Local Environmental Perceptions and Cognitive and Affective Learning in a Rural, Andean Community in Mollepata, Peru

Luisella Mazzone De Angelis

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Local Environmental Perceptions and Cognitive and Affective Learning in a Rural, Andean Community in Mollepata, Peru

By

Luisella Mazzone De Angelis

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science Department of Environmental Science and Policy College of Arts and Sciences University of South Florida

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Dedicación

Esta investigación se dedica a la gente de Mollepata que me ha dado la bienvenida en su comunidad desde que era niña. Ésta es la misma ciudad que acogió a mi abuelo maternal, Horacio Tamayo Jordania desde la niñez. A mi familia Tamayo, les agradezco a todos por su tiempo, paciencia, amor y apoyo. Mi encanto con el Cusco y con Mollepata en particular proviene directamente de mi amor profundo por ustedes. Le agradezco especialmente a Tía Gloria Tamayo de Ramos por alojarme en su hogar y por alimentarme con cuentos y danzas tradicionales (por Jim Morrison y Pink Floyd también) y por ser una de mis amigas más estimadas y mi segunda madre. A mi prima Fanny Castelo Tamayo por sus traducciones exigentes. A Enrique Castelo Tamayo por su amistad, confianza y apoyo eterno y a María Luz Castelo Tamayo por estimular algunas de las mismas preguntas que intento contestar aquí. Otro agradecimiento especial va a mi prima Ingrid Roxana Tamayo Machicado por facilitar el acceso a los profesores, a los padres y a los estudiantes de David Samanez Ocampo en Mollepata y por compartir su hogar y su mesa con mi hijo Andres y conmigo. Mi trabajo no hubiera podido ser realizado sin su entusiasmo y ayuda. Gracias a los niños de Mollepata por jugar conmigo y con Andres en su comunidad hermosa. A mis padres, Doris y Eduardo González, gracias por su ayuda financiera y a mi mamá particularmente por cultivar las relaciones profundas cuales ahora comparto con mi familia en Perú. Soy infinitamente agradecida por ambos. A mi hijo, Andres, que no puede todavía leer estas palabras, le agradezco por su amor incondicional y la energía y alegría que trae a todo lo que hace. Es verdaderamente contagioso y ha sido a menudo una fuente de gran fuerza durante esta investigación. A mis mejores amigas, Rikki Jean Voss, Katie Culbert y Mishou Sánchez y a mi nuevo amigo, Peter Torres Castro, por su apoyo incansable y simplemente por compartir los mejores días de mi vida conmigo. Por último, un agradecimiento especial a mi primo y amigo, Luis Eduardo Castelo Tamayo, por compartir su amor por los diferentes parajes de Mollepata y por prestarme sus alas de modo que pueda apreciar mejor los paisajes variados de su tierra querida cuales nunca hubiera descubierto sin él.
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Local Environmental Perceptions and Cognitive and Affective Learning in a Rural, Andean Community in Mollepata, Peru

Luisella Mazzone De Angelis

ABSTRACT

This study examines the linkages between environmental field trips and cognitive and affective gains in two groups of homogenous elementary-aged students in Mollepata, Peru. One group participated in an environmental field trip to a local, non-profit farm (Aprodes) to explore watershed and agricultural issues. The second group received the same content within the classroom setting. The research also examines the environmental perceptions of local residents via semi-formal open-ended interviews to assess their environmental awareness and their willingness to receive environmental education services from an outside organization.

Data were collected both quantitatively and qualitatively via pre and post tests containing science content and environmental attitudes items; pre and post student journals and parent and teacher interviews. Data were analyzed within the framework of the United Nation’s goals of environmental education in the Belgrade Charter (1975) and within the context of theories on human-nature relationships.

Students in the field trip group scored slightly better in the cognitive portion of the tests though differences were not statistically significant. Similarly, slight gains in pro-environment attitudes occurred in the field trip group over the classroom groups though overall results for both groups were nearly identical. Parents and teachers are moderately aware of environmental problems within the town but do not equate agricultural problems of synthetic chemical usage or other agricultural related problems cited to broader watershed issues. They consistently desire for their children to receive advanced educations in the city so that they become better than their parents. Adults interviewed...
placed a high value on education and claimed to welcome an outside group providing environmental education to the entire community. The data indicates a need for additional environmental knowledge and awareness and that students in rural, Andean settings may benefit from structured classroom lessons paired with experiential experiences outside of the classroom.

It is the researcher’s firm belief that addressing cognitive and affective growth with regards to environmental education will collectively contribute to developing a world population that is aware and concerned for the environment and the knowledge, skills, attitudes, motivation and commitment to work toward solutions to and prevention of environmental problems.
Historically, agricultural communities used traditional, organic methods of fertilizing their crops and avoiding insect pests. Today, in many of parts of the world, even rural communities like Mollepata, Peru, synthetic chemical fertilizers and pesticides are being used (M.L. Castelo, Personal communication, 2009) with no regard for or knowledge of the potential long-term impacts on the local watershed. Traditional, non-toxic methods are being abandoned in favor of chemical farming techniques.

