yielded an unique glimpse into the processes of incorporating sustainability in the curriculum and classroom. The validity of the study was enhanced due to triangulation.

Triangulation is when multiple methods and multiple sources of data are collected and analyzed to increase validity of study (Merriam, 2009). In addition to an interview and a short survey, several sources of data such as course Blackboard sites, course documents, assignments, and professional development documents and activities were analyzed in order to add validity for the study. Analysis of the data from multiple sources in a holistic manner adds to the credibility of the study (Yin, 2009; Merriam, 2009).

Organization of the Study

In chapter one, I have provided the background, the statement of the problem, the purpose, and the research questions. In chapter two, I have reviewed literature on the classic diffusion model for the adoption of any new innovation. In addition, I have delved into the literature review of sustainability, the historical content, and teaching and learning of sustainability. In chapter three, I have explained the research methodologies used in the study. In this chapter, I have detailed the case study methodology and provided information on methods for collecting and analyzing data. In chapter four, I have provided the results of the study and analyzed the data. In chapter five, I have discussed the results

specifically pertaining to the research questions and the specific policy and practical recommendations of teaching sustainability in higher education.

CHAPTER 2

Literature Review

He who loves practice without theory is like the sailor who boards ship without a rudder and compass and never knows where he may cast (Leonardo da Vinci, nd).

In order to successfully implement sustainability education in the community college, it is critical to understand the various dimensions of innovation as they pertain to higher education. This chapter begins with a literature review of the theoretical framework called “diffusion of innovations” and how the diffusion process applies to educational change. A case study of diffusion of innovation using instructional technology is described as an example to explore sustainability education in the community college. Then a historical review of the definition of sustainability is given to establish the interdisciplinary nature of sustainability in a systems-thinking approach.

Research literature in sustainability education is reviewed in order to provide a foundation for the holistic approach to pedagogy and professional development practices. This chapter concludes with a discussion of the community college system and faculty members in sustainability education. In this study, sustainability education (SE) or education for sustainable development (ESD) or education for sustainability (EFS) will be used interchangeably.

Theoretical Framework: Diffusion of Innovations

The research topic of sustainability education is a new discipline in higher education. Sustainability encompasses economic, social and environmental factors. Since sustainability education is a relatively young multidisciplinary subject, new ways of teaching and learning are being developed, such as new curriculum, pedagogy, and innovative ways of teaching and learning in a systems-thinking approach. The theoretical framework adopted for this study is known as *diffusion of innovation*. In this research study, diffusion of innovation is used interchangeably with the term diffusion theory.

Diffusion of innovation research has been in existence since Ryan and Gross's groundbreaking work on an agricultural study of the spread and acceptance of hybrid corn (Ryan & Gross, 1943; Rogers, 2003). They found that social contacts, social interaction, and interpersonal communications were critical for the adoption of a new innovation. Empirical models were derived for the innovation of new products in order to substitute old or existing products in railroad, steel, brewery, and coal industries (Mansfield, 1961). In 1977, Mahajan analyzed several public policy innovations in the continental United States and found that social contacts, social interactions and interpersonal communications were critical factors for adopting an innovation (Mahajan and Peterson, 1985).

The seminal work by Rogers, *Diffusion of innovations*, has provided the theoretical framework for nearly every other research study in diffusion

theory. "Diffusion is a process in which an innovation is communicated through certain channels over time among members of a social system" (Rogers, 2003, p 5). The basic foundation for diffusion theory is that new innovations are mainly communicated through contacts between people through interpersonal communication. (Ryan & Gross 1943; Rogers & Beal, 1958; Katz, Levine, & Hamilton, 1963; Valente, 1995; Valente & Rogers, 1995; Valente & Davis, 1997; & Rogers 2003). Diffusion theory has been used in a large number of educational research studies where teachers/administrators work collectively to make innovative decisions. The four key elements in the diffusion process are: (1) Innovation, (2) Channels of communication, (3) Time, and (4) Social System (Rogers, 2003).

Innovation. "An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption, and innovation does not necessarily mean new knowledge" (Rogers, 2003, p.12). Even though an idea has been in existence for long, it will be considered an innovation as long as it is new to the individual adopting it. In educational innovation, three phases have been identified: design, evaluation and dissemination (Brickell, 1962). For the design of an ideal instructional source, innovators are provided freedom to try new ways of solving problems, and given ample resources and support. Brickell suggested that evaluation needs to closely monitor the innovation. Evaluation should be unbiased as it will determine the fate of the innovation. Brickell further

suggested that a thoughtfully designed educational innovation which has undergone a thorough evaluation can be adopted across the institution making the innovation a normal routine way of teaching and learning. Innovation and change are constantly occurring in academia. Innovation could mean change; however, change does not always mean innovation (R. H. Davis, 1979; Dill and Friedman, 1979; Keil, 1969). An example of an educational innovation is the adoption of active learning technologies in the classroom. In education, if a faculty member using new active learning pedagogy in the classroom reverts back to lecturing due to discomfort using the new innovation, then change has happened but not an innovation. Hence innovation and change cannot be used interchangeably because innovation is a move towards new behaviors whereas change could sometimes reflect reversion to old behaviors (Davis, 1979). Wejnert (2002) grouped the variables of innovation into three categories:

Characteristics of innovation. Key characteristics of an innovation such as learning curve for the innovation, problem solving elements, and ease of implementation determine the efficacy of an invention. If an innovation was perceived as advantageous due to social prestige factors, it had a relative advantage and was more likely to be adopted. Compatibility of an innovation with existing values and beliefs of a social system help in successful adoption of the innovation.

Characteristics of an innovation also affect social factors such as peer pressure and social acceptance (Wejnert, 2002).

Characteristics of the innovator. Wejnert (2002) determined six variables that characterize the innovators (a) societal entity of innovators, (b) familiarity with the innovation, (c) status characteristics, (d) socioeconomic characteristics, (e) relative position in social networks and (f) personal characteristics that are associated with cultural variables. Trail blazing faculty members who adopt new innovations in teaching and learning have higher chances of successfully disseminating the adoption. However, if an innovator has a reputation of taking risks or if the innovator's position in the social network is not high, then the chances of successfully disseminating the invention across the institution will be minimized.

Environmental context. Wejnert (2002) identified four subgroups for environmental characteristics: (a) geographic setting, (b) societal culture, (c) political conditions, and (d) globalization and uniformity. The geographic setting of an educational institution is particularly critical when adopting an innovation in a controversial discipline such as sustainability. Factors such as globalization, the societal culture and political conditions can dictate the adoptability of an innovation. The environmental context in educational research is critical for the successful adoption of an innovation.

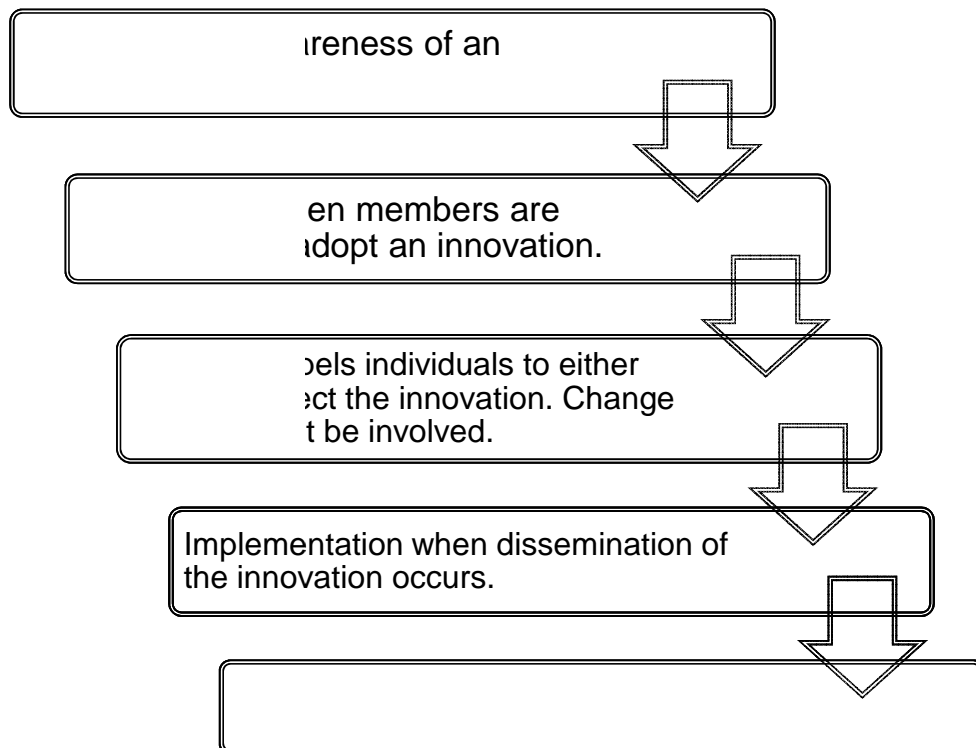
The three variables of an innovation: the characteristics of an innovation, the characteristics of an innovator and the environmental context significantly influence whether an innovation is successfully adopted (Wejnert, 2002).

Communication Channels. The second key factor in the adoption of an innovation is the communication channels amongst participants. Communication is “the process by which participants create and share information with one another in order to reach a mutual understanding” (Rogers, 2003, p. 18). The essence of the diffusion process is the effective communication of the innovation by early adopters to others who are unaware of the adoption experience (Miles, 1964; Rogers, 2003). In an educational institution, faculty members who have similar education, socioeconomic status, and beliefs are more likely to form communication channels.

A change agent is an individual who influences innovation decisions in a positive manner. An example of a change agent in an educational setting is a faculty developer who promotes the innovation through the process of faculty development (Chait & Gueths, 1981). Faculty developers are prominent people in an educational institution who influence innovation decisions through interpersonal communication. “Change agents often use opinion leaders in a social system as their lieutenants in diffusion activities” (Rogers, 2003, p.27). Faculty members who have high social status and expertise in innovation are more

successful in diffusing an innovation through interpersonal connections and are termed opinion leaders.

Time. The third key element in the diffusion process is the length of time between awareness of an innovation to the implementation of the innovation (Van de Ven & Rogers, 1988). Based on the early ideas of Hassinger (1959) and Ryan & Gross (1943), Rogers has conceptualized the five steps in the diffusion theory as illustrated in Figure 1 (Rogers, 2003).



Time is an important element in the diffusion process since the adopters of an innovation are grouped into five different categories based on when they adopted the innovation. The five categories are based on when the innovation is adopted by the participant and range from awareness of an innovation to persuading others to when an innovation becomes the norm in the institution as illustrated in Figure 1. Hence, time is a key element in the adoption of an innovation.

Social Setting. The fourth key element is a social system which is defined as a “set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The members of a social system may be individuals, informal groups, organizations and/or subsystems.... Diffusion occurs within a social system” (Rogers, 2003, p.23).

Using statistical analysis and the criteria of *innovativeness*, Rogers identifies five adopter categories in a social system: (1) innovators, (2) early adopter, (3) early majority, (4) late majority, and (5) laggards. The innovators are the venturesome brave people inventing the new idea. The early adopters are the opinion leaders that embrace an innovation and are highly respected. The early adopters persuade others to adopt the innovation. The early majority people are careful but accept change earlier than the average people. They are thoughtful and deliberate for a while before adopting an innovation. Due to their thoughtfulness, early majority people play a large role in either the adoption or the rejection of an innovation institution-wide. The late majority people are skeptical and the

pressure of peers is necessary for them to adopt an innovation. The late majority participants only adopt an innovation when large scale dissemination of the innovation has occurred. The laggards are the last in the social system to adopt an innovation and will only do so when the innovation has become mainstream or the norm in the institution.

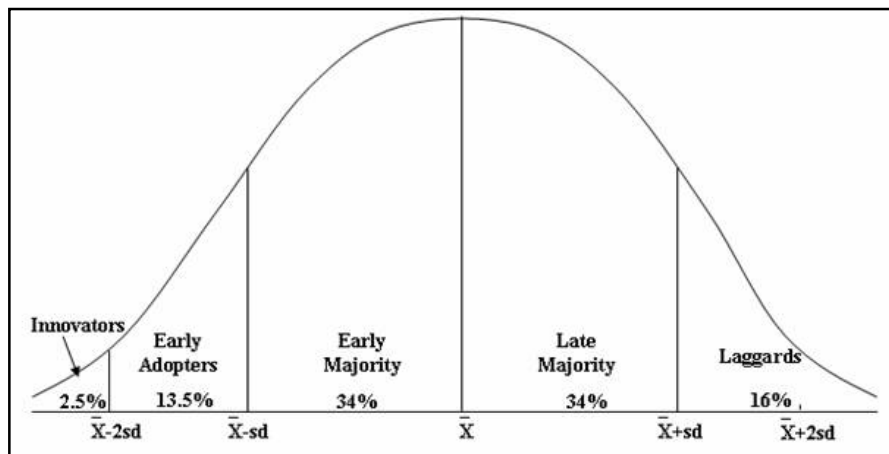


Figure 2. Five adopter categories. The innovativeness is measured with respect to the time taken by an individual to adopt an innovation. Five adopter categories are identified by intervals of standard deviation (sd) from average time of adoption (\bar{x}). From Rogers, 2003, p. 281.

Rogers used a normal distribution curve to represent the five adopter categories as illustrated in Figure 2. The classification of the adopters in the normal distribution is asymmetrical in that there are three categories on the left and two categories on the right of the normal distribution curve.

Moore adapted Roger's model to high technology markets with respect to early market, mainstream market and late market (Moore, 1991). Moore modified Roger's distribution of adopters to include a gap

between the early adopters and early majority, which he called the chasm. There are transition points as the innovation passes from one group to the next but the most difficult transition point is between the early adopter and early majority due to the presence of the gap or chasm. A successful innovation makes the transition between the early adopter and early majority (Moore, 1991). Failure to cross the chasm can often lead to an unsuccessful innovation. Geoghegan applied Moore's distribution of adopters as illustrated in Figure 3 to the adoption of instructional technology in academe (Geoghegan, 1994).

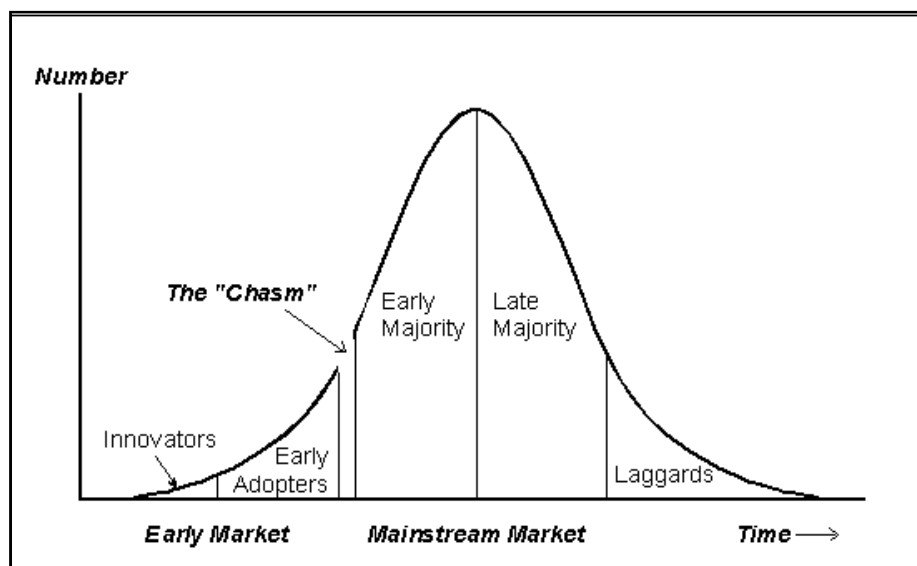


Figure 3. The chasm shows a gap between the early adopters and early majority called the chasm. From Geoghegan, 1994, p.9.

Case study of Instructional Technology

The adoption of instructional technology as an educational innovation provided a useful context to explore sustainability education in the community college. Instructional technology was considered a great

innovation of teaching and learning almost four decades ago. However, despite massive expenditure and availability of computers to higher education faculty, instructional technology was not adopted by the majority of faculty until the early 1990's (Geoghegan, 1994).

Drawbacks of diffusion of innovation. Based on Moore's (1991) adaptation of the diffusion of innovation theory, Geoghegan (1994) proposed the following reasons why instructional technology initially did not bridge the chasm. These reasons can be applied to any educational innovations:

1. Ignorance of the gap: In the case of adoption of instructional technologies in educational institutions, early adopters failed to recognize the chasm and hence there was no systematic way to transition the use of instructional technology to the early majority (Refer to Figure 3).
2. The technology alliance: Alliances between the innovators and early adopters and major stakeholders unknowingly excluded the mainstream population from adopting the innovation.
3. Alienation of the mainstream: The success of the early adopters (visionaries) actually alienated the mainstream (pragmatic). The visionaries were ready to take risks that the mainstream population were unwilling to venture into.
4. Lack of a compelling reason to adopt: Needed buy-in from the early majority for an innovation to succeed. The innovation

needed to be of substantial value such as an improvement of an existing task.

Any new innovation in education could face similar drawbacks such as the case of the adoption of instructional technology in the early 1990's. The creation of strategies for successful diffusion of innovation could help bridge the gap sooner and lead to successful adoption of an innovation.

Strategies for successful diffusion of innovation Geoghegan proposed strategies for successful crossing of the chasm from early adopters to early majority and these can be applied to any educational innovation (Geoghegan 1994):

1. Recognition: "It is essential to recognize mainstream faculty as forming a distinct constituency ... and to respect the differences that distinguish them from early adopters (Geoghegan, 1994, p. 19). It is important to include the mainstream population in planning and policy decision making so that they can take ownership of the innovation.
2. Vertical orientation: Early and late majority population need support staff services in planning, developing, implementing an innovation such as instructional technology. Geoghegan (1994) suggests having a peer support system to help the early majority embrace the innovation. In academe, mentoring early majority populations by early adopters has

led to better acceptance of the innovation (Goodwin & Stevens, 1998).

3. Compelling value: Adoption of a new innovation creates a marked improvement in an important existing task and the benefit is visible to the early majority. Geoghegan has stated that "it must provide value far in excess of the cost of money, time and effort needed to acquire, learn and use the application (Geoghegan, 1994, p. 21).
4. Institutional commitment: The administration encourages and supports the innovation by recognizing the achievements of the mainstream population and by providing quality professional development workshops.
5. Social system: For an innovation to succeed, the innovators and the early adopters need to convince the majority of the population the benefits of adopting the innovation. Change agents play an important role in bridging the gap between the early adopters and the early majority population.

Application of these aforementioned strategies to any new educational innovation can lead to a successful adoption and implementation of the innovation (Geoghegan 1994). The theoretical framework of the diffusion theory has been applied to over 4000 research studies in multiple disciplines (Rogers, 2003; Wejnert, 2002). Although diffusion studies have been applied to many diverse disciplines, the rate of

diffusion and the adopter categories are common to all the various disciplines (Rogers, 2003). The diffusion of innovation was used as the theoretical framework for this research study on sustainability education in the community college.

Sustainability: A Historical Perspective

Sustainability education began as a grassroots effort and evolved into a notable movement as prominent signatory organizations gave credence to the grassroots work. The term *sustainability* has been in existence for a long time. In 1712, German forester Hans Carl von Carlowitz, labeled the term sustainability in his text *Sylvicultura Oeconomica* to explain long term preservation of forests (Scoones, 2007). In the 1800's, prominent nature writers and great thinkers, including Henry David Thoreau, Ralph Waldo Emerson, and Walt Whitman made the original shift towards ecocentrism and away from an anthropocentric focus. These writers combined their passion for nature with their literary acumen to instigate a major environmental reform. Sustainability gained wider currency during the environmental movement of the 1950's to 1970's (Wenz, 2007). The writings during this time period analyzed the effects of industries and pollution on the environment. Wenz labeled the term *anthropocentric environmentalism* where humans were destroying natural resources due to the industrial revolution.

The rampant destruction of the environment by humans during the industrial revolution led to the "first wave of environmental concern" during

the 1950's (Davison, 2001, p. 15). This time period was identified as an era of antigrowth ideology. Rachel Carson instigated the green environmental movement with her study of the toxic effects of insecticides such as DDT in *Silent Spring* (Carson, 1962). Carson's seminal work, *Silent Spring* is considered as the beginning of the reactionary period when environmental justice issues came to the forefront. The reactionary periods of the 1960's evolved and led to the proactive period of the 1970's with formation of major environmental reform.

Davison characterized the "second wave of environmental concerns" in the 1970's as the era that led to environmental education programs, the formation of the Environmental Protection Agency in 1970, the first Earth Day on Apr 22, 1970, the first United Nations conference on the human environment in 1972 at Sweden, and the *Environmental Protection Act of 1973* (Davison, 2001; Sterling 2004a). Each of these initiatives were defining moments that helped sustain and propel the environmental movement.

The emergence of the environmental education in the 1970's was augmented by a new movement in social sustainability: fighting for human rights and justice, eradicating poverty and racism, and building sustainable communities. However, the environmental movement was perceived by the developing countries as a problem pertaining to only wealthy nations (Runnalls, 2008, Tucker, 2008). As the glaring disparity in poverty levels between developed and developing countries became more evident, there

was conflict between developed and developing nations based on sustainability principles of environmental protection versus economic prosperity. Discord grew between environmentalists wishing to curtail development and the industrialists wishing to expand for economic prosperity.

Due to the link between the environmental movement and the development of nations, a commission on sustainable development was formed in 1987 chaired by Gro Brundtland, the prime minister of Norway (Brundtland, 1987). The work from the commission culminated in a landmark report entitled *Our common future* or *The Brundtland Report*. This report produced the definition of sustainable development that is universally accepted across many countries as illustrated in Figure 4.

Sustainable development
meets the needs of the
present generation without
compromising the ability
of future generations to
meet their needs

Gro H. Brundtland

*definition of sustainable development in
report was universally accepted.*

In spite of universal acceptance of the Brundtland definition of sustainability, this definition was open to interpretation and resulted in

intellectual debates across various disciplines (Brundtland, 1987). The United Nations mediated and actively promoted sustainability education internationally by taking a leadership position (United Nations Conference on Environment and Development, 1992).

In 1992, the United Nations Summit on sustainable development focused on sustainability education as a pathway for enabling people to better their lives and become productive members of a vibrant society (UNCED, 1992). These values, listed below, were adopted by more than 178 governments across the world and reaffirmed in the Johannesburg summit on sustainable education (WSSD, 2002):

1. Respect for the dignity and human rights of all people throughout the world and a commitment to social and economic justice for all;
2. Respect for the human rights of future generations and a commitment to intergenerational responsibility;
3. Respect and care for the greater community of life in all its diversity which involves the protection and restoration of the Earth's ecosystems;
4. Respect for cultural diversity and a commitment to build locally and globally a culture of tolerance, nonviolence and peace (WSSD, 2002).

