Educating for Sustainable Development: A case study of the SIT Study Abroad Iceland 2009 program

Caitlin Wilson Brötzmann

Faculty of Life and Environmental Sciences
University of Iceland
2010

Educating for Sustainable Development: A case study of the SIT Study Abroad Iceland 2009 program

Caitlin Wilson Brötzmann

60 ECTS thesis submitted in partial fulfillment of a
Magister Scientiarum degree in Life and Environmental Sciences

Advisor
Marey Allyson Macdonald

External Examiner
Ingólfur Ásgeir Jóhannesson

Faculty Representative
Brynhildur Davíðsdóttir

Faculty of Life and Environmental Sciences
School of Engineering and Natural Sciences
University of Iceland
Reykjavik, May 2010

Educating for Sustainable Development: A case study of the SIT Study Abroad Iceland 2009 program
Educating for Sustainable Development: A case study
60 ECTS thesis submitted in partial fulfillment of a *Magister Scientiarum* degree in Life and Environmental Sciences

Abstract

Though the global situation is complex and daunting, education for sustainable development attempts to empower students with the knowledge, values, and ability not only to understand but also to act upon that understanding so that they might create a world in harmony with the environment.

In summer 2009, 19 university students from North America came to Iceland to study renewable energy on the SIT Study Abroad (a program of World Learning) program "Iceland: Renewable Energy, Technology, and Resource Economics." The students traveled around the country, stayed with host families, underwent intensive coursework, visited power plants and policy firms, and conducted independent study projects.

This case study evaluates the program through in-depth interviews, qualitative analysis, and discussion of the emergent theory and its implications for practice. It was found that the students were most influenced by their cultural experiences with their host families which made them reflect on themselves and their place in the world. They learned real-life applications and gained confidence for the future by seeing renewable energy and examples of sustainability in practice in Iceland.

From the analysis and discussion, it emerged that the program could be improved by emphasis on ethics in the course, creation of a forum for critical, multidisciplinary, open discussion, and community involvement and student agency in the independent study project. Reflection on my role as facilitator led me to realize that I need to create a challenging but encouraging learning environment in order to enable authentic, transformative, sustainable education.

Útdráttur

Menntun til sjálfbærrar þróunar er tilraun til þess að færa nemendum þekkingu, viðhorf og hæfni til að skilja flókinn og erfiðan veruleika nútímans. Í slíkri menntun er lögð sérstök áhersla á að nemendur geti brugðist við þannig að þeir geti lifað í sátt við umhverfið.

Sumarið 2008 komu 19 háskólanemendur frá Norður-Ameríku til Íslands til að stunda nám um endurnýjanlega orku á námskeiði sem nefnist SIT Study Abroad (Skólinn fyrir Alþjóðlega Menntun og Náms Erlindis) og RES-Orkuskólinn. Nemendur ferðuðust um landið, gistu hjá íslenskum fjölskyldum, sóttu erfið námskeið, heimsóttu virkjanir, kynntu sér stefnu fyrirtækja og unnu sjálfstætt verkefni.

Rannsókninni er ætlað meta námskeiðið. Hún fólst í ítarlegum viðtölum, eigindlegri greiningu og umræðu um niðurstöðurnar og þýðingu þeirra fyrir framkvæmd námskeiðsins. Í ljós kom að nemendur urðu fyrir mestum menningaráhrifum af fjölskyldum gestgjafa sinna. Þetta gerði þeim kleift að ígrunda sjálfa sig og stöðu þeirra í heiminum. Þeir lærðu um raunverulegar aðstæður og öðluðust traust til framtíðar með því að sjá endurnýjanlega orku og dæmi um sjálfbærni í framkvæmd á Íslandi.

Hvað varðar námskeiðið sjálft kom í ljós að rétt væri að bæta við áherslu á siðfræði og að skapa vettvang fyrir þverfaglega, opna umræðu með þátttöku samfélagsins í hinni sjálfstæðu rannsókn námskeiðsins. Hugleiðingar um hlutverk mitt sem kennari á námskeiðinu urðu til þess að ég áttaði mig á því að ég þarf að búa til námsumhverfi sem í senn er krefjandi en uppörvandi til þess að stuðla að öflugri og sjálfbærri menntun.

Dedication

This work is dedicated to my husband Maik and our son Felix Finnbogi.

Table of Contents

List of Figures

List of Tables

Acknowledgements

1　Introduction

1.1 Rationale and research questions

Civilizations have risen and fallen since the dawn of humanity. In his book *Collapse*, a sweeping analysis of why some societies collapse while others succeed, Jared Diamond concludes that the interaction of the following factors have in the past determined the fate of any given society: deforestation and habitat destruction, soil problems, water management problems, overhunting, overfishing, effects of introduced species on native species, overpopulation, and increased per capita impact of people. Furthermore, he propounds that four additional factors will be significant in the present and future fate of society: human-caused climate change, buildup of toxins in the environment, energy shortages, and full human utilization of the earth's photosynthetic capacity (Diamond, 2005). While our contemporary global society may appear doomed by this analysis, I believe that in reflection lies our salvation. The fact that we do painfully muster self-awareness and take measures to improve our situation and prevent self-destruction distinguishes us from societies who blindly chopped down the last tree and fished the last fish (such as the Easter Islands). In this simple act of thoughtfulness do I find greatest reason for hope that we can sustain modern society. But it will require more: we must not only think, but also act on our intelligence.

As the latter half of the 20th century progressed, the concept of sustainable development went from being radical to progressive to necessary to popular and widely accepted. It is almost commonplace today. The movement was motivated by the collective impact of population growth, environmental degradation, and socio-economic class disparity, both within and among the nations of the world. Sustainability is now generally accepted to be the mode of existence in which present generations thrive such that future generations may have the same opportunities to thrive; or, the harmonious balance among industrial activity, environmental conservation, and social justice. But it is more than the sum of its three parts—economy, environment, society—it shall comprehend in its grasp all of the cultures of the world and their respective ways of being. Sustainability is the means to an end, and the end is not so much a static target itself, but a dynamic equilibrium in which a global society thrives perpetually on a healthy planet. Thus sustainable development is not an easily contained concept, but relates to every school of thought and every human activity.

Education is a powerful tool in the hands of society. It shapes the coming generations through formal schooling; it pervades all of society through informal educating media. In education lies the potential to raise up a culture of sustainability. Education for sustainable development attempts to do just this: to foster holistic, responsible thinking in the minds of global citizens and planetary stewards. According to UNESCO, "Education for sustainable development aims to help people develop the attitudes, skills and knowledge to make

informed decisions for the benefit of themselves and others, now and in the future, and to act upon these decisions" (UNESCO, 2010).

What exactly does this mean in practice? Education for sustainable development has yet to be widely formalized, with many teachers simultaneously and informally researching and testing new methods to find the most effective ones. For the past two years, I have been involved in facilitating the educational experience of a group of undergraduate students studying abroad in Iceland for a seven-week, intensive summer program in renewable energy science and technology and sustainable development. The course is a program of SIT Study Abroad (a program of World Learning, Inc.) in Vermont, US, in collaboration with the School for Renewable Energy Science (RES) in Akureyri, Iceland, and The University Centre of the Westfjords in Isafjordur, Iceland. During the seven weeks, the students travel from Reykjavik to Akureyri to Isafjordur and back to Reykjavik, and see much of the country on the way. The scheduled program consists of lecture time, site visits to geothermal and hydropower plants and to agencies and firms directly involved in renewable energy implementation and policy, and in independent research projects.

This research investigates and evaluates the educational experiences of the students on this program in 2009 and my role as program facilitator.

The research questions my study endeavors to answer are:

1) What characterizes the learning experiences of students in the SIT Iceland summer program, and how does this impact their conceptualization of sustainable development?

2) As a facilitator, how can I incorporate these results into future program planning to create a more transformative educational experience?

Through action research in the form of observation and in-depth interviews, my study investigates what the students learned and how they learned it. It aims to discern among and evaluate the impact of the various learning experiences the students have on the program. In doing so, I hope to reveal some of the more internal learning processes, which occur both subtly and dramatically during such an experience as this intensive program. According to Kemmis and McTaggart, evaluation is beneficial for improving programs by engaging interested parties in a critical debate about the program (1982). They write:

Evaluation should thus aim to contribute to program improvement both directly and indirectly: by its direct interaction with program participants and by feeding and refining the interaction between program participants and their audiences. (Kemmis & McTaggart, 1982)

My study is also self-reflective on my role as facilitator. I use the observations and interviews, as well as my reflections to discuss and analyze my efficacy as program facilitator. Part of the outcome of this thesis will be to improve myself as an educator with the intention to change according to my conclusions.

1.2 Development of sustainability

The roots of education for sustainable development lie in the environmental education movement, which began in the 1960s and 70s as environmental awareness generally rose to new levels. Two significant events crystallized the realization that humans disproportionately impact their environment—the publication of *Silent Spring* by Rachel Carson (1962) and the formation of the Club of Rome in 1968. *Silent Spring* documented the damage of the pesticide DDT on bird populations, bringing to the attention of the public clear evidence of a link between human activities and a deteriorating environment. The meeting of the Club of Rome and the subsequent publication of *Limits to Growth* in 1972 also brought to the public the academic theory that the human population will exceed its carrying capacity and break down. The idea was not new: in the early 1800s, Thomas Malthus predicted the collapse of humanity due to overpopulation. However, Malthus was proved incorrect when mankind rapidly adapted and innovated at the end of the 19th century with industralization, technology (particularly with respect to agriculture), and medical advances that enabled not only the endurance but also the growth of the world population. By the 1970s, awareness that the human population was multiplying exponentially and human activities were dramatically and negatively affecting the environment coalesced into a concerted effort to mitigate these and build a society based on harmonious relations with respect to humanity and the environment; that is, sustainable development (SDC, 2010).

In 1972, the United Nations (UN) held the Conference on the Human Environment, marking the first of major international conferences dealing with sustainability the UN would hold in decades to come. After this conference, an International Workshop on Environmental Education was held in Belgrade, Serbia (then Yugoslavia) in 1975. The first of two formative conferences, the Belgrade workshop led to the groundwork paper "The Belgrade Charter: A Global Framework for Environmental Education." The charter defined the role of environmental education in the global environmental situation. Describing a world of rampant growth for a small population at the expense of other living beings and the environment, the charter called for "nothing short of a new global ethic" (UN, 1975). This ethic envisioned equal society, sustainable development, fair distribution of necessities, and respect for other cultures. "Disarmament should be the ultimate goal," it stated (UN, 1975). In this global re-prioritizing, the Belgrade Charter called for environmental education as the way forward. "Governments and policy makers can order changes, and new development approaches can begin to improve the world's condition—but all of these are no more than short-term solutions, unless the youth of the world receives a new kind of education" (UN, 1975).

In 1977 came another significant step for environmental education, the UN Conference on Environmental Education held in Tbilisi, Georgia. Building on the International Workshop for Environmental Education, it reiterated the urgent call to action of the Belgrade Charter: "In the last few decades, man has, through his power to transform his environment, wrought accelerated changes in the balance of nature. The result is frequent exposure of living species to dangers which may prove irreversible" (UN, 1977). The Tbilisi Declaration expanded further on the ethos of the Belgrade Charter. It outlined objectives, characteristics, and guiding principles of environmental education, grounding the theory with practical instructions. The Tbilisi Conference and Declaration are directly used in

Chapter 36 of Agenda 21, quoted as providing the "fundamental principles" for its proposals (UN, 1992, 36.1). The most significant of these fundamental principles, and the primary goal of Chapter 36 of Agenda 21 is "reorienting education toward sustainable development" (UN, 1992, 36.2).

In the 80s, the name "sustainable development" was first applied to the sustainability movement as a result of the Brundtland Commission's publication of the landmark document *Our Common Future*. This paper is the manifesto of sustainable development and contains the most-often quoted definition of sustainable development: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 1987). As sustainable development came into its own, so did education for sustainable development.

The year 1992 marked the seminal conference for sustainability: the UN Conference on the Environment and Development in Rio de Janeiro, Brazil. This conference agreed upon Agenda 21 which, as shown above, recognized the importance of education to sustainable development. In 1997, the United Nations Education, Scientific, and Cultural Organization (UNESCO), in its "Rio +5" review, emphasized the resolutions committed to in 1992, and called for the subscribers to reorient education "to promote widespread public understanding, critical analysis and support for sustainable development" (UN, 1997). It reiterated the material core of education for sustainability, reminding nations that it includes "lifelong learning, interdisciplinary education partnerships, multicultural education and empowerment" (UN, 1997).

From 1997 to 2002, education for sustainable development defined its parameters more clearly. Significantly, UNESCO argued that it was neither an extension of environmental education nor an integration of development and environmental education (Huckle, 2006). UNESCO emphasized that education for sustainable development is a "catalyst for social change, a means of fostering the values, behavior and lifestyles required for a sustainable future" (Huckle, 2006). In special recognition of the importance of education for sustainable development, the UN, with UNESCO as the lead agency, has named the decade from 2005 to 2014 the *Decade of Education for Sustainable Development*, the purpose of which is to integrate sustainable development into education and to utilize education to achieve the UN millennium goals.