Natural resource assets such as melt water from mountain top glaciers flush these chemicals throughout the local watershed in Mollepata, and eventually to the Apurimac River (See Figure 1). Besides providing wildlife habitat, this river valley draws adventure-seeking tourists because of its highly regarded rapids (Egg and Benites, 2006) and thus it is a source of income for the local community.

Some negative consequences of these new, chemically-based agricultural methods have been noticed by local residents, such as the disappearance of frogs, and the increase of crop damaging pests. Other consequences of chemical farming, such as soil and water contamination, are less immediately apparent, but are also damaging to the long-term sustainability of Mollepata. This research provides a first step towards solutions for the disconnect between farming practices that utilize synthetic chemicals and the environment’s degradation (M. L. Castelo, personal communication, 2009).
With a background in environmental education and environmental science, the principal investigator for this research utilized the local elementary school as a starting point for the assessment of attitudes toward the environment and the reintroduction of environmentally friendly practices.

How to justify such an effort without documented need or desire from the community presented a potential problem. Additionally, how to provide such education opportunities, if it was determined to be feasible, was also a concern. After consultation with one of the school teachers in Mollepata, a solution was arrived at that allowed us to address our desire to assess the students level of environmental awareness, to educate the students in some of the basic concepts of environmental science, and in the long term, which is beyond the scope of this study, to potentially curb environmentally damaging agricultural practices in the future, and promote a higher level of environmental understanding.

This research determines the relationships that exist between a short-duration environmental education field trip and cognitive and affective learning in a rural, Andean town in Cusco, Peru. Additionally, I determined parents’ and teachers’ perception of any environmental problems in the town and their openness to an outside group providing additional environmental learning opportunities to their children or students.

By investigating the effects of out-of-school field trips, versus standard classroom instruction of basic watershed concepts, this research sought to ascertain which learning method is most effective in promoting environmental awareness and understanding for the study population. Additionally, teacher and parent attitudes toward the environment were assessed to gauge their level of understanding and their attitudes towards the environment. The collection of this type of data as part of this research also bolsters
future efforts to provide environmental education opportunities to the local community, via an outside group or agency, such as a non-governmental organization (NGO).

Peru’s own Ministry of Education recognizes that learning is a communal process; that it does not take place only in the classroom. Learning, specifically with regards to the development of an environmental consciousness, is a socio-cultural phenomenon potentially taking place through associations with businesses, non-governmental organizations, indigenous groups, social and sporting clubs, universities, artists’ studios, cultural and tourism centers and political parties, to name a few (www2.minedu.gob.pe).

Within the last 30 years, farmers in Mollepata have begun using synthetic chemicals for pest control and for fertilizing their crops. For as many years, I have visited Mollepata, and have noticed environmental and social changes within the town, which became apparent approximately 10 years ago. Non-organic litter clogs the stream running near the town square, and is scattered along the streets. Disposable bags, plastic bottles and wrappers littering the town are now commonplace. More recently, local citizens reported that frogs have disappeared from the town’s landscape, and that non-beneficial insects have been infesting fruit trees, and other fruit and vegetable bearing plants. Add to this the gradual disappearance of mountain top glaciers in the region, through global warming, and the results are potentially disastrous for the population of Mollepata and other nearby communities, all of which rely heavily on glacial melt water for irrigation and drinking water supplies. Additionally, these same local citizens have not mentioned a potential connection between synthetic chemical usage and the disappearance of frogs or increased crop pests, perhaps indicating a disconnect from the realities of their agricultural pursuits and degradation of the environment. If agriculture in Mollepata fails, the town will cease to exist in its current form. As my ancestral home, and as an important agricultural center, I ask, can I play a role in avoiding further environmental degradation?

I contend that field trips in the local community’s natural areas, along with increased locally-based environmental education on the water cycle, water conservation, sustainable agriculture and global warming, for example, could potentially minimize the negative impacts of some of the above mentioned factors, and thus assist in preserving the area’s natural environment and the community’s livelihood. Putting this idea into
practice can start with assessing the level of environmental awareness that the local school children possess, and building upon this base of knowledge to eventually establish a tradition of sustainable practices within the community. This, in addition to APRODES, a local farm that provides assistance to local growers from seed to product sales, could have a positive impact on sustainable agricultural practices and watershed conservation in Mollepata.

This research also adds to the little studied relationship between out-of-school learning experiences and cognitive and affective learning. While the majority of studies included in the current body of literature support that cognitive and affective gains do take place following field trip experiences, this field of research is relatively new. Most of the studies available have focused solely on scientific content knowledge gains with the complete exclusion of affective learning. This research addresses both areas of learning to add to the growing body of evidence and to address the current research’s lack of data on affective learning.