The Rio and the Johannesburg summits on education for sustainable development represented a new, holistic, and interdisciplinary vision for education that brought together the complexity and the interconnectedness of global issues in social, environmental and economic areas (UNCED, 1992; WSSD, 2002). Universities and colleges worldwide adopted this new vision for sustainable education.

A consortium of 350 university and college presidents called the University Leaders for a Sustainable Future (ULSF) signed the Tallories Declaration (ULSF, 1990) in the first public commitment to infuse environmental sustainability in higher education. The consortium of university and college presidents agreed to a 10 point action plan that included the goal of creating campus cultures of sustainability and educating students on ecological literacy (ULSF, 1990).

Due to the Tallories movement there was an impetus to focus on education for sustainable development. Subsequently, the decade of education for sustainable development was declared from 2005 to 2014 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) “to integrate the principles, value, and practices of sustainable development into all aspects of education and learning” (UNESCO, 2005). Main tenets of the decade of education for sustainable development include the following: “provide education focusing on the triple bottom line of sustainability, revise educational strategies around content and pedagogy in sustainability education, relate classroom curriculum to the outside world, and promote lifelong learning” (UNESCO, 2005). These tenets have created a foundation for teaching and learning sustainability globally.

In order to implement the decade of education for sustainable development, higher education institutions across the United States have joined the American College and University Presidents Climate

Commitment (ACUPCC) initiative to create changes in the way universities and colleges function. In addition, the American Association of Community Colleges created a program called the Sustainability Education & Economic Development (SEED) as a leadership initiative and resource center in order to provide strategic guidance and detailed resources for community colleges to dramatically ramp up their programs to educate America's 21st century workforce (AACCC, 2010). In 2006, an organization called the AASHE was created whose charge was to promote sustainable practices in higher education institutions nation-wide (AASHE, 2006). In spite of having many international and national initiatives that promote the importance of sustainability in higher education institutions, there is still a dearth of educational programs in sustainability. This could be attributed to the lack of a common language and definition for sustainability that is agreed upon by multiple disciplines.

Definitions of Sustainability

The Merriam Webster dictionary defines sustainability as “of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged.” (Merriam-Webster, 2004). Sustainability is currently in the “top 1% of look-ups and the 278th most popular word” in the dictionary (Merriam-Webster, 2004).

Sustainability has also become a cliché and hence subject to multiple interpretations by different disciplines. The reason for discord could be due to the differing interpretations of sustainability. In the

disciplines of technology and economics, sustainability looks at growth issues (Orr, 1992; Hawken, 1993). Those involved in ecological sustainability and environmental justice view sustainability with respect to conservation of resources or limits to growth (Orr, 1996). In biology, sustainability is defined as the responsible use of natural resources and is particularly critical since the increasing world population is leading to greater consumption of natural resources (Wilson, 2006). In philosophy, sustainability is the “means of paying attention to the long term consequences of actions and, by implication, thinking of others who might suffer from the immediacy of one’s personal greed” (Cullingford, 2004).

Noted environmentalist, E. O. Wilson made a call to religious leaders and scientists to work together to find common ground in a shared concern for environment (Wilson, 2006). The term sustainability has emerged due to a shift from environmental education to a more holistic view of the pressing problems of the world from a social, economic, and environmental perspective. Irrespective of the fact that there are multiple definitions of sustainability when approached through varied disciplinary perspectives, the United Nations definition of sustainability has been acclaimed to be central to the concepts of sustainability and most commonly accepted (Brundtland, 1987; WSSD, 2002).

Implementation of Sustainability Education across Disciplines

As vanguards of education, universities and colleges thrive on research and development, quest for knowledge, and educational reform

to empower youth with the knowledge and skills necessary to become future leaders of society. If universities and colleges can be leaders in acquisition and dissemination of knowledge, why not be the same for sustainability education in order to create vibrant societies with social equity, economic growth, and environmental justice?

Traditionally social, economic, and environmental issues in education have been bound by disciplinary silos. It could be argued that multiple meanings of sustainability are actually strengths, not weaknesses because sustainability can be interpreted by different disciplines using different curricular contexts (Corcoran & Wals, 2004). However over time, the boundaries between the disciplines have been broken and sustainability has evolved into an interdisciplinary subject.

The study of environmental, economic and social issues is termed the triple bottom line of sustainability (Keiner, 2004). Keiner has interpreted the triple bottom line of sustainability with respect to three discrete circles in a triangle that are all integrated together as illustrated in Figure 5.

The triple bottom line of sustainability comprises of social equity, environmental justice and economic growth to help maintain a sustainable society. The traditional triple bottom line of sustainability as depicted in

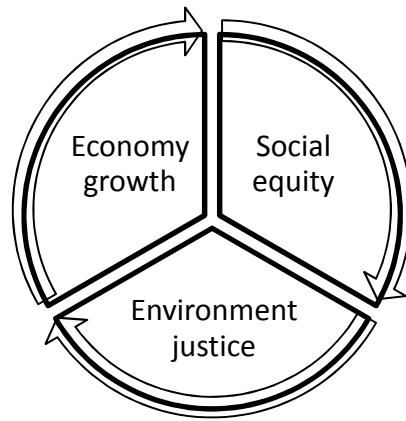


Figure 5. Triple bottom line of sustainability encompassing environmental, economic and social issues.

Figure 5 has been modified by researchers with diverse disciplinary backgrounds and has led to more than 255 visual interpretations of sustainability (Mann, 2009).

Researchers have expanded on the triple bottom line of sustainability to include other disciplines such as technology (Morrison, 1992; Libra, 2007), politics (O'Connor, 2007; Smith, 2011).), spirituality (e.g., Chile & Simpson 2004), ethics (e.g., Hundloe 2007; Tucker, 2008), and theatre (Clark, 2008).

Though these disciplines are extremely diverse, a benefit of interdisciplinary approaches in curriculum is to understand the interconnections between the different disciplines (Dulcovich et al., 1998, Caviglia & Harris, 2004; Huckle, 2004). However, there are also many barriers to sustainability education precisely because of the interdisciplinary nature of the subject.

Barriers to implementation of sustainability education. Myriad reasons could contribute to the failure of adopting sustainability education systemically in higher education institutions. Academic structures lend themselves to be organized in disciplinary silos whereas sustainability is an interdisciplinary field. The approach to teaching and learning in traditional disciplinary context is usually content focused whereas in sustainability education the focus is on addressing problems and issues (Bartlet & Chase, 2004). Since the focus is on application of knowledge as opposed to acquiring knowledge, many educators feel that there is a lack of rigor in interdisciplinary fields like sustainability when compared to traditional disciplines. Hence, viewed from a disciplinary perspective by traditional teachers, lack of rigor in interdisciplinary courses is considered a barrier.

Academic inertia and resistance to change adds to the pessimistic attitude towards sustainability. Campus resources and the reward system for faculty members are primarily geared towards traditional disciplines. Even if faculty members decide to go beyond disciplinary boundaries to make interconnections between disciplines for sustainability education, it is time consuming, exhausting and without any recognition or rewards (Bartlet & Chase, 2004). In addition to lack of time, a lack of support and lack of resources have been cited as barriers to sustainability education (Johnston, 2009).

Johnston also stresses the lack of communication between teachers as a barrier for sustainability education. The *NWF Campus Report Card* found that there was a “complete disconnect” among various disciplines within a given campus (NWF, 2008). Lack of communication between faculty members of different disciplines could also lead to compartmentalization of the subject matter. Furthermore, different disciplines approach sustainability with diverse goals, outlook, and methodologies. Hence faculty members need to devote time and effort to understanding another discipline and appreciating its concepts, methods, relevance, and applications to sustainability (Lynch, 2006).

In addition, a major barrier is a lack of expertise in pedagogy using a holistic approach; thus interdisciplinary courses end up being taught by different departments in a fragmented manner (Caviglia & Harris, 2004; Cowan, 1997; Monhardt & Henriques, 1997). It is a challenge for faculty members to not only present diverse ideas from various disciplines but also to encourage their students to think critically in the various disciplines (Cowan, 1997).

Solutions for implementation of sustainability education.

Partnerships between faculty members of various disciplines would be a critical step in breaking down disciplinary barriers in higher education. Lessons need to be learned from the business models where partnerships between businesses and nonprofit organizations have led to a win-win scenario (Segawa & Segal, 2000). Such partnerships provoke change and

each individual partner is accountable for excellence. Accountability and trust would be important aspects of a partnership as faculty members work together for the common good of the students (Segawa & Segal, 2000). The partnerships between faculty members of various disciplines could create synergistic solutions to overcome the challenges of disciplinary boundaries.

It is not only important to create partnerships across various disciplines, but also to get the administration involved and institutional support for sustainability education. Senge (2009) has emphasized the importance of partnerships and collaboration to bring about change and to create a healthy sustainable world. Senge elaborates that trust and understanding are necessary to create a true collaboration between diverse entities. Senge further posits the need to bring the key stakeholders together for dialogue in order to reach an understanding, “design creative possibilities” and engage with “what matters to all participants as the means of building commitment” (Senge, 2009, p. 225).

Collaboration is key to success and requires compatible objectives, mutual strategy, and respect (Senge, 2009). Applying Senge’s, (2009) principles on partnerships and collaboration to sustainability education; it would be critical to get all the stakeholders such as administrators, faculty and staff from diverse disciplines together to dialog on a shared vision to bring about transformations in teaching and learning of sustainability.

Teaching and Learning of Sustainability

Transformational sustainability education can be achieved through acquisition of knowledge, reflecting and thinking deeply about the topics and issues, and applying what is learned to real life situations.

“Sustainability education infuses curriculum with concepts that link social, economic and ecological systems; apply technology to solve, not create problems; foster respect for all people; and nurture creativity, compassion and cooperation” (Santone, 2003, p.61).

For effective teaching and learning, Shulman has identified the main knowledge base for teaching and learning as “content/curricular knowledge, general pedagogical knowledge, classroom management strategies, knowledge of learners and their characteristics, and knowledge of educational contexts ranging from classroom to community and cultures” (Shulman, 1987, p. 8). This characterization of the knowledge base for teachers in terms of content knowledge, pedagogy, and educational context is particularly applicable to teaching and learning of sustainability education. The interdisciplinary nature of sustainability leads to a holistic systems thinking approach to incorporation of sustainability in the curriculum.

Systems thinking in sustainability stresses on the interconnections between concepts and transitions from purely content knowledge to the study of processes that connect concepts (Sterling, 2004b). Sterling has

analyzed the holistic nature of sustainability using a systems thinking approach and has classified the learning into three levels:

First-level learning is the effectiveness and efficiency of doing things better and does not change the values of a learner. “It is essentially noncritically responsive to sustainability and involves operating *modus operandi*” (Sterling, 2004b, p. 55).

Second-level learning is the deeper learning of doing better things. Second-level learning involves making sense of the meaning and is “characterized by positive feedback loops between the system and the environment” (Sterling, 2004b, p. 55).

Third-level learning is seeing things differently and involves transformative learning. Sterling contends “learning within a paradigm does not change the paradigm, whereas learning that facilitates a fundamental recognition of a paradigm is by definition transformative” (Sterling, 2004b, p. 55).

Sustainability demands understanding one’s relationship with oneself, humanity, and the natural world. It is critical for faculty members to be cognizant of these relationships in order to create meaningful, comprehensive curricula that enhance the learning experiences of students.

Development of sustainability curricula. Sustainability curricula can be developed by creating new courses or by adding sustainability topics to existing courses. Based on the classification of learning levels,

Sterling (2004b) argues against add-ons of sustainability to an already overcrowded existing curriculum. Sterling cites the example of adding sustainability concepts such as biodiversity or carrying capacity to a course curriculum and argues that it leads to an unsustainable educational model. Instead of add-ons, Sterling stresses the importance of incorporating sustainability ideas across the entire curriculum with respect to content, skills and values (Sterling, 2004b).

Aurandt and Butler (2011) used the following two approaches for incorporating sustainability in engineering courses.

The first approach was to revise existing traditional chemistry courses to incorporate sustainability in the undergraduate curriculum while still adhering to the learning objectives of the existing course.

Sustainability was incorporated into each and every topic taught in the class. Students were evaluated for knowledge before and after taking the courses. The pretests and posttests were compared between the green and traditional chemistry classes and assessments were 33% higher in the green chemistry class. In addition through feedback from self assessment tests, the students mentioned that they gained a deeper understanding of the role of chemistry in society and engineering.

The second approach was to create a new upper-level elective course in sustainability in which the topic was incorporated into an engineering course. Through feedback from self assessments, students showed that they had a greater appreciation for the connections between

engineering, economic and social issues together. An online assessment survey was created to elicit feedback but the sample size was too small (only five students responded) and the results were statistically insignificant. This study demonstrated that the incorporation of sustainability principles throughout a traditional chemistry course reiterates Sterling's assertion that incorporating sustainability ideas across the entire curriculum with respect to content, skills and values leads to deeper learning by seeing things differently (Sterling, 2004).

In a K-12 study, comparisons were conducted on how sustainability was incorporated into the curriculum at two schools that had similar curricular outcomes (Metz, McMillan, Maxwell, & Tetrault, 2010). These were the Manitoba school and the CAIRA school. The Manitoba school incorporated sustainability into existing disciplinary structures; sustainability was taught from one to ten hours per week in the diverse disciplines and from one to many weeks in an academic year. In the CAIRA school, stand-alone sustainability courses were developed and taught from thirty to forty hours per week for forty weeks in the semester.

At CAIRA, contextual learning was used to study disciplinary based science or social outcomes e.g. organic gardening, butterfly migration and medicinal plants. At Manitoba, the disciplinary centered approach did not lend itself to contextual learning. Since a discipline's primary focus is its content area, thematic learning of concepts were not possible due to time constraints. There is nothing intrinsically wrong with sustainability being

taught from a disciplinary perspective. However there is a possibility of losing the social, environmental and ecological focus of sustainability, as it might seem superfluous to teachers who are advocates of their traditional disciplines (Metz et al., 2010).

Even though a complete overhaul of the sustainability education system is necessary for true incorporation into curriculum, one needs to be pragmatic recognizing that such change might be hard to come by. It has been further postulated that it is not necessary to discard what is working in the Manitoba schools since the disciplinary system has worked well for them. Instead a recommendation is needed on how sustainability education can become a valued part of a discipline structure (Metz et al., 2010).

Cortesi reiterates using the system thinking approach to sustainability education with focus on both lateral rigor across disciplines and vertical rigor within disciplines (Cortesi & McDonough, 2001). Cortesi's mode of thought regarding the rigors of knowledge reaffirms Shulman's saying, "a teacher must have not only depth of understanding with respect to the particular subjects taught, but also a broad liberal education that serves as a framework for old learning and as a facilitator for new understanding" (Shulman, 1987, p.9).

Development of pedagogy. Sustainability education can be effectively incorporated into the curriculum by combining content knowledge with pedagogy using real world experiences (Nolet, 2009). In

order to facilitate new understandings and connections across disciplines, the following pedagogical strategies for sustainable development have been identified:

1. Thematic education using a systems approach to study the interconnections between social, economic, and environmental perspectives of sustainability (Cortesi & McDonough, 2001; Sipos et al., 2008; Tilbury, 2004).
2. Use of case studies can enhance understanding and connection with concepts of sustainability and global citizenship. Critical thinking and problem solving are needed in order to address the challenges of sustainable development at both the local and global levels (Steiner & Law, 2006; Dillon, 2004; Sipos et al., 2008).
3. Values driven using civic engagement and real life application of classroom theories to help students become well-informed citizens (Nolet, 2009; Bartee, 1973; Sipos et al., 2008; Orr, 2005).
4. Experiential and service learning programs extend the curriculum in the classroom to the community in order to provide meaningful service (Sipos et al., 2008).
5. Critical thinking and problem solving of sustainable practices using active learning strategies in the classroom (Bartee, 1973; Sipos et al., 2008; Stark et al., 1990).

6. Discourse on a just, sustainable society by asking socially critical questions in a place such as a classroom, local community garden, or space is relevant to the discussion (Metz et al., 2010).
7. Inquiry based learning where students learn actively by questioning, designing science experiments and learning by doing leads the students to be actively involved in their own learning (Beard & Wilson, 2006; Major & Palmer, 2006). In an inquiry-based classroom, faculty engage students in a discussion of prior knowledge in order to build on the knowledge and confront any misconceived notions with alternative approaches. Students are actively involved in reasoning and in the process of inquiry to build knowledge (Donovan & Bransford, 2005).

In essence, teaching about sustainability requires a shift in mental models from the faculty members as lecturers to faculty members as facilitators. The pedagogy for sustainability education should move from teacher-centered to learner-centered, from individual learning to collaborative learning, from sheer knowledge accumulation to problem solving (Wals & Jickling, 2002). Sustainability education combines academic rigor both laterally across disciplines and vertically within disciplines along with use of the pedagogical strategies mentioned above (Cortesi & McDonough, 2001). Hence, it is imperative to provide

professional development programs for faculty members to help them fully comprehend teaching and learning for sustainability education and prepare them for the changing world (Nolet, 2009).

Professional development. There is a need for professional development learning communities for teachers to develop a curricular vision and learn about professional practices that address sustainability education. Sustainability education is complex since it is a relatively new interdisciplinary subject that is rapidly evolving across traditional disciplinary boundaries. As discussed above, sustainability is a relatively young discipline, it is important not to treat it as an add-on to an existing overcrowded curriculum and for faculty members to move from being experts to being learners in a safe professional setting such as a professional development program (Nolet, 2009).

Professional development programs can help faculty members make these changes by learning about the didactic nature of sustainability with respect to content knowledge and pedagogy of teaching and learning. Many professional development programs were put into place such as the Ponderosa project and the Piedmont project (Bartlet & Chase, 2004). These professional development programs focused on incorporating sustainability into the classroom and served as a national model for professional development for sustainability education. However, these two nationally acclaimed projects served only a small number of faculty members. As the interest in sustainability education has peaked in

colleges and universities nationwide, there has been a need to increase such exemplary professional development models nationwide. In addition, a large scale quantitative study of professional development programs was conducted by the NWF and published in the *Campus Report* (NWF, 2008).

A survey of 1,076 colleges and universities across the United States, which amounts to 27% of all higher education institutions, was conducted to glean information about several indicators of sustainability (NWF, 2008). As illustrated in Table 1, this survey determined that there was a decrease in the number of professional development programs in colleges and universities from 50% in 2001 to 38% in 2008. The decline of professional development programs in universities and colleges have created a dearth of safe spaces for faculty members to become learners, to question their assumptions and values on sustainability, and to have rigorous discourse with their peers. One of the drawbacks of the NWF study was that there was no analysis of data collected and no recommendations were made to improve offerings of professional development programs.

In spite of the considerable international agenda on sustainability education, there is a lack of research on professional development programs that have helped educators comprehend the interconnectedness of sustainability between humans, society, and nature in order to bring about curricular change (Holsdworth et al., 2008). In

addition to the lack of training and professional development opportunities for sustainability education, there is very little support in terms of time and recognition from institutions (Holsdworth et al., 2008).

With institutional support and recognition, professional development programs can thrive and energize faculty members to become change agents in their institutions (Rowe, 2005). Colleges and universities can bring about broad based change if they can make sustainability one of their college goals. A genuine liberal arts education will foster a sense of ecological citizenship and will provide the knowledge and competence to act on such knowledge (Orr, 1992 p.101).

Role of Community Colleges Faculty in Sustainability Education

Community colleges are considered to be engines of higher education and they affect millions of students (SEED, 2011). “Community colleges make up nearly half of all higher education institutions and they employ 43% of all faculty members” (Townsend & Twombly, 2007, p. 1). In spite of the large numbers of community college faculty, there is a lack of research on the role played by these faculty members in sustainability education. This reiterates what Cohen and Brawer have posited; that community college faculty members rarely write for publications and barely have time for research due to their heavy teaching loads (Cohen & Brawer, 2003).

Community college faculty members' hours are always allocated to teaching and rarely to research or scholarship. The majority of research is

conducted at the four-year university level institutions. Hence most sustainability education research involves the framework of the four-year institution. As a result, community college faculty members are undervalued, overlooked, and portrayed as inferior to university faculty members (Townsend & Twombly, 2007, p. 1).

To rectify this situation, the American Association of Colleges and Universities has created the SEED program to help community colleges and faculty members to position themselves to become real innovators in sustainability education by building partnerships with schools and industry (SEED, 2011). Community college presidents from all over the country have signed up for the SEED program. As a result there is a concerted effort nationwide for community college faculty development and engagement in sustainability education. The SEED program provides over 300 green curricular resources curated by higher education experts for community college faculty (SEED, 2011). However, since the SEED program is fairly new, there is not much data available regarding the impact on sustainability education at community colleges.

Summary

Sustainability is a relatively new interdisciplinary subject that colleges and universities are beginning to incorporate into the curriculum. I used the diffusion of innovations as a conceptual, theoretical model for studying how sustainability as an educational innovation was evolving. I began the literature review with a definition of innovation along with a

comparison of the characteristics of an innovator versus that of a change agent. Then I delved into the case study of the diffusion of innovation of instructional technology as an example to explore sustainability education in the community college.

Then, I provided a historical review of sustainability education and the many definitions of sustainability to establish the interdisciplinary nature of sustainability in a holistic systems thinking approach. This was followed by a discussion of the barriers and solutions to implementation of sustainability education. I provided a review of the content and pedagogy to incorporate sustainability in the classroom followed by a discussion of professional development programs. The chapter concluded with a discussion regarding the lack of literature on community college faculty and sustainability education.

Chapter 3

Methodology

The difference between what we do and what we are capable of doing, would suffice to solve most of the world's problems (M.K. Gandhi, 1927).

This chapter provides an overview of the methodology for research on sustainability education at the community colleges. The chapter begins with an introduction to the qualitative research process. Then a rationale is given for using the case study method. The research design addresses the research questions and the conceptual framework of the study. It also clearly delineates the data collection and analysis process. Lastly, the chapter describes the validity, limitations, and the role of the researcher.

Qualitative Research

In qualitative research, words are used for data mining instead of numbers. Qualitative methodology helps a researcher grapple with the meaning of complex research questions in lieu of looking at numbers and statistics (Erickson, 1986; Guba & Lincoln, 1994; Denin & Lincoln, 2005; Merriam, 2009; Creswell 2009; Yin, 2009). Qualitative research methods have been used in America since the 1900s, starting with University of Chicago's Sociology Department leading the development of this research methodology. In 1935, there was a public showdown between professors of Columbia University who supported quantitative research and those of the University of Chicago who were proponents of qualitative research (Tellis, 2004). Quantitative researchers objected to the case study method

because they perceived it as a flawed research method due to the small, insignificant sample size. After the University of Chicago lost that debate in 1935, there was a subsequent decline in use of qualitative research methods. In 1967, Strauss and Glaser renewed the use of case studies with their grounded theory approach (Tellis, 2004). They argued that case studies of one, two, five, or ten cases can be sufficient as long as the purpose of the study and objectives of the research question have been met. Rather than focusing on large sample sizes, qualitative researchers place importance on the depth of the investigation, the observations, data collection, data analysis, and interpretation (Merriam, 2009; Guba & Lincoln, 1994). According to Merriam (2009, p.13), “qualitative researchers are interested in understanding the meaning people have constructed, that is, how people make sense of their world and the experiences they have in the world”.