1.3 Theoretical perspectives

To change our ways, we must change our minds. To change our minds, we must receive a different kind of education. The sustainable development envisioned above necessitates a new approach to education. Education is undeniably crucial to this global movement for sustainable development. Sustainability is an abstract concept, so education must be used to lay the groundwork for and reinforce the ideas of sustainability. In tackling the problems of understanding, building, and achieving sustainability, education must be solidly in place to lead the way forward. In Table 1 below, which John Huckle (2006) developed to schematically represent Agenda 21 (the UN "comprehensive action plan" for implementing sustainable development both globally and locally), education is listed in the third column as one of the tools key to the processes used to achieve the sustainability goals in the first column (UN, 1992). Education is ranked among capacity building,

regulation, market mechanisms, and investment as one of the most effective ways to implement sustainable development.

Table 1.1 Agenda 21 goals and methods (Huckle, 2006, emphasis mine)

Content	Process	Tools
Reduce use of resources and production of waste, increase resource efficiency, reuse, recycle	Active planning and management	**Education, information, awareness raising**
	Consultation, participation, empowerment	**Capacity building, institutional know-how, confidence, experience**
Conserve fragile ecosystems	Decisions at most local possible level, local government pivotal	Regulations and enforcement
Social equity (between and within countries and across generations)	Partnerships and collaborations between all sectors	Market management, taxes, levies, subsidies
Quality of life (broader than standard of living)		Public investment
Respect for traditional knowledge, ways of life, diversity		

Chapter 36 of Agenda 21 explicates education as a tool for sustainability:

> Education, raising of public awareness and training are linked to virtually all areas in Agenda 21… Education, including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues… It is also critical for achieving environmental and ethical awareness, values and attitudes and behaviour consistent with sustainable development and for effective public participation in decision-making. (UN, 1992, chapter 36.1 – 36.3)

In looking back through all the years of conferences and documents, we hear time and again a call for a new kind of education. But what exactly does that mean? What is education for sustainable development? There are perhaps as many interpretations as there are of sustainable development itself. In order for education for sustainable development to be a coherent philosophy, it must have a strong integrity, united around core values and practices. Below follows a discussion of the main elements of education for sustainable development, as agreed upon in the UN and corroborated by education theorists. Though the early UN work dealt with environmental education, it is included here because it is from these seeds that education for sustainable development grew.

The Belgrade Charter in 1975 was the first UN document to take on the issue of education as it relates to the environmental crisis. Its tone is ambitious and radical. It describes this

new kind of education as breaking from convention. It is holistic, inter-disciplinary, and interactive. The Charter boldly defines the goal of environmental education as fixing global environmental problems. First, it teaches awareness, knowledge, and attitudes. Then, the Charter continued, environmental education teaches practical skills, evaluation ability, and participation. The Belgrade Charter represents environmental education as a powerful, comprehensive solution to the world's problems in 1975 (UN, 1975).

The Tbilisi Declaration of 1977 serves as the practical guide for environmental education. It elicited an environmental education that revolves around making connections between individuals, nations, and the land (UN, 1977). In its worldview, the environment is the convergence of natural and manmade phenomena, e.g. technology, economics, politics, cultures, histories, all filtered through moral and aesthetic codes. The scope of environmental education, according to the Tbilisi Declaration, extends beyond conventional understanding of the boundaries of education. It should be lifelong, continuous, and both formal and informal. The curriculum crosses many disciplines, yet is grounded in the specifics of each, and retains a balance among all. The content is problem-based, including both local and distant issues, to give the student insight into similarities and differences around the globe. Time periods covered span past, present, and future, with a focus on cause-and-effect and trends. The importance of international as well as local and regional cooperation is emphasized. Development should be learned with specific regard for sustainability and environmental factors. The method of teaching is also different; students develop agency in lessons in order that they are empowered through decision-making and feeling that they own their education. For younger learners, the focus is on their own community. Environmental education enables students to discover and recognize for themselves evidence of environmental problems and their causes. Lessons can present environmental problems in all their complexity, but also teach the analysis and problem-solving skills that can penetrate that complexity. Finally, a key divergence from conventional education methods, environmental education should utilize many different types of educational settings. There should be extensive practical experience and learning in the earth's classrooms. The Tbilisi Declaration fleshed out the meaning of the Belgrade Charter, and gave its audience (nations, regions, localities, individuals) a handbook by which they could adopt the principles of environmental education. Importantly, it provides definitions and examples for all aspects of this new education.

In subsequent years, the UN reinforced these ideas in its efforts to encourage nations to improve their education systems as they reorient towards sustainability. Rio +5 essentially reminded us that education for sustainability is lifelong, interdisciplinary, multicultural, and empowering (UN, 1997). Johannesburg reemphasized education's role in sustainable development, but also worked to distinguish education for sustainable development as an end in itself. It is in Johannesburg and in the focus on the decade of education for sustainability that it is stressed that education for sustainable development is itself a process. The *Draft framework for the Decade of ESD* reads:

> Education for sustainable development has come to be seen as a process of learning how to make decisions that consider the long-term future of the economy, ecology and equity of all communities…This represents a new vision of education, a vision that helps people of all ages better understand the world in which they live, addressing the complexity and interconnectedness of problems such as poverty,

wasteful consumption, environmental degradation, urban decay, population growth, health, conflict and the violation of human rights that threaten our future. This vision of education emphasises a holistic, interdisciplinary approach to developing the knowledge and skills needed for a sustainable future as well as changes in values, behavior, and lifestyles. (UN, 2003, p. 4)

Bonnett (1999) an educational theorist, explores the idea that sustainability taken as a "frame of mind" rather than as a set of policy goals has positive and far-reaching impacts for education. He argues that underdevelopment correlates with environmental problems such as malnutrition, low literacy, insufficient medical and educational facilities, low income and productivity per capita, and high infant mortality. The "frame of mind" that allows for injustice, exploitation, and oppression is the same, whether it be towards humans or nature, and is therefore in conflict with sustainable development. He argues that we ought to conceive of sustainability as a way of relating to the environment. The ultimate goal of education for sustainable development is to have the "right" relationship to nature, and so also to humanity. However, this is subjective and culturally, historically, and geographically specific. To develop environmental awareness, education should not focus on economic growth, energy supply, or even biodiversity. Rather, education for sustainable development is how to identify and realize a "flourishing, mutually sustaining relationship in its lived day-to-day occurrence" (Bonnett, 1999). In this provocative article, Bonnett preaches honesty. He argues we need to come clean with respect to nature and our intentions with nature and we need to be honest about education. Education is never neutral; there is always a motivation behind it, and education for sustainable development is no exception. Bonnett claims that our environmental problems are symptoms of the underlying causes of social, economic, and political maladies. Therefore students must have the capacity and the capability to understand this and to engage in academic enquiry about sustainability and modern global issues. This shift in our approach to education will be uncomfortable and more difficult than the traditional system which bases the teaching of sustainable development on easy assumptions, such as that certain policy actions will lead to certain states of affairs (Bonnett, 1999). In this way, education for sustainable development is a socially critical education.

How does one attain a "frame of mind"? Huckle (2006), a consultant in the UK on education for sustainable development, interprets Bonnett to mean that sustainability as a frame of mind shall not be rational, but celebratory. It shall aspire to attunement; that is, to a sense of harmony in our relationship to nature and our responsibility to it. It will be characterized by receptiveness, genuine responsiveness, openness, engagement with the multifaceted nature of things. In this way, it is like studying great art. Education for sustainable development is not exclusively or even predominantly scientific. Huckle writes:

> The science of nature and society needs to be set in a broader context provided by the arts and humanities for only then will they be alive to the many facets and significances of nature that shape understanding of the world, the self, and what counts as development. (Huckle, 2006, p. 18)

Sustainability as a frame of mind must involve commitment to a basic environmental ethic which must be instilled, in much the same way as a human ethic is instilled in school and at home. Sustainability as a frame of mind can be part of the informal untaught curriculum. The ethos and practices of the school will be an expression of the state of mind. Thus

Bonnett and Huckle understand the practical meaning of education for sustainable development as a process or a frame of mind.
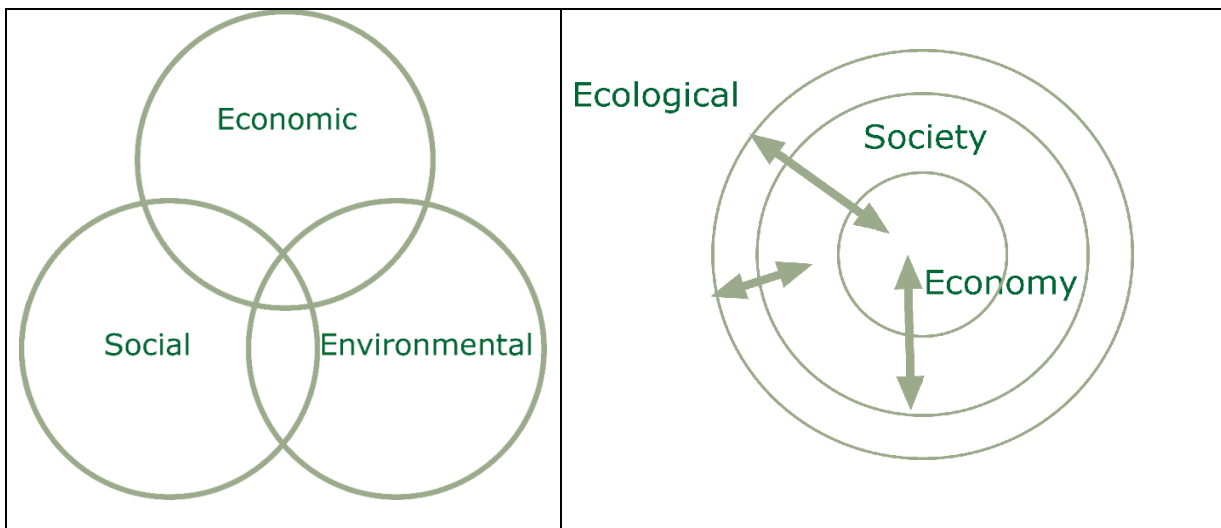
Figure 1.1 Conceptions of sustainable development (Webster, 2001, cited in Huckle, 2006)

Huckle goes on further to identify the implications of sustainability on education content and teaching method. First, he challenges the widely accepted representation of sustainable development as having three pillars and existing in the tiny space of their overlap as seen above left in Figure 1. He proposes that we should rather think of the three "pillars" as nested systems representing the co-existent, interactive nature of the three elements. In the first view, the focus is on balance and compromise among economy, society, and the environment, which operate independently of one another. This view "obscures the need to develop the economy or society within ecological limits and fosters reductionist rather than holistic or systemic thinking" (Huckle, 2006). The nested diagram represents sustainability as a function of environmental limits. It transmits the message that the three components of sustainable development are mutually dependent. It conveys that we must generate economic welfare and practice social justice within ecological limits.

Education for sustainable development is interdisciplinary and holistic, so it marks a departure from environmental education's traditional scientific nature and from its traditional subject matter of dealing almost exclusively with environmental problems. The ten key themes for the Decade of Education for Sustainable Development highlight this holistic nature: "overcoming poverty, gender equality, health promotion, environmental protection and conservation, rural transformation, human rights, intercultural understanding and peace, sustainable production and consumption, cultural diversity, and information and communication technologies" (UN, 2003).

Education for sustainable development marks a shift in science and education from the modern to the postmodern (which will be discussed in more detail below in section 5.3) (Huckle, 2006). It challenges the way science has traditionally been conducted. It is a move away from empiricism and positivism to a more pluralistic, democratic understanding of science. The postmodern way of thinking contributes to sustainability as a frame of mind because it is more enabling and encouraging of individual critical thinking. Such a radical change in educational theory might lead one to think that an entirely new curriculum is

necessary. On the contrary, education for sustainable development requires a change in approach more than a change in content, as we have seen in the work of Huckle and Bonnett. The changed approach will enable connections in existing content, thereby creating an interdisciplinary, holistic curriculum.

Cultural-historical activity theory contributes a practical educational model to education for sustainable development. Since its inception in the 1930s when Vygotsky used it to critique the "'atomistic'" mode of psychological analysis, activity theory has evolved to encompass the problem of disconnect between theory and praxis generally, and is applied widely to fields from psychology to sociology to education to philosophy to computer science (Roth and Lee, 2007). Though it has evolved over the decades since then, activity theory is still inspired by the goal to understand mental processes in the context of subjective experience colored by needs, interests, and preferences of the individual, or to use Vygotsky's term, to reintegrate analysis of how people think and learn into the context of the "'fullness of life'" (Vygotsky cited in Roth and Lee, 2007).