**Research Questions**

The research questions for this thesis are:

1. Do short-duration field trips increase elementary school student science-related content retention and positive attitudes towards the environment?
2. Do parents and teachers in the community recognize potential environmental threats and the consequences of watershed contamination?
3. Are parents and teachers likely to support efforts to increase environmental awareness in their children via outside sources working with the school?

**Objectives**

The overall objectives of the research are:

1. To determine if students participating in an out-of-school environmental education field trip score better on cognitive content-related items and have a positive change in attitude towards the environment over their peers receiving only standard classroom curriculum.
2. To determine if parents and teachers of the students in the study perceive any environmental problems with regard to watershed issues and if they would look favorably on increased environmental education opportunities for their children via local community excursions.
3. To determine if parents and teachers will welcome an outside group (for example, a non-governmental organization) providing the above mentioned educational experiences to their children.
CHAPTER 2
THE LITERATURE REVIEW

The purpose of this review of the literature is to provide an overview of what is currently known, and what questions remain, in areas related to retention and effective learning about the environment. The current state of knowledge related to the role that field experiences play in learning about the environment, human and nature relationships, informal learning and concepts of active learning are assessed as well. As a result of this review, the shortcomings and strong points of previous research in these areas become evident. It also delineates research needs, as indicated by the literature, with the aim to optimize and document field trip related content retention, as well as positive affective learning outcomes. Additionally, this research provides a basis for recommending and implementing local, community based environmental learning strategies into the current school curriculum in Mollepata.

Environmental Field Trip Effects on Related Content Retention and Affective Learning

Science education is by and large restricted to indoor, formal classroom activities and science laboratories in the school setting. While these formal classroom experiences teach basic scientific concepts, the real science processes and complexity of scientific discoveries are left out. Add to this, formal education’s nearly complete ignorance of learning taking place outside of schools and what results is a student population disinterested in science (Braund and Reiss, 2006) and disconnected from the out-of-school world as places of learning.

School age students spend approximately 2/3 of their waking lives outside of the formal education environment, yet formal education has largely ignored the potential for learning “out there” (Braund et al., 2006). Yet, all too often, students and adults alike
perceive that learning stops once school lets out. Educators should consider that an individual’s education encompasses all of their experiences in addition to the formal classroom setting (Braund et al., 2006). Field trips can serve as a bridge for the continuance of learning in a variety of environments and science related subject matter (Braund and Reiss, 2006) that can extend well beyond the formal school age years into adulthood.

A case can be made for supplementing formal science education with informal out-of-school visits to places such as farms, local water bodies and local natural areas. Over 20 million students worldwide attend informal environmental field trips to places such as aquariums, zoos or local nature centers in addition to receiving regular classroom instruction (Knapp and Barrie, 2001). Cognitive and affective learning following field trips are well documented in the literature (Knapp and Barrie, 2001; Farmer et al., 2007; Bitgood, 1989; Braund et al., 2006; Hamilton-Ekeke, 2007) and support the inclusion of such excursions as supplements to the standard curriculum. In spite of this, some school districts across the United States and in Peru have severely limited the number of school year field trips. In Hillsborough County (the largest school district in the state of Florida), for example, teachers are limited to only one or two field trips per school year (D. Gonzalez, Personal Communication, 2009). In Cusco, Peru, out-of-school field trips are similarly limited to one school day per year (R. Tamayo, via email contact, 2009). One has to wonder how these limited experiences in the community via informal learning opportunities impact learning outcomes outlined by local or national learning standards and how these experiences may positively influence environmentally responsible behavior in the future.

Global Evolution of and Goals of Environmental Education

The evolution of environmental education (EE) on the global stage formally began in 1972, with a report from the United Nations (UN) Conference on the Human Environment in Stockholm. This report marks the first formal recognition, known as Recommendation 96, of the need to establish an international, interdisciplinary EE program targeting the general public of all ages in rural and urban communities and within formalized educational facilities and the community at large, each according to its
culture, abilities and resources. Recommendation 96 establishes program guidelines that include the inventory of current pedagogical practice and educational systems as well as the training and retraining of interdisciplinary professionals (including teachers). The exchange and discrimination of research on educational systems and experimentation in teaching as well as the development and evaluation of new approaches in EE are considered essential components of this global change, along with the formation of an international panel of experts from different sectors of environmental disciplines to encourage the exchange of experiences among countries with similar environmental and developmental conditions (p.2).