Qualitative research was utilized in this study to understand how faculty members incorporated sustainability in the classroom. This study emphasized the process of teaching and learning sustainability and described how faculty members interpreted their experiences.

Case Study

Creswell presented five basic approaches to qualitative research: narrative research, phenomenology, grounded theory, ethnography, and case study (Creswell, 2007). Creswell defines case study research as a “qualitative approach in which the investigator explores a bounded system

(case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observations, interviews, audiovisual material, documents and reports) and reports a case description and case-based themes” (Creswell, 2007, p.73).

A qualitative case study is an in-depth analysis of a bounded system (case) limited to a specific individual, organization, or program. Factors such as access and convenience influence case selection (Yin, 2009; Merriam, 2009). According to Merriam (2009, p.40), “a bounded system is a single entity, a unit around which there are boundaries”. In this research study, the bounded system was sustainability education at the GCCD and the faculty member was the unit of analysis.

Miles and Huberman define a case as a “phenomena of some sort in a bounded context.” They have graphically depicted the case study as a circle with a heart in the center where the heart is the focus of the study and the circle represents the edge of the case (Miles & Huberman, 1994, p.25). This model, shown in Figure 6, has been adapted to the case study of sustainability education at the community colleges.

The case study approach was ideally suited for researching sustainability education at GCCD because, as the model illustrates, it was important to understand the personal experiences, assumptions, and values of the faculty members (unit of analysis) involved in sustainability education.

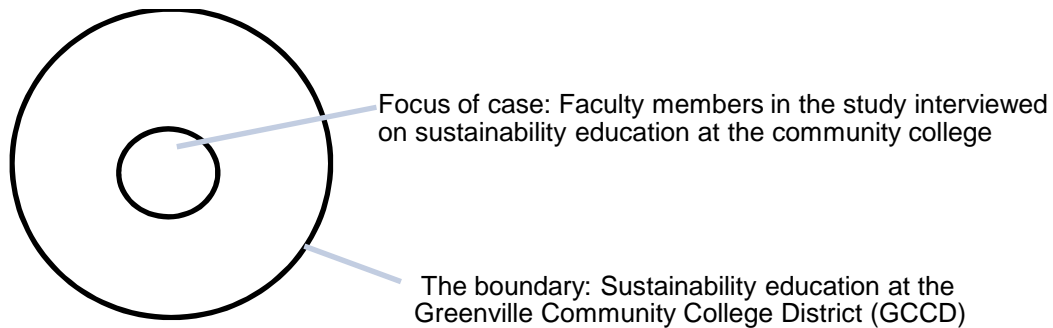


Figure 6. Adaptation of case study model to sustainability education

This research study of sustainability education at the GCCD was “instrumental” because the case was studied in depth and the results were scrutinized in order to learn more about sustainability education at community colleges. As evidenced in the literature review, there was a paucity of knowledge concerning sustainability education in the community colleges. Hence this qualitative research study was critical in order to drive future changes in policy and practice.

Research Questions

The case study method was selected due to the nature of the study’s questions. Creswell posits that qualitative research strategies should be based on the research questions in a study (Creswell, 2009). As Creswell and others asserted, case study methodology should be used if the research questions are in-depth descriptive questions aimed at developing an in-depth understanding of an issue or a case (Creswell, Hansen, Clark Plano, & Morales, 2007). From an epistemological viewpoint, qualitative research can give answers to detailed and complex research questions (Erbil & Akıncıtürk, 2010).

Many surveys and quantitative data were available on the topic of sustainability education, one of which was the *Campus Report Card* (NWF Campus Report, 2008). In 2008, the *Campus Report Card* conducted a survey of 1068 colleges and universities across the United States on sustainability education with respect to campus operations, curriculum, and leadership. Quantitative data gathered by these surveys on the number of classes incorporating sustainability and the numbers of professional development programs did not provide a sufficient insight into the processes in place for sustainability education. In order to examine the research questions of how curricula was developed and sustainability was incorporated into the classroom, it was necessary to gather information from key stakeholders whose opinions and experiences drove curricular changes and informed professional development policies and practices.

This research study examined how faculty members developed, incorporated, and evaluated sustainability curriculum in the classroom. Yin emphasizes that case study research investigates a phenomena within a real life context (Yin, 2009). A good case study collects and analyzes data from multiple sources (Yin, 2009). The research problem should be the basis for choosing the sample to be interviewed or the documents to be analyzed (Merriam, 2009). Several sources of data such as interviews, Blackboard sites, course documents, assignments, and professional development activities were used for this study. During the interviews, the eight faculty members were given the opportunity to articulate how they

developed innovative pedagogy in their teaching and learning of sustainability in the classroom. The effectiveness of the professional development strategies were examined and the factors that supported or impeded faculty members as they incorporated sustainability in their classrooms were evaluated. The research questions of this study led to the framing of the interviews with eight faculty members. The interviews were conducted in a conversational style in a semistructured format (Merriam, 2009; Jessop & Penny, 1999; Kamberelis & Dimitriadis, 2005). Once the interview data were gathered, the data were coded and translated into themes and patterns.

Conceptual Framework

This research study employed the theory of diffusion as the conceptual framework. The study revolved around Roger's model of innovation and the factors that contribute to the pattern of innovation with respect to sustainability education in the community colleges. Rogers identified four factors: innovators, communication channels, time for dissemination of innovation, and members of the social system that adopt the innovation (Rogers, 2003).

These four factors from Roger's model of diffusion of innovation were analyzed in this research study on sustainability education as follows: how the innovators developed the curriculum and pedagogy, the communication in the social system of the community colleges, the time it took for the diffusion of innovation, and the faculty members of the social

system. This study further examined the participants with respect to the adopter categories of innovators, early adopters, main majority, late adopters, and laggards (Moore, 1991). In this case study, the conceptual framework of the diffusion of innovation theory was applied to determine the pathway of innovation and the adopter categories for sustainability education in the community colleges.

Data Collection

In qualitative research, the nature of data collection is critical in order to add to the body of knowledge. The primary sources of data for this case study were the interviews of the eight faculty members. In addition, multiple sources of information such as surveys, professional development tools and activities, course syllabi, assignments, Blackboard sites, and course documents were examined for triangulation.

Sampling. Qualitative researchers normally use small sample sizes; therefore, sampling is crucial and needs to be conducted in a purposeful, thoughtful manner. An in-depth analysis of a qualitative research study with a small sample size could be more beneficial than a large sample size study where penetrating interpretations cannot be made (Kvale, 1996). "Sampling involves decisions not only about which people to observe or interview, but also about setting, events, and social processes" (Miles & Huberman, 1994, p. 30). Purposeful sampling is the process of selecting participants from whom researchers can gain the most insight and discover and understand the phenomena (Merriam,

2009; Coyne, 1997). Based on the aim of the research, participants were selected based on certain traits or qualities that they possessed such as attending a GCLI workshop on incorporation of sustainability in the classroom.

It is critical to align the sampling parameters with the research questions. The research questions guide the sample chosen for the study in a set boundary within the limits of time and means (Miles & Huberman, 1994). This study's sample was chosen purposefully and comprised of eight faculty members who attended a GCLI workshop on sustainability. Four faculty members were chosen based on the fact that they attended a single GCLI dialog day workshop called "Sustainability Conversations" on the incorporation of sustainability in the classroom, whereas the other four participants were chosen because they attended a more in-depth 18-hour multiple sessions workshop called the Learnshop on the incorporation of sustainability in the classroom. The strategy of selecting individuals with the aforementioned explicit criteria helped increase the confidence in and reliability of the findings of the study.

A potential caveat was that a purposeful sample selection could create a uniform sample that does not represent the diverse population of faculty members in the GCCD system. In order to avoid uniformity of sample population, an important guiding principle was to strive to include people within the parameters of the criteria identified that have the most diverse perspectives (Mays & Pope, 2000; Higginbottom 2004). In order to

add variation within the sample population, faculty members were identified from five different colleges within the GCCCD system that met the criteria of attending a GCLI-sponsored Learnshop or the dialog day, faculty development workshop on incorporation of sustainability in the classroom.

In spite of selecting participants from different colleges within the GCCCD for this research study, the uniformity of the sampling population chosen would have made the study too narrow. A narrow study can lead to bias since there is danger of the researcher crafting the study to the outcomes of what he or she likes to achieve (*Koerber & McMichael, 2008*). To avoid this danger, another sampling technique was exercised called the *maximum variation sampling* (Guba & Lincoln, 1989). In addition to finding the sample population of faculty members that had maximum passion and interest in sustainability education at their respective colleges, a concerted effort was made to identify persons who were no longer active in sustainability education or even be a dissident of sustainability education. Considering questions such as: “who else needs to be interviewed that is not central to the phenomena of sustainability education or maybe even a dissident?” helped identify one such individual for the study. The advantage of maximum variation sampling is that one can learn about a different contrasting perspective to a single central view of the phenomena (Guba & Lincoln, 1989).

Another variation that was added to the study was to choose faculty members that had diverse disciplinary backgrounds such as physical sciences, life sciences, social sciences, humanities and career and technical education. Such variations in the sample added multiple perspectives and enhanced the research study. Pronouns such as I, me, my, and myself were used to represent the researcher in order to create a dialogic environment in a personalized setting so as to indicate the decisions made by me as a researcher during data collection and analysis processes (Freeman, deMarrais, Preissle, Roulston, & St. Pierre, 2007; Guba & Lincoln, 2005).

Informed consent. My initial goal was to have five faculty members identified for the study. I created a preliminary recruitment letter for inviting the participants for the study. In order to make the study purposeful, I initially created a short list of five faculty members from five different colleges who would be ideal for the study and invited them to participate in the study. In the end, I was successful in obtaining eight participants for the study. Once the participants were identified, the next step was to inform them of the general topic of the research and logistics of where and when to meet for the interviews (Cannella & Lincoln 2007; Guba & Lincoln, 2005). In addition to providing the general topic of the research study, I emphasized the importance of the unique contribution that each of the participants would make to the study (Murray, 1998).

The unique contributions of the participants to the study were elicited through survey instruments and in-depth interviews. I administered a preliminary survey to the participants of the study, since surveys help glean more insight into the phenomena (Yin, 2009). The surveys were followed by interviews involving in-depth questioning. Since some questions were personal in nature, there was a need to build a rapport of mutual trust and respect between myself and the participants (Bloom & Crabtree, 2006). I also assured the participants of anonymity with respect to their names and the names of the community colleges where they worked in order to gain their confidence. I provided the participants an informed consent form approved by the Institutional Review Board (IRB, Appendix F) at Arizona State University and at the GCCD that clarified their role in the research and my role as a researcher. The IRB informed consent form also provided assurance to the participants regarding the confidential nature of the research.

The setting. The interviews of community college faculty members were held at a place convenient to the participants. A neutral location where participants were not likely to be identified by observers was chosen as the interview setting (Kamberelis & Dimitriadis, 2005; Charmaz, 2006).

The interviews were recorded on audio tapes. In addition, I took detailed notes during the interview using a “smart pen” that simultaneously recorded the interview while I was writing the notes. Immediately after the

interviews, I reflected on the interview process and made copious notes in my journal.

Interview questions

In preparation for the case study interviews, I formulated the questions in a semistructured, conversational format (Merriam, 2009). A semistructured interview is defined “as an interview whose purpose is to obtain descriptions of the life world of the interviewee with respect to interpreting the meaning of the described phenomena” (Kvale, 1996, p. 5). In essence, an interview is a conversation in a professional setting that has some structure and meaning. However, it is not a normal conversation where there is equal interchange of discourse between two people; it is structured so the researcher can purposefully elicit information from the participant. Semistructured interviews are planned with a set of open-ended questions, which lead to follow up questions during the interview. In many studies, the basic research question could be used as an interview question followed by 5–10 questions that delve deeply into the research issue (Dicicco-Bloom & Crabtree, 2006). Based on the nature and flow of the discourse during the interview, the researcher might need to deviate from the planned interview questions. This might lead to a more rewarding interview (Kvale, 1996; DiCicco-Bloom & Crabtree, 2006).

Using these theoretical guidelines, I initially developed a large list of interview questions with prompts. Following Kvale’s guidelines for creating

interview questions, I had the following types of questions in my initial list (Kvale, 1996):

1. Introducing questions; The first few questions were meant to put the interviewees at ease. An example of a structured question used was “Please tell me a little bit about your educational background that has led you to where you are now?”
2. Follow up questions; These questions emerged during the course of the interview and were based on the participant’s answers by using a significant word, a nod or direct questioning of what was said. It was important to keep the research question on sustainability education in mind and not digress too much from the topic. An example was “Could you please elaborate about how you are involved with sustainability education at your community college?”
3. Probing questions; Depending on the answers, I elicited more information by using probing questions. An example was “What are the factors that sparked your interest in this topic?” or “What are some factors that hinder you from getting involved in this sustainability initiative?”
4. Specifying questions; These questions were more operational kinds of questions in order to get precise descriptions. One of the criteria for choosing the participants

in my sample was the attendance of at least one professional development workshop on incorporation of sustainability in the classroom. Keeping this criterion in mind, I synthesized a couple of specific questions, such as “Have you incorporated sustainability in your classroom? If so, can you describe in detail how you have done so? If not, can you describe some obstacles that have hindered you from incorporating sustainability in your classroom?”

5. Direct questions; These questions were asked towards the end of the interview when a new dimension to the interview was introduced. I shared Moore’s model on the adopter categories of an innovation and explained the rationale for the different adopter categories. Subsequently, I asked the participant the following question: “Where do you see yourself in Moore’s model of the adopter categorization on the basis of innovation and what factors prompt you to classify yourself in the category?”
6. Indirect questions; These were projective questions that referred to other faculty members and required careful questioning. An example of an indirect question was “How can one help other faculty members cross the chasm in Moore’s model in order to adopt the innovation?”

7. Interpretive questions; These questions involved just rephrasing the answer or clarifying an answer or the questions could be speculative such as “Do you see any connection between the offerings of the professional development activities and adoption of sustainability education as an innovation by mainstream faculty?”
8. Structuring questions; These questions were necessary sometimes if a participant diverged into a path irrelevant to the study. I changed the course of the interview by introducing a new topic, such as “How effective are some of the professional development activities available to you in sustainability education?”

At the end of the interview, I gave a brief summary of what we discussed during the interview, and asked the participant whether they had any questions.

With the purpose of the study in mind, I examined my initial list and prepared a smaller, more precise list of feasible questions (Kruegar & Casey, 2000). I removed the yes/no answers, the why questions, and paraphrased some questions into an open-ended format to obtain the list. I also removed leading or suggestive questions from my initial list since even a slight rewording of the questions can change the answers (Kvale, 1996).

A good case study revolves around not only asking good questions but also being a good listener. “A good listener is able to assimilate large amounts of new information without bias” (Yin, 2003, p.60). An active listener not only listens to what is being said, but also listens between the lines and gains new insights. This could lead to a new questioning strategy. Allowing pauses during the interview, gives the participant some time to think, reflect, and hopefully break the silence with new information pertinent to the study (Kvale, 1996). As a researcher, I gave the participants the space to finish their thought process, tolerated pauses, and was open to far-out opinions. Overall, as a productive qualitative researcher, one needs to learn to ask the right questions, be an attentive listener, and be flexible in order to prepare for the interviews (Merriam, 2009). I tried to actively listen and came up with follow up questions based on what the participant said during the interview.

Data Analysis

In tandem with the interview data, I analyzed the artifacts collected for the study such as the professional development documents, preliminary survey results, course syllabi, assignments, Blackboard sites, and course documents. Analysis of data should include all forms of data collected and leave no loose ends (Yin, 2009). After the personal interviews, the audio tapes of the interviews were transcribed into written format. Each interview lasted between sixty-five minutes to one hundred and twenty five minutes based on how the participants elaborated on the

interview questions. I used the Express Scribe software to transcribe my interviews. At times, when the audio recording was not clear, this software enabled me to easily go back and verify what was said. I tried to stay true to the data and transcribed the interviews verbatim with pauses and repetitious words in the hope that this information might be useful for later analysis. Since I transcribed the interviews myself, I was able to relive the interviews and was able to ascertain that my initial thoughts and notes about the interviews were accurate. I also verified the transcriptions with the notes and the voice recording that I had taken with my smart pen. I used code names to maintain anonymity of the participants as I transcribed the interviews. Once the interviews were transcribed, I sent the participants a copy of the transcripts to review, edit, and comment on before I began further analysis of the data (Creswell, 2007). When I transcribed and reflected on the interview, I found some gaps in my interview data for two of my participants. I sent these two participants follow up questions through email as soon as I discovered the gaps and obtained prompt replies that clarified their responses.

Data collection and analysis are recommended to be done simultaneously; therefore, I began data analysis immediately after I transcribed the interviews (Merriam, 2009). For the very first interview, I began data analysis using the old fashioned method of paper and pen in order to make meaning of the data. I examined the transcript line-by-line and made notations, coding and comments. With eight interviews to

analyze, I felt that using data analysis computer software was a better and more efficient method. From the second interview onwards, I used a computer software to analyze the data. I evaluated two different computer software for data analysis; In Vivo software and the Microsoft Office One Note software. Due to ease of use and lack of a steep learning curve, I finally decided to use the Microsoft Office One Note software for data analysis. My initial description gave an overview of the participants, their work, and gave a glimpse of their thought process. Then I continued to analyze specific situations that were mentioned in the interview. Looking at prominent issues within the first couple of interviews helped me in determining the complexity of the study (Creswell, 2009). Once the main issues were identified, I searched for patterns and common themes in subsequent interviews (Yin, 2009; Creswell et al., 2007). As I searched for common themes, I tried to find evidence in the different interviews to substantiate these patterns and themes (Yin, 2009). I utilized these approaches and strategies for data analysis in order to make sense of the data and answer the research questions.

Reliability and Validity

As data were collected, analyzed and interpreted, reliability and validity needed to be addressed (Merriam, 2009). "Reliability pertains to the consistency of the research finding...and validity refers to the truth and correctness of the statements" (Kvale, 1996, p. 235–236). Reliability and validity are of foremost importance in any research study. They are

especially critical in a qualitative case study where the researcher discerns the information from the interviews of participants. Reliability means to reproduce the findings of a qualitative study in another setting and it depends on the protocol used (Creswell, 2007). The relationship between the researcher and participant needs to be considered for data analysis and the presentation of the results of the study. Reproduction of a qualitative study is challenging due to the nature of the interviews and the significant role of the researcher-participant relationship in data analysis.

Validity is ensured if quality control is used at each stage of the study rather than only at the end of the study. As I developed the interview questions, I avoided leading questions that might create a bias in the study. A study free from any bias is termed objective and is referred to as “reliable knowledge, checked and controlled, undistorted by personal bias and prejudice” (Kvale, 1996, p. 64). Objectivity is an important, yet challenging, factor in creating knowledge that is free from bias. During the interview, as a researcher, I needed to be tolerant of conflicting and controversial opinions and not bias the study with either verbal or nonverbal gestures. While transcribing the interviews, I paid close attention since a word or punctuation can change the meaning of what the participant wanted to convey. Hence, I verified and validated at each stage of the study. In addition, I was open and looked for alternate explanations to the data collected.

“Triangulation is generally considered as using multiple perspectives to clarify meaning, verifying the repeatability of an observation or interpretation” (Stake, 2005, p. 241). Triangulation means to look at data from multiple sources that increase credibility of data collection (Yin, 2009). In this research study, data were collected from professional development documents, course syllabi, assignments, Blackboard sites, course documents, preliminary surveys, and interviews in order to make the study more reliable and triangulated.

As a practitioner in the area of sustainability education at the community college, I saw myself as a coparticipant in the study and benefited from such a perspective. Use of a researcher’s expertise and prior knowledge in the area of study is considered an advantage for data analysis (Yin, 2009). However, I was aware that this brought some complexity into the study as I interacted with the participants of the study because of my prior experiences, assumptions, and beliefs.

During an interview, “both parties bring biases, predispositions, attitudes and physical characteristics that affect the interaction and the data elicited...[even] a skilled interviewer accounts for these factors in order to evaluate the data being obtained” (Merriam, 2009, p. 109). Creswell posits that melding with the group is seen as an advantage in qualitative research since it allows the researcher to know the culture of the organization and gain a deeper understanding of the language, traditions, and customs of the culture (Creswell, 2007). Researchers can

become coparticipatory and engage in both learning about the research study and working with the participants (Shi, 2006).

Due to the duality of roles for the investigator as a researcher and a coparticipant, it is key to maintain a critical distance to reflect on the research practices in order to make methodological decisions (Hewitt, 2007; Shi, 2006). Being aware of my dual role as a researcher and coparticipant, it was imperative to be as objective as possible and not compromise the objective nature of the research study.

Limitations of the Study

One of the limitations of the study was that it involved only eight faculty members from one community college district. The results of the study may or may not apply to faculty members at other community colleges since the setting and campus culture would be different.

Another limitation was that all eight faculty members belonged to the same community college district, the GCCD. In order to add more variation in the sample, the eight faculty members were selected from five different colleges of the ten colleges in the GCCD. Criterion based sampling was used to choose the eight faculty members. Maximum variation sampling was used to choose at least one of the eight faculty members who were not actively involved with sustainability education or even antagonistic to sustainability education. Also, a concerted effort was made to choose faculty members from diverse disciplinary backgrounds.

These approaches created more variation to the sample and helped to increase the study's reliability.

Another limitation to the study was that I worked for a sustainability initiative at my community college and could bring in my own biases, assumptions, and preconceived notions to the study. I was cognizant of this risk of bias and tried to be as objective as possible at each stage of the study.

My Role as a Researcher

I have been involved in sustainability education at my campus and GCCD district for the past six years. At my campus, I have been successful in getting some world renowned leaders in sustainability education such as Debra Rowe, Hunter Lovins, and Kevin Danaher to present to our faculty members and students. I am the faculty advisor of the student club called the Humanitarian and Environmental Action Team (HEAT). As a result, I have provided guidance to our students on club activities such as the dumpster dive, campus recycling efforts and other student led programs. I initiated the graduation pledge at our campus; a sustainability pledge that students take during the graduation ceremony. For the past five years I have been organizing the campus Sustainability Day every April where there is a poster symposium and a speakers' corner. Approximately 160 to 200 posters have been displayed at the poster session and there have been approximately 50–60 presentations at the speakers' corner on any given year.

At the district office I began a grassroots Greenville sustainability initiative program called the Sustainability Network. Employees from all the ten colleges gathered together to discuss varied issues of sustainability with the main focus being student learning and classroom pedagogy and practice. Since 2006, I organized, facilitated and presented at the 3–4-hour GCLI dialog days workshop called “Sustainability Conversations” on incorporating sustainability in the classroom. In addition, I organized, facilitated, and presented an 18-hour Learnshop on incorporating sustainability in the classroom for two semesters. Presently, I am one of the Tri-chairs of the Greenville-wide Sustainability Committee.