In education, activity theory aims to holistically understand the learning process. An activity system can be described by the components shown in the "activity triangle," seen below in Figure 1.
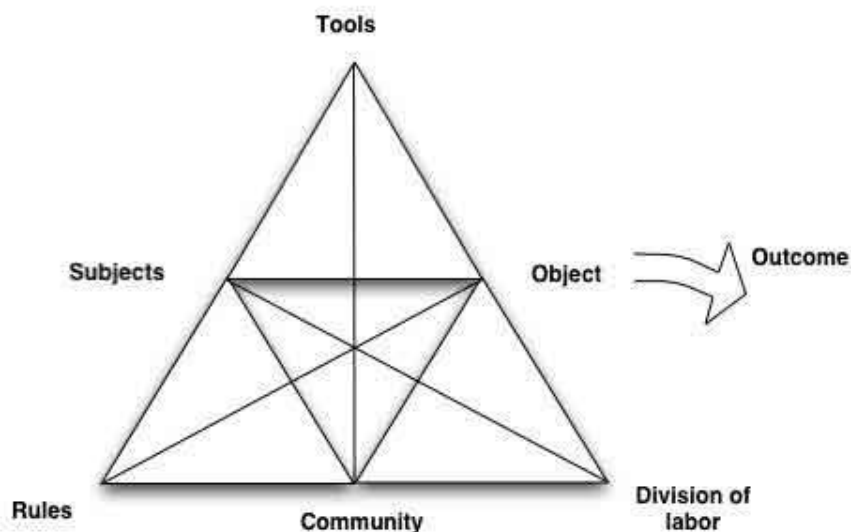
Figure 1.2 The "activity triangle," a widely used activity theory heuristic (Roth and Lee, 2007)

To understand a system, start at the top triangle within the larger triangle. In education for sustainable development, "subjects" could be students; "object" is actually the subject of the course or lesson, or the desired piece of knowledge or understanding—the goal of the education. The subjects attain the object through use of certain tools, whether physical or conceptual or both. The progression from subjects to object via tools constitutes an outcome, and "learning outcomes" are part of educational jargon for describing the concrete products in the student of a lesson, a class, or an entire course of study. The subject-tool-object forming the core activity are contextualized by the rules-community-division of labor. "Rules" are the codes that constrain teachers, students, or other participants within the activity. The "community" can be understood as communities of

students, classes, teachers, schools, and so on. "Division of labor" refers to the roles that participants take on during the educational process. Again, this can operate on many levels, from the task of the student within the small group working on a single project, to the student's role of sharing the group's project within the larger class, to the class's or school's interaction within the larger community by dissemination of knowledge. Each component influences the others; the educational process is characterized by their collective interaction.

In summary, education is one good tool by which the goals of sustainable development are translated into action. Education for sustainable development is holistic, interdisciplinary, participatory, problem-based, value-laden, lifelong, pluralistic, and is a frame of mind. It raises awareness, draws out knowledge from the learner, develops skills, connects past to present to future, empowers, realizes interconnectedness, and is a process in itself. Activity theory is useful for understanding education for sustainable development at both the learning-level and the educational model-level.

1.4 Significance of the study

Action research in education sharpens our craft as educators. It enables us to explore the experience of the student in our courses, and how education affects them. In education for sustainability, it is no secret that the goal is to develop in students a frame of mind that enables sustainability, indeed, that is sustainability itself. My project is designed specifically to bring to the surface the change that learning about sustainability initiates. Each of the students on the program experienced something remarkable, learned something that challenged their assumptions, underwent some kind of change. The aim of this study is to uncover trends in the students' answers in order to come to some useful conclusions about education for sustainable development.

This study potentially answers many questions educators share around the world. How do people really learn in a meaningful way? What educational methods nurture intellectual curiosity, empower students, and give them the ability to think critically? What kinds of learning create lasting impressions? How dooes knowledge change values and attitudes? How do we effectively achieve transformative education for the betterment of society? These questions go beyond the scope of the research questions, and point towards the substantive and formal theory this study endeavors to generate.

Specifically, this research project will positively influence the SIT Study Abroad Iceland program. It will provide a benchmark body of knowledge as well as serve as an assessment of the 2009 program. It will offer valuable insight into the students' experience of the various aspects of the program, thereby testing its efficacy, and can be used as a tool to inform future programs.

1.5 Structure of the thesis

In this first section, I presented the fundamental elements of the research project. I stated the purpose of the study, as well as the questions I strive to answer with this research. Then, to give a sense of events which form the foundation for this thesis, I reviewed the

historical background. Next, the theoretical context explicated the school of thought of which the project partakes and in which it participates. Finally, I stated the significance of the study.

In the second section, I outline the context of the project itself, the research design and methodology for data analysis. Strengths and weaknesses of the methodology are then identified. In the third section, I consider the results of the interview process. This section represents the first stage of analysis, as I have consciously reduced the large body of data into manageable information, as well as selected particularly significant responses.

The fourth section analyzes and discusses the interview results in light of my observations, self-reflection as program facilitator, and relevant research and theory. The fifth section, implications for practice, follows, drawing conclusions from the results and discussion, and indicating emergent substantive theory. Finally, potential for future research is considered.

2 Methodology

It is no coincidence that this thesis, both its subject and its execution, fall into the postmodern category of science education. A new approach to education also calls for a new approach to educational research. As such, this study is an example of educational action research, in which the educator participates in the action being studied. The study is value-laden, its intentions are clearly to promote sustainability education as well as sustainable development. This also makes it political. In the words of Wilfred Carr and Stephen Kemmis, it is an assumption badly in need of debunking: "that it is either possible or desirable for educational action research to be anything other than 'political'" (Carr & Kemmis, 1986).

Education does the work of "social reproduction: the social process by which each new generation is initiated into the language, rituals, roles, relationships, and routines which its members have to learn in order to become members of a society" (Carr & Kemmis, 1986). Education plays the important role in society of maintaining practical continuity within and among generations. However, society is constantly changing, so education also serves a "*transformative*" function in which the educating generation attempts to improve the life of the generation receiving the education (Carr & Kemmis, 1986). In this way, education is both conservative and progressive at once, so the questions of what to teach and how to teach it are necessarily controversial. Thus, to engage in educational action research is to engage in political debate because it is to evaluate the educational agenda and the ideology it propagates.

This is completely appropriate; in fact, it is the act of education taking responsibility for itself. As Carr & Kemmis (1986) put it forth,

> If *educational* action research is a form of research that is not so much "in" and "about" education as "for" education, then deliberating on and responding to problems of what to do in order to make one's practice *educational* is primarily (though not solely) a matter for *educators*. It is a matter for each educator as a person, for educators collectively as a profession, and for the institutions established in order to care for the goods that are internal to education—namely the development of the capacity for good in each person being educated, and development of the collective capacity for good in and for humankind. What this has meant in past times, and what it will mean in the future, is a contested and thus necessarily political matter.

As an educator and an educational researcher, it is my hope that this learning process is transformative on the personal, professional, and political levels. As Carr and Kemmis further explain, "Virtues, the unity of practitioners' lives, the existence of institutions, and the orienting power of traditions are mutually necessary and mutually constitutive of *educational practice*" (1986). Educational research necessarily is invested in and influences all these aspects. It is my goal in undertaking this research to incorporate the values and practices of education for sustainability, to let my action research project mirror

that which it examines. I hope that something transformative will be realized for sustainability education on all these levels and that this project is truly an educational journey for sustainable development.

In part 2.1 of this section, I introduce the educational setting, the context of the case study. First I include a brief history of Iceland that is sent to the students before they arrive (SIT, 2009). This information is in many cases the only source of previous knowledge of Iceland the students have. This subsection also serves to orient readers who are less familiar with Iceland in order to give an idea of the context in which the SIT program operates in Iceland.

Then in 2.2 I describe the action research project design—the particular methods and procedures used to address the research questions. Finally, in 2.3 the method of data analysis is presented.

2.1 The educational setting

2.1.1 Introduction to Iceland

Iceland was settled by Norwegians between the year 874 and about 930, during a relatively warm climatic period. The country was uninhabited before settlement, thus the country has no indigenous people other than Icelanders. The Norwegians brought slaves with them from Ireland and Scotland, so many of the bloodlines are actually from those countries, as confirmed by current DNA research. Iceland converted to Christianity in the year 1000. Various Scandinavian countries ruled Iceland at different times, most recently Denmark. When Germany invaded Denmark during World War II, Icelanders took the opportunity to declare their independence from Denmark. Iceland became a republic in 1944. The British subsequently occupied Iceland and set up military bases to protect North Atlantic shipping with American troops eventually replacing the British. After the war, Iceland joined the North Atlantic Treaty Organization (NATO) and American troops stayed until an abrupt departure in 2006.

Politically, Iceland is a parliamentary democracy with a number of active political parties. The prime minister is head of government, while a president attends to more ceremonial head-of-state duties, but does have rarely-used veto power. The parliament or Alþingi was founded at Þingvellir in 930, and has run more or less continuously ever since.

Iceland was essentially a subsistence economy from settlement in 874 until World War II. Over the centuries since settlement, Icelanders endured many unfavorable climate changes and natural disasters (e.g. volcanic eruptions), exacerbated by deforestation and soil erosion. These led periodically to widespread famine and death and emigration, with large groups departing to North America in the late 1800s. In the early 1900s trawlers and steam-powered ships were introduced. Starting in the mid-20th century, mechanization of the fishing fleet and increasing world demand for fish brought new prosperity to the small population. In the last 60 years, Iceland has steadily built up its economy, infrastructure, educational system and social services, and until 2008 was one of the more prosperous countries in the world. Fish are still the most important export, though other industries are growing, notably aluminum smelted with inexpensive and renewable electricity.

Wealth is relatively evenly distributed in the country (compared to most other countries), and unemployment was very low until the economic crisis of 2008, and now hovers around 9%. The population is still small at about 330,000, about two thirds of which is concentrated in the capital area. Iceland is a member of the European Economic Area (EEA), and it is now easy for people from other European countries to work there. During the economic boom, low unemployment, high wages, and need for workers in Iceland attracted a wave of immigrants, bringing social pressures to a country that had been relatively isolated for centuries. Since the financial crisis approximately 10,600 people, both Icelanders and immigrants, have left Iceland, but it is still considered multicultural.

The program takes place in the capital city of Reykjavik, the large town of Akureyri (population 17,000) in Eyjafjordur in the north of Iceland, and the small town of Isafjordur (population 3,000) in the remote Westfjords.

2.1.2 The SIT Iceland summer program

The SIT Iceland summer program took place from June 1st to July 16th, 2009, and was mainly based in Akureyri, in the north of Iceland, where RES-the School for Renewable Energy Science is located. The ethos of the educational program is strongly experiential, based on real-life problem solving and involving site visits and travel to learn about the course topics. It is also interdisciplinary; undergraduate students from various backgrounds (including environmental studies, engineering, geology, psychology, and public health, among others) and different universities in the US and Canada participated in the program. There were 12 male students and 7 females, most students were around 20 years of age, and they did not know each other before the program. The 6-credit/12-ECTS course critically presents renewable energy (with a focus on hydropower and geothermal power) from a variety of perspectives on the academic spectrum from engineering and technology to economics and policy to the social and environmental aspects of renewables. It is holistic; the goal of the program is to give students the ability to approach an analysis of a renewable energy system in its social and environmental context. For their final independent research projects, they must use the knowledge and perspective they have gained to evaluate a specific aspect of renewable energy in Isafjordur, Iceland (SIT, 2009).

The course roughly divides into thirds: one third of course time is spent in lectures, during which an expert lecturer presents his/her subject matter in a conventional educational setting; another third is structured observation, composed of site visits in which students are directed to learn for themselves based on firsthand experience; the final third is unstructured observation during travel and free time in which students explore the greater context in which the course material is taught; that is to say, they observe the particular physical and cultural situation of Iceland, which forms the basis for renewable energy and sustainable development in Iceland, the understanding of which the course aims to convey.

These thirds also represent a rough but convenient breakdown of the learning methods into general categories that cross the spectrum from conventional/structured to unconventional/unstructured: the more formal lecture style in which knowledge is conveyed from teacher to student, the combination of formal and informal in guided observations of specific, course-relevant sites, and the totally informal, unguided, open

observation and experience of Iceland which informs the students' understanding of the course material, as well as is a valuable educational experience in its own right.