Stemming from the identification of EE needs on a global scale, the UN subsequently adopted the “Declaration on the Establishment of a New International Economic Order (1974)” which specifically, and for the first time, addressed problems of development and raw materials. Though concerned primarily with the development of equitable economic practices, this declaration includes the need for creation of indigenous technology, an end to natural resource waste and the sharing of modern science and technology to benefit developing countries and to promote better living conditions with the end of realizing the human dignity of all peoples (p. 3). Through this declaration, the link between natural resources, economic development and quality of life was established within the international community. One year later, The Belgrade Charter (1975) set guiding principles, objectives and target populations for a common EE agenda.

According to the United Nations Educational, Scientific and Cultural Organization’s (UNESCO) “Belgrade Charter: A Global Framework for Environmental Education (1975),” environmental education should examine the total environment in terms of “natural and man-made, ecological, political, economic, technological, social, legislative, cultural and esthetic (p.4)” components; should be life-long (both in and out-of-school), and interdisciplinary; should focus on active involvement seeking to prevent and solve environmental problems of the present and the future; should consider major threats to environmental integrity from a global perspective while promoting the values and needs of local, national and international players in providing solutions; and should “examine all development and growth from an environmental perspective (p. 4).” In short, UNESCO calls for nothing less than a “new global ethic (p.1)” encompassing respect for
the perspectives, resources, needs and challenges of all States as well as the imperative need for the global community to consider humanity’s place in the biosphere with the end of pursuing equitable and sustainable use and management of the world’s collective natural resources to promote peace, coexistence and positive, comparable quality of life among all people (p.1). Here the call to action is for each nation to identify actions that will contribute to social and individual harmony the biosphere and human-made environment and the definition of a quality of life within the environmental context (p.2).

Environmental education (EE) seeks to change the behavior of individuals in how they interact and perceive the environment. Understanding environmental concepts and each person’s place in the environment, promoting pro-environment values and behaviors and, ultimately, the creation of environmentally conscious persons who take an active role in environmental protection in its social, economic and ecological context are the primary goals of this pedagogy (United States EPA, 2009). In a global context, the goal of environmental education is “to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and prevention of new ones (UNESCO, 1975, p.3).”

Environmental education carries the burdens of global sustainability, the responsibility of motivating individual action and the promise of healthier and more equitably distributed natural resources. In spite of EE’s lofty expectations as the “most critical element[s] of an all-out attack on the world’s environmental crisis (UNESCO, 1975, p.2),” this branch of education has largely acted independently of the context of human-nature relationships.

Human-Nature Relationships

To achieve the goals of EE, one must examine how humans develop relationships with and learn in nature. By using human interpersonal relationship research as the basis for how humans develop a relationship with nature, Schultz (2002) identified 3 components of inclusion with nature. He describes inclusion with nature as a person’s understanding of her place in nature, the value placed on nature and the consideration of how actions
impact the natural environment. The 3 core components of inclusion with nature he identified are connectedness (the cognitive), caring (the affective) and commitment (action). He defines connectedness as the “extent to which an individual includes nature within his/her cognitive representations of self (p. 67).” Caring is the feeling of connection and affection to nature and commitment is what an individual is willing to do or invest to continue the relationship with nature (p.68-69).

In an interpersonal relationship, individuals may develop a sense of interdependence with each other. This sense of interdependence is developed by identifying traits shared in common. Sometimes, this identification with an individual leads to the feeling or belief that the self and the other are one (Schultz, 2002). This is the framework for understanding the connectedness or cognitive component of the inclusion with nature theory.

The caring component of the human-nature relationship addresses the feelings of intimacy or closeness and affection with nature via caring that occurs between people. Intimacy is here defined as the sharing of oneself with another or of oneself with nature. This sharing leads to a “deep level of knowledge about the other” allowing individuals to feel closeness and caring for the other (Schultz, 2002, p.68). In other words, just as two people might establish or deepen a relationship by sharing the self with another, by sharing with nature, one can establish a relationship with or connect with nature in a way that develops feelings of caring about nature. This caring component implies an investment of time and energy and repeated positive interactions with nature (Schultz, 2002, p.68). This component seems of particular importance to the goals of EE because it implies that, if interpersonal and human-nature relationships do develop similarly, then opportunities to experience nature must be positive, repeated and developed over time, an important consideration in this research which will only examine a one-day EE field trip. If people become more intimate as they spend time together, then the same is true for the feelings of intimacy towards nature that one might develop through repeated interactions according to Schultz’s framework (p. 68).

The third component of Schultz’s inclusion with nature, commitment, receives only a cursory explanation but is related to the second component of caring. The strength of one’s intention to continue the relationship involves a person’s willingness to invest time
and resources into the relationship (p.69) as noted above. This strength is relatable to an individual’s commitment to act on behalf of nature and to make choices that are pro-environment even if these choices include a sacrifice on the part of the individual.