Along with a team of faculty, I founded the Greenville district-wide Sustainability Instructional Council (IC) in 2009 and have been the chair of the council since inception. This instructional council was supported by the executive vice chancellor for academic affairs and the GCCD district-wide curriculum committee. This interdisciplinary instruction council is comprised of faculty members from 19 varied disciplines and has made decision on curricular issues.

At the executive level, I have worked with the Chancellor’s Executive Council taskforce on sustainability. This team drafted the sustainability resolution which was signed by the chancellor and adopted by the governing board. In addition, based on the recommendations of the task force, the Chancellor signed the American Colleges and Universities Presidents Climate Commitment in 2010. The Chancellor has initiated a

Greenville-wide sustainability council which is co-chaired by the upper administration of the GCCD. I represent the Greenville faculty members on this sustainability council.

All the interviewees were faculty members of GCCD and being a faculty member myself, I had access to the interviewees and was familiar with the value issues and culture of the organization. Yin asserts that “the ability to perceive reality from the viewpoint of someone “inside” the case study rather than external to it is invaluable in producing an “accurate” portrayal of a case study phenomena” (Yin, 2003, p. 94). As I designed the study, I was sensitive to the bias issue and thus, endeavored to be very careful not to become a supporter of the phenomena studied and was committed to be as objective as possible.

Introduction of the Participants

A very brief description of the participants of the study has been provided here in order to give the reader some background. The eight faculty members who participated in the study were chosen from five colleges. The five colleges included two of the largest colleges in the GCCD district, two of the medium colleges that were farthest apart geographically, and an online college. The names of the colleges have not been mentioned in order to protect the participants; instead, a number was assigned to each college. Five of the eight faculty members were also members of the Sustainability IC. Table 2 illustrates the diverse disciplinary focus of the eight participants in the study. The purposeful

sampling method was used to ensure that the participants were representative of a wide variety of disciplines. There were two participants each chosen from colleges one, two, and four. Only one participant each was chosen from colleges three and five in order to add variation to the sample population.

Table 2
Disciplinary focus of the participants

Participant name	College	Discipline
Ginger	1	Geography
Jane	2	Philosophy and religious studies
Ethan	3	Economics
Sharon	5	Chemistry
James	4	Biology (Anatomy and Physiology)
Scott	2	Geography
Jasmine	1	Interior design
Lydia	4	English and Women's studies

Here are some brief descriptions of the participants:

Ginger has a doctoral degree in geography. She has taught geography at her college for the past ten years. She has experience in team-teaching a course and enjoys bringing real life current events into her classroom. Ginger has been a leader in sustainability curriculum development at her campus and the district.

Jane began her education in biology, switched to French and then to philosophy. She started out as a nun and then decided to leave the

church. She then obtained a master's and a doctoral degree in philosophy, an MBA in business administration in computer information system, a master's degree in education and human relations and also got certified in computer programming and theology. Jane presently teaches philosophy and religious studies at her campus. Jane has incorporated sustainability by revamping the entire environmental ethics curriculum.

Ethan had great role models in his mother and grandmother. His grandmother inspired him to excel in academics and he has been a straight A student since sixth grade. Due to taking dual credit classes in high school, he entered the university directly as a junior and was all set to major in psychology for his undergraduate degree and had his honors thesis in psychology published. On a whim, he went with his friend and attended an economics class. He loved it so much that he ended up double majoring in economics and psychology. He then obtained a master's degree in economics and has been teaching for the past six years. He is an avid environmentalist with a passion for nature. He has taken a leadership role in sustainability at his campus and enjoys working on student assessments.

Sharon has a bachelor's and master's degree in chemistry and has taught chemistry for ten years at her campus. With a young daughter at home, Sharon is constantly thinking about the future. Sharon is passionate about nature and has taken a leadership role in creating a sustainability

rubric for her campus and developed courses and curriculum in sustainability.

Scott has a master's degree in geography and has taught for the past twenty years. After receiving his degree, he took a few years off to work on a dive boat in the Caribbean with the fishes and the coral reefs. He has been working at his campus for the past twenty years. He has piloted a sustainability course at his campus and enjoys thinking about student learning and developing new lesson plans.

James has a bachelor's degree in psychology and took a lot of premedical classes. He obtained a master's degree in counseling and continued to get a doctorate in naturopathic medicine. He also has a lot of informal education in the business world. He then practiced naturopathic medicine for a few years. He was not planning or training to be a teacher but once he tried teaching, he enjoyed it and decided to do it full time. He now teaches anatomy and physiology for the past five years. James loves to recycle and is an environmentalist at heart, which got him involved in sustainability education.

Jasmine got her bachelor's degree in home economics with a concentration in interior design. She then worked for a design firm, furniture dealership, an architectural firm, and a small interior design firm before starting a family and returning to academia to graduate with a master's degree in design. Jasmine is passionate about green built environments and is innovative in her teaching. She has completed all of

the course work in an Environmental Planning doctoral program. She has been teaching at her campus for the past twelve years.

Lydia went to a science and mathematics magnet school and went into college thinking she was majoring in science and mathematics. She was halfway through her bachelor's degree in chemistry when she switched her major and became a British studies major. She obtained her master's degree in English literature with a certificate in women's studies. She is a huge proponent of learning communities because of her interdisciplinary background. She has been teaching for 11 years and is a leader in diversity programs.

The participants for the study were all residential faculty members of the GCCD. Due to the interdisciplinary nature of sustainability, a great deal of effort was used to identify the participants of the study. Great care was taken to ensure that the faculty members chosen for the study had varied educational backgrounds and the diverse disciplinary focus.

Summary

The aforementioned eight faculty members were interviewed and their voices heard to learn about teaching and learning of sustainability in the community colleges. These faculty members were chosen from different campuses with diverse disciplinary backgrounds. Various data were collected such as course syllabi, assignments, Blackboard sites, course documents, professional development tools, preliminary survey, and personal interviews. Data was simultaneously analyzed during sample

collection for common patterns, themes, similarities, and differences in order to answer the research questions.

CHAPTER 4

RESULTS

Research is to see what everybody else has seen, and to think what nobody else has thought (Albert Szent-Gyorgyi).

This chapter contains the results of the data collection and analysis in relationship to the research question: “What are the processes and procedures used by the GCCD faculty to make sustainability part of the curriculum and the classroom?” The chapter begins with an introduction on how the participants’ interest in sustainability was sparked. Then the chapter focuses on how faculty develop sustainability curriculum in order to incorporate it into the classes. This is followed by a description of the pedagogy used by the faculty for teaching and learning of sustainability curriculum. The chapter then focuses on the interdisciplinary nature of sustainability and the benefits and the barriers of offering courses in an interdisciplinary topic such as sustainability. The chapter also delineates the connections between the conceptual framework of diffusion of innovation and sustainability education at the community colleges. The chapter then delves into the professional development strategies used for sustainability education and the effectiveness of these strategies. Lastly, the chapter focuses on the factors that support or impede GCCD faculty as they endeavor to incorporate sustainability in the classroom.

Data Collection and Analysis

Eight interviews were conducted in a semi-structured format at different locations based on the convenience of the participants. All of the

interviewees were provided with the same preliminary survey to complete; seven participants completed the survey and one participant completed half the survey. Six participants provided assignments, lesson plan documents and rubrics as artifacts for the study. Two of the participants granted access to their entire course Blackboard site. The interview transcripts, preliminary surveys and artifacts provided by the participants were used for data analysis.

Participant Characterization from Surveys

All the faculty members interviewed were residential faculty members at their respective campuses. The faculty members interviewed for this case study had diverse disciplinary backgrounds as illustrated in Table 3; five of the faculty members were females and three of the faculty members were male. The faculty members had wide-ranging experiences in teaching; their experiences ranged from five years to 40 years. The faculty members had varied teaching experiences in sustainability ranging from zero years to 18 years. Five of the faculty members had taught sustainability from one to six years. Conducting the preliminary survey helped in determining the faculty members teaching experience in sustainability (Table 3).

Interest in Sustainability Education

The participants shared their passion for sustainability and how they initially got interested in sustainability education. According to the participants, though it was hard to pinpoint a single reason for their

Table 3
Participant characteristics

Name	Discipline	Years of teaching experience	Years teaching sustainability
Ginger	Geography	10	0
Jane	Philosophy and Religious studies	40	6
Ethan	Economics	6	1
Sharon	Chemistry	18	18
James	Biology	5	2
Scott	Geography	20	5
Jasmine	Interior design	12	5
Lydia	English and Women's studies	17	10

interest in sustainability education, one or more of the three following factors seemed to contribute to their interest: love of nature, inherent nature of their discipline, and equity.

Love of nature. For the majority of the participants, the interest in sustainability education stemmed from a respect and appreciation for the environment. Ethan, an avid backpacker and hiker who enjoys being in the solitude with nature, said, “It is hard to have an urgency of sustainability if you do not have a personal connection with nature to some degree.” Most of the participants were interested in sustainability education due to an intrinsic love for nature. As Jane very succinctly said,

I have a fundamental belief that we have to reverence the world that we are living in, and I think I can do that rationally. It is not just a [sic] emotional thing even though that's where it starts. I just like the world I am living in. I love the plants, the animals, and even bacteria.....So it all has to be revered. So we have to use it all properly so that everything has the best chance to live and express

itself. Whether it is human, animal or plant, I get excited about things like that.

In addition to love of nature, Scott mentioned that he has both “selfish and altruistic reasons” for his interest in sustainability education. Scott attributed the selfish reason to being bored with teaching his discipline for 20+ years and wanting to try something new. The altruistic reason was to impart knowledge and incite excitement in his students about such a vital issue of our world today.

Due to having a young daughter at home, Sharon felt that it was important to take care of the earth’s resources for the future. James always was interested in recycling and saving the earth’s resources. However, he got involved in sustainability education through a professional development workshop. James said,

I kind of feel good about doing things to minimize the footprint that I have on this earth. And so, when I saw [the GCLI] sustainability class....I thought I want to do that. Learn more. I want to learn more about it and see what is out there. So it is really through [the GCLI] class that I got into the sustainability education aspect.

Seven of the faculty members mentioned that an added impetus to teach sustainability was due to the students’ excitement to learn about sustainability. As Scott said, “I like teaching it just because these things are most important and the students are excited about it.” The faculty members mentioned that they were excited to teach sustainability because the students were excited to learn about the interconnections between the social, environmental and economic aspects of sustainability.

Inherent Nature of Discipline. Some of the participants attributed their investment in sustainability to their disciplines, which were ideal for incorporating sustainability education. Ginger mentioned that the inherent nature of her discipline, geography, is such that “it naturally lends itself to incorporation of sustainability.” Hence she has been involved in sustainability education from the beginning of her career though she has not personally taught a sustainability course. Ginger said,

I don't want to see this as a discipline that saves the world. My first motivation is I want to make sure that sustainability is embraced. But not necessarily look at sustainability as changing the world. I want sustainability to be recognized as a discipline and embraced.

Jasmine got involved in sustainability education during the accreditation process of her campus. Even though Jasmine's discipline, interior design, naturally lent itself to sustainability, it was the passion that Jasmine had for sustainable practices that compelled her to be a leader in this field. As Jasmine said,

I have always been a sucker for sustainability. Interior design is....about making the environment functional and beautiful which is a very worthy cause.....I know it sounds kind of nutty. I can make the interior environments healthy rather than make people sick. It elevates the purpose and it elevates my passion for interior design. Not only are you doing things for people, but you are doing things to help civilization, in a way. It is just a higher calling. I call it the highest form of functional design integrity.

Equity. One of the participants, Lydia, attributed her interest for sustainability education to her passion for the environment and for equity. According to Lydia,

For me it is a sense of equity I guess.....There is a responsibility we have to folks who don't have the power or control of resources. So,

for me, it is partly a political issue; it makes sense. So, I try to work it into my classes that way, particularly in my women's studies class, because it is a field that is academic but one that deals with activism.

Lydia felt that sustainability education is “something concrete” that one can do to change one’s lives and others’. Since the basic premise of sustainability is for all people in the present and future generations to live well, equity and social justice are important aspects of social sustainability.

Sustainability Curriculum Development

Community college faculty members have indicated in national surveys that critical thinking is one of their primary instructional goals (Stark, 1990). When students are encouraged to think critically, they go beyond basic memorization and learn to apply what they have learned, ultimately leading to deeper understanding. Most of the faculty members interviewed have thought deeply about sustainability and invested time developing the curriculum. These faculty members have developed curriculum in sustainability that requires their students to go beyond basic memorization to the application of higher order thinking skills. They have developed the curriculum for a sustainability course around the following major themes: urban heat island effect, urban sprawl, climate change, peak oil, transit development and renewable energy sources, sustainable agriculture, resource depletion and problems of exponential population growth. Each individual has faced unique challenges in his or her quest to develop sustainability curriculum.

Scott and Ethan approached sustainability curriculum development by delving deeply into the problems facing our society today and then going into the solutions. As Scott explains,

We are looking at the big picture here. But the problem is that we spent the first seven weeks talking about the problems.....I am torn. Students are saying, 'This is depressing to just discuss the problems. When do we start talking about what we can do?' I am torn...you do not want to bore students[sic]. You do not want to focus on negative side of what we are doing because that is a bummer. We need to look at the solutions. But, at the same time, you need to understand the depth of the problem before you can truly understand how badly the solutions are necessary and warrantedHow would you know how critical the problem is? How would you know how meaningful it [the solution] is if you do not understand the depth of the problem?

Ethan begins the semester with a discussion of the general concepts of sustainability and understanding what sustainability really means. Then he asks students to evaluate the "different practices going on in this earth through the prism" to determine if it is really sustainable. He questions students,

If it is not sustainable, what could we do to make it sustainable? And I always try because it is so easy to get bogged down by the bad news and be scared about it. But I like to think of solutions to the problems in a really creative way....How do we get to a world where we protect the environment and we create well paying respected jobs for people and we have a society where they have a basic living and they have an opportunity to have a good life?

Ethan kindly shared his course Blackboard site, from which it was evident that he had invested an extensive effort in the incorporation of sustainability principles into his economics course. Ethan wears two hats at his campus; he is a leader in the sustainability program and also heads the student learning and outcomes assessment team. As a result, the

assessments of lesson plans are built into the process of development of curricula. Ethan further elaborated as follows:

I work with faculty all the time creating student outcomes measures and support the way to take that data and make curriculum decisions based on that. So it seems natural to me. It also seems weird, not having taught for too long that that hasn't been the standard practice. Sustainability assessment is also fairly new, you know, in the last 20 years or so. There is resistance or whatever from some faculty. But how else are you going to learn about student learning if you will not be measuring it?

Ethan further explained that he has friends in the private sector, in business and information technology, that have been using metrics, goals and measures for years of how well they have achieved their goals. Ethan felt that even though faculty members did not have the “entrepreneurship spirit to create profits,” applying the same business principles of metrics, goals and measures made sense.

Sharon faced a different challenge while developing curriculum for online classes due to the wide breadth of the topic. As she and her team of teachers worked on the lessons, they tried to “refocus measuring, meeting those outcomes, writing the assessments to measure what we want and trying to keep the focus of the course so that it does not become too overwhelming.” Sharon focused on balancing the excitement of teaching sustainability with fulfilling the competencies of the course.

Jane has been teaching logic and theory in her environmental ethics classes and has interspersed cases that portray different issues of sustainability within her curriculum throughout the semester. Presently, Jane is trying to create a paradigm shift in the way she approaches

sustainability in her classes. She has chosen a textbook on sustainability cases and plans to supplement the textbook with different aspects of philosophical theory. After redoing the course curriculum and piloting it in her classes, she plans on sharing her innovation with fellow faculty. Jane was kind enough to share her course Blackboard site in which there was evidence of the extensive work that she has invested in building the curriculum for the course.

Due to the nature of career and technical education programs, Jasmine, in her interior design courses had to adhere to approximately 100 indicators of sustainable materials throughout the courses within a three-year curriculum. She built her program by introducing concepts in her introductory survey courses and building on them as the students moved onto the next level courses in the following semester. In Jasmine's classes, students initially learn about a renewable material and are tested on it. Then the students apply the knowledge they gained in class by selecting a material "that is made of a renewable resource and using it in a design. So, the curriculum builds upon terminology and concepts." Some of the components of Jasmine's courses were the "elements of design, the principles of design, building codes, AutoCAD or any computer application software, and architectural accessibility."

Ginger developed curriculum based on courses that were already available in the area. She used the four-year university syllabus as a guide

to create the course curriculum. Ginger summed up her relationship with her counterparts with the four-year university faculty members as,

Using their [university faculty member's] syllabus as a guide, developing based on what they have already established so that we have some good relationship, a symbiotic relationship with our students transferring into the university. It was a matter of making sure that we met our needs here and at the district level and we were meeting the needs of perhaps of transfer or articulation into the system. This was the main reason I developed the course.

In order to develop courses in sustainability, an instructional council was formed in the GCCD. Five faculty members interviewed for this research study served on the Sustainability Instructional Council (IC) and were instrumental in the key achievements of the council. As Ginger said, "We have an IC... We are doing tremendous amounts of work in a very short period of time. As far as academia is concerned, we are going at a glacial rate." One reason why the Sustainability IC was successfully formed was due to the work of faculty members in the district-wide curriculum committee that came up with a specific definition of interdisciplinary courses. This definition of *interdisciplinary* enabled the instructional council to categorize sustainability under three main prefixes: Sustainability/Natural Sciences (SUS), Sustainability/Social Sciences and Humanities (SSH) and Sustainability/Career and Technical Education (SCT). The Sustainability IC faculty members then identified specific disciplines under these three prefixes of SUS, SSH, and SCT (Appendix E). Once the prefixes were categorized, hiring qualifications for the faculty teaching the courses were agreed upon by the faculty members belonging

to the instructional council (Appendix E). Jasmine reflected on the hiring qualifications that were agreed by the Sustainability IC and said,

From an instructional standpoint, we wrote the hiring qualifications. And, when I collected all four of my transcripts, I don't know if I have enough hours. I think it needs to be 18 in any one area. I might have spread myself so thin....I have to go back. I have got my transcripts, I have got the hiring qualifications so that may mean I may not be qualified to teach it all by myself, but I will have to team teach....You either want somebody that has the broad based education or have two people come together with the broad based education. That was the whole purpose of writing the hiring qualifications the way we did. So you know, just a realization, that if I had to do it all over again and if I had known, I would have made sure and funneled all my courses into one prefix rather than spreading them between the three.

Once the hiring qualifications were determined for each of the sustainability prefixes, the faculty members developed the course competencies and objectives for the courses. Lydia did not personally create curriculum in sustainability but patterned her courses with sustainability curricula already available. Being an experienced faculty who is passionate about women's issues, she developed curricula in her discipline of gender studies. Although James said that he had not developed curriculum for a course in sustainability, being a naturally innovative faculty with years of curriculum development in his specific discipline, he developed an innovative lesson plan on sustainability in his biology course.

All the faculty members had experience in curriculum development. However, six of the faculty members had revamped their entire curriculum. Five of the faculty members served on the instructional council and

worked on developing stand-alone courses in sustainability. Overall, the passion for teaching sustainability was the driving factor for developing broad-based curricular changes in sustainability education.

Pedagogy and Teaching and Learning in the Classroom

Community college faculty members pride themselves on innovation and using creative pedagogy in the classroom. This was evidenced in all the eight interviews, the preliminary surveys and the various artifacts collected/examined for this study. For example, Jasmine incorporated numerous active learning strategies in her classes. As a huge proponent of experiential learning activities in the classroom, Jasmine attempted to provide her students with hands-on exposure to sustainability incorporation into interior design. Jasmine initially had trouble “integrating the students with the design communities and the industry partners” since there was a little bit of a “push and pull with the administration.” However, due to her perseverance, Jasmine was able to instigate the editing and revising of the travel forms and assumption of risk forms which allowed her students to travel to manufacturing floors.

In the first two weeks of the semester, Jasmine discusses what good quality questions are and how to come up with them. For each of the experiential learning activities, prior to going on the field trip, Jasmine prepares the students in class. The students do a lot of background research; they examine the industry website and develop questions based on the information. During the field trip they are given opportunities to ask

their questions and elicit answers. As Jasmine described, “Ultimately they are evaluated on the information they acquire. If they don’t ask the right questions, they don’t acquire the right information and that is going to show up on the quiz.” Jasmine asks students to do *reflective learning* as soon as they complete the field trip and determine what they forgot to ask. Students are given an opportunity to meet the industry partners a week later so that they will have an opportunity to ask questions that they forgot to ask before or new questions that might have arisen during the reflective learning. In the end, students are given an open note quiz. The open note quizzes are designed to teach students about “organizing information and acquiring information” rather than “committing it to memory.” The students need to learn to ask questions of the industry partners and design community while on the field trips. “For, if they forget to ask it, then it will not be in the notes and they will not be able to answer the quiz. This will get them into the habit of asking questions.”

In addition, Jasmine has a final semester project where students gave a final presentation. Students need to identify novel materials, “seek out industry partners, buy their own materials”, and present the novel material to the class. Jasmine said, “I can talk about it in the classroom, but it is not going to have nearly the impact or the depth of learning that it does when we are out there in the field.” Jasmine shared her assignments and documents on experiential learning. In addition to the experiential

learning activities, Jasmine developed a series of team projects based on problem-based learning that she elaborated on.

You want to design something beautiful but you want to design it in a way that it does not harm the earth; it helps the society and is economically viable. And they have to discover... how to solve the problem on their own. I become the guide on the side and not the sage on the stage. I really am the guide on the side instructor. I am there to enthusiastically guide them in the right direction but I want them to discover the solutions on their own.

By learning from many different perspectives, students find unique solutions to complex issues. By sharing these solutions with one another, students reap the benefits of their education. Jasmine affirmed that the “retention in her classes were higher” as a result of these problem based learning activities.

Scott and Ethan used similar approaches to teaching sustainability. Scott divided the semester into different themes. Each week prior to discussion of a new theme or topic he created folders on Blackboard with 4–5 readings and the students were assigned these reading. Students were given approximately 40 questions to answer on each of the topics prior to attending the class every week. At the beginning of each class, they were given a very short quiz of two questions. If a student had done the readings, it was easy to answer the quiz questions since the quizzes were open book. Then, Scott led an active classroom discussion on the topic for a week or two depending on the topic. Scott summarized by saying, “I used to try to cover everything in class before. But now you

know what, I stopped teaching whole segments of my class – well, not really whole segments but within a topic.”

Ethan used a similar strategy as Scott and Jasmine for teaching sustainability and ran into similar issues of time constraints. Ethan found it “hard because there is a lot to teach to meet the course competencies. It is a challenge to infuse sustainability but I feel that it is important to do so.” Ethan used the Blackboard discussion board site extensively, where he posted articles pertaining to sustainability the night prior to the class.