The program schedule from 2009 is as follows (SIT, 2009):

1 June	Arrive at Keflavík, night near airport. Introductions, health and safety, and Blue Lagoon trip
2-4 June	Sightseeing in Reykjavik, orientation, and introductions.
4-6 June	Travel by bus from south to north Iceland, stops at Þingvellir, geothermal sites and other places of interest. Spend night at hostel in northwest Iceland
6 June	Arrive in Akureyri, meet host families.
8-30 June	Classes at RES-the School for Renewable Energy Science, including several excursions. General areas of study for the energy course are:

- Hydropower
- Geothermal energy
- Transportation fuels
- Resource economics

30 June- 10 July	Program at University Centre of the Westfjords. Independent study projects in Isafjordur, Iceland
10-11 July	Travel by bus and ferry from the Westfjords to Reykjavík
12-15 July	Meet with ministries and learn about local policy in Reykjavik
16 July	Program ends

2.2 Action research project design

2.2.1 The case study

Case studies analyze in depth a particular example of something with the aim to generalize the conclusions from that one case to other similar ones (Cohen, Manion, & Morrison, 2007). The case consists of real people in real situations, so has the advantage of establishing cause and effect based on observation (Cohen et al., 2007). "Case studies opt for analytic rather than statistical generalization, that is they develop a theory which can help researchers to understand other similar cases, phenomena or situations" (Robson in Cohen et al., 2007). This case is an *instrumental case study* because it studies the SIT Iceland 2009 program in order to provide insight into education for sustainable development in practice (Stake, 2000). As Stake explains, we want to "learn what the

selected case does—its activity, its functioning" (2000). In case studies, the researcher is integrally involved in the case, so they are quite useful for educational action research (Cohen et al., 2007).

2.2.2 Methods and procedures

As organizer and facilitator for the program, I was intimately acquainted with all its aspects and activities, and was present throughout the program; therefore personal observation forms the foundation of my study and analysis. Furthermore, I designed an interview process to elicit impressions, memories, and reflections from the students on what they learned and how they learned it during their time in Iceland. All students were given the choice to respond and the option to withdraw their responses at any time. All of the students participated in all steps of the interview process.

The interview was semi-structured: it had predetermined questions and order, but was open-ended. It can be classified as a "depth interview" because respondents were free to answer on the broad topics the interview questions prompted (Miller and Crabtree in Robson, 2002). Electronic mail was used as the interview medium for several reasons: convenience for both parties because of time difference, cost efficiency, and because of the ease and readiness with which students of their generation, so called "digital natives," use technology to communicate and express themselves. Also, the researcher was familiar with all the respondents. Initially, I intended to follow up the written interviews with phone calls, but after trying this with a few students, came to the conclusion that the verbal interviews generated no further significant data. Responses to the e-mail interview were impressively rich, and gave ample matter for analysis.

The interview process was carried out in three stages such that the questions would build on each other.

The first were the most general, and were sent via email a few months after the students returned home from Iceland, giving time for their memories to form. They were chiefly reflective, asking the student what was most memorable or made the greatest impression on them from the program in Iceland. I also asked what they got the most out of, to give a first indication of which experiences were most significant and in what way.

The second set of questions asks the students more specifically about the kind of education they received. I asked them to compare both the kinds of education they received within the program and compare the program with their home university education. The purpose with these questions was to gain insight into the students' perspective on various types of education and their effectiveness.

The third round sent by email probed deeper into the students' understanding of the subject matter, asking them first to describe their understanding of a sustainable society. Then I asked them to reflect on and evaluate Iceland as a sustainable society. Finally, I asked them whether their experience in Iceland affected how they look at the world in terms of sustainability. This is the critical question of "change": ultimately as an educator and in this my study, I am interested in what changes a student's mind, what deepens a student's understanding, what forms their worldview.

In the results section, I present the outcome of these interviews. My final data analysis in the discussion section takes into account my personal observations of and the written interviews from the students as well as my relf-reflection.

2.2.3 Data analysis

As an educational case study rooted in experience, I have chosen grounded theory for my data analysis methodology. According to Anselm Strauss and Juliet Corbin, among the founders of the school of grounded theory, "A grounded theory is one that is inductively derived from the study of the phenomenon it represents…One does not begin with a theory, then prove it. Rather, one begins with an area of study and what is relevant to that area is allowed to emerge" (Strauss & Corbin, 1990). In the groundwork text on grounded theory, *The Discovery of Grounded Theory*, Strauss and Glaser explain how to do this kind of research: "Generating a theory from data means that most hypotheses and concepts not only come from the data, but are systematically worked out in relation to the data during the course of the research. *Generating a theory involves a process of research*" (Glaser & Strauss, 1967, p. 6, emphasis original). In this spirit, I look for the categories in the body of data, and form connections as they are suggested from the data itself. These categories, their properties, and the apparent connections together formulate the emergent theory. Taking into account several kinds of data is advantageous in social qualitative research. "Different kinds of data give the analyst different views or vantage points from which to understand a category and to develop its properties; these different views we have called *slices of data*" (Glaser and Strauss, 1967, p. 65, emphasis original). My slices of data are: observation, self-reflection, and interviews. Glaser and Strauss (1967, p. 68) argue that using different slices of data does not dilute the research into endless relativism, rather it gives a proportioned, balanced view of the evidence through comparison because particular biases become apparent and reconcile themselves through deeper investigation and understanding.

In doing the data analysis, the researcher engages continually in systematic coding and analytic memo-writing, looking for emergent categories (Glaser & Strauss, 1967, p. 72). She reformulates the categories as their properties become clearer, and narrows her list of categories while simultaneously developing hypotheses and integrating her theory (p. 72). The results of the analytical process are often "substantive theories," which are the intermediate step toward formal theory (Glaser & Strauss, 1967, p. 79). "Since substantive theory is grounded in research on one particular substantive area…[it] may have important general implications and relevance, and become almost automatically a springboard or stepping stone to the development of a grounded formal theory" (Glaser and Strauss, 1967, p. 79).

From my analysis and identification of substantive theories, my discussion and conclusion will point to more formal theories with wider relevance and application. The overarching goal of this research is to make sense of this particular educational experience in order to produce theories which can be extrapolated to more general educational experiences in other contexts. As an action research project, this means that not only will the theories pertain to the students' experience, but also to mine as a researcher and educator.

2.2.4 The researcher's perspective

In action research, the researcher is involved both as the one doing the research and as part of the subject being studied. Thus it is important to recognize the researcher's perspective as it plays a role in the research. As facilitator for the SIT Iceland program and in conducting this research project, I have the unique perspective of sharing a similar experience to my students. I am a North American, received my undergraduate education in the U.S., and then came to Iceland in 2006 to study sustainable development. I can relate to the students on several levels: on being a North American in a foreign country, on being part of a group of North Americans together in a foreign country, and on studying sustainability in Iceland. This perspective underlies and informs my observations and analysis, though I aim to be as objective as possible.

2.2.5 Description of data

These results are compiled from fifty pages of interview transcripts, received electronically and inputted into Microsoft Excel, which I used for ease of making notes on memos and codes to either side of the responses.

As I prepared the results of the interviews, I used data reduction.

> *Data reduction* refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up field notes or transcriptions…Data reduction is not something separate from analysis. It is *part* of analysis. The researcher's decisions—which data chunks to code and which to pull out, which patterns best summarize a number of chunks, which evolving story to tell—*are all analytic choices*. Data reduction is a form of analysis that sharpens, sorts, focuses, discards, and organizes data in such a way that 'final' conclusions can be drawn and verified. (Miles and Huberman, 1994, p. 10, emphasis original)

While I have performed data reduction on these results, it is my aim in this section to faithfully and fairly represent student responses to the interview questions.

2.3 Strengths and weaknesses

This study was carried out with the best intentions to be an ethical, fair, and constructive critical analysis of the 2009 SIT Iceland program. Having written interviews via email turned out to be a productive method of gaining multi-faceted insight into the participants' thoughts. However, gathering more data—such as through video recording and interviews during as well as after the program—would certainly have contributed to more perspectives on the educational experiences and so a fuller body for analysis. This would require more time, resources, and effort, but may be worth it to conduct a more thorough study.

3 Results

This chapter presents the students' responses to the interview. The following three subsections correspond to the three interview rounds.

3.1 Reflecting on the course

Initally students were asked to reflect on their experience in Iceland generally and answer the following questions:

- What part of your experience in Iceland made the biggest impact on you?
- Or what was most memorable?
- What did you get the most out of from your time in Iceland?

Responses from the students expressed three broad categories of influential experiences from the program in Iceland: the personal growth aspect of studying abroad, the experience of Iceland's natural environment, and the experience of seeing renewable energy in practice. Personal growth comprised influence from the homestay experience, cultural expansion, development of personal relationships, and change in worldview. These topics were most frequently remarked upon by the students in their responses. Icelandic nature followed in frequency of mention as having created strong memories. Several students also wrote of the impact they felt from seeing renewable energy practices in place.

Many students described their study abroad experience as personally significant: cultural identity, relationships, and worldview or outlook were all noted as being influenced by studying in Iceland. The homestay, in which students lived with an Icelandic family in Akureyri, Iceland for three and a half weeks, is most often cited as having been a rich learning experience. In describing the homestay, students cited kindness, openness, and insight into Icelandic culture as the most rewarding aspects of the experience. One stated that the experience taught him "to appreciate kindness and hospitality." Another remarked that he "learned so much from just sitting and talking…much more about Icelandic culture than I ever could through a textbook." Likewise, another student stated: "Staying with Icelanders is probably the best education in Icelandic culture/language possible. Both my homestay in Akureyri and my friend in Reykjavik taught me more than I ever could have learned without such relationships." One even claimed that staying with an Icelandic family helped her in learning renewable energy: "Renewable energy in Iceland made much more sense with the perspective gained from the homestay." Yet another claimed of her host family: "Their openness gave me a glimpse of real Icelandic culture." Other students asserted that feeling a part of their host family had the greatest impact on them. One wrote: "I became a part of the family in those three weeks. That will undoubtedly last a lifetime."

For others the cultural experience of the homestay as well as studying abroad generally affected them positively in a personal way. One stated that studying abroad "made me

realize more about myself than I was expecting to learn" and "that I shouldn't be intimidated to…have new and different experiences." Similarly, others perceived themselves as more "independent," "calm," and "balanced" after studying in Iceland. On experiencing Icelandic culture, some students reflected positively. One wrote: "I do think I saw in Iceland pieces of how society should work." Another found that: "the culture there focuses more on effort and heart than money." Several observed a connection between the presence of renewable energy resources and Icelandic culture. "I really learned about where there is a will there is a way. Icelandic people took the high cost of fossil fuels and adapted by bringing energy to a local level." One remarked on the negative effect of the abundance of resources on Icelandic society:

> Realistically the thing that was most memorable…is my realization of how connected Iceland's lack of gusto behind an environmentally conscious society is based off its highly advanced technology and surplus of both energy and water. This idea is really unnerving to me and I am trying to find examples or develop strategies to increase environmental awareness/consciousness even in areas not suffering as directly from the impacts of global warming.

The study abroad experience caused many of the students' worldviews to shift, and they commented on this in their responses to the first set of questions. One wrote: "I gained a much stronger sense of how interconnected the world is." Another said "it opened my eyes to how different the US is from foreign countries." Another student realized "that we live on a big planet with endless possibilities." All of the above statements taken from student responses express some form of personal growth influenced by their experiences in Iceland.

Icelandic nature left a strong impression on several students. Some of the words used to describe it were: "majestic," "completely unforgettable," "stunning," "unique, but desolate," "magnificent," "raw," "refreshing," "wide open," "undeveloped," and "rugged." One student wrote that he was most impacted by "its epic forces of awe." In a similar reaction to the landscape, another student wrote of being "blown away by the beauty of the country and the vast differences in the landscape." For one the difference between the "noise and constant motion" of her home city and the relative "peace and quiet" of Iceland was "soothing." She also stated that she perceived and appreciated the cultural "respect for retaining the country's native landscape." The environment was also influential for a couple of students for its "healthiness." One spoke of the "health benefits of breathing such clean energizing air and drinking such pure, refreshing water," while another remarked that it was "extremely refreshing to spend so much time outdoors." Several students also remarked on the adventurous aspect of study abroad as having left a big impact. Going for hikes, swimming in natural hot springs, visiting waterfalls and beaches, seeing lava fields, and staying in the mountainous West Fjords were all listed as being particularly memorable.

Seeing renewable energy in place was impressive for several students, motivating one to write of a sense of possibility for the future:

> Lately, I've personally been feeling more and more like the political powers of the world just aren't going to be able to sort out the issues regarding climate change and sustainable policies. However, my time in Iceland was a reminder that it is possible.

Despite having to rely on imports for a lot of things, I was really impressed with how well Icelanders take advantage of their local resources when possible, and I think it's a model and a frame of mind that would do wonders for the rest of the world. Overall, my time in Iceland gave me a frame of reference for what I think a "sustainable society" should, or at least could, look like.

Others also said they felt encouraged by seeing renewables providing for most of the energy needs of the nation. One wrote: "I think it is surprising that the technology exists but is still not implemented, and I was truly impressed by Iceland's ability to adapt to its environment in order to benefit from its surroundings." Several remarked that seeing renewable energy technology firsthand was a positive experience: "It was awesome to see that the stuff we learned about in the classroom wasn't just theoretical, but was actually happening." Another wrote that he was impressed by "the implementation of renewable energy types that are only discussed in mass in the United States rather than used in mass." Overall, students cited that they felt "confidence" upon seeing that renewable energy is "feasible." One summarized the sentiment when he wrote that he felt that there "was just a sense that it is possible for countries and societies to function in a sustainable manner."