Schultz summarizes the link between the 3 components as follows: Commitment cannot occur in the absence of caring. Caring cannot occur in the absence of connectedness. Commitment cannot occur in the absence of caring and connectedness (p.70). But if the result is the same (for example, making a pro-environment decision based on selfish motives like preservation of the self) do the other 2 components have to be present? To this Schultz answers that a person with low inclusion in nature (not meeting all 3 components) can replace nature with technology, to some extent, to solve environmental problems that affect them (p. 73). Nature continues to be a commodity rather than a partner. Schultz closes the analogy of interpersonal and human-nature relationships by stating that the “only sure path to sustainability” is through inclusion with nature (p. 74). This analogy is sympathetic to Vining’s (2003) review of how and why humans bond with animals such as pets, in their desire to simultaneously be part of nature (through interactions with other animals) and to reconcile their feelings of shame (through caring for other animals) at the exploitation of nature for selfish motives.

Figure 2. The Researcher’s Son Exploring a Family-owned Orchard (2009)

(industrialization, mass production of animal based foods).
Learning in Nature

In seeking to inform the scientific community on the utility and value of such a case study, it is necessary to delve into the literature with regards to theories of learning in nature and how that might relate to learning theory in general. Environmental education research and practice have developed independently of a sound theoretical framework due to its lack of an identity (i.e. needing to be separate from other educational disciplines while considering how learning best takes place). Brody (2005) addresses this need by proposing a theory to inform curriculum, research and teaching in EE to fill the lack of a sound methodological foundation. The main components of his theory, developed over the course of 30 years’ experience in science, environmental and marine science education are that learning in nature requires “direct experience, cognition, personal and social learning, affective development and time.” These core components encompass the thinking, feeling and acting pieces of human experience, reminiscent to Schultz’s (2002) connectedness, caring and commitment components of human’s inclusion with nature.

Brody offers that the theory of learning in nature is, “that learning in nature is a result of direct experience(s) over time in which personal and social knowledge and value systems are created through complex cognitive and affective processes.” The main 3 components of thinking, feeling and acting are further broken down into physical, personal, social and time dependent categories explaining what is needed to optimize learning in nature.

Acting involves the experience of being inside nature. Physically, this requires the direct experience of being outside with nature as well as being aware of the various aspects of nature, from weather to landscape features. Personally, individuals must have direct interaction with the physical setting via the senses by actively engaging in and with key aspects of the setting as well as being aware of them. Socially, individuals must interact with others while having these direct experiences in nature so that they may share ideas, compare and interpret information and learn from each other. With regards to time, individuals must reflect on their experiences before, during and after to reflect on changes of ideas over time.
Thinking involves using and adding to what is currently known. The physical component involves the awareness of the setting by perceiving patterns, differences and similarities in nature to form new or add to existing knowledge. Personally, the learner is accepting or rejecting new ideas into existing knowledge systems by reviewing their existing understanding and attempting to match up new concepts to them. Socially, the sharing of ideas, the contrasting of new concepts and “seeking confirmation or elaboration of” individual’s understanding is key in the process much as a scholarly scientific community shares ideas, critiques and elaborates on other scientists’ work. With regards to time, reflection involving predictions prior to experience, during the experience to reflect on what is happening and after the experience to rethink events will allow learners to think about why things happened the way they did and if their ideas changed in any way.

Feeling involves the development of values about nature. Physically, individuals must be aware of their feelings and values in relation to the physical setting as learners will “associate feelings with the direct experience.” Personally, the awareness of these feelings and values are important in either gradually confirming or rejecting existing values or developing new ones. Socially, the willingness to share attitudes, feelings and values with others as well as to accept these from others leads to a shared group value about nature. With regards to time, the learner will reflect on her attitudes over time and recognize that these too may change.

The ideas of Vygotzky, Piaget and Ausubel tie in closely to Brody’s (2002) categories of learning in nature. In general, they believed that people learn new concepts best when they have an existing schema or background knowledge based on experience to draw from. For meaningful learning, beyond rote memorization, to take place, a learner must be able to relate the new concept(s) to something they already know such as situations and problems they experience in their daily lives. Though the three differ on how best to initiate learning activities; activating prior knowledge through advance organizers, providing access to pieces of the big picture before the overall concept or through supported acquisition of knowledge by a capable adult or peer (Brody, 2002) by scaffolding; their research points to what a student brings to the learning environment as key to the process of learning (Cakir, 2008). Ask any teacher and she will tell you that
students that come to them with a variety of life experiences encompassing educational, artistic, social, cultural and other realms fare better academically because they can understand the broad context of new information even as they work to learn the concepts. It is only when a learner has a system of related concepts that draw from the rich array of personal experience, classroom curriculum and to situations existing in the learner’s daily life, that she is able to accept new information into an existing schema or to reject the new information.