I spent a considerable amount of time looking at Ethan’s course Blackboard discussion board. He had posted 16 assignments/prompts for the 16 weeks of the semester. The assignments were comprised of readings, short videos, or interviews with experts in the field. Students were required to complete the assignments and post their thoughts based on the three legs of sustainability: environmental, economic and social aspects. They needed to also comment on each other’s posts as part of their grade. I browsed through the discussion board and found the quality of the student posts demonstrated the depth of their knowledge. There was an average of 30 posts per week by the 24 students in the class. Ethan used the Blackboard discussion board to introduce the topic and this was followed by discussion in the classroom where students come up with a “spurt of ideas.” Assessments were built into the course throughout the semester. As a result of Ethan and his team’s work in sustainability assessment, his campus was the first higher education institution in

Arizona to be rated by the Sustainability Tracking Assessment and Rating System (STARS) at the bronze level. The program, STARS, is a self-reporting framework for higher education institutions to self-assess the different aspects of sustainability.

Sharon also worked extensively on sustainability assessments and rubrics for the sustainability courses at her campus due to the STARS program. Sharon used an inquiry-based approach to incorporate sustainability in her classes. Sharon shared her inquiry-based activities and rubric on the concepts of acids and bases' where she incorporated sustainability in the chemistry classroom. The students were assigned a reading on acids and bases. They learned about acid rain and used their knowledge of acids and bases to discuss the triple bottom line of sustainability in terms of the "economic impact, how it impacts society and the environment." The readings then led to a classroom discussion.

Sharon said that she used the inquiry approach to "put the idea out there and everybody comes together with their own experiences and own motivation for learning... incorporating their own experiences back into the assignment." She provided the students with the definition of sustainability and asked them to read an article on climate change, sea level rising and ocean acidification. This was followed by some critical thinking questions on the triple bottom line of sustainability involving economic, environmental and social issues. She created a sustainability rubric for the different sustainability lessons that she has incorporated into her course.

The sustainability rubric incorporated the “triple bottom line and the responses were not just environmental but it was how the environmental aspects could impact the other two areas.”

Sharon developed a rubric and a checklist for learning outcomes specifically for sustainability, which she shared with me. The document had the definitions of sustainability, the core values of sustainability for Sharon’s campus, the checklist for general learning outcomes for the general education course, followed by a sustainability rubric that looked for evidences of higher order thinking skills in students work. Sharon piloted this rubric in some of the sustainability courses. Her ultimate goal is to use the checklist and rubric in all the courses that incorporate sustainability.

Jane incorporated an extensive research element into each of the sustainability topics in her environmental ethics classes. Her course Blackboard site had an average of 20 journal articles/video clips/newspaper articles for each of the topics she covered in her environmental ethics classes. She expected her students to read the articles and conduct research on their own to gather more information prior to classroom discussion. Jane contends that

The students are more open, once they do the research, to sustainability issues. The biggest problem is breaking down the barriers presented by the news media...and by various leaders whether religious, political, social, or on our campuses. The barrier is a worldview barrier. Students don't want to see past their cell phones and facebook pages. The greatest help is the availability of research through the net. I am able to have students

work on topics and find information that is readily at hand. They are able to put things together and see for themselves where some of the problems are.

After classroom discussion, she expects students to write papers and to present on different topics. As an expert in research, Jane has utilized technology effectively by making folders on her computer for all the great philosophers such as Aristotle, Plato, John Rawls, etc. She has also created folders for all kinds of different issues on the environment. She has cross-referenced the articles so that she can access them easily. For example, if she was teaching a unit on Henry David Thoreau, she could quickly access an article on nature due to cross-referencing her files. This seemed to work very effectively for Jane. If fellow faculty members asked her help, she could pull out the resources and share with them.

Ginger and James were very innovative in the classroom and used many active learning strategies while incorporating sustainability into their courses. Both of them used classroom discussion and presentations in their respective classes. One example of an activity that James designed and shared with me was called the worst toxin activity. Student teams were assigned “one of the six most toxic substances on the planet.” Their task was to argue that their toxin is the worst toxin, both by writing a paper and doing a presentation. As students engage in this competition for the worst toxin, they “realize the environmental pollution, physiological consequences and the financial bind that most of our country is in,

because companies make these toxins for profit.” A strategy Ginger has successfully incorporated into her class is to begin the class with the news of the day. It can be anything such as the recent “cold front passage” in the previous day’s newspaper. Then she discusses the science behind the climate change and the students make the connections between the news of the day and the science involved.

Triangulation of data from numerous sources helps in establishing the validity of the study and makes the findings of the study more reliable. Therefore, I requested the eight faculty members to share their lessons, assignments, rubrics and even their entire course Blackboard sites so that I could analyze these artifacts in conjunction with the responses from the semi-structured interviews. I employed the Microsoft One Note software to simultaneously analyze all the artifacts and the interview transcripts. I found that these various artifacts corroborated and supported the interview transcripts data and thus contributed to the credibility of the research study.

All the faculty members interviewed for the study were extremely innovative in their approaches to teaching and learning of sustainability. The faculty members spent a great deal of time and effort in the development of innovative sustainability pedagogy. All the faculty members were very willing to share their

Interdisciplinary Nature of Sustainability

Sustainability is truly interdisciplinary. As evidenced by the wide-ranging fields that the interviewees teach in, sustainability is addressed within a variety of disciplines. In his sustainability course, Scott emphasized the following:

We talk about geology of the world, the physics of the atmosphere; we talk about politics, we talk about people who literally do not like trains; some politicians think trains are socialist, they are inherently socialist. So we talk about politics, we talk about chemistry, there is anthropology, there is city design, there is art, etc. I would think that [the interdisciplinary way] would be the only way to teach sustainability. How else can you teach sustainability?

All the eight faculty members interviewed highlighted the crucial role of the interdisciplinary approach to sustainability education.

Benefits of an Interdisciplinary Approach. There are a myriad of benefits to the interdisciplinary nature of sustainability such as 1) Broad range, 2) More encompassing holistic knowledge, 3) Real life application, 4) Team-teaching, and 5) Help in retention.

Broad range. The overarching nature of sustainability across multiple disciplines made sustainability very broad based. Sharon elaborated that the “broader range and perspective, more encompassing knowledge” of interdisciplinary courses can “motivate students.”

Lydia mentioned the “growing pedagogical interest in transnational feminism and ecofeminism.” Lydia stressed the aspect of intersectionality – the belief that what happens in one dimension is related to what happens in others. As Lydia summed it up:

You cannot talk about gender without talking about all the other things that make you a human being. You cannot talk about gender

without talking about race; you cannot talk about, you know, poverty and politics and the environment. People come to the composition class and they just say, "I just have to write a thesis statement. So leave me alone. I learned how to write in high school and so I don't want to talk about your issues." So there, they see themselves as something that their instructors are forcing them to talk about.Maybe they are not at the right place you know.

Therefore Lydia stressed the interdisciplinary nature of her discipline and she approaches her classes in a holistic manner.

More encompassing holistic knowledge. Ethan discussed moving away from traditional silos in order to teach sustainability in an interdisciplinary way as evidenced in his statement:

I think the benefits to interdisciplinary courses are that you will be helping the students integrate different topics with different ways of thinking and different approaches. That is crucial in today's society. So much of higher education is taught in silos... We bring our own set of assumptions to the table and have a preferred way of approaching topics. So, that, so, in that way breaking the [traditional disciplinary] silos in itself is pretty good.

Real life application. Jasmine considered interdisciplinary courses to portray the real world; she liked to teach her classes in an "integrated setting, not a segregated setting." Jasmine had the option of incorporating sustainability in her interior design course but felt that this would not adequately prepare the students for the real world. In the real world, people work in "charrettes" where a group of individuals work collaboratively to brainstorm solutions to a design problem. In the workplace, people from different disciplines work together on a project with the client and create a charrette so that everybody builds from that collectively. Therefore, in order to better prepare her students for the

workforce, Jasmine opted to create an entire course in sustainability which she will be teaching shortly.

I am a little nervous too. I obviously could teach to the interior part heavily but I don't know a lot about solar energy. So it is going to take a lot of reaching out to a lot of problem-based learning. You have students who have a wide range of interests in the same classroom. You almost have to formulate assignments so that they can spearhead their interests and bring it back and let everybody share what they learned from their perspective and their focus. So, the assignments have to be very broad based to allow everybody [sic] to benefit in the way they want to in a multidisciplinary course.

Scott and Lydia liked teaching interdisciplinary courses because it was interesting. Scott had the multidisciplinary background to teach the course singlehandedly. However, other faculty members liked to team-teach the sustainability courses.

Team-teaching. Lydia was a big advocate of learning communities and enjoyed team-teaching. According to Lydia, students see how “things are connected” and it makes the “course interesting” for her to teach.

If I had to talk about tenses and thesis statements and why you need the introduction and the format and why it has to to [sic] be this way.....I can do it but it does not add anything professionally to me as well.....So changing it up and talk about Biology, talk about Law, it sort of keeps me on my toes as an instructor as well..... I think it is good for the students to see as well. They ask a question; I think they are so intrigued if I say I don't really know the answer to the question. Why don't we find the answer to the question?

Lydia enjoys team-teaching with someone else in the classroom since she can “bounce ideas off” them. The students add to the discussion due to their different points of view from their own life which makes the classes interesting.

During the development of courses, Sharon said, “none of us are experts in the field; it is good to bounce ideas of [sic] different areas and work collaboratively. There are a lot of benefits to that approach.” Both Jane and Ginger talked about the benefits of team-teaching interdisciplinary courses. Ginger mentioned the importance of finding like-minded individuals but with different perspectives to teach the course. Jane talked about the benefits of getting compatible people together to teach a course. If however the two faculty members teaching it are not like-minded, it might cause issues in the classroom.

Help in retention. Lydia and Jasmine mentioned that teaching interdisciplinary courses such as sustainability is interesting and students are motivated by the topic. Even though she did not have any data to support it, Lydia believed that “one of the benefits of offering courses in sustainability would be to help to increase retention.” Jasmine seemed to agree that anecdotally, retention increased in her interior design classes that had incorporated sustainability. These aforementioned benefits to the interdisciplinary courses are offset by many barriers to sustainability education.

Barriers of Interdisciplinary Approach and Courses. Though there are many benefits to teaching in an interdisciplinary manner, there are some sizable barriers to overcome such as 1) time, 2) interdisciplinary aspect of sustainability, 3) open communication between faculty, 4) increased workload for team-teaching, and 5) faculty knowledge base.

Time. Time to develop interdisciplinary lessons and courses were considered a big barrier. Lydia said, “I don’t have the time to grade all the papers that I have now. So how am I going to work on this new module on sustainability?” Ethan brought out the idea that two faculty members “collaborating and compromising” could be challenging though he has never tried a learning community himself due to time.

Interdisciplinary aspect. Sharon reasoned that there could be conflicts due to the multidisciplinary aspect of sustainability if one area or discipline wanted “control of the topic and if we do not see eye to eye on how it must be delivered, from different viewpoints.” Jane made the case that everyone has become very specialized and not interested in what others are doing.

Each and every subject starts with its own premise. If I am arguing in ethics, then I have a different premise than over in biology or chemistry. No. Not if I am looking at the truth.... We have to get into our education more Plato and less Aristotle. Aristotle puts everything into little categories. Plato draws together, sharing information. We follow Aristotle too much.

Jane talked about “broadening out,” and how “narrowness is going to ruin our creativity and adaptability” and she talked about the importance of “adapting” and creating a change.

Open communication between faculty members. Ginger team-taught a geography course that had elements of sustainability incorporated in it. Ginger asserted the importance of “open communication” between faculty members that team-teach a course.

Citing the course that she team taught as an example, Ginger felt that the

course did not “go smoothly” because the other faculty member did not really have the time to prepare, “so it was like two ships passing in the night and it was frustrating for the students.” Ginger found it “challenging if you are talking over here on one side and someone else talking over on the other side; the student then is left to put the two together” because the students may not have the “tools necessary to do that at this point as an undergraduate.” Ginger emphasized the challenge of teaching interdisciplinary courses:

Academics come from, you know, a little cube where we are enclosed and we learn how to approach our discipline and we learn all about our discipline. Opening of that cube and sharing with others and becoming inter- and trans-disciplinary is challenging because we have our paradigm where we are kind of stuck in sometimes and opening up that umbrella and allowing everyone to come under the umbrella or sharing an umbrella is challenging; but I think it has benefits because we get ideas that would never have blossomed under our closed umbrella or canopy. So I think the benefits overcome the challenges - I really think so.

Increased workload for faculty members. Jasmine talked about time and increased workload due to team-teaching interdisciplinary courses such as sustainability. “Sometimes faculty are so heavily burdened with their current job descriptions, the thought of team-teaching is almost repulsive.” Faculty members get irate if they have to lose their “focus on teaching because of administrative duties.” Since Jasmine is a department chair, her teaching responsibilities have decreased significantly, and her administrative duties have increased exponentially. Jasmine said, “There are days that I barely think about teaching. I run into

the classroom and because I have taught it for so long I can do it without a lot of preparation.”

Faculty knowledge base. Some faculty members might not have the credentials or knowledge base to teach interdisciplinary courses such as sustainability unless they team-teach with other faculty members. The Sustainability IC faculty members created a set of guidelines for the hiring qualifications of faculty members teaching sustainability. Scott and James mentioned that some faculty members might meet the instructional council guidelines for hiring qualifications and have the educational background and training to teach sustainability courses. Hiring faculty members with such credentials might alleviate the barriers of team-teaching.

Jane discussed the importance of hiring interdisciplinary faculty members that are knowledgeable about the subject matter for teaching the interdisciplinary courses. Giving an example of a faculty member teaching an interdisciplinary course encompassing religion, philosophy and history courses, Jane said, “We have problems with that and pretty much narrowed it down and got rid of the extra interdisciplinary stuff. We are not doing a whole lot with that.” Due to the nature of the discipline, sustainability can only be taught in an interdisciplinary manner. One cannot “get rid of extra interdisciplinary stuff” in sustainability. Hence Jane and the other faculty members stressed the lack of knowledge base of faculty members as a barrier for teaching sustainability courses.

Offering and teaching sustainability courses. In order to offer courses in sustainability, there are many procedures and steps to follow. The Sustainability IC was created in order to streamline the process. Ginger brought up the issue of hiring qualifications for the faculty members as the “toughest roadblock” for deciding who would be able to teach the courses. In the Sustainability IC, she wanted to make sure that her discipline, geography, was “recognized as both a cultural and physical science and it met the needs for teaching sustainability.” Jasmine reiterated that one of the main responsibilities of the Sustainability IC was to come up with a set of guidelines for the prefixes for sustainability and the hiring qualifications of faculty members. Scott asserted that anyone having an interest in sustainability would need to justify “why their department is best for sustainability. But what we did was we went through what were the actual hiring qualifications and more importantly the competencies.” Scott had to meet the dean of his college and convince the dean that sustainability belonged to his discipline. He had to inform his dean that he knew “enough about about[sic] biology and chemistry and physics of the atmosphere and cultural classes and human geography” and convinced the dean that sustainability belonged to geography.

Ginger wrote the curriculum and justification for creating a new sustainability course. She had to “advance in our local curriculum committee here on campus, then advance it through the district instructional council and it had to be approved.” As the course curriculum

went through the approval process in the Sustainability IC, there were “dissenting voices” that she had to work with and justify the need for the course. She tried to make sure they “met their needs and addressed their concerns and explain the justifications for the coursework. Some of the courses have had more of a tough time than others”. Even though the instructional council members were critical and questioned the interdisciplinary nature of the courses, they all worked collectively and collaboratively to finally approve the sustainability courses. Reflecting back on the approval process for the sustainability courses, Ginger was reassured that the sustainability courses that she helped advance were very robust because they withstood the critical evaluation by the Sustainability IC.

James perceived sustainability as “one of those nice to have but is not necessary” disciplines because he did not see a lot of careers “driving it.” James saw “a limitation in terms of hiring people” to teach sustainability:

I think one of the drawbacks could be, again, creating the demand. If you have one person with multiple backgrounds, then the one person could really teach a sustainability course. But then hiring the person! The person must already be on staff. If they are not on staff, then, you need to hire them. Right now, with everybody vying like crazy for every new line, I think sustainability will be pushed pretty far down on the totem pole. So, I think that will be a drawback. It is the seeming optional nature of sustainability.

Monetary reasons played a significant role during the decision making process of offering and teaching sustainability courses. Jasmine compared the workplace with educational institutions and found that

sustainability was very integrated in the workplace. However in colleges, monetary reasons played an important role in determining which traditional departments got sustainability. Jasmine contended,

It is a fight because there are disciplinary silos. This is my discipline; these are my students. Especially in career and technical education! So who gets the FTSE when we teach a sustainability course. Which program? And we know that FTSE generates resources. So....who is going to teach the class? It could be anybody from any discipline. So you give up a lot of ownership and let it go. Let it go.

Jane's recommendation to overcome the barrier would be to have a sustainability department. Her idea was to "borrow teachers from different disciplines to come over and teach the sustainability courses." However, she realizes that this might lead to financial issues:

How we are going to divvy up some other way that does not make the student suffer or the knowledge suffer? Because we are a bunch of greedy financiers! We have to put education first; it should not be the money. Yes, I know it is about the money but it does not have to be. We should divvy it up different. We do not have to do it the way we are doing it.... We cannot just go in and say I need this money for my department. What do we need as a college and as an institution? We have to stop thinking me and think us.

Jane suggested creating a "single department and share faculty" in order to unify the campus. Even though there were many barriers to developing, offering and teaching sustainability courses, six of the faculty members that were interviewed for this study felt the dire need for the existence of sustainability courses and justified the importance of offering these courses.

Professional Development Activities

Ethan, Scott, Jane, and James attended the GCLI 18-hour Learnshop on “Incorporation of sustainability in the classroom.” Jasmine, Ginger, Sharon, and Lydia have attended the GCLI dialog days on sustainability. Jasmine, Ginger, Scott, and Jane mentioned that they have no formal professional development activities at the college level. Ethan, Sharon, James, and Lydia have various professional development activities at their respective campuses.

Effectiveness. All faculty members that completed the preliminary survey said that the professional development workshops at the district were worthwhile and effective. During the interview, Ethan elaborated further:

I think there was [the GCLI] workshop that got the ball rolling for me. Really I just grappled with the problem of....these course competencies that had not got anything to do with sustainability. It seemed like it was an add-on, like it was forced. It was like forcing this foreign concept into my curriculum. But I think just hearing the ideas. The most important things about these workshops were hearing ideas. It was hearing the success stories of what people were actually doing and [this] gives me the courage to do it yourself [sic] and encouraged to do it for yourself in your own way that has your stamp on it. This is what we did in [GCLI] class.

Ethan is still constantly revising and “brainstorming ways to add more sustainability” to his courses. He felt that he could not have done this a few semesters ago. Jane mentioned that the “professional development activities were effective.” As part of the 18-hour workshop, she developed a Blackboard site for her environmental ethics classes and posted her extensive links for research for each topic.

James also said that the professional development activities on sustainability at the district were very effective. He emphasized that faculty need to believe in sustainability and practice it in their personal lives in order to teach it to others:

Definitely! I think the the [sic] course, the Learnshop.... I thought that was very effective. I think that because what [the facilitator] did was that [she] personalized it for each of us. I think that when you personalize it, people start to get more of a sense of accountability Sustainability is one of those things that you really cannot teach it if you do not practice it. But, if you are practicing it, then you know, you are more likely to teach it then. So, I think that, that'sone of the effective approaches that [the facilitator] took is that [she] got us thinking about our own life, got us to be accountable in our own lives and that helps us gear us, made us think, ya [sic], I need to teach this. I need to integrate this is into my curriculum because I see how it affects me personally. I think that was very effective. [She was] very effective.

Sharon said that the professional development workshops “on incorporating sustainability in the classroom dialog days” were “extremely effective” at the district level because [the facilitator] had “people show this is what I have been doing, sharing of information, sharing of ideas. It can definitely encourage people.” When Sharon was asked what she had taken away from these professional development workshops, she said,

I would definitely say ideas. And I think motivation. It is nice to see what other people are doing and it motivates me. Oh - you know, that is a great idea, now how can I use it or realize it. Also you know, the courses that I am teaching, I think when [the facilitator] showed the dumpster dive, I said, Oh, that is a great idea and we have just, brainstorming you know, off of [sic] other ideas. I have definitely always taken something away and be [sic] encouraged to create something or actually use the resource though.

Sharon further elaborated that she has seen people come to her at her campus professional development workshops informing her that they

added a lesson on sustainability. “It definitely has helped and I have also seen that it has increased infusion of sustainability.”

Scott found the professional development activities to be effective with the caveat that the drive to the district office was long. He said that the [GCLI] workshop was “great because there were at least 3–4 things that [she] did in the workshop such as, carbon footprints” that he incorporated into his class.

However, Scott contended that it was better to offer professional development activities at the college rather than at the district because of the commute. He had no solution to this except “maybe light rail.” His campus has not made professional development a “priority.” “It will be a huge job to take on” and the key people are “already doing so many things. We have achieved a lot.....and so, maybe I need to bring that up.”

Recommendations for Promoting Sustainability Education

Although the necessity of sustainability education may be apparent to the interviewees, this concept is far from widely spread. Based on their own observations and experiences, many of the interviewees provided their own recommendations for promoting and advancing sustainability in higher education institutions.

Jane was at a loss regarding how to get more faculty members to attend the professional development workshops at the district. She mentioned that the district “was a long way off” and recommended an online version of the workshop. Both Jane and Sharon suggested having

an online resource site available at a centralized place or a district sustainability website. Sharon suggested a site for curriculum ideas that people could post and share. Sharon also suggested follow up activities: “People could go there and talk about—I did this and it worked well or did not work well. Just some follow up throughout the year”.

Although Scott realized the issues of distance, he was not confident that people would sign up for an online workshop, stating, “I would not join. I am not a big fan of online.” Ethan, with his economics background, asserted, “incentives drive a lot of people's decisions. Creating a set of incentives to have faculty participate is a challenge but has to be overcome.” According to Ethan:

Faculty are a privileged group of people. Even if we do not have tenure, which most faculty do, it is still very difficult to fire them. Not only that, you do not have much incentive for doing the professional development programs. I have a master's degree not a PhD and I can still go up on the salary scale. I do have motivation for attending the faculty professional development events. But I can still decide which events I am going to do.It is the busy lives we lead. So what I was trying to say earlier was that there is not a stick if we are not doing it nor there is a real carrot for doing it.

Lydia focused on the positive aspects of workshops:

Germinate a conversation on sustainability with a level of people that you know you are comfortable with. You will have a bigger effect because they have already started thinking about it and have an idea of how my discipline is connected with. Look at how my discipline is connected to sustainability and let me go and meet people in other disciplines to see how sustainability is connected to their disciplines.

Ginger said that faculty members need to be engaged and letting them know “how it benefits students” might be effective. Ginger further

elaborated that people came with “preconceived ideas and notions and it does not matter what you would say....It will be very difficult to get through their paradigm.” Ginger suggested giving out “little nuggets for right place, right time kind of taking up information” when people are ready to incorporate sustainability. Ginger believes that making small changes can lead to big changes.