Each student underwent a unique experience during their study in Iceland. For the majority, cultural interaction affected them the most. Icelandic nature and renewable energy practices also left a strong impression on many students. Whether from their personal growth through cultural interaction, from the stimulating setting of the Icelandic environment, or from the act of seeing firsthand renewable energy technology functioning, students recorded a positive experience from studying in Iceland.

3.2 The learning experience

The second round of interview questions was concerned with the educational experience of the students. They were asked to respond to the following questions:

- How did your education in Iceland differ from your regular college education?
- Which do you find more effective for learning about sustainability, and why?
- In Iceland, what did you learn inside the classroom and what outside out of it?

Students described their educational experience in Iceland, as compared to their home universities, as: "unstructured," "informal," "interactive," "hands-on," "intense," "experiential," "interdisciplinary," "memorable," "engaging," "involved," and "pervasive." One student elaborated thus:

As a psychology major [at my home university], the majority of my classes were huge lectures – impersonal, scripted and rarely interactive. My education in Iceland was pretty much the exact opposite. Because the group was so small and became so comfortable with each other, it was easy to get engaged in conversations, to ask questions, to explore certain topics in depth, and become more involved in the material being taught. Because the group of students was genuinely interested in sustainability and renewable energy, and it was the one thing we all shared in common, these discussions often extended beyond the classroom…This was

certainly not my experience in college in the US. Education all too often ended when the class did. When learning about most topics, sustainability included, it is important to engage, question, discuss, compare, contrast, relate, etc. When considering sustainability, this conversation is all the more important as it is an ever changing process. Our interactions with the environment are always changing, our effects never entirely known, and it is through our personal experience and that of others that we can learn and adapt the way we live to create sustainability.

Another student wrote:

The experiential learning process certainly made me feel like what I was learning was much more applicable and relevant. I could see firsthand how the sustainable practices we learned about were being used in a real world setting, which made the goal of a sustainable society seem much more feasible rather than just some far-off vision. I also appreciated that we had so many different people teaching us throughout the program. It helped the course stay fresh and it was interesting to learn from people with so many different backgrounds. This reinforced the idea that there are so many ways for a society to become more sustainable and it's not all just about reducing the use of coal and oil.

However, the lack of structure and variety of teachers was not effective for all students. One wrote: "The education system in the States is more formal, I believe. Clearly the SIT system focused more on interactive learning…I believe learning is most effective when you have the same teacher throughout. The field trips, however, are very nice because they help give visual reinforcement to the in-class education." Another thought the variety made the course shallow: The "variety of teachers with different backgrounds and specialties…makes sense for sustainability since achieving it requires synthesis in economics, science, technology, and the social sciences. However in the short time period we did not have enough time to delve deeply into these subjects."

One student found field learning particularly useful:

"Being on site really opened my eyes; it was more than just text. There was the connection of actually seeing sustainable practices at work. For example, the garbage dump that captured output gases, so when discussing sustainability and landfills with peers and they say, 'can't be done;' I can reply 'I have seen it done.'"

Another student agreed that real-world learning was useful for sustainability:

"We were able to directly relate what we were learning to the real world instead of everything being theoretical. Since sustainability and renewable energy is an emerging field that is constantly changing it is much more effective to be able to get out and see what people are actually doing."

On remembering these field learning experiences, one student remarked that "the more intense part of the education was just hanging on to real-life information about stuff that was observed." Another student wrote of how strong memories formed in the field:

I can still think back and remember exactly what it was like to be on the IDDP [Iceland Deep Drilling Project] drill rig, and looking at the blow-out preventer. Looking back on my experience, my memory of that is much clearer than my memory of what we did in my fluid mechanics class just last week. In any event, when it comes to learning about sustainability, it is important to have both the memorable hands-on experience, and the less exciting chalkboard lecture. Being able to learn about a technology or concept in detail in a classroom, and then go see it and recognize the parts of the real thing that match what the teacher put on the board ties things together in a much more solid way than when you just have one of those experiences.

Other students also commented that classroom and field reinforce each other; that both work best together. "Being able to incorporate classroom time with hands-on experience is a really effective way of really understanding the things you are studying," observed one student. Another echoes this sentiment: "I believe that a combination of the two educational styles [classroom and field] would be the most effective."

In response to the question about what was learned inside the classroom and what outside, below is a table paraphrasing the students' compiled answers.

Table 3.1 Learning inside versus outside the classroom

Inside	Outside
Facts	Application
Theory	Real-life implementation
Basic background	Holistic understanding
Science	Culture
Technology	Physical limitations
Concepts	Interaction
Energy economics	Functions of society

One student summarized the distinction thus:

When in the classroom in Iceland, I learned about a lot of the concepts and theories behind what we had or were going to see. I thought it was about getting down the details in an environment that had less distractions. Once we were in the field, and out of the classroom, I learned about the application of the theory. Since the details had already been nailed down, it was about seeing what you learned and realizing that it was more than just an animation in a powerpoint.

Another wrote:

Within the classroom we learned about concepts. We learned about geological history and science, we learned about renewable energies, and we learned about environmental policies. Outside of the classroom we were able to put visuals behind what we learned in the classroom to give us a greater understanding. More practical knowledge was learned outside of the classroom.

Describing how classroom and field learning complement each other, one student remarked: "Inside the classroom I learned how the things I'd seen outside of the classroom worked, but there was a lot of opportunity to then put it all together outside the classroom again."

3.3 Understanding sustainability

The third round of questions aimed to unpack students' understanding of sustainability, as well as the role that Iceland played in forming their understanding. To that end, the students were asked to respond to the following:

- Describe a sustainable society.
- Was your idea of sustainability influenced by your trip to Iceland?
- Is Iceland developing sustainably, and do you think the rest of the world can learn from Iceland?
- Did your experience in Iceland change how you look at the world? How?
- One scholar of sustainability and education, Michael Bonnett, describes sustainability as having the "right relationship to nature" in which nature and man "flourish" in a "mutually sustaining" way. Does this resonate with you and what you learned in Iceland?

In answering the first question, the students offered several descriptions of an ideally sustainable society. To combine all of their ideas, a sustainable society minimizes waste, operates efficiently and within its means, values the environment, embodies stewardship principles, has reverence for nature, and can offer a good life quality. It is egalitarian, future-oriented, independent, cooperative, and cognizant. One student painted this picture:

> Sustainable societies embody the kind of values in their development that carry them through generations infinitely without concern of resource depletion or degradation. This does not mean that one has to live cold and in the dark to consider themselves to be living sustainably…It means that we must meet a balance between the extremes that protects our environments not because they offer us goods and services, but because without them we would not have life at all here on earth.

Another student cited Solheimar, an eco-village in South Iceland that the program visited, as a model sustainable community:

> Solheimar is an example of a sustainable community, where the needs of its residents are met, it sustains itself economically through the sales of its crafts, and is environmentally responsible through its use of renewable energy, forms of agriculture, building methods, etc. The practices of Solheimar can be applied to a greater society so that it is able to base its economy on environmentally and socially responsible projects and services.

On whether or not Iceland is a sustainable society, the students had a variety of opinions. Those who held that yes, Iceland is sustainable, gave the following reasons: abundant natural resources, ability to work together toward a common goal, progressive political agenda, carbon neutral energy production, investment in infrastructure and social services such as healthcare and education, political and industry leadership, environmental protection, and adaptability. Examples given of sustainable practices included: hydropower, geothermal power, fisheries management, and alternative fuel research and development. One student even concluded that "In short the rest of the world should strive to be like Iceland." Those who had reservations about calling Iceland sustainable, or who felt simply that it is not a sustainable society, gave several reasons. Most often quoted was that the Icelandic model is not replicable; it is due to unique geologic conditions and a low population density. Several also noted that its economy was proven completely unsustainable during the crisis of 2008. Lifestyle habits such as excessive use of automobiles and waste of water and electricity constituted others' reasons for Iceland failing to be sustainable. A few students observed a general lack of public awareness about environmental issues and sustainable development. Views on Iceland and sustainability ranged across the spectrum, but in most cases were shared by more than one person.

When asked how their experience in Iceland changed how they look at the world, most students answered that it broadened their worldview. One student wrote, "I know it's cliché, but my experience in Iceland taught me just how huge the world is. It extended my view beyond [my home town]." Others found it "mind-opening," saying they perceived how "similar" people are and how "connected" global society is. One student said that "it opened my world up…My experience in Iceland offered fresh insight on my own world back [home], with new perspectives from foreign lands…In more ways than I can list the experience changed my perception of the world." One felt "positive…towards 'socialist' societies" and several others claimed feeling "hope" for a sustainable future based on their experiences in Iceland. One explained that he saw a different kind of environmentalism in Iceland. "I'm not sure that the current version of American environmentalism is very productive. After all, development of a clean Icelandic energy system was not the product of a romanticized view of the natural world…" Several stated that learning about another part of the world caused them to reflect on themselves as individuals and as members of society. One wrote that "learning more about other types of people has helped me learn about myself, and learning more about other societies has helped me learn tons about the way any society interacts." Another explained that "it was the first time I was a visitor in someone else's homeland and that is an experience that I think changes the way you see things in your own life and culture." Two students reported that though their knowledge of the world has increased, the way they look at the world had changed very little or not at all.

The students responded differently to the quotation from Michael Bonnett describing sustainability as having the "right relationship to nature" in which nature and man "flourish" in a "mutually sustaining" way. When asked whether this resonated with them and what they learned in Iceland, most replied positively. Those who agreed with Bonnett elaborated that sustainability means equilibrium not stasis, requires a closeness to nature as part of culture and everyday life, recognizes the intrinsic value of nature, and leaves natural cycles unperturbed. One student, though she agreed with Bonnett's description, posed an insightful criticism to it:

This does resonate with me on both spiritual and intellectual levels. However, I would be suspicious of what that "right" relationship with nature would be. After all, in Iceland I found far different ideas about "right" relationship with nature from what I'm accustomed to in America. Whose understanding of this "right" relationship should we follow?

Some students held that Iceland lives up to Bonnett's description, while others did not. One presented Iceland as sustainable on Bonnett's terms:

The people of Iceland have certainly benefited from the country's efforts to promote sustainability, and there has been a decreased impact on the environment. Both are able to flourish and sustain each other. The government has set up programs to protect the environment, while it simultaneously uses it as a source of energy that has promoted the country's development. It has made a point to avoid depleting the country's natural resources, and has used them to increase tourism which has stimulated the economy. It is a mutually beneficial relationship that is a good example for other countries.

Another noted that in Iceland "the culture embraces and is not disconnected from their environment." Likewise another student observed that "the local resources still play such a vital role in everyday life (from fabric to dairy products to energy)." One student pointed out that while geothermal energy is a "great example" of the "mutually sustaining" relationship, "hydroelectricity plants" and "[aluminum] smelters" do not promote sustainability. Illustrating a "mutually sustaining" relationship, one student shared the following story:

The best lesson I received in Iceland about sustainability was from my host family. The way they harvested Eider down follows this right relationship with nature. The family only takes a little Eider down every day to not risk hurting the eggs but to get the eider duck to pluck more down. They also protect the Eider Ducks from predators to keep them alive and producing each year. This is sustainable and both my host family and the eider ducks profited off the relationship (though the minks that hunted the Eider eggs may not have) and is a good example of how a society that has lived in one of the harshest places in the world has almost instinctively cultivated sustainable practices in order to flourish. It gives me hope that humankind will be able to cultivate a sustainable culture in order to flourish with diminishing resources.

3.4 Summary

The students were most moved by their interactions with their host families—on the personal, cultural, and even in some cases the academic level. The relationships they developed in their homestays produced personal growth, often with the student developing confidence by staying with an Icelandic family. Their cultural experiences opened their worldviews, challenged their preconceptions of themselves and their society, and generally gave them new perspectives.

Icelandic nature impressed students as well, for both its beauty and its energy potential. Seeing renewable energy in place taught students that it is feasible to develop sustainably, at least in terms of electricity production. Many quoted feeling encouraged by this, claiming that sustainable development is possible for the future. Several students gave the eco-village Solheimar as an inspiring example of a sustainable community. Through all of the responses, for many different reasons, there is the common thread of students cultivating a positive outlook from their experiences in Iceland. With this in mind, the discussion that follows will critically examine these educational experiences and hold this program up to the tenets of relevant educational models.

4 Discussion

4.1 Sustainable education

The review of the historical and theoretical background to this thesis referred to "education for sustainable development," but Stephen Sterling, an influential educator in this field, proposes the term "sustainable education" instead (2009). He argues that "any 'education *for something*,' however worthy…tends to become both accommodated and marginalized by the mainstream" (Sterling, 2009). However, "the term 'sustainable education' implies whole paradigm change, one which asserts both humanistic and ecological values" (Sterling, 2009). Sustainable education thus embodies a sustainable frame of mind, and teaches it wordlessly. It addresses seamlessly the various "disciplines" of science (engineering, technology, ecology, economics) and the humanities (sociology, philosophy, anthropology, history), but also the very personal nature of this kind of education. My goal as an educator and facilitator is to create such an educational environment, one which enriches the "'whole person'—spirit, heart, head, and hands" (Sterling, 2009) and which, as in the original Latin meaning of the root word *educere*, draws out from within the student knowledge, understanding, and the ability to realize in both senses of the words "to see" and "to make real." A student of sustainable education is able to wholly view the world, to understand and critically analyze it, and then to make that knowledge real with his and her own life.