Contrast this to Paulo Freire’s (1993) conceptualization of education as a banking transaction and the disconnect between how we truly learn and traditional classroom pedagogy is stark if not painfully dull. Freire’s banking concept works like this: Picture a bank. What does one do there? One makes deposits, occasionally withdrawals, but mainly it is a place to safely store money. Replace money with knowledge. Now imagine the teacher as the one making the deposits and the students as the bank itself, passively receiving information and storing it for as long as possible. This is similar to the expository style of teaching. Both have the teacher leading, talking and asking key questions while students take notes, answer when prompted and repeat back the information they have just heard.

Freire suggests that this type of pedagogy reflects oppressive political systems and that these same political establishments work to maintain the status quo via expository teaching styles. A population that is used to being fed information and gladly regurgitates it in exchange for praise, acceptance and success, keeps itself subjugated and dehumanized; thereby maintaining the government’s elite powerful and in control. According to Freire, the focus on information retention keeps students from developing critical thinking skills. These same skills may enable them to view themselves as in control of their environment and capable of changing the world. “To alienate human beings from their own decision-making is to change them into objects,” he writes. Objects exist in the world but are not active participants in the world. He advocates true solidarity between teachers and students by participating in communication which transforms teachers into students and vice versa to facilitate the free exchange of information and ideas which so often can inspire revolutionary problem-solving.
Freire’s banking concept of traditional education conflicts directly with the goals of EE proposed by UNESCO (1975) which depends on a committed population to act on behalf of the environment. To breed conformity is to deny human beings the power to make meaningful changes in their world (including the natural environment) and to deny them the ability to engage in creative, innovative problem-solving to equitably share and care for the Earth’s resources.

In light of the predominance of this traditional pedagogical style in Latin American countries (Gonzalez-Gaudiano, 2007), it simply may not be reasonable to expect any changes in how one views the environment or one’s willingness to act to improve or protect it when students and subsequently adults have been rendered helpless subjects through the political systems in which they live and learn. Peru itself with its history of colonization, rampant government corruption and secret military armies is a living example of the kind of oppression Freire suggests is infused even in classroom pedagogy. From this, one can conclude that meaningful EE is a process that must involve revolutionizing the way we teach and learn and the way we participate in our governmental systems. Environmental education is, at its very core, a call to civic action.

The Benefits of Informal Field Trips for Student Learning

The majority of environmental education data that has been collected to date falls in the empirical realm. While this information is valuable in measuring cognitive, content-related gains, there is much left to be discovered when referring to qualitative measurements of changes in attitudes, feelings towards the environment, likely indicators of future environmental activism and other affective learning information. Research on environmental education field trips indicates increased related content retention (Knapp & Barrie, 2001; Farmer et al., 2007) and changes in affective domains of learning (Bitgood, 1989; Farmer et al., 2007) such as environmental awareness, positive attitudes towards the subject matter, positive memories and positive attitudes to science that stimulate further learning (Braund et al., 2006). These gains are not limited to environmental or ecological field trips but have also been documented in physics excursions (Braund et al., 2006). Hamilton-Ekeke (2007) successfully demonstrated that the field trip method of instruction resulted in cognitive gains in ecology content versus
students taught the same concepts via the expository method of instruction. The field trip method includes trips outdoors to local, community areas for first-hand observation of the topic to be learned, while expository involves teacher-centered instruction via lecture and question and answer sessions in which students are passively listening to information, taking notes and answering questions in the classroom.

While some studies indicate limited cognitive and behavioral impacts (Knapp & Poff, 2001), the case for further research into field trip research focusing on both cognitive and affective learning via quantitative and qualitative methods is strong. The need for more qualitative studies in the field of environmental education has been recognized by a variety of institutions and researchers (Knapp & Poff, 2001; National Wildlife Federation, 1995; Dierking et al.). Anecdotal and scientific evidence suggests that how an individual feels about a topic, influences their acceptance, rejection or consideration of the topic. High levels of interest may lead to gains on cognitive tests (Braund et al., 2006). If a positive feeling is associated with a field trip locale, it is more likely that a student will better retain the information presented at that location.

Braund and Reiss (2006) list 5 ways in which out of classroom experiences including school and home-initiated experiences such as visiting a zoo or reading printed media, enhance science learning. They are:

“1. Improved development and integration of concepts.

2. Extended and authentic practical work.

3. Access to rare material and to “big” science.

4. Attitudes to school science: stimulating further learning.

5. Social outcomes: collaborative work and responsibility for learning.”

Still, some researchers continue to snub their noses at the value of field trips maintaining that, at best, field trips support the acquisition of little science concept knowledge and, often times, foster the development of misconceptions about science (Braund et al., 2006).
What Promotes Effective Learning within the Context of a Field Trip?

If the goal of field trips is to create motivational experiences that also serve as effective curricular learning experiences, we must look to the research to find what factors influence effective field trip planning and situations. In particular, if effective field trips are to be judged based on students’ retention of related content knowledge and on positive affective outcomes, then the research establishes key components that increase the likelihood of these results.