Jasmine recommended informal learning spaces that “allow more interaction amongst the faculty outside the classroom.” Due to her research on the “the social component of sustainability,” Jane suggested:

Creating informal learning environment and social capital which was divided into two parts[sic]: social bonding and social bridging. ... Anything that you can do to encourage formal or informal learning environments, to encourage social bridging and social bonding especially social bonding to occur amongst faculty.

Jasmine recommended having “incentives” for faculty to participate in faculty development activities. Ginger also suggested,

Most academics are probably open to learning and giving them opportunities for learning whether it is cash form or one on one or whether it is more structured formal kind of approach. I think it probably has to come from the leadership though. If we are going to affect change and often change people's perceptions, then I think it has to be a top driven situation that is supported by the administration. I think we do have that at this campus and at the district. But I think they have to lead by example. I think they are.

According to the survey data and the interview transcripts, all the faculty members found the professional development activities at the district effective. However two faculty members mentioned the issues of driving to the district office as a barrier. Online professional development webinars were recommended by a couple of faculty members. However,

other faculty members interviewed did not find any value in offering online workshops. They stressed the importance of face-to-face interactions and networking with fellow faculty members and said that they would not attend if online workshops were offered. Other faculty members recommended giving small “nuggets of information” on sustainability and offering a series of follow up workshops in order to build a community of faculty members invested in sustainability.

Diffusion of Innovation Theory and Sustainability Education

During the interview, I initially asked the participants if they were familiar with the diffusion of innovation theory. If they were not familiar with this theoretical concept, I spent a few minutes to explain the diffusion process. Subsequently, I showed the adopter categories graph depicted in Figure 3 and requested the faculty members to self-evaluate where they considered themselves to be. The participants identified themselves in the adopter categories and justified why they considered themselves as belonging to a certain group:

Ginger considered herself to be an early adopter.

It is weird because we are comparing ourselves to what everyone is saying. I don't think if I am an innovator. I would probably put myself as an early adopter. Oh... That was tough. That was a hard one....But I certainly recognize the importance of sustainability and want to inform what is happening. Maybe I am closer to the chasm - at the very end of the early adopter.

Scott considered himself to be an early adopter. “We have early adopters in [my] campus. We have about 11 or 12 people who have incorporated sustainability so we are all early adopters.”

Jane also considered herself to be an early adopter. She stated, “I can see how others think I am and how I think of myself. I see myself as mainstream but other people like to put me over here.” (Laugh, Jane pointed to early adopters)

Ethan considered himself between an innovator and an early adopter, “It is not necessarily a place....that I am comfortable with. You know, as maybe I am not a risk taker as a usual innovator. But I feel compelled to do that.” When questioned why he felt compelled, Ethan replied,

Just my values. I mean just how I see the world and that I want to leave the world a better place. And maybe with my economics mind, I always think about what are my options for the best ways of doing that and have the most value added or most leverage. I, for example, I cannot do a lot of volunteering. I mean I give to charity but time is scarce for me; and you know, maybe serving on a phone bank or something for a charity that I care about could be good. But maybe that is not as much of an impact as if I could use my role at the college to infuse more divergent and impact more people and to do more change in the world. That is what compels me and that is why I push myself in areas less comfortable. But I feel that it needs to get done.

Sharon went back and forth between early adopter and early majority. Finally she decided that she was an early adopter.

I definitely think that with our sustainable foods program, we have beenpushing it through the curriculum. So we have definitely been an early adopter. And then also really working on making one of our student learning outcomes across the college, you know, not only reading and writing but also looking at making sustainability one of our learning outcomes. So that means that it will be measured throughout all our courses through all our disciplines.

James considered himself to be in the early/main majority region. When asked why, he said, "This is in terms of sustainability education. For education, I am an early adopter."

Jasmine thought of herself as an early adopter or an innovator. "I will say that I am one of the first to become a LEED [Leadership in Energy and Environmental Design] accredited professional. I am one of the first 100 in my state. To me that is pretty good."

Lydia considered herself to be in the main majority region.

But I think maybe because of how much time I have put into it, maybe I am on the other side. I need other people to figure out and do all the work. So once they figure out, I will do it....But now I think I am with the big hump people (pointed to majority).

In conclusion, the findings of this research study indicated that the majority of faculty members interviewed in this study self evaluated themselves as early adopters but did not see themselves as risk-takers. Two faculty members that were periphery to sustainability education saw themselves as mainstream majority faculty.

During the interviews, all the participants said that the innovation of sustainability education was a grassroots driven, bottom-up approach and not a top-down approach. The participants' responses for the reason why the sustainability education is grassroots driven is illustrated in the Table 4.

Table 4

Participants reasoning on sustainability education

Participants	Participants' quotes elaborating why sustainability education is grassroots driven
Ginger	It wouldn't have gone anywhere if it hadn't been from bottom-up at first. This came from [...] guys in getting interested and thinking this was important for the district and getting the buy in from the district administrative level....It started at the bottom and was embraced by the top and this brought the other people on board.
Scott	It is grass roots in the sense that it is faculty driven. It is a handful of people. We have been supported at the top... but it is not top driven but it is grass roots driven.
Jane	Grassroots...I have little hope for Administration....they have to be forced into sustainability practices.
Ethan	It is definitely grassroots. But it is becoming more top-down now which is good. So hopefully we will meet in the middle somewhere which would be good.
Sharon	I think this stems from some passionate faculty members and students that have brought their attention to the need for this initiative and change around the College. I also see this at the District level; it started as a bottom-up approach which increased the District's knowledge. I think this has now spread the approach across campuses.
James	I would definitely think that it is a bottom-up approach. I think faculty are pretty much completely resistant to anything top-down. (Laughs) They will resist anything from the top-down. They will fight and fight and fight for academic freedom like nothing else. So, I think this is exactly a bottom-up kind of approach.
Jasmine	It is grassroots. I mean in the last year or two I feel like the bottom has pushed the top.
Lydia	It is initiated by people at the ground level and work its way up till somebody in some seat of power notices. Oh that is a good idea. We should focus on it too.

Lydia further elaborated that she does not “doubt the sincerity of the people at the upper levels,” but she thinks it is the grassroots level coming together and getting the sustainability education started:

Once you get beyond a certain level like deans and vice presidents, everybody sort of, I don't know, I think they juggle with the idea wanting to be very innovative and wanting to be very pragmatic. Once you move past, you know, a certain level, there are all these other concerns and questions that they need to throw into the mix.

Lydia said that it is easier for a faculty member to adopt an innovation; and, if it works, share it with others. Lydia elaborated that for the administration to get involved in sustainability,

It takes...years talking about it, getting buy-in from all the different constituents, whereas people in a classroom can say, “I am going to try this and we will see if it works. So, if it works, then I will share it with 15 other people.” If they think it works, then it spreads.

Four of the eight faculty members said that the bottom-up grassroots effort on sustainability education has made the higher administration at the GCCD district embrace it in the past couple of years. However, at the individual colleges, there was disparity in terms of support of sustainability education. As Ethan eloquently said, “The institution administration.....can set the environment for letting the grassroots efforts grow faster or more slowly.” Majority of the faculty members agreed that they have support from their college administration though two faculty members disagreed. Only one faculty member was “wary of the administration” at their individual college and their approach to sustainability education.

Time is an important element in the diffusion process. The time for adoption of an innovation is critical and range from when a participant has knowledge of the innovation to when the innovation becomes the norm in the institution. As Scott said, “Unbeknownst to myself, I guess I was incorporating some sustainability topics in my geography classes for a long time.” Likewise, seven of the faculty members found it hard to pinpoint the actual time it took for them to adopt sustainability education after they obtained knowledge or awareness of it since they intrinsically believed in the ideals of sustainability.

Barriers for the diffusion of innovation for sustainability

education. People perceived the following myriad reasons as barriers for diffusion of the sustainability education innovation: 1) Time and work involved, 2) Political nature of sustainability, 3) Pure inertia and unawareness, 4) Stubborn ways of faculty members, 5) Hard to find teaching resources, 6) The interdisciplinary nature of sustainability, 7) Lack of social bonding and bridging, and 8) Lack of content knowledge.

Time and work involved. Almost all the participants mentioned that one of the main barriers for the diffusion of the innovation of sustainability education was time and increase in workload. Ethan reiterated the main sentiment of all the participants, stating that one of the “Main barriers is that they are afraid of the work and the time it takes.” He elaborated saying:

It is the carrots and the stick. Hopefully with time, the administration will get better with wielding the carrot and sticks. As I said earlier, the faculty are an interesting breed, you know. We have that job security and lots of competing demands on our time. We do not have any financial incentive; everything that we do is not financially motivated but it sure does help. Those are the barriers that encumber us.

Lydia considered both time and workload as a barrier too. Lydia felt that a major “hindrance could be if they see sustainability as a lot of work. It is all the work to add it in the courses.”

Political nature of sustainability. Jane perceived the political nature of sustainability as a barrier, where people might respond, “Oh sustainability, oh you must be a tree hugger.” Jane also brought out the link between sustainability and business: “It is that kind of thing where they are equating it something that is antibusiness. No, it is not antibusiness; it is anti bad business practices.” Scott and Ginger mentioned the connections between the political nature of sustainability and the campus climate. Scott perceived the following political barriers for sustainability:

There are people who do not like the sustainability theme because they think it is socialist and anti-American. There is a political survey or political barrier because you will never get some people to adopt because they are literally outwardly hostile. If you include those people the barriers are high. If you exclude the openly hostile people, then the barriers are quite low.

Pure inertia and unawareness. Scott suggested that “pure inertia and unawareness” could be the barrier for the adoption of sustainability as an innovation in the classroom. “They will think that it will be a lot of work. We have to literally bribe them.”

Sharon said that “it is just a lack of desire to change or being innovative or a desire....There is not like that there is a goal or a passion for the topic or even to realize what the point is.”

Stubborn ways of faculty members. Ginger explained how people in academia are “very stubborn and set in their ways and don't want to do what administration says or wants them to. So there are a lot of challenges out there. It is hard.” Ginger also asserted that offering sustainability courses could bring its own set of unique barriers for adoption by mainstream faculty due to the financial climate and the economy. Ginger further said,

I think people are worried about making classes, worried about turf wars. We are seeing them pop up over at other campuses. There are huge ownership issues and if [sic] there is a perception that we are going to take some of their students, then I think it might harden them to the ideas. So it might come down to turf war kinds of situations which is unfortunate.

Ethan seemed to convey the same, “One of the barriers is to engrain the concept of sustainability through a larger prism. People are set in their ways; I am too. It is hard to change people's ways if they don't want to change themselves.”

Hard to find teaching resources. Sharon found it hard to get “credible resources around sustainability. Those are the [sic] really the only things that encumbers me.” Sharon suggested developing an online resource site where faculty members could find credible sources on sustainability. Ethan suggested developing a district-wide common

sustainability website that contains lesson plans and links to online resources that are credible and authentic.

The interdisciplinary nature of sustainability. Jasmine said that one of the barriers could be the interdisciplinary aspect of sustainability and team-teaching:

I can see that where there are a lot of people who are just used to being the sole instructor and not able to collaborate with another person and there is going to be a lull. People who are sage on the stage still teach that way till this date. And they will never change. I still have students that talk about instructors that read the chapters.

Jasmine talked about how she has noticed as a department chair, “when people start to see other people progressing and actually enjoying, they feel left out. That feeling of feeling left out, that I think would bring the people on board.” Jasmine also mentioned that as a large, very old college, it is tough to change the old culture:

I think the faculty is very independent. Extremely independent, you know. If you think about it, where else do you see this? Really you create your own hours. You do not necessarily have to interact with anybody other than your students really. I mean, very little anyway. You can come and go, teach your class, office hours and do the contractual agreement. I know some who do that.

Lack of social bonding and bridging. Jasmine considered “social bonding and social bridging” in their large campus as a large barrier for diffusion of sustainability education. “So what are some barriers that impede our movement across the chasm? You cannot have integrated teaching, team-teaching if you do not have an integrated culture.” Jasmine considered time as a barrier and said, “There is not a single day where

there is a bunch of little things that distract us and keep us from focusing on teaching.”

James also mentioned the lack of communication between faculty members as a major barrier. James said,

There is not much dialogue going on at the science division level. I never hear about sustainability other than what [facilitator] is doing. You never hear that coming up. You know, between the different biology or even between the anatomy and physiology professors; we never have dialogue. So I think the college as a whole seems to support sustainability but there needs to be more personal dialogue between faculty.

James self-evaluated and felt that he himself has never talked about his sustainability project with other anatomy and physiology professors and they had no idea about his work.

Lack of content knowledge. Majority of the GCCD faculty members are trained in a traditional discipline and hence are content experts in their respective discipline. Due to the interdisciplinary nature of sustainability, Lydia cited lack of content knowledge in multiple disciplines as a barrier:

As a teacher, one feels that one should know all the stuff. If they they [sic] are not comfortable with what they know about sustainability. You might not want to test that out in a roomful of 20 year olds where you are not getting or might not know enough. And that might be an issue.

Lydia also said that people might not want to be the “only person from Physics that wants to talk about sustainability.” Lydia mentioned that acceptance from the colleagues in a department is important for promotion and tenure for probationary faculty members. She said, “Particularly if you

are a probationary person And so, whether or not you want to be the lone person in your department doing this new thing could be a barrier to some people.”

Many of the aforementioned barriers, such as the time and work involved, faculty inertia and stubbornness, and the interdisciplinary nature of sustainability seem insurmountable. However, all the participants were very optimistic about the future of sustainability education and gave suggestions and strategies for adoption of sustainability education.

Strategies for adoption of sustainability education by mainstream faculty. Many strategies were recommended by the interviewees for the adoption of sustainability education such as 1) Rewards, recognition and encouragements, 2) Bragging about sustainability, 3) Giving concrete ideas 4) Building a district-wide resource site, and 5) Keeping politics outside the classroom. These recommendations are explained in detail.

Rewards, recognition and encouragements. Sharon and Scott recommended giving rewards for people to cross the chasm; Sharon recommended giving people “support and encouragement, even time allotment.” She went on to say that everything must be done in order to “allow time for the faculty member to spend on sustainability.” Sharon also suggested giving resources to faculty which she feels is a “big issue” and has helped her “in being an early adopter.” Sharon further suggested

giving “opportunities to interact with other faculty members that have done it and incorporated it and get some ideas from them.”

Scott also said that “giving release time will be a big incentive.” He suggested that faculty be given three hours of release time. He stated that although “It will not be enough to rewrite your curriculum,” it may provide a “start for people interested in exploring sustainability education.” Scott recommended that the three hours will work if the “faculty met with someone from the committee and worked on the three things in the curriculum.” Scott compared “completely redoing the curriculum or ...putting a few puffs of sustainability into the curriculum.” Scott felt that putting “puffs should not be that hard.”

Bragging about sustainability. Ethan suggested that at the “social level,” faculty should begin talking about sustainability and “bragging” about their successes. He suggested that faculty talk to other faculty about incorporation of sustainability in the classroom, impact on students and the “discussions you are having in your classes on it.” He commented that human beings are “social beings” that like to mimic other people in the “group or the bandwagon effect or just convince deep down inside. Some cool message has to be communicated.”

Faculty members interviewed for the study found that students were motivated and engaged when they incorporated sustainability into their curriculum. Jasmine mentioned that she would invite a faculty to come for a minute and talk to her students. She said,

And when in there, maybe say a comment or two in conjunction with him and before you know it, you know, it kind of begins to chisel away at the wall and break a little hole and pretty soon, the structure comes down. It is almost like management in a way, you know; it is getting people to go in a direction you want them to. It is also strategic planning. If the college is to make sustainability one of the strategic priorities, you know, that always helps to shift, a paradigm shift.

Giving concrete ideas. James also mentioned disseminating and giving concrete ideas about sustainability to faculty members. He mentioned that some people are “natural risk takers and would tend to be early adopters whether they are interested or not.” He perceives the barriers as “battling personality and comfort with risk.” He also recommended “giving concrete examples to help increase awareness and reduce perceived risks.” James was particularly interested in thinking about ideas, incorporating the ideas and “sharing ideas between faculty.”

Jane said that she likes to give ideas to people and let them take it, “Because there is one thing in the Buddhist belief. We do not care who gets the credit as long as the job gets done.”

Ginger suggested giving mainstream faculty members “resources or giving them ideas or little sparks, little information” that they can use to incorporate sustainability in their respective classes. The approach to sustainability needed to be subtle. “I don’t want to hit them over the head because that will turn people off. So giving them ideas.....trying to open their minds to new ideas and concepts.”

Scott was a big proponent of keeping politics outside the classroom. Whenever he taught controversial topics such as climate

change, he did not discuss politics but only focused on the scientific data and the greatness of American climatologists and scientists. Scott explained,

You can't start with a politician in a classroom talking about science. We go to the JPL [Jet propulsion laboratory's] website. How amazing is American technology, mission to Jupiter, Mars, Solar system, all the machine, who designs satellites—the JPL top rocket scientists, another wing devoted to earth science and they have found out about atmosphere. Here is what the top rocket scientists view climate change. I have never had anyone give any problems. Sustainability is accepted more if the disciplinary focus is preserved in the classroom.

The faculty members recommended the aforementioned strategies for diffusion of sustainability education. Some of the strategies could be easily adopted such as leveraging the student motivation and interest in sustainability to get other faculty members involved in this endeavor.

Movement across the chasm and professional development. In addition to the general strategies for adoption of sustainability education, the faculty members interviewed for the study were asked specifically about how professional development activities could help move mainstream faculty members across the chasm. Some of their responses are included below.

Ginger realistically said that “not everyone is going to take advantage of those [professional development] opportunities.” She suggested,

Giving them a pathway so that they can take advantage where it is not impacting their pocket book, where it is not impacting or becoming a hardship or burden on their time. I think that might

open up more of those opportunities.....all that it will come down to is money and time... It is challenging.

In order to give faculty members more time to plan and develop sustainability lessons, Ginger suggested paying for somebody to cover some of their classes. Ginger suggested making it easier for faculty to “kind of move out of the mold that they are in; we might have success.”

Ginger also asserted that “there are faculty that are interested in participating but have many roadblocks or stumbling blocks in front of them.” So her suggestion was to work on “removing the roadblocks and stumbling blocks.”

Scott and James made the argument that “professional development activities will not help” bring people across the chasm. He said that it needs to be a “slow campaign by a core of dedicated people. It is a slow campaign to grab people one by one.” James made this argument:

My first inclination is to say no; the professional development activities will not help faculty move across the chasm. I think adopters will always be adopters. I think professional development can increase awareness but won't change someone's risk tolerance.....faculty will dislike it if they are told what to do.

James further suggested giving faculty “clay and then they are going to be molding it into what they want to do.”

It is just a faculty thing. Let them create their own but you need to give them a lot of good stuff for them to create. And then let them be creative. Because ownership is incredibly important! Because the feeling of ownership...will make them to [sic] be an early adopter or innovator. And [facilitator is] really good about that too, by the way. [facilitator] is really good at giving a lot of concrete ideas; this is what are some examples, without ever pushing

anything. [Facilitator says], “Hey you could be doing this” and then [the facilitator] let us decide for ourselves. And I think that works really really well. Really well!

Ethan suggested meeting faculty personally and giving them concrete examples. Giving faculty “small examples” might help “get people across the gap.” He suggested asking the faculty questions, such as:

How do we use sustainability in the classroom? How do we challenge preconceived ideas that sustainability only works with the environment? Talk about all these issues in a sustainable lens and it will just become a de facto of looking at and it makes sense, in a collegial and cooperative process.

Ethan conveyed that having such professional development events at the college level can help people move across the chasm. Ethan also suggested building a website and creating sustainability modules. “For each one, faculty will have an opportunity to, you know, learn about what other colleagues are doing, share ideas, and give encouragement.” Ethan elaborated:

We cannot assume to think that people know what sustainability means. Maybe, you know, creating modules on different topics at different levels such as level 1, 2, and 3. For each one, faculty will have an opportunity to, you know, learn about what other colleagues are doing, share ideas, and give encouragement. I think another thing too is to create web resources that have examples of sustainability.

Lydia suggested marketing to draw new faculty into sustainability. Create a two hour “quick and dirty” workshop and maybe even require it because “sustainability is one of the college initiatives.” Also provide a “bigger workshop beyond a certain level of understanding and not just have pockets of people telling what sustainability is.” Use a more

“conversational style” that is more inviting. Overall, six faculty members said that professional development workshops could help majority of the faculty members to cross the chasm and adopt sustainability education. They mentioned that this could only work if incentives were given to the faculty members.

However, two faculty members had mixed feelings regarding the role of professional development activities in getting the majority of mainstream faculty members to adopt sustainability. Offering professional development workshops at the individual colleges would be a good way to augment the professional development workshops already in place at the district level. Some of the faculty members were of the opinion that having a core group of faculty members giving little “nuggets of information” regarding sustainability would be very beneficial.

Factors that Support or Encumber Sustainability Education

The various participants interviewed for this study were very diverse in their thought process as they delineated the factors that support or encumber faculty for incorporating sustainability in the classroom.

Ginger felt that her environment, her “little cocoon was a safe and happy cocoon.” She could be as innovative as she liked and had the freedom “to write the curriculum as needed” and she would have full support on her campus. However “different campuses or even different disciplines” at her own campus “might hinder” her if she “wrote the curriculum.” She observed other campuses as having a “different focus”

and “ownership” issues happen. Another challenge that Ginger found was the challenge between the faculty and administration:

In academia you will have those challenges where people are very stubborn and set in their ways and don't want to do what administration says or wants them to. So there are a lot of challenges out there. It is hard. I do not know what is the best approach.... Other residential faculty had to go through road blocks. Other faculty had tried and then kind of reached a certain point and fallen back. I was of the mindset that I thought this was important and I was not going to let this fail. I was highly motivated and I did not see any reason why it couldn't advance since we have some classes with university neighbors.

Scott said that his college had neither helped nor hindered him personally but it was because he had not asked for any help. Scott then went on to further explain that his campus had set aside funds for sustainability demonstration projects for both “sustainability sake and for teaching and pedagogy sake.” Scott did not see any encumbrances, “We have money, support from the president, dean; and they are allowing us to teach these classes, gave it to the department that asked for it. They are willing to spend money on demonstration projects.”

Jane, concurred with Scott about having no hindrances from her college. However, when asked about the district, she replied:

Our college has a reputation of of [sic] not cooperating with District unless we feel like this. If we decide to do something else, then we just tell district that we are doing it and we will fight. And we will fight with each other, which is why I like our campus because we will fight with each other and always for the good of the student. That is the ultimate goal which makes fights worthwhile.

Sharon did not find any encumbrances personally though she has noticed that it has been difficult for classes to be approved:

Overall, the formation of the IC has been a huge support. It has helped us to, you know, to have a common goal and bring us all together. I think it has really helped us to get courses developed through the curriculum process. It seems to me that the Sustainability IC has a focus, you know; it has been a huge support.