It is from this perspective I begin this discussion. I believe that the SIT program in Iceland, though certainly not flawless, is a working example of sustainable education, at least within the world of the program itself, and thus a starting point for a constructive discussion on education for sustainable development. For these students the program is a departure from their normal education, so it is still a marginal component of their wider education. However, it is a rich and memorable learning environment, as I will argue further below. My goal then with this discussion is to answer the research questions:

1) What characterizes the learning experiences of students in the SIT Iceland summer program, and how does this impact their conceptualization of sustainable development?

2) As a facilitator, how can I incorporate these results into future program planning to create a more transformative educational experience?

To begin with the first part of the first question: what characterizes the learning experiences of students in the SIT program? That is, how does this program differ from traditional university education and what effects does it have on the students? How do all the program elements function and interact? What kind of learning experience is created? Incorporating the student responses to the interview, as presented in the results chapter above, with my observation and in light of relevant research, I will answer these questions.

I have also included a few photographs from the students to represent their perspective and to contribute to the discussion on their educational experience.

4.1.1 Cultural expansion

"It opened my eyes…"

Image 4.1 Students freely explore the cultural heritage site Glaumbær. Photo:T. J. Pepping

First of all, the most prominent response to the reflection questions in the interview was the homestay. As program facilitator, I was involved very little in the daily interactions between host families and their guest "daughter" or "son." I am honestly taken aback by how much an impact this experience clearly had on the students. I was not at all aware of it during the program, though I am heartened to know that it was so influential and beneficial for most. The homestay component of study abroad has not been heavily studied elsewhere. However, as observed in one study, "Ask study abroad students to evaluate their programs, and the majority will begin immediately talking about their host families" (Schmidt-Rinehart & Knight, 2004). This study went on to closely examine the homestay experiences of students on three separate programs, and found that all three corroborated each other to show that homestay universally enhanced study abroad (Schmidt-Rinehart & Knight, 2004). They also conclude that the homestay phenomenon deserves further study, to which the following discussion contributes.

Study abroad has steadily grown in popularity along with the emphasis on internationalization of universities (Chan and Dimmock, 2008). Students have historically chosen to study abroad in order to learn a foreign language, experience another culture, as well as for the desire to travel (Talburt & Stewart, 1999). Studies investigating how students benefit from study abroad have found that, according to the students, they include: learning a foreign language, gaining a critical perspective on the U.S., receiving insight into a foreign culture, and becoming more socially competent (Carlson Talburt & Stewart, 1999). With more demanding lines of study constraining students' ability to leave their home universities for a year or even a semester of study abroad and universities reticent to lose their customers, short-term study abroad programs, such as the 7-week SIT Iceland

program, have been on the rise. They have been given a critical eye for their ability to deliver a meaningful study abroad experience (Talburt & Stewart, 1999).

The results of this study challenge this criticism. Although students only spent three and a half weeks with their host families, they claim the same benefits that students of more traditional, long-term study abroad programs do. The most significant gain students claimed from the homestay was that of cultural insight. The effects on the students were manifold: greater understanding of Icelandic culture and society as a whole, the self-reflection triggered by experience of another culture, and their personal relationships with their new Icelandic families, which in some cases may well be lifelong. It seems this contact to Icelandic culture is also beneficial for learning about renewable energy in Iceland. Through this cultural insight, students cited being able to understand how Iceland could develop sustainably. Furthermore, because this program is a shorter study abroad program offered in the summer, it attracts engineering students who follow a very structured line of study and would not otherwise be able to study abroad. One such student, who was in fact skeptical and dismissive of "the cultural and political" aspects of sustainability as "hippie stuff," actually claimed that he got the most out of "all of the cultural expansion I experienced while in Iceland." For this student, the study abroad experience, though short, was clearly transformative.

For some students, the cultural insight was more negative. Several noted wastefulness and environmental blasé in Iceland were likely caused by the country's abundance of water and energy. These students observed that because sustainability is essentially taken care of by top-down policies, the general public is either clueless or apathetic. I was quite surprised that this critical perspective was not more pervasive, as it is one I and many Icelanders themselves share. Though Talburt and Stewart (1999) speak from a different context (the experience of an African American student studying abroad in Spain), they found that when a sensitive cultural difference was openly discussed among the study abroad class, the conversation was limited. They propose incorporating such issues as the students' experiences of study abroad into the curricula to better confront these differences (Talburt & Stewart, 1999).

I would propose that in the future with the SIT program students be given access to critical perspectives in their readings, lectures, and site visits as well as a forum in which to voice their own opinions. I have already amended the reading list, incorporated a debate on hydroelectric dams and aluminum smelters, and plan to lead an informal weekly seminar in which we will address ethical, social, cultural, and philosophical issues relating to sustainability generally as well as the students' perceptions of it in Iceland. I will also give the students more time with their host families. Whereas in the past we have taken the students away on weekend trips, this year I will rather leave them to spend more time with their families. Whether the insight into Icelandic culture leaves a negative or positive impression, it is the insight that is the meaningful goal of study abroad.

4.1.2 Nature

"I was blown away…"

Image 4.2 A student hikes up Mt. Kaldbakur in the Westfjords. Photo: David Fryauf

The second most commonly cited as memorable was Icelandic nature. Students seemed to appreciate it for its purity and health benefits, as well as for the adventurousness of hiking to the top of a mountain overlooking a stunning fjord and swimming in natural hot springs. Although many used dramatic words to describe the Icelandic environment and their experience of it, I had expected more responses about nature enhancing their learning experiences. From my personal experience as an outdoor educator, I believe that nature is a natural teacher, particularly of ecology, geology, environmental studies, and sustainable development. Students understand earth cycles more fully by seeing them with their own eyes. I have found that I learn more about natural balance in an environment with limited human development, and expected that this would be a lesson students would take home from Iceland, like the one did learn from his host family about harvesting Eider down.

On the whole, there was a noted lack of a critical view of Icelandic nature. Only one or two students remarked that the landscape was fragile or had been degraded; many more praised Icelandic conservation efforts. This indicates a lack of deeper understanding of the environmental situation in Iceland, which has actually been devastated since settlement. Erosion is the greatest problem facing the nation currently, with satellite images showing the land literally blowing away into the sea. This false perception of Icelandic nature as a pristine wilderness is propagated by the tourist board. Their marketing has been all too successful, and actually undermines environmental efforts in Iceland. Though the students had access to some information about the geological formation of Iceland in class and the human history since settlement in museums, this knowledge is overridden by images of Iceland as pure and untouched, which it surely looks like on the surface compared to their hometowns in the U.S.

Based on the lack of deeper experience in nature, I must conclude that the students either did not have enough or the appropriate access to nature. In his article "The Mechanics of Nature Appreciation," David Pepi calls on the spirit of Henry David Thoreau and Aldo Leopold when he suggests that "a critical approach to nature appreciation offers an alternative to much of present practice, because it teaches students how to apprehend, assess, and make reasonable claims about inherent values, in order to achieve the richest and most satisfying experiences possible" (1994). To this end he recommends "direct intercourse with nature" (Pepi, 1994). In order to amplify students' learning experience in the natural environment, we will spend more time outdoors and engage in discussion on the social and natural history of Iceland and environmental ethics and aesthetics.

4.1.3 Renewable energy

"It was awesome to see…"

Image 4.3 A student takes in the sights and sounds of a geothermal borehole. Photo: Forest Gallien

Since the topic of the course was renewable energy, I was pleased as course facilitator that it was mentioned among the most memorable aspects of the program. I was actually surprised that none of the students complained that there were too many visits to power

plants. I had anticipated these complaints because not all the students were as enthusiastic as the engineering students about the technological aspect of sustainable development. We visited three large geothermal power plants, two large hydropower plants, and several smaller types of both. I was not sure that the variations on technology would not be lost on the students, but it seems that they did indeed appreciate how Iceland utilizes different types and sizes of plants to harness energy in different situations locally. From their experience of witnessing renewable energy in practice, almost all the students described it as a confidence boost. They were impressed that it is possible to source alternative, renewable forms of energy on a large scale and in many different ways. This is one marked success of the program.

4.1.4 Experiential education

"We were able to directly relate..."

Image 4.4 Students peer into the powerhouse of the Kárahnjúkar hydropower project. Photo: T. J. Pepping

For almost all the students, the experiential or field component of the program was different and transformative for learning. The more enthusiastic among them felt it was rewarding and essential for learning about sustainability while the less enthusiastic, though they stated they enjoyed seeing the subject firsthand, felt the program suffered from lack of structure and consistency. Several are quoted as saying some form of the sentiment "science is best learned in a classroom." I remember one point during the intensive lecture portion of the program (in which lecturers changed twice a week and covered topics ranging from resource economics to fuel cell technology) in which the students complained of the chaotic presentation of course material. When it was explained that it was supposed to be that way, that they should take each lecture as a piece of a puzzle and put it together themselves, their attitudes changed instantly. Suddenly, instead of receiving the lecture

with consternation about how to understand it, they were open and active in their education. I realized in that moment that they had become agents of their own education.

A critical characteristic of experiential learning is learner control or involvement in learning. Illeris (2007) gives a survey of attempted definitions of experiential learning from the influential scholars John Dewey, David Kolb and Roger Fry, Susan Warner Weil and Ian McGill, and David Boud to conclude that each contributes to ideas that make up experiential learning. Dewey wrote of connecting past and future experiences through worthwhile learning experiences (Dewey in Illeris, 2007)); Kolb and Fry depicted it as concrete experience, observation and reflection, formation of abstract concepts, and testing in new situations (Kolb and Fry in Illeris, 2007)); Weil and McGill contributed their idea of learning villages based on primary experience in different settings (Weil & McGill in Illeris, 2007)); and Boud put forward the learner-centered approach and importance of freedom in learning (Boud in Illeris, 2007). Illeris finds that none of these satisfactorily encompasses experiential learning, and goes on to attempt his own. On learner involvement, Illeris writes that each learner brings to the learning environment his or her own specific culture, place, time, and experience, which in the late modern globalized world "offers unlimited, and to a great extent also unstructured, possibilities for learning" (2007). He goes on: "Hence, the often formulated need for learning to learn, that is creating a personal structure or a value system to sort out what is worth learning from what is not" (Illeris, 2007).

Illeris' description of the modern learner rings true with my experience with the SIT students. They sensed the unstructured, multidisciplinary nature of the course material, and were unprepared from their more traditional university educational settings to interpret the information for themselves. But how does a facilitator teach students to learn? In the case of the SIT summer program, a discussion on philosophy, ethics, and spirituality is missing in the debate. The students need the opportunity to understand their own personal structure or value system. This motivational or emotional facet of understanding is also part of experiential learning. Jean Piaget and David Ausubel authored in the 50s and 60s seminal theories concerning individual acquisition during a learner experience and the linking of past with present learning. This is often the domain of cognitive psychology, and psychologist Hans Furth expanded the theories of Piaget and Freud to show importance of emotions in learning (Furth in Illeris, 2007)). Illeris (2007) elaborates that this emotional side incorporates feelings, volition, motivation, and incentives. Thus I would argue that it is through personal codes of ethics that we understand our emotions and motivations in relation to experiential learning about sustainability.

The SIT program is strong in creating memorable learning experiences, ones that are effective links between past, present, and future experience and learning. As one student wrote of standing on the Iceland Deep Drilling Project rig, the physical sensation of the wind and the sound and seeing the mechanical workings of the blow-out preventer, that experience has stayed with him more so than his more recent lectures. These picture memories are also important puzzle pieces in the students' education. As we know from Proust and psychology, physical stimulants can transport us instantly to a former experience. The goal as educator then is to provide for as many of these moments as possible.

4.2 Sustainability and science education

To revisit the first research question, what characterizes the learning experiences of students in the SIT Iceland summer program, and how does this impact their conceptualization of sustainable development? I have given several examples and pictures of students' learning experiences on the SIT program, and discussed them to some length. What I will turn to now is the second part of the question, that is, how did their learning experiences impact their conceptualization of sustainable development?

4.2.1 The educational experience

Education for sustainable development, in my opinion, is best accomplished with multidisciplinarity, active student participation, immersion in nature, experiential learning elements such as field study, a critical approach, holistic presentation, firm grounding in reality, as well as consideration of ethical issues on the personal, subjective and sociocultural levels. In the time outside the classroom, students recorded experiencing some benefits of some of these elements, such as greater and more practical understanding, more balanced and holistic perspective, and realization of the reality of renewable energy. These aspects of their education in Iceland appear to have at least informed their conceptions of sustainability.