Key Experiences

These experiences are evocative instances that stand out in a field trip participant’s memory such as making a surprising discovery, seeing a wild animal in its natural habitat, holding or feeding an animal, or something as simple as a spectacular sunset (Braund and Reiss, 2006). Research suggests that these key experiences may lead to related content retention as well as positive feelings towards the field trip site and towards the environment and wildlife. Nundy (1999) found that the strength of student memories appeared to rely on the degree to which the event lay outside of a student’s normal frame of reference. The more unique the experience, the more likely the student recalled the information associated with it. Science taught in innovative and exciting ways promotes student enthusiasm which may in turn increase their desire to learn and understand more (Braund et al., 2006; Nundy, 1999).

Classroom science is often presented as a regimented, step-by-step process with predictable answers leaving little or no room for chance discoveries or outstanding experiences. The same can be said of traditional instruction in Latin America in which the teacher is the absolute instructor regardless of the curriculum’s goals (Gonzalez-Gaudiano, 2007). No wonder students are turned off to science and increasingly reject scientific careers. In a field trip situation, learning may occur serendipitously further enhancing the idea that learning can and does occur outside of the classroom and connecting the student with the place via an emotional experience (Braund et al., 2006).

Active Learning
Students do not necessarily absorb knowledge simply by attending a field trip. Students need to be engaged in the scientific process through physical and cognitive inquiry for learning to take place (McLoughlin, 2004). They should be allowed to explore and to use their bodies through activities that allow them to simulate ecological and biological processes. The activities and related concepts recalled most often by children participating in interpretive field trips are those that involved movement, active participation, simulations and animal encounters (Vining, 2003). This active participation can take many forms including the sketching or photographing of interesting features or animals, writing questions for use in a post-trip assessment or for game show style games back in the classroom. Additionally, students can compose skits, poems or prose based on the information learned during the trip (McLoughlin, 2004).

Hamilton-Ekeke (2007) found that students using a guided discovery approach to learning about soil composition performed significantly better than the group receiving expository (teacher-led) instruction. Similarly, Hamilton-Ekeke (2007) discovered that students receiving expository instruction in biological concepts performed below their peers receiving a discovery method of teaching. Discovery method students better retained the biological concepts taught.

**Authentic Science**

Learning science strictly in a classroom or laboratory setting does not mimic the process that real scientists participate in. Students need to be answering questions to real-life problems, finding possible solutions, testing them and realizing that there is no absolute end or right answer to this process (Braund et al., 2006).

Collaboration between teachers and scientists before, during and after a field trip has been shown to increase field-based learning (McLoughlin, 2004). Working with local scientists answering authentic questions, using the methods, tools and processes they use and making observations in the field add authenticity to students’ studies, increases teacher credibility and puts activities in context to the real world.

Authenticity also implies processes that differ from expository classroom instruction. Authentic learning is student centered and open-ended (Braund et al., 2006) allowing students to lead and guide their inquiries in much the same way real scientists question,
hypothesize and amend or confirm their beliefs without the notion that their hypothesis is absolute and uncontestable. This process harkens back to the very roots of scientific exploration, specifically the biological sciences born out of fieldwork and natural history studies. Field trips provide students the opportunity to link theory and observation (Hamilton-Ekeke, 2007).

Additionally, informal science centers often have access to rare and genuine specimens and artifacts which allow students to experience the stuff of scientific musings and to form their own questions through genuine scientific thought (Braund et al., 2006). The same can be said of outdoor excursions in which children may find real specimens in their natural context. In short, field trip experiences bring science to life through partnerships between students, teachers, scientists and the local community.
CHAPTER 3
THE STUDY AREA

Mollepata is a rural, agricultural town with a population of approximately 1,500 Spanish and/or Quechua speaking residents. “Molle” refers to a native tree and “pata” meaning height or hill. It is located within the jurisdiction of Cusco, Peru, best known as the cultural capital of the country and the location for the ancient Inca city of Machu Picchu. Mollepata is located 2,803 meters above sea level (asl), between the city of Cusco and the Machu Picchu ruins (see Figure 3 for approximate location), and encompasses a total area of 389 square kilometers (Fuchsloch, 2005). Its population of primarily mestizos (indigenous and Spanish descendants) relies on mountain top glaciers for their drinking and irrigation water, as does much of the country (Vargas, 2004).

The area is characterized by an abundance of natural resources such as thermal baths, snow covered peaks, such as the Salkantay towering at 6271 meters asl (Fuchsloch, 2005; see Figure 4), and virgin high altitude forest home to such species as the spectacled bear and the condor (L.E. Castelo, 2009). Some of the crops grown in Mollepata for later sale in the markets of Cusco and Lima include kiwicha, tara, quinua and menestras (Luciano, 2009). Two archeological treasures, the Inca cities of Machu Picchu and Choqekiraw, are located near the town (Fuchsloch, 2005), drawing in tourists seeking alternative and unregulated routes to these magnificent ruins. Tourists primarily pass through in large
touring buses and only small groups stay within the town on occasion (D. Tamayo, 2005).

Peru is a remarkably biologically diverse country containing various climates, ecosystems and ecological regions within its political boundaries encompassing 1,285,215.60 square kilometers. The annual average rainfall in Cusco, Peru is 671.2 mm (26.4 inches) with annual average temperatures of 12.3 degrees C (54.1 degrees F) (www.worldclimate.com). Eleven ecological regions are recognized in Peru. They are the cold sea, tropical sea, the coastal desert, equatorial dry forest, Pacific tropical forest, the steep sierra (in western Andean slopes between 1,000 to 3,000 meters asl), the Puna or high Andean plateau (to the south and over 3,500 meters above sea level, with great areas of thick scrub forest), the pa’ramo (between upper forest line and permanent snow line; over 3,500 meters asl), high altitude rainforest (between 1,000 to 3,000 meters above sea level), low altitude Amazonian rainforest (below 1,000 meters asl), and the palm savannah (Egg and Benites, 2006). All but 3 of these (desert, pa’ramo and Amazonian rainforest) exist within Mollepata’s jurisdiction (L.E. Castelo, 2009). Eighty-four of the one hundred and seventeen recognized life zones worldwide exist in Peru as well as 28 of the 32 climatic zones contributing to the country’s amazing biological as
well as cultural diversity (Egg and Benites, 2006). More broadly, Peru is generally divided into 3 regions: Coast, Sierra and Rainforest. Mollepata’s climate, altitude and vegetation place it in the Sierra among the Cordillera Blanca (Egg and Benites, 2006 and Fundacion Telefonica, Geografia del Peru 2009).

Peru is a biodiversity hot spot containing 20% of all bird species, 13% of all continental fish, 10% of all plant, mammal and amphibian species and 5% of all reptilian species on Earth (Fundacion Telefonica, Geografia del Peru). Yet, in spite of worldwide attention due to its biological diversity, water contamination is one of the most severe problems faced in Peru. The principal contributing factors include industrial waste from mining, fisheries and petroleum; lack of adequate post-use water treatment facilities, indiscriminate use of agrochemicals and the deterioration of river basins (Egg and Benites, 2006).

Topographically, Peru contains the most tropical glaciers in all of Latin America, 18 in all. Peru’s loss of 20% of its 1,615 miles (2,600 kms) of glaciers in the central and southern Andes in the last 30 years has been attributed to global climate change. Glacier melt waters supply much of the country’s energy through powering hydroelectric plants, which provide 70% of Peru’s energy. Glacial melt water is also used for agricultural irrigation, industry and to supply half of the country’s population located in the desert coastal regions with water. Increases in melt water have the potential for flooding some areas and leaving others in drought situations. In 1998, a mudslide caused by melting ice near the Salkantay peak, visible from Mollepata, destroyed a hydroelectric plant (Vargas, 2004). Peru also contains the tropic’s largest snow-capped mountain range, La Cordillera Blanca, the White Range, which includes over 50 snow-capped peaks reaching 6,000 meters in height (Egg and Benites, 2006).

Demographically, approximately 40% of the total population is indigenous with an estimated total population in 2007 of 27.9 million. In the same year, 53% of the population fell below the national poverty line (The World Bank, 2007). Life expectancy for women and men is 74 years and 69 years, respectively. Nearly 1.3 million inhabitants over the age of 15 are illiterate, most of these women. Child labor is not unheard of as 8 of every 100 children between the ages of 6 and 14 work to provide basic needs for themselves and/or their families (Fundacion Telefonica, Geografia del Peru 2009).
Students are expected to complete 6 years of primary and 5 years of secondary school, after which time they may apply to technical institutes, public state-funded colleges, private colleges or begin working. The drop-out rates in the primary grades was 10.3% in 2008. Spending for public education in the same year comprised 16.39% of government spending. From 2005 to 2007, the labor force with a primary education has increased from 9.20 % to 32.40 % while the labor force with a secondary education has decreased from 54.20 % to 31.80 % in the same time period (The World Bank, 2007).

It is within this context that Mollepata is situated, a town whose very existence is both a time capsule of the results of Spanish colonialism and a potential case study in the making of a dying town whose demise is being perpetuated by access to synthetic chemicals and non-biodegradable products as well as by the far-reaching tendrils of the tourism industry.

Mollepata is the ancestral town of my maternal grandparents via the Tamayo family. I have been visiting Mollepata since I was a small child and have seen first hand changes caused by tourism, the introduction of non organic waste and the consequences of