Lydia said that one of the good things about Greenville is noninterference which she considers “nice.” She finds her college to be “supportive of some new initiatives of people incorporating sustainability.” However she feels that the district has not been so supportive of her work in gender studies and diversity issues. “My complaint is that there is a whole lot of talk about things and everybody seems to agree with,” but she has not seen any concrete changes. She is not sure of sustainability other than pledging not to waste paper.

Ethan conveyed that

Administration is lukewarm about sustainability, and sustainability does not get as much recognition as some of the other committees at his campus. But then there is so much else going on that it is not just something that you get recognized for. So it is hard to make it a priority. Hence it is hard to get people to adopt sustainability. But I do not care because I am passionate about it. But I can understand how other faculty that do not have the passion, you know, I understand those incentives matter.

Jasmine felt that the main support for sustainability was her students. She gets her “biggest jolt” from her students and that really drives her. She feels her fellow faculty members are her encumbrances.

Encumbrances, my own fellow faculty members that are in similar disciplines that are umm [pause] there are walls around their career and technical education programs rather than building bridges. Mine, mine, mine, mine, mine, you know. Don't you take my students away. They see this rather than a part of the college; they see their program as being an appendage or a separate entity

sometimes....This is my discipline and I am not going to share it. You know what I am talking about it. That to me is the biggest encumbrance

Jasmine said, "I am looking forward to the day when we can put sustainability in a team-teaching and integrated classroom together." She is looking forward to a time when there are no time constraints, hurdles, feelings of "don't step on my turf, the mine, mine, mine philosophy."

Ginger summarized as follows:

I want sustainability to be recognized as a discipline and embraced. I am very mindful of turf wars and of people. People's mindsets are set. Don't want to call it a turf war but that is what it is. Right people are needed for the right job. Innovators like the [facilitator] bring sustainability to us. There are people like me that work and make it happen. Everyone is so diverse and there comes a time when I say it is enough discussion and let us move forward.

Ethan finally concluded by saying that the goal we should reach for is when sustainability becomes mainstream in the campuses.

"Sustainability should be seamless in the fabric of what we do, in practice and in the classroom. So, it is not going to happen overnight but we are moving towards it."

Summary

This chapter contains the results of the data collection and analysis with respect to the research questions of the study. The chapter began with an overview of how the participants' interest in sustainability was developed. The participants interviewed for this research study gave numerous reasons why they were interested in sustainability. As I began

coding and classifying the data, three main categories emerged: love of nature, inherent nature of their discipline, and equity.

The chapter then focused on development of curriculum by faculty. Most of the faculty have thought deeply about sustainability education and have invested a lot of time for curriculum development. The participants were all extremely excited to share their innovative pedagogy used in the classes. All participants were passionate about teaching and learning and common themes of pedagogy emerged such as thematic education using case studies, experiential learning, problem based learning, and inquiry based learning along with a heavy focus on research. Some of the participants have taken a leading role in creating appropriate assessment tools for the sustainability lessons developed.

The participants interviewed identified myriad barriers for teaching interdisciplinary courses such as sustainability and common themes of time constraints and increase in workload emerged. According to the faculty members interviewed, sustainability education at the GCCD was primarily a grassroots driven approach due to the work of a core group of faculty members. The participants' self-evaluation of the diffusion of innovation adopter categories demonstrated that most of the faculty members were early adopters except for a couple of people who categorized themselves as early majority or mainstream majority. Strategies for helping mainstream faculty members move across the chasm such as time, rewards, recognition, support and encouragement,

students' motivation and passion for sustainability, and creating a network of core faculty to help spread sustainability education were identified. Finally, the factors that support or encumber sustainability were examined from the standpoint of common themes and diverse views of the participants. Chapter 5 will delve into the discussion of the results, and recommendations for policy and practice of sustainability education at the community colleges.

Chapter 5

Discussion and Conclusions

Education is not filling a bucket, but lighting a fire (W.B. Yeats).

This chapter provides the discussion and conclusions of the research study on sustainability education at the community colleges. The purpose of this study was to analyze the processes and procedures used by a small sample of faculty members of the GCCD to integrate sustainability into the curriculum and classroom. The diffusion of innovation was identified as the conceptual framework for the study. The case study methodology was used for the analysis and identification of the major themes. I have strived to establish a framework for understanding how sustainability education is developing at the community college level, to address the implications of the study, and to provide recommendations for further research on the practice of sustainability education at the community colleges.

Motivation

The most common thread amongst the interviewed faculty members was a passion and love for nature. During the interviews I determined that the participants linked their passion to their knowledge of their respective disciplines to develop sustainability curriculum. The interviewed faculty members demonstrated altruistic reasons for teaching sustainability, including a desire to motivate and excite students to bring about change in this world. Igniting students' passion and engagement in

sustainability was a key motivational factor for many of the faculty members interviewed. I found many parallels between the participants' experiences and my own. I am motivated to work on sustainability curriculum because of my own passion for the environment and commitment to equity issues. As an educator, I also enjoy developing innovative curricula in order to excite, energize and inspire students.

Faculty members also identified their commitment to equity as a major motivating factor for their involvement in sustainability education. James, Ethan, Lydia, and Jane spoke about how sustainability education is leveling the plane for the “haves” and “have-nots” since it was related to issues of equity, gender and race. As Lydia eloquently pointed out, “Because it is a field that is academic but one that deals with activism.... sustainability education for me is one of the ways that you can point to people and say, “Here is something concrete that you can do that can change your life and others”...and this motivates students.” Moreover, based on my own experience as a faculty member, I consider motivating and energizing students to become stewards of sustainability and equity to bring about social change to be a crucial component of sustainability.

Many sustainability scholars focus on equity issues as well; Sterling (2004a) and Tilbury (2008) posit that change in sustainability education needs to go beyond the classroom into the real world in order to grapple with issues of social equity and improved quality of life for present and

future generations. The results of this study demonstrate the integration of this concept into the development of sustainability education.

Research Questions

As mentioned previously, the data gathered in this research study, the findings and the conclusions have been organized around the primary and subsidiary research questions. The primary research question is “What are the processes and procedures used by the GCCD faculty members to make sustainability part of the curriculum and the classroom?” In order to determine the answer to the very broad primary research question, a number of subsidiary research questions were developed with respect to sustainability curriculum, innovative pedagogy, professional development programs and factors that support or impede sustainability education.

In order to answer the research questions, I analyzed the data collected through preliminary surveys, interviews and artifacts. Reflecting on the study, I found that all the faculty members interviewed were very thoughtful and worked hard to either adapt an existing curriculum or create new innovative curriculum and pedagogy for sustainability education. While developing courses, Donovan and Bransford (2005) identified four design characteristics to describe an active learning classroom: knowledge-centered, learner-centered, assessment-centered, and community-centered lens in the classroom. Sustainability courses can be developed using these design characteristics of what to teach, how to

teach, and how to measure student learning, which translates respectively to curriculum, pedagogy, and assessment. The faculty members in this study discussed various aspects of design characteristics in response to the subsidiary research questions.

Sustainability Curriculum

The first subsidiary research question is “How do the GCCD faculty members develop sustainability curriculum in order to incorporate it into the classroom?”

The creation of the Sustainability Instructional Council (IC) paved the way for making sustainability a part of the curriculum. This interdisciplinary instructional council has been highly successful due to the diverse disciplines of the faculty members. By drawing upon their diverse perspectives and incorporating their different approaches to thinking, these faculty members have collaborated to build an interdisciplinary sustainability education program. In spite of the collaborative spirit of the faculty members serving on the Sustainability IC, I found many nuances in the make-up of the three prefixes of sustainability due to the traditional disciplinary barriers. For example, one of the faculty members interviewed got involved in the Sustainability IC mainly because she wanted to make sure that her discipline was represented as an “equal component contributor” during identification of the disciplines under the three prefixes. These disciplinary barriers in education may translate to a less optimal platform for integration of knowledge for students in their future careers.

In the workplace, people from all walks of life and diverse disciplinary backgrounds must join together to work collaboratively to solve problems. It is ideal to mimic this ideology of an integrated environment in the classroom in a holistic systems-based approach to teaching and learning. As David Orr (1991, p. 13) argues, "All education is environmental education..... The subject matter is simply the tool. Much as one would use a hammer and chisel to carve a block of marble, one uses ideas and knowledge to forge one's own personhood." During the interviews, I discovered that the faculty members combined the scholarly nature of their disciplines with their personal commitment to sustainability. Most of the faculty members conducted intense research on sustainability topics from the point of view of their discipline and developed the sustainability curricula with a focus on interdisciplinary connections and relationships using higher order thinking skills of analysis and synthesis.

I identified the following common themes of curriculum development within the study: breadth versus the depth of coverage in the classroom, scaffolding lessons based on prior knowledge, and assessment strategies to measure student learning:

The faculty members were very cognizant of the issue of breadth of coverage versus the depth of coverage and spoke of "add-ons" to the curriculum as opposed to completely revamping the curriculum. It has been reported in the literature that completely revamping an entire curriculum was better than adding-on a couple of lessons to an already

existing full curriculum (Sterling, 2004b). Six of the faculty members interviewed incorporated sustainability by completely revamping their curriculum. In spite of Sterling's argument against add-ons of sustainability to an already overcrowded curriculum, James recommended adding-on a simple lesson in sustainability for faculty who are new to sustainability so that it would not be too overwhelming in the beginning and enable them to "get their feet wet". I concur with this recommendation because it might be overwhelming for a brand new faculty member to completely revamp an entire course to incorporate sustainability. In essence, the majority of the faculty members followed Cortesi and McDonough's (2001) ideas on lateral rigor and vertical rigor for incorporating sustainability in the curriculum.

Jasmine and Scott created sustainability curriculum by using scaffolding and building on previous knowledge. This approach to curriculum development is identified as learner-centered where one focuses on "preconceptions, and begins instruction with what students think and know" (Donovan and Bransford, 2005, p. 13). Jasmine built an entire program by scaffolding on what students had learned in the previous semester whereas Scott's students were required to construct themes based on interconnections made between small bits of information. Such constructivist approaches to teaching and learning leads to deeper learning by students.

Having well thought out assessment instruments that measured student learning was thought to be critical for curriculum development. Faculty members such as Sharon and Ethan focused on writing assessment instruments and having specific outcomes and metrics during curriculum development. Sharon developed assessment instruments for all the general education courses at her campus that incorporated sustainability using the triple bottom line of sustainability.

Overall, almost all the faculty members invested a lot of time and effort into the development of the curriculum. It was the passion that these faculty members felt towards sustainability that made it worthwhile for them to work extremely hard without caring for any remuneration or recognition. I deduced from the interviews that teaching basic bread and butter courses using a canned curriculum became very routine and sometimes even boring for these faculty members. Creating interdisciplinary curriculum made teaching and learning interesting for them. However, due to the time commitment and the amount of effort that it took to develop new curriculum, two faculty members adapted existing curriculum from the four year university instead of “reinventing the wheel” and creating new curriculum. Adapting existing curricula from four year universities by the community college faculty members could lead to easier transfer and articulation of courses between the two educational institutions.

Innovative Pedagogy

The second subsidiary question is “How do the GCCD faculty members develop innovative pedagogy in their teaching and learning of sustainability in the classroom?”

The very nature of sustainability lends itself to the use of active learning strategies in the classroom. In a traditional classroom environment, the faculty member lectures on facts and expects the students to memorize and regurgitate the information while the students sit passively in the classroom, which leads to a very shallow level of learning. However, in a classroom that espouses active learning strategies, students are meaningfully engaged in classroom discussion to think critically, solve problems, discover new solutions and hence learning occurs at a deeper level. All the faculty members mentioned that they like to facilitate a discussion in the classroom and not lecture in the traditional manner. Analyzing the preliminary surveys, the interviews and the artifacts, four common categories of pedagogy emerged: thematic learning using case studies, experiential learning, inquiry-based learning, and critical thinking and problem solving in the classroom as illustrated in Figure 7.

In all of the methodologies demonstrated in figure 7, the students were encouraged to be cognitively engaged in exploring ideas and making connections in order to gain a deeper understanding of sustainability.

Thematic education and case studies. The faculty members built their curriculum through thematic learning around the topics of urban heat island effect, urban sprawl, climate change, peak oil, transit development

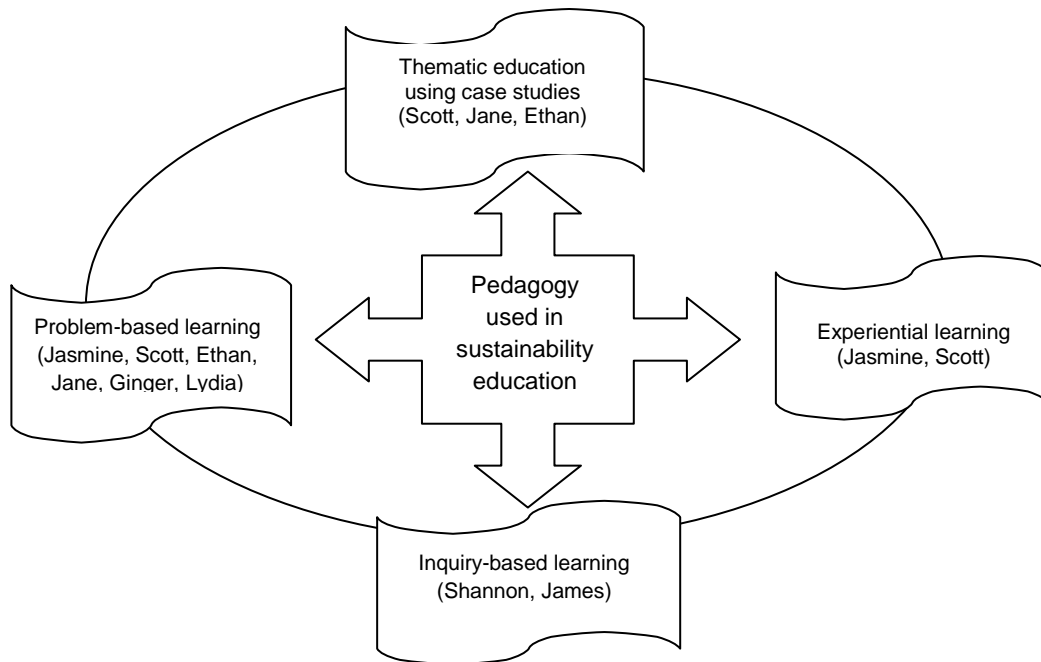


Figure 7. Pedagogy used in sustainability education.

and renewable energy sources, sustainable agriculture, resource depletion, lack of biodiversity, fracking and problems of exponential population growth. Within these overarching themes, faculty focused on unique case-based lessons on sustainability that were studied in depth. Each of these thematic units required the students to use a holistic approach and look for interconnections around the triple bottom line of sustainability; social, economic and environmental aspects of sustainability.

The faculty members, created lessons, and came up with extensive reading lists of video and animation lists for students and also built assessments for each of the topics. Sterling (2004b) analyzed the holistic nature of sustainability in a systems thinking approach at three levels: first level involving doing things better, second level concerning with doing better things, and third level which pertained to seeing things differently involving transformative learning. As a fellow educator, I was given a unique opportunity to look into the course documents of the participants' Blackboard sites and to access their assignments and lesson plans. These faculty members motivated their students to research the critical nature of the problems and issues in sustainability in order to come up with innovative and meaningful solutions.

Experiential learning. Experiential learning encompasses any learning that takes place either inside or outside the classroom where the students are involved in thinking and reflecting about the concepts. Many of the faculty members used experiential learning activities such as field trips, internships, campus demonstration projects, community gardens, and service learning in their classes. Jasmine developed and integrated multiple experiential learning activities in order to teach “sustainable built environments.” Not only were her students given an opportunity to do research prior to field trips and internships, but they were also expected to take ownership of their learning and reflect after the experience in order to identify gaps in their knowledge base. Students were then given

opportunities to synthesize questions and try to find answers to gaps in their knowledge base. Scott has created experiential learning activities for his students using campus demonstration projects and field trips. During the field trips, Scott challenges his students to think out of the box and come up with innovative solutions to some of the environmental issues created by humans. In summation, these faculty members have combined experiential learning activities with classroom curricula through well thought out assessments, and they have demonstrated that pedagogy of learning is as important as the content knowledge. These aforementioned examples exemplify Beard and Wilson's (2006) definition of experiential learning as the "sense-making process of active engagement between the inner world of the person and the outer world of the environment" (p. 2).

Problem-based learning. "Problem-based learning is an approach to learning in which complex and compelling problems serve as the catalyst for learning" (Major & Palmer, 2006, p.623). Scott, Ethan, Ginger, Jane, Lydia and Jasmine used problem-based learning extensively in the classroom. The lessons were structured in team projects through a series of questions around a realistic problem. As Jasmine stressed many times, she was "the guide on the side and not the sage on the stage" and encouraged her students to work together in teams.

Faculty members felt that the problems or the issues around which the lesson plans were developed should be of intrinsic value to the students. Both Jane and Lydia pointed out that students were generally

apathetic to the global problems and issues since they only saw the world within a five mile radius. Using video clips, Jane motivated her students to think about others who were not as fortunate as them and to engage in conversations to try to solve the issue facing the global society today. Lydia pointed out that she gets bored when teaching about tenses and thesis statements and formatting in her English classes. However, when she added sustainability in her classes, it made teaching and learning more interesting and fun. As I reflected on the interviews and my own experiences as a faculty member, I found that if students do not perceive the connections to their own lives, it is very hard for them to be passionate about their learning. I also found that it was crucial to develop problem-based learning modules that highlighted real world situations so that students are challenged to work in teams to tackle complex societal issues using critical thinking skills.

Inquiry-based education. In an inquiry-based classroom, faculty use instructional materials and teaching strategies that harness students' innate curiosity for knowing "how we came to know" things rather than confirming "what we know." Inquiry is an active process of building robust understanding in students rather than a passive transfer of knowledge from the faculty to student (Donovan & Bransford, 2005). Sharon and James developed inquiry-based lessons on sustainability. They provided students not only with content knowledge, but they also encouraged the students to do extensive outside reading. The faculty members also

developed rubrics for inquiry-based modules, based on the triple-bottom line of sustainability.

As Minstrell and Kraus (2005), have said, “We need to acknowledge students’ attempts to make sense of their experiments and help them confront inconsistencies in their sense making” (p. 476). This research study and the literature showed that sharing different perspectives enabled students to engage in classroom discussion and build on each other’s ideas to provide new insights on the subject matter. Instead of focusing only on factual knowledge, inquiry-based education enables students to question, reason, and synthesize information. The study showed that the faculty guided students in their journey from curiosity to understanding and students played an active role in their learning.

All the faculty members interviewed for this study were innovative in their pedagogical approaches to teaching and learning. Each of the faculty members had taken the time to think deeply about teaching strategies in the classroom to enhance student learning. A few of the faculty members were very focused on student outcomes and assessment with sustainability education and had developed well designed assessment tools to measure student learning. All the aforementioned methods of innovative pedagogy overlap considerably since they involve active learning in the classroom. As a proponent of active learning strategies in the classroom, I have consistently found that using multiple modalities of

learning such as problem-based learning around a real life scenario, service learning, role playing activities, collaborative activities using oral discourse, and building scientific arguments that impact student learning positively.

Professional Development Programs

The third subsidiary research question is “which professional development programs were most useful to the faculty members for incorporating sustainability in the classroom?”

All the faculty members interviewed said that the professional development workshops on sustainability offered by the GCLI were extremely effective. These workshops gave many of the faculty members the opportunity to get involved in sustainability education and also provided them with ideas on how to incorporate sustainability in the classroom. In addition, the workshops helped many faculty members already involved in sustainability to go from just having add-on lessons to completely revamping their respective curricula. While they mentioned large time commitments as a barrier, they pointed out that one of the most valuable reasons for the effectiveness of professional development activities were the face-to-face interaction and networking with like-minded faculty members, which would be lost in an online workshop.

Institutional support and recognition were cited as ways to motivate faculty members to attend the professional development workshops in spite of the barriers of driving and time commitment.

According to Holdsworth et al., (2008), professional development activities in sustainability at higher education institutions were lacking due to lack of support in terms of time and recognitions. I have found that attending professional development workshops provided the knowledge, skill sets and confidence to try out innovative pedagogy in the classroom. Faculty members can build their knowledge bases and gain expertise within the safety of a professional development workshop in agreement with the findings from Nolet (2009).

Factors That Impede or Support Sustainability Education

The fourth subsidiary research question is “What are some factors that impede or support GCCD faculty members as they endeavor to incorporate sustainability in the classroom?”

One of the main challenges that impeded Greenville faculty members as they endeavored to incorporate sustainability in the classroom was the increased time and workload. The faculty members felt that they needed support from the administration in terms of rewards of release time to compensate for the increased workload.

Some faculty members perceived lack of communication between faculty members to be a major barrier to sustainability education. Jasmine, Sharon and Ginger stressed that the instructional council was a huge support especially in the development of sustainability courses, programs and certificates. Open communication and partnerships between faculty members of diverse disciplines could lead to breakdown of disciplinary

boundaries (Segawa & Segal, 2000). Collaborations and partnerships help develop trust and understanding between diverse entities and this could bring about change in the campus culture (Senge, 2009). My finding was that the IC provided opportunities for faculty members from diverse disciplines to interact in a nonthreatening atmosphere to develop trust and understanding. This led to strong social bonds and partnerships focused on student learning.

The interdisciplinary nature of sustainability was seen as a barrier by many of the faculty members. Jasmine and Jane saw fellow faculty members who are set in traditional disciplinary boundaries as the major hindrance for an interdisciplinary subject, such as sustainability. The participants mentioned that a lot of time, effort, and coordination was needed to create learning communities and to team-teach classes.

Faculty members might be experts in their own discipline but they may not be the content experts in the other disciplines. Lydia enjoyed team-teaching because she liked to interact with fellow faculty members and was not threatened by the content experts of the other disciplines. I found that Lydia's own educational background in interdisciplinary education gave her the confidence and the knowledge to be effective in both team-teaching and learning communities. Lydia also felt that many other faculty members might be uncomfortable not knowing the material from other disciplines because students expect the faculty members to be content experts in the classroom. While I agree with Lydia's concern, I find

that once faculty members acquire the knowledge and skills sets to teach sustainability, they would embrace team-teaching with like-minded fellow faculty members and challenge students to take responsibility for their learning.

In addition to demands of time, a dearth of communication and partnerships, and lack of interdisciplinary knowledge, the participants perceived the following challenges to adoption of sustainability education: 1) politicization of sustainability 2) perception that it is antibusiness 3) pure inertia 4) unawareness 5) lack of goals or passion and 6) stubbornness of faculty as many are set in their ways. The barriers for the adoption of sustainability education were compared to the barriers for adoption of instructional technology (IT) in the classroom (Geoghegan, 1994). The aforementioned barriers for adoption of sustainability education were found to be very different from adoption of IT in the classroom such as issues of technology alliance, lack of systematic transition for early majority, and ignorance of the gap. This could be attributed to the fact that there are some fundamental differences between the two; sustainability is an interdisciplinary subject whereas IT is a pedagogical tool. Sustainability depends on faculty members to work together whereas IT depends on innovative technology.