Surprisingly, several cited Solheimar, the eco-village in South Iceland where we spent one night, as a prime example of a community thriving sustainably. I was surprised at this because of the little time spent there and the fact that they were only given a brief introduction to the community. They were however given free time to explore the area, so perhaps they took in more than I realized. Because of the positive reception last year, this year I have planned three days at Solheimar. I have in mind to use the days, which are at the beginning of the program, as orientation for the students not only into the necessary rules and safety guidelines, but also into the spirit of the education. I have a few of my own ideas for how to do this, but I have also been influenced by Camino, Barbiero, and Marchetti's (2009) experience in teaching learning processes with science researchers and trainee teachers in Italy. I am particularly interested in their study because of several parallels between our programs: they had a group of students in higher education from a variety of academic disciplines but who were all working at the Interdisciplinary Research Institute on Sustainability (IRIS), they had a residential portion of their course in which they stayed as a group in the mountains, there were a variety of course activities as well as course teachers or tutors, and their purpose was to promote transdisciplinary dialogue about sustainability.

The three researchers, as part of a larger Science Education Research Group, designed a course on sustainability based on their past experience. They followed these guidelines: provide a variety of choices of educational offerings that enable all students to be stimulated; use a variety of strategies that range from silence to open exchanges, from individual reflection to group cooperation, and that link disciplinary knowledge to everyday life to contextualize scientific knowledge; employ a multiplicity of relational approaches to break down hierarchical relationships into equality, respect, and value for difference but non-violence (Camino et al., 2009). Their primary objective was to move beyond "a simple exchange of information" to lay bare the differences in methodologies

"as well as their implicit assumptions and paradigms" (Camino et al., 2009). Among the course participants were a chemists, physicists, other scientists, a linguist, a psychologist, and performance artists. In engaging in this transdisciplinary dialogue, they reported having "a deeper insight into their own as well as others' disciplines, from both a methodological and an epistemological point of view" (Camino et al., 2009).

> Moreover, students were given the opportunity of developing metacognitive competences (Bateson 1973; Varela et al., 1991) for dealing with problems by going beyond the empirical evidence, and above all, for accepting—at least in part—the sense of limitedness of human knowledge and the importance of creativity and intuition in the production of new knowledge (Camino et al., 2009).

It was a humbling experience for both students and teachers, and student appreciated the sense that their tutors were their equals in their investigation of sustainability. However, Camino et al. do note that "At the same time, it was useful to refer to the synthesis made from time to time by the more experienced tutors" (2009). It appears that tutors were able to operate both on the same level with the students as well as on a level of authority.

Students of the course in Italy reported undergoing a "total change of mindset…their view of things had changed" (Camino et al., 2009). They had gained new conceptual tools and new interpretive schemes rather than simply transferring ideas (Camino et al., 2009). The researchers note that this did not come quickly and easily, but was learned over time. They then unveil their approaches that were most effective. On bringing to light different disciplinary angles: "From a student's point of view, becoming aware of what are the interpretive schemes guiding scholars in exploring the problems that are typical of their own discipline can be extremely useful for understanding the motives that guided, as well as for making the objectives of the inquiry explicit" (Camino et al., 2009). Some of the conceptual tools they use would also be valuable for my program.

The concept of boundary, a practical way to divide among things which is natural and useful, is analyzed in its use in academia. The example they use to help students understand their point is ecology: it is almost impossible to draw boundaries between ecosystems because they are so interconnected. One study even comes to the conclusion that "the discrepancies between scientists accurately reflect the diversity of the real world" (Corn, 1993 cited in Camino et al., 2009). They propose relationships and flows instead of boundaries as a way to organize thought on not only ecosystems but also climate change and other sustainability issues. They move from the conceptual tool of boundary to energy flows and matter transformations to discuss the energy needs of humanity. Energy study is divided among the scientific disciplines of physics, chemistry, biology, and engineering, and each uses a different measurement and scale to quantify energy—volts, calories, joules, watts. The tutors lead a critical discussion on energy flows, production and consumption, and scales of energy, slowly increasing in complexity. They use a number of techniques including narratives, thought experiments, artistic representations, and sharing personal experiences. Concluding their study, Camino et al. present some study responses to the course which show how their perspectives and understandings changed rather drastically through the course (2009).

One activity in particular I will borrow from Camino, Barbiero, and Marchetti. In order to bring to the surface the nature of our values and attitudes toward nature, the participants are

asked to write down a childhood memory connected to nature and to share it with the class. After the class gets beyond any shyness or embarrassment, and takes the activity seriously and with respect toward their colleagues, then it turns into a sensory-rich, emotional illustration that builds self-awareness (Camino et al., 2009). I see this as directly working in line with experiential learning to connect past, present, and future.

4.2.2 Understanding the learning process

Cultural-historical activity theory provides a useful framework for understanding and evaluating the renewable energy program in Iceland. Roth, Lee, and Hsu (2009) tout its useful application to modern science education. Since activity theory is not only about understanding but also about transforming practice, it can aid in shaping sustainable development education to the goals of transforming learner attitudes, values, and behavior. By acknowledging and utilizing all aspects of the activity triangle (see figure 1.2), it can be used to improve science learning environments and create opportunities for expansive learning (Roth et al., 2007). But, it is more than just being aware of all the points on the triangle; their interaction is critical for producing the outcome. Roth gives the example of a 7th grade class tackling community water quality issues (2007; Roth and Lee, 2007). Rather than the teacher assigning tasks to the students, they are allowed to decide for themselves one aspect of the problem to approach, the tools they will use to investigate it, and present their projects themselves to the class and the community. Parents, local experts, and journalists were involved in the project, which was quite successful.

The most prominent characteristics of such an educational environment appear to be: larger community and societal involvement in the learning process (which subsequently also grounds the subject material in reality), variety of tools employed in attaining the object of learning, and student freedom of choice and control in the educational environment. The SIT program achieves each of these to a certain degree, but can also improve in all directions. It emerged from the discussion that the experiential learning aspect effectively rooted the course in reality and made students feel that what they learned in the classroom was significant outside of it. The students' access to community via the homestay was overwhelmingly positive and enhanced their educational experience. The variety of lecturers, settings, and learning styles provided for a more comprehensive understanding of renewable energy and sustainability. Students appreciated the freedom they were given to explore the country, though it must be noted that in spite of the fact that this forms an informal, rather peripheral aspect of the educational program, it was nevertheless meaningful for the students.

In terms of activity theory, the characteristics the SIT program fails to fully achieve are societal involvement in the learning process, a wider variety of conceptual and actual tools for carrying the subject to the object, and student ownership of the education. As mentioned in the discussion, the program could improve in these areas by: allowing more time with host families; spending more time in nature and having critical discussion of environmental issues; staying at the eco-village Solheimar longer and integrating it into class discussion; using critical conceptual tools in a seminar forum where students can lead an open discussion of their personal and ethical opinions on sustainability issues.

5 Implications for practice

The following discussion responds to the second research question,

> As a facilitator, how can I incorporate these results into future program planning to create a more transformative educational experience?

5.1 A sustainable future

The main way in which Iceland influenced students' thoughts on and understanding of sustainability was that it made them feel a sustainable future was "possible" and "feasible." They wrote that a sustainable society is one that considers the future. Overall, the students reported gaining a positive outlook for the future. Futures studies is a field that clarifies goals and values, analyzes and interprets the recent past and present, explores projections of current trends, and carries out systematic studies of possible, probable, and preferable futures (Lloyd & Wallace, 2004). David Lloyd and John Wallace make the case that future studies are a necessary and valuable dimension in science learning (2004). As became apparent to me from reading the overwhelming inclusion of the word "future" in student responses which did not specifically ask them about the future, it is a concept inextricable to sustainable development.

Students' ability to imagine the future depends largely on factors like confidence and comfort and relationship to the class and teacher (Lloyd in Lloyd & Wallace, 2004). Students' images of the future subsequently act as a type of interpretative framework and therefore influence learning (Bloom in Lloyd & Wallace, 2004). From the results of the interview, the most common effect on students, from a variety of experiences on the SIT program, was quoted as an increase in confidence in some form or another—feeling hope, undergoing personal growth, believing that sustainability is possible, and having a more positive outlook on the world. This effect is not unintentional, but I do not think the program can take full credit for having such a good influence. Some of these benefits are the byproduct of study abroad, particularly the homestay, and some are directly related to Iceland and its renewable energy practices. But that does not diminish the rather dramatic overall effect of empowerment and growth in confidence. Because many of the students of the SIT program take home from Iceland a positive, future-oriented experience—developed competence, practical knowledge, and optimism—their interpretative frameworks also developed and will in turn contribute positively to their future learning and their futures generally.

5.2 Ethics and sustainable development

In a recent course in my graduate study entitled "Educational Action for Sustainable Development," Education and Philosophy Professor Ólafur Páll Jónsson (University of Iceland) and Philosophy Professor Nigel Dower (University of Aberdeen) discussed the ethical implications of sustainable development. The challenge, it appears, is to extend our ethical considerations to distant places and times—that is to say, across the globe and into the future. No education can be for sustainable development then without this ethical dimension. The students in my study appear to have rather unintentionally and unconsciously developed somewhat in this direction. The conglomerate effect of the study abroad experience, the homestay, being in Iceland, and the formal and informal educational experiences about renewable energy all together promoted positive personal development, expanded and diversified worldview, created deep and memorable learning moments, and left students with a general sense of possibility and hope for the future. Their awareness was raised regarding their own culture and identity as well as a culture outside their own, the vastness of the world, and the importance of present action for the future. While this is indeed a positive evaluation of the SIT program, there are several notable areas for improvement. Primarily, bringing a level of consciousness to the process of change would enhance their ability to learn in a meaningful way.

In a study on climate science education, researchers argue that empowering students to act responsibly to make ethically founded knowledge-based decisions should be an important goal of education (Schreiner, Henriksen, & Hansen, 2005).

> "Key elements in education for climate empowerment and action are identifying and understanding the science and the societal situation; elaborating on the meaning of sustainability in this context; articulating and sharing hopes on visions for the future; putting the plan of action into practice; and eventually evaluating the outcome." (Stapp in Schreiner et al., 2005)

The SIT program does a good job of teaching the science of renewables and of rather indirectly accomplishing the rest to some extent. It is these aspects of the program in particular, that of understanding the societal situation as the context for sustainability and of providing a more formal forum for articulating and sharing visions and action plans for the future, where the program could benefit from a more direct approach.

5.3 The independent study project

However, there is one aspect of the SIT program heretofore not discussed which has great potential for tying all these areas together and becoming a transformative educational experience: the independent study project. Since the beginning of the SIT program several years ago, this portion of the course has evolved from a class project where each student takes on one task to an individual research project in which each student examines one aspect of renewable energy of particular interest to them. Last year, projects ranged from proposing a micro-hydropower station on a nearby farm to an evaluation of the town's environmental awareness. Students accessed data by contacting the appropriate firms and offices (such as the local power company) in the town, and incorporated outside research

into their papers. Finally they presented their projects to the rest of the class with slideshows. The independent study project has all the elements of being an empowering educational experience by measure of activity theory, but fell short for several reasons. The students voiced reticence to approach the project as village outsiders coming in and acting like they had the authority and the ability to solve the village's problems. They also had difficulty getting all the tools (data, other research, contact with experts) they needed to conduct a thorough research project in such a short period of time—ten days. Based on the presentations I saw, they also seemed to need more guidance in narrowing down the scope of their research. Many, perhaps because they did not want to address the village's problems specifically, kept their topic very general.

First, to address their problem with acting like authoritative researchers telling the village how to solve its problems, I would suggest a different approach to the students. The reason the projects are conducted in a village in the Westfjords is that it is a geothermally cold area, so has conditions for energy production more similar to their hometowns. I think this aspect of connecting the village to their hometown needs to be emphasized. The students will more readily accept that they have some level of expertise on their home situations, so can approach the Westfjords village as a comparative study. This would also aid in the problem of data collection (which was sometimes due to the fact that the desired data was in Iceland): students can incorporate data and research in English into their projects. Another way I will try to remedy this situation this year is by pairing students up with a local expert to advise them in their research. This Icelandic person can help guide the students in choosing a research topic, in finding information, and, if they are very generous, in helping the students understand material in Icelandic. Thus, the students might have a change in attitude and see themselves rather as comparative researchers contributing to the village's body of knowledge than as all-knowing experts dictating solutions from outside the village. Central to this issue is perhaps the perceived scientific tradition in the minds of the students. Below is a selection from a table compiled by Huckle (2006) which shows in list form the characteristics of traditional science that are at odds with sustainable development science and education.

Table 5.1 Characteristics of normal (modern) versus post-normal (postmodern) science. (Huckle, 2006)

Normal (Modern) Science	Post-normal (Postmodern) Science
Empirical data leads to indisputable facts or true conclusions.	Recognises uncertainty and a plurality of competing but legitimate perspectives.
Scientific knowledge is assumed to be qualitatively different from the lay and tacit knowledge of the public. It seeks orthodoxy, replicability, and universality.	Scientific knowledge is complemented by non scientific expertise or elements of the public's lay and tacit knowledge (local knowledge, contextual knowledge and active knowledge).
Accredited scientific experts discover 'true facts' for the determination of 'good policies'. The public are seen to lack expertise and knowledge of science and are effectively disqualified from participation in scientific debates. Expert scientists speak for the environment in policy debates.	Scientists participate in dialogue with the private sector, government, and civil society to assess the quality of scientific knowledge in the context of real life situations. Scientists help citizens to produce citizens' science and speak for the environment in policy debates.
Values are irrelevant (hidden).	Values are central (explicit).
Knowledge alienates passive citizens.	Knowledge empowers critical and active citizens as agents of sustainable development.

The shift from normal to postnormal is critical for successfully incorporating the community/society component of the activity triangle. The relationship between students and the local community needs to be managed such that both perceive it as mutually beneficial. Involving locals will certainly contribute to this, but I also think that disseminating the research results in the community will help make both parties feel the undertaking makes a difference. To this end, instead of having a powerpoint presentation, we will have a poster exhibition this year. Students will design posters that are simple visual representations to communicate their projects to a general audience. The students can present their own posters at the end of their time in the Westfjords, but the posters can also be displayed after the students are gone. I also have the ambitious idea to let it be a traveling exhibition around to the places where the students studied and visited in Iceland and back to their home universities. Relating education to a wider community and to society at large is essential to connect learning with the real world and to empower students.

To diversify the tools by which the students reach their learning objects in the independent study project, I will need to encourage the students to think beyond strictly traditional scientific research. It is my experience that these undergraduate students have had little exposure to the wide variety of quantitative and qualitative research methods available to them, so I plan to hold a few class sessions giving them this overview and to meet with them individually to discuss specific possibilities. I will also harvest information and sources ahead of time to have materials ready to get them thinking from the start.

Student agency in their education is valued by proponents of cultural-historical activity theory, experiential learning, and education for sustainable development. Almlöv and Moberg (2008) find that student leadership within a course encouraged an authentic democratic process and a sense of individual responsibility. They go on to argue that these are important aspects of education for sustainable development because "students develop knowledge and insights as well as perceptions of their future lives, their visions and their ability to act responsibly" which is important for developing the "ability to evaluate global and inter-generational issues" (Almlöv and Moberg, 2008). This is the kind of education I hope to foster with the SIT program, one which develops the whole person, and that person knows for himself or herself what "the right relationship to nature" is.

5.4 The educator's role

The remaining question then is how to accomplish these improvements well. As educator and facilitator, I must carefully contemplate how I can enable this kind of transformative education. This goes beyond changing what one does to changing how one does it. At an educator workshop on education for sustainable development that I attended last fall in Visby, Sweden, one seasoned educator told me the most important thing any teacher needs to know: "You cannot teach students anything at all. Knowledge can only grow." I took him to mean that transmissive education, the business of telling students what they should know, at best produces in the student the ability to recite pieces of knowledge. But if we want to create transformative education whose students embody knowledge and are able to understand the world and its problems in their complexity and remain undaunted, then we must enable empowering educational experiences. During that workshop, I realized that most teachers need to stop talking so much and let learning happen. Educators needs to be very perceptive to try to see and understand the learning process each of their students is undergoing in order to tailor the situation to best stimulate them.

Alice and David Kolb (2005) argue that "learning is best conceived of as a process, not in terms of outcomes," and quoting John Dewey, "'the process and goal of education are one and the same thing'" (Dewey in Kolb & Kolb, 2005). They propose the following principles to create learning spaces for the enhancement of experiential learning (Kolb & Kolb, 2005):

1. Respect for learners and their experience
2. Begin learning with the learner's experience of the subject matter
3. Creating and holding a hospitable space for learning
4. Making space for conversational learning
5. Making space for development of expertise
6. Making spaces for acting and reflecting
7. Making space for feeling and thinking
8. Making space for inside-out learning
9. Making space for learners to take charge of their own learning

The first two principles deal with experiential learning in two senses: that the students experience the subject matter so learn by directly relating to it and that the past experience of the students is recognized and valued. The latter contributes to confidence building in students, who are treated as already having a body of knowledge which they can contribute

to the class. Because students process new knowledge through their personal interpretative frameworks that in turn determine their values, attitudes, and behaviors, the best way to create an educational experience that influences both knowledge and the framework is by acknowledging the experience of each student. The second two principles address the learning environment. Kolb and Kolb hold that critical thought and discussion of issues and differences are only constructive in a positive, safe, hospitable environment. The ambience in the class must encourage fearless communication and expression of differences by welcoming and supporting each individual (Kolb & Kolb, 2005). Furthermore, discussion should be more conversational and conducive to natural thought and speech, as opposed to the rules of the traditional lecture method of sitting and listening. "Making space for good conversation as part of the educational process provides the opportunity for reflection on and meaning making about experiences that improve the effectiveness of experiential learning" (Keeton, Sheckly, & Griggs, and Bunker in Kolb & Kolb, 2005). Principles 5 through 8 talk about letting student interest guide their education. Emotion influences whether and what we learn, and can determine cultivation of life purpose out of education (Kolb & Kolb, 2005; Dewey in Kolb & Kolb, 2005). The final principle regarding student ownership of his or her education echoes the same sentiment that has sprouted up from many directions in this thesis. Kolb and Kolb (2005) emphasize that it enables students to learn in a meaningful way that ultimately influences their self-perception and life goals.

5.5 Emergent theories and further research

What we see from the above discussion is that 1) direct experience of the learning object, 2) connection to community and society, 3) critical, multidisciplinary approach to course material, 4) a supportive, expressive learning environment, and 5) student autonomy cultivate transformative educational experiences. It emerged from this research process that the SIT program succeeded in creating these kinds of transformative educational experiences to some extent and with varying degrees of intention. It was most strong in fostering positive growth among the students, enabling meaningful cultural exchange, and creating experiential, interactive education about renewable energy and sustainability. In the future the program can benefit from a more purposeful approach to strengthen these program elements even more. Thus, this year I will improve upon the independent study projects and introduce the weekly seminar. I will also be cognizant with my attitude as facilitator of acknowledging and incorporating the students' experiences, bringing in critical perspectives to the subject material, fostering holistic understanding through multidisciplinarity, and, above all, promoting synthesis of the complex educational experience by raising student awareness and self-reflection about their experience in open discussion.

One unexpected and significant realization I had from doing this research is that study abroad could be a powerful tool for education for sustainable development. From my personal experience studying abroad as an undergraduate, one forms uniquely strong bonds with one's classmates. I saw this as well in the group of students on the SIT program. They come from a wide variety of backgrounds and experiences, but are motivated by a common interest, and then share the powerful experience of study abroad together. This is naturally conducive to creating a supportive learning environment in which their differences can be

openly and conversationally discussed. Study abroad also naturally widens worldview, extends cultural understanding, and engages interest. To be an effective educator in this extraordinarily dynamic setting, I need to understand and acknowledge the various forces at play and facilitate their constructive interaction. My goal this year is to streamline all these levels of stimulation and development into a cohesive, meaningful, authentic educational experience of sustainability. My greatest hope as an educator is that this educational experience would build part of the students' own sustainable frame of mind.

This study logically suggests further research on the SIT Iceland program, particularly evaluating the effectiveness of the changes that will be implemented this year. The common threads that emerged from this study could be more closely examined and monitored particularly with respect to the relevant theory and research that have been applied in analyzing them in this study.

The final suggestion that study abroad enhances education for sustainable development is quite new and interesting and relatively unstudied. In general, programs in line with experiential learning, activity theory, and education for sustainable development, as with any educational model, must be constantly re-examined to ensure educational quality. I believe that qualitative case studies such as this one are effective means for gaining insight into the actual educational process in the student, so should be employed further. In the words of Lawrence Summers, President of Harvard University, "'The only true measure of a successful educational model is our students' experience of it'" (Summers in Kolb & Kolb, 2005).

References

Almlöv, M., & Moberg, E. (2008). Students in possession of the issues of tomorrow: an innovative studentled course project. *Journal of Education for Sustainable Development*, *2*(2), 173-179.

Bonnett, M. (1999). Education for sustainable development: a coherent philosophy for environmental education? *Cambridge Journal of Education*, *29*(3), 313-324.

Camino, E., Barbiero, G., & Marchetti, D. (2009). Science education for sustainability: teaching learning processes with science researchers and trainee teachers. In D. Gray, L. Colucci-Gray, & E. Camino (Eds.), *Science, society and sustainability: education and empowerment for an uncertain world* (pp. 119-153). New York, NY: Routledge.

Carr, W., & Kemmis, S. (1986). *Becoming critical: education, knowledge and action research*. Oxon, UK: Deakin University Press.

Carson, R. (1962). *Silent Spring*. New York, NY: Houghton Mifflin.

Chan, W., & Dimmock, C. (2008). The internationalization of universities: globalist, internationalist and translocalist models. *Journal of Research in International Education*, *7*(2), 184-204.

Diamond, J. (2005). *Collapse: how societies choose to fail or succeed*. New York, NY: Penguin Group USA.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education*. Oxon, UK: Routledge.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: strategies for qualitative research*. Chicago, IL: Aldine Publishing Company.

Huckle, J. (2006). Education for sustainable development: a briefing paper for the training and development agency for schools. Retrieved in April 2007 from
http://john.huckle.org.uk/publications.jsp

Illeris, K. (2007). What do we actually mean by experiential learning? *Human Resource Development Review*, *6*(1), 84-95.

Kemmis, S., & McTaggart, R. (1982). *The action research planner*. Oxon, UK: Deakin University Press.

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: enhancing experiential learning in higher education. *Academy of Management Learning & Education*, *4*(2), 193-212.

Lloyd, D., & Wallace, J. (2004). Imaging the future of science education: the case for making futures studies explicit in student learning. *Studies in Science Education*, 40, 139-178.

Meadows, D., Meadows, D., Randers, J., & Behrens, W. (1972). *The Limits to Growth*. New York, NY: Universe Books.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis*. Thousand Oaks, CA: Sage Publications, Inc.

Pepi, D. (1994). The mechanics of nature appreciation. *Journal of Environmental Education*, *25*(3), 5-14.

Robson, C. (2002). *Real World Research*. Oxford, UK: Blackwell Publishing.

Roth, W-M., & Lee, Y-J. (2007). "Vygotsky's neglected legacy": cultural-historical activity theory. *Review of Educational Research*, *77*(2), 186-232.

Roth, W-M., Lee, Y-J., & Hsu, P-L. (2009). A tool for changing the world: possibilities of cultural-historical activity theory to reinvigorate science education. *Studies in Science Education*, *45*(2), 131-167.

Schmidt-Rinehart, B. C., & Knight, S. M. (2004). The homestay component of study abroad: three perspectives. *Foreign Language Annals*, *37*(2), 254-262.

Schreiner, C., Henriksen, E. K., & Hansen, P. J. K. (2005). Climate education: empowering today's youth to meet tomorrow's challenges. *Studies in Science Education*, *41*(1/2), 3-50.

SIT Study Abroad (2009). Iceland: Renewable energy, technology, and resource economics. Retrieved in June 2009 from http://www.sit.edu/studyabroad/sss_ice.cfm

Stake, R. E. (2000). Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 443-466). Thousand Oaks, CA: Sage Publications, Inc.

Sterling, S. (2009). *Sustainable education: re-visioning learning and change*. Devon, UK: Green Books Ltd.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: grounded theory procedures and techniques*. London, UK: Sage Publications, Ltd.

Sustainable Development Commission (SDC) (2010). A brief history of sustainable development. Retrieved in May 2010 from http://www.sd-commission.org.uk/pages/a-brief-history-of-sustainable-development.html

Talburt, S., & Stewart, M. A. (1999). What's the subject of study abroad? Race, gender, and "living culture". *The Modern Language Journal*, *83*(2), 163-175.

United Nations (1975). *Belgrade charter: A global framework for environmental education.* Retrieved in December 2007 from http://portal.unesco.org/education/en/ev.php-URL_ID=33037&URL_DO=DO_TOPIC&URL_SECTION=201.html

United Nations (1977). *Tbilisi declaration.* Retrieved in December 2007 from http://unesdoc.unesco.org/images/0003/000327/032763eo.pdf

United Nations (1987). *Report of the world commission on environment and development: our common future.* Retrieved in December 2007 from http://www.un-documents.net/wced-ocf.htm

United Nations (1992). *Agenda 21.* Retrieved in December 2007 from http://www.un.org/esa/sustdev/documents/agenda21/index.htm

United Nations (1997). *Report of the 19th special session of the general assembly of the United Nations: earth summit + 5.* Retrieved in December 2007 from http://www.un.org/ga/sessions/special.shtml

United Nations (2003). *Draft framework for the decade of ESD.* Retrieved in December 2007 from http://portal.unesco.org/education/en/file_download.php/9a1f87e671e925e0df28d8d5bc71b85fJF+DESD+Framework3.doc

UNESCO (2010). *Education for sustainable development (ESD).* Retrieved in April 2010 from http://www.unesco.org/en/esd/