However, as both are educational innovations; some parallels were found between the findings of Geoghegan's (1994) study on adoption of IT and this research study on sustainability education. Both studies

recommend recognition of faculty who adopt an innovation, a peer support system to help mainstream faculty implement it, and the demonstration of the compelling value in adopting the innovation. In addition to the aforementioned factors, campus support helped drive the adoption of the IT. Many of the faculty members conveyed that their college had neither helped nor hindered them personally as they adopted sustainability education. However, some of these faculty members never asked their administration for help. All the faculty members interviewed for this study unanimously agreed that the diffusion of sustainability education was due to a grassroots effort by key faculty members in the district. In addition, four of the faculty members mentioned that sustainability education is now being recognized by the upper administration. I concurred with the four participants and considered sustainability education to be primarily a grassroots effort that began six years ago, but it is now fully supported by the administration. As I reflected on the process, I realized that a top down approach would not have worked in the GCCD system; on the other hand, only grassroots efforts would not have been as effective either. Presently there is a combination of an extremely active grassroots movement with full support and encouragement from the top; this joint effort is helping in wider diffusion of sustainability education. This joint collaboration between the administrators and faculty members have been instrumental in the creation of the Sustainability IC courses and programs.

Implication for Policy and Practice

The quintessence of sustainability education at the community college is to put forth policies that help open lines of communication between diverse departments, promote innovation in the classroom and help students learn about creating and living in sustainable just societies where diversity is embraced and celebrated. However, higher education has found it hard to embrace sustainability due to the interdisciplinary nature of the subject matter. The following implications need to be considered by administrators and faculty members for policy decisions:

1. Policy makers such as administrators and faculty members must keep in mind that social bridging and social bonding are important elements of the campus culture. Since sustainability education spans over multiple disciplines and bridges disciplinary boundaries, communication and networking should be encouraged between faculty members of diverse disciplines.
2. The campus policy decisions need to focus on student learning. In order to encourage experiential learning opportunities, campus administrators need to support faculty in creating campus demonstration projects and provide spaces for students' community projects. In addition, there should be support for faculty that would like to incorporate service learning into sustainability education.
3. Campus administrators should formulate policies that enable the creation of an interdisciplinary sustainability department that

offers joint appointments for faculty members. Creation of a sustainability department could open lines of communication between diverse disciplines and mitigate many financial issues.

4. As sustainability courses become the norm statewide, policies need to be set that can enable mechanisms for seamless transfer and articulation between the community colleges and the universities.
5. Campus policy makers must keep sustainability in mind as they formulate their strategic initiatives and college goals. This will not only enable sustainability education and impact student learning but will also create a campus culture that prides itself on green operations and the institutionalization of sustainability.

In addition to the aforementioned policy implications, adoption of sustainability education at the community college has significant implications for practice. Through this study, we can extrapolate a set of practice guidelines for sustainability education:

1. Offer enhanced professional development programs district-wide and at individual campuses with incentives for faculty to participate in them. It is highly desirable to have a variety of ways to promote and disseminate information about these professional development programs.
2. Find multiple ways to provide recognition for faculty members who get involved in sustainability education. Establishment of

programs to recognize key faculty members and stakeholders will help build momentum for adoption of sustainability in their respective classrooms.

3. Provide community college faculty members with incentives to pursue working on the scholarship of teaching and learning in sustainability education. Such incentives will be an added impetus for faculty members to work on developing sustainability curriculum, study the impact on student learning and publish findings.
4. Establish a mentoring system for new faculty members to adopt sustainability education. Having a well established mentoring program will help new faculty members adopt sustainability in a nonthreatening manner.
5. Create an extensive website that has credible sustainability resources and a database of lesson plans that Greenville faculty members can access easily would enhance adoption of sustainability education.

Sustainability education has a unique set of characteristics along with unique barriers and drawbacks. This research study has provided implications for both policy makers and practitioners to step out of the box and think in innovative ways in order for sustainability education to become a norm at higher education institutions.

Recommendations for Future Studies

This qualitative case study is limited to sustainability education at one large community college district in the United States. In educational research, “We face particular problems and must deal with local conditions that limit generalizations and theory building” (Berliner, 2002, p. 19). As in this research study, the ability to generalize is limited due to the extensive variability in educational approaches nation-wide, I recommend researchers continue expanding the study to other community colleges across the country.

Moreover, I found a dearth in the literature on sustainability education at the community colleges; hence, more research needs to be conducted on sustainability education at the community colleges. This research study only focuses on the insights and perceptions of eight faculty members on sustainability education. Since adjunct faculty make up a large percentage of community college faculty, I recommend expanding this study in the future to adjunct faculty to learn their insights and perceptions about sustainability education.

Another avenue for research could be to study the impact of career and technical education courses in preparing students for the workforce in renewable technologies and green jobs. Due to the paucity of literature on sustainability education at the community colleges, conducting longitudinal research studies examining processes for institutionalizing sustainability education would be extremely beneficial.

Summary

This qualitative research study has provided an in-depth description of the processes and procedures used by the GCCD faculty to make sustainability a part of the curriculum and classroom. While the faculty members gave multiple reasons for why they became involved in sustainability education, the primary reasons were a love of nature and an innate interest in issues of equity and social sustainability. Based on their personal investment in the subject, these faculty members spent a lot of time and effort in incorporating sustainability in their curriculum. While implementing their curriculum, faculty members were highly gratified by their students' response to learning about sustainability. In fact, their investment in sustainability education was intensified due to the students' interest and engagement in creating a sustainable world. They were motivated to continue with their efforts to offer better educational experiences for their students by developing new curriculum and creating innovative pedagogy in the classroom. Some faculty members credited the Sustainability IC as a huge support for developing and offering courses in sustainability and to work collaboratively to promote sustainability education. Active learning strategies such as thematic education using case studies, experiential learning problem-based learning, and inquiry-based learning were used to incorporate sustainability in the classroom.

Faculty members identified the interdisciplinary nature of sustainability as both a barrier and an advantage. Collaboration with

faculty from diverse disciplinary perspectives was seen as a motivation to get involved in sustainability education. These interactions overcome the barriers of traditional disciplinary silos and thus enhance the applicability of sustainability education to solving real world issues.

Faculty members mentioned that sustainability education could be adopted institution-wide if a core group of faculty members provided small nuggets of information on how to incorporate sustainability in the classroom. This might work effectively in addition to traditional professional development programs that are already in place at the district office. Many of the faculty members recommended additional professional development programs at the individual campuses to foster wider diffusion of sustainability education. Engaged and interested students in sustainability education might also energize more faculty members to adopt this innovation in their respective classrooms.

Sustainability education is an important subject matter since it affects quality of life for present and future generations. As David Orr says, "Higher education institutions are crucibles for learning about sustainability" (2005, p. 13). Since sustainability is to improve quality of life, it is a broad subject that encompasses many disciplines. As a community college faculty, I feel that it is essential to excite and motivate our students to learn about sustainability to bring about change; change to environmental justice, economic freedom and social equity. As our students go into the real world, they need to think about improving the

quality of life through informed choices and help sustain the earth's resources for future generations. As faculty members, we should aspire to educate our students about sustainability and empower them to become the leaders of tomorrow; we can aspire to motivate and energize our students about sustainability to create a society where environmental resources are protected and where people of all races, ethnicities and gender would live well and are treated equally.

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APPENDIX A
RECRUITMENT LETTER

Pushpa Ramakrishna
Graduate Student
Mary Lou Fulton Teachers College
Arizona State University
Tel: (480)940-9969
Email: pushpa.ramakrishna@asu.edu
Date

Dear _____

I am a graduate student under the direction of Professor Alfredo G. de los Santos Jr. in the Mary Lou Fulton Teachers College at Arizona State University. I am conducting a research study on 'Sustainability education at the community college; Implication for policy and practice'.

I am requesting your participation, which will entail a minimum of two hours. Your participation will involve filling in a survey, and an interview, which will be audio taped. Your participation in this study is voluntary. Although there may be no direct benefits to you, the possible benefits of your participation in the research would be to add to the scholarly body of knowledge on sustainability education at the community college. If you choose not to participate or to withdraw from the study at any time, there will be no penalty. Please do not answer any question that you are not comfortable with. The results of the research study may be published, but your name will not be known.

If you have any questions concerning the research study, please contact Professor Alfredo G. de los Santos Jr. at (480) 727-7724 or call me at (480) 732-7219.

Sincerely,

Pushpa Ramakrishna

Graduate Student

Mary Lou Fulton Teachers College

APPENDIX B
INFORMED CONSENT LETTER

Sustainability Education at the Community Colleges

Implication for policy and practice

INTRODUCTION

The purposes of this form are to provide you (as a prospective research study participant) information that may affect your decision as to whether or not to participate in this research and to record the consent of those who agree to be involved in the study.

RESEARCHERS

Professor Alfredo G. de los Santos Jr. and Graduate student Pushpa Ramakrishna have invited your participation in a research study.

STUDY PURPOSE

The purpose of the research is to analyze the processes and procedures used by a small sample of faculty of the Greenville County Community College District (GCCD) to integrate sustainability into the curriculum and classroom.

DESCRIPTION OF RESEARCH STUDY

If you decide to participate, then you will join a study involving research of sustainability education at the community colleges and the implications for policy and practice. These policy studies will be a great benefit to the higher education research. You will be a part of the 5-10 Greenville faculty chosen for the study from the ten Greenville community colleges.

The study will encompass a short preliminary survey followed by a semistructured interview. Artifacts such as professional development

documents, course syllabi, access to course Blackboard site, course assignments and documents will be collected during the study.

If you say YES, then your participation will last for approximately two hours at a location convenient to you. During the meeting, you will initially be asked to fill in a preliminary survey which will be followed by an interview. At the end of the interview you will be asked to share any of the aforementioned artifacts with the researcher. You can skip questions during either the survey or the interview or decline to share any artifacts for the study at any time.

RISKS

There are no known risks from taking part in this study, but in any research, there is some possibility that you may be subject to risks that have not yet been identified.

BENEFITS

Although there may be no direct benefits to you, the possible benefits of your participation in the research are as follows:

There is a minimal quantity of literature on 'Sustainability education at the community college'. This research study adds to the scholarly body of knowledge on sustainability education and to the literature on the diffusion of innovations of a content area. It is critical to infuse sustainability in community college from a faculty development perspective. Community colleges play a critical role in educating the leaders of tomorrow and hence the significance of this study.

CONFIDENTIALITY

All information obtained in this study is strictly confidential. The results of this research study may be used in reports, presentations, and publications, but the researchers will not identify you unless you give permission.

In order to maintain confidentiality of the records, you, as a participant will not be mentioned by name. Instead, alias names and codes such as P1, P2 P3, P4, P5 etc will be used for you and for each of the participants of the research. You will be referred by your alias name and code during the note-taking of the interview and during the transcription of the interview. The same alias names/codes will be used during the analysis of the interview transcripts and for synthesizing the reports and the dissertation. All records will be kept confidential and only the researcher and the advisors will be able to access the records.

I would like to audiotape the interview. The interview will not be recorded without your permission. Please let me know if you do not want the interview to be taped; you also can change your mind after the interview starts, just let me know. I will label the audio tapes with your alias name and assigned code prior to storing them. I would like to store the tapes till I finish my doctoral degree. I will destroy all the tapes after I complete my graduation by recording over it and throwing it in the trash. The e-mail communication will be saved under the alias name to protect

the participants in the study. All emails will be expunged at the end of the study.

WITHDRAWAL PRIVILEGE

Participation in this study is completely voluntary. It is ok for you to say no. Even if you say yes now, you are free to say no later, and withdraw from the study at any time.

If you decide to withdraw from the study at a later date, the audio tapes will be destroyed immediately and the emails expunged.

COSTS AND PAYMENTS

The researchers want your decision about participating in the study to be absolutely voluntary.

There is no payment for your participation in the study.

VOLUNTARY CONSENT

Any questions you have concerning the research study or your participation in the study, before

or after your consent, will be answered by

Pushpa Ramakrishna
Email: pushpa.ramakrishna@asu.edu
Tel: 480-732-7219

Alfredo G. de los Santos Jr.
428 E Farmer Building
Arizona State University
Tempe, AZ
Email: delossantos@asu.edu
Tel: 480 965 2149

If you have questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk; you can contact the Chair of the Human Subjects Institutional

Review Board, through the ASU Office of Research Integrity and Assurance, at 480-965 6788.

Please let me know if you wish to be part of the study.

By signing below, you are giving permission to use your quotes for presenting or publishing this research.

Subject's Signature	Printed Name	Date
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APPENDIX C
SUSTAINABILITY SURVEY

Name/username_____

The purpose of this survey is to understand your interest in sustainability.

Please fill out this survey to the best of your ability:

PART 1:

What disciplines do you teach? _____

How long have you been teaching? _____

PART 2: PROFESSIONAL DEVELOPMENT

Do you think it is important for community colleges to have training opportunities for faculty such as the 'Learnshop', dialog days etc?

Very
important

Important

Somewhat
important

Not
important

No opinion
/Not
applicable

Is it

Feasible?

Somewhat feasible?

Not very feasible?

Please comment:

Do you think it is important to provide opportunities for community college faculty to attend meetings and conferences for professional development purposes?

Very important	Important	Somewhat important	Not important	No opinion /Not applicable
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Is it

Feasible?	Somewhat feasible?	Not very feasible?
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Please comment:

PART 3: CURRICULUM

Do you think it is important for community colleges to offer courses in sustainability – for general education?

Very important	Important	Somewhat important	Not important	No opinion /Not applicable
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Is it

Feasible?	Somewhat feasible?	Not very feasible?
-----------	--------------------	--------------------

Please comment:

Do you think it is important to infuse sustainability in your classroom?

Very important	Important	Somewhat important	Not important	No opinion /Not applicable
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Is it

Feasible?	Somewhat feasible?	Not very feasible?
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Please comment:

PART 6 : FINAL THOUGHTS

Any final thoughts? Reflections?

APPENDIX D
INTERVIEW QUESTIONS GUIDE

1. Please tell me a little bit about your educational background that has led you to where you are now?
2. Could you please elaborate about how you are involved with the sustainability education at the community colleges?
3. What are the factors that sparked your interest in this topic?
(Basically – why are you interested in sustainability? What motivated you?)

Or

What are some factors that hinder you from getting involved in this sustainability initiative?
4. Have you incorporated sustainability in your classroom?
5. If so, can you describe in detail how you have done so?

Or

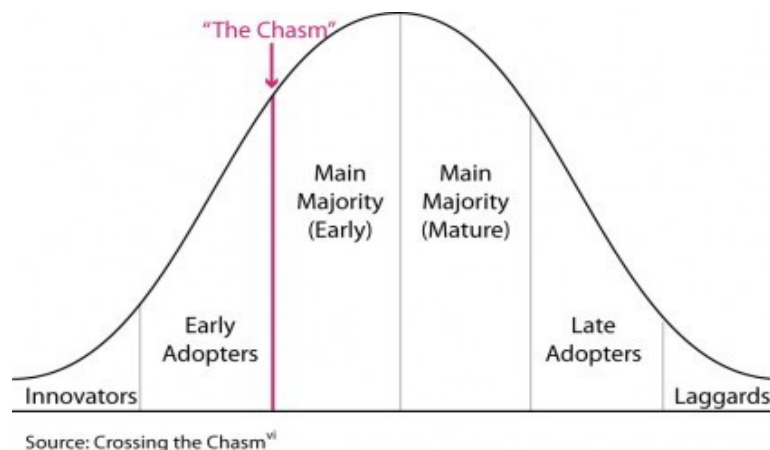
If not, can you describe some obstacles that have hindered you from incorporating sustainability in your respective classroom?
6. Have you developed any curriculum on sustainability?
7. If so, can you describe the steps of how you have created the curriculum?
8. If not, have you created any other curriculum for any other classes and how did you go about doing so?
9. What are the steps you needed to go through to offer classes on sustainability?

Or

If not, can you give some pros and cons of developing sustainability curricula and offering new classes in sustainability?

10. How has your college/district helped or hindered you as you go through the process of incorporating an innovation as sustainability in the classroom?
11. Many sustainability courses/programs are designed to draw on more than one discipline.
12. In your opinion, are there any benefits in offering interdisciplinary courses?
13. Are there any benefits in teaching interdisciplinary courses?
14. Are there any drawbacks for teaching interdisciplinary courses?
15. What are some of the professional development strategies used to encourage GCCD faculty to incorporate sustainability elements in their course work? At the district? At your college?
16. How effective are these professional development models?
17. What have you taken away from these professional development workshops on sustainability?
18. Did you make any changes in your teaching due to attending these events?
19. What impacted you the most?
20. How would you change these professional development programs?

21. What kinds of pedagogy do you use when you teach an interdisciplinary topic such as sustainability? Please give a few examples.
22. How did you develop them? Or adapt them from existing pedagogy?
(Or if participant has not yet taught sustainability or has mentioned that they have no plans to do so, then ask the following question)
23. Have you used any innovative pedagogy in any of your classes? If, so how have you used them? Developed them? Adapted them?
24. Are you familiar with this model for innovation (If not - I will take a couple of minutes to explain the model to the participant)
25. Please take a few minutes to look at the following model:



26. Where do you see yourself in Moore's model of the adopter categorization on the basis of innovation in sustainability education at the community colleges?

27. How do you classify yourself in the category? (What are the reasons?)
28. What factors can help you (or fellow faculty members) to move from the majority mainstream section to the adopter section?
29. What are some barriers that impede such movement across the chasm?
30. Do you see any connection between the offerings of the professional development activities and adoption of sustainability education as an innovation by the majority of faculty? Please elaborate.
31. Overall, what are some factors that support or encumber you, as a Greenville faculty as you endeavor to incorporate sustainability in the classroom?

My notes:

1. Since the interview is semistructure, during the interview, based on the conversation, here are some sample questions that I could ask:
2. How have fellow faculty members in your division viewed your innovation? Have any of them adopted your innovation in sustainability?
3. You mentioned that you changed the way you teach other courses due to this innovation in sustainability education, how have you adapted the innovation to the other courses you teach?

4. If another faculty member who was thinking about making changes to their course and was concerned about developing a sustainable innovation came to you for advice, what advice would you give them? Are there any specific factors that you would tell another faculty member to consider before embarking on an innovation?

APPENDIX E

SUSTAINABILITY PREFIXES AND HIRING QUALIFICATIONS

Three Sustainability Prefixes are identified as SUS Sustainability/Natural Sciences, SSH Sustainability/Social Sciences and Humanities and SCT Sustainability/Career and Technical. Here are the descriptions of the content area and the hiring qualifications as recommended by the Sustainability Instructional Council

SUS Sustainability/Natural Sciences

Description of the Content Area that will be taught under the new subject: Courses in the SUS prefix will have jurisdiction over topics of Sustainability in the areas of environmental responsibility, social equity, and economic viability. Disciplines included in this prefix are: Physics, Chemistry, Geology, Life Science, Geography, Anthropology (ASM), Exercise Science/Health, and Environmental Sciences.

Hiring Qualifications, as recommended by the assigned instructional council, required for a faculty member to teach courses that fall under the new subject: (Above and beyond academic)

A Master's degree in Sustainability or related field (such as Environmental Sciences and Environmental Studies)

or

A Master's in any teaching field with at least 24 upper-division and/or graduate semester hours. The semester hours must be derived from three of the [Sustainability/Natural Sciences] component fields (including Physics, Chemistry, Geology, Life Science, Geography, Anthropology (ASM) and Exercise Science/Health, Environmental

Science), with a maximum of nine (9) hours from two of the fields and six (6) hours from a third component field (Example: 9 hrs./9hrs./6 hrs)

or

A Master's in any teaching field with 18 graduate semester hours from three of the [Sustainability/Natural Sciences] component fields (including Physics, Chemistry, Geology, Life Science, Geography, Anthropology (ASM) and Exercise Science/Health, Environmental Science), with a maximum of 6 hours from any one of the component fields.

SSH Sustainability/Social Sciences and Humanities

Description of the Content Area that will be taught under the new subject: Courses in the SSH prefix will have jurisdiction over topics of Sustainability in the areas of environmental responsibility, social equity, and economic viability. The following disciplines included in this prefix are: Social Sciences and Humanities (SSH): Philosophy, Cultural Geography, Anthropology (ASB), Education, Economics, Southwest Studies, American Indian Studies, Exercise Science/Health.

Hiring Qualifications, as recommended by the assigned instructional council, required for a faculty member to teach courses that fall under the new subject: (Above and beyond academic)

A Master's degree in Sustainability or related field (such as Environmental Studies)

or

A Master's in any teaching field with at least 24 upper-division and/or graduate semester hours. The semester hours must be derived from three of the [Sustainability/Social Sciences and Humanities] component fields (including Philosophy, Geography, Anthropology (ASB), Education, Economics, Southwest Studies, American Indian Studies, Exercise Science/Health, Humanities, Environmental Sciences, Women's Studies) with a maximum of nine (9) hours from two of the fields and six (6) hours from a third component field (Example: 9 hrs./9hrs./6 hrs)

or

A Master's in any teaching field with 18 graduate semester hours from three of the [Sustainability/Social Sciences and Humanities] component fields (including Philosophy, Geography, Anthropology (ASB), Education, Economics, Southwest Studies, American Indian Studies, Exercise Science/Health, Humanities, Environmental Sciences, Women's Studies), with a maximum of 6 hours from any one of the component fields.

SCT Sustainability in career and technical

Description of the Content Area that will be taught under the new subject: Courses in the SCT prefix will have jurisdiction over topics of Sustainability in the areas of environmental responsibility, social equity, and economic viability. Disciplines included under this prefix will be career and technical courses.

Hiring Qualifications, as recommended by the assigned instructional council, required for a faculty member to teach courses that fall under the new subject:

A master's degree in sustainability or related field (such as Environmental Studies),

or

A master's degree in any teaching field with at least 24 upper division and/or graduate semester hours in sustainability related courses,

or

A master's degree in any teaching field with 18 graduate semester hours in sustainability related courses,

or

A bachelor's degree plus three (3) years work experience in sustainability or related career experience (such as LEED AP, Alternative Energy),

or

An associate's degree or 64 semester hours and five (5) years work experience in sustainability or related career experience (such as LEED AP, Alternative Energy).

EDU250 – Teaching and Learning in the Community College – or equivalent must be completed within two years of date of hire.

APPENDIX F
INSTITUTIONAL REVIEW BOARD LETTER

To: Alfredo De Los Santos
ADMIN A 20

From: Mark Roosa, Chair
Soc Beh IRB

Date: 09/06/2011

Committee Action: **Exemption Granted**

IRB Action Date: 09/06/2011

IRB Protocol #: 1108006804

Study Title: Sustainability Education at the Community College: Implications for Policy and Practice

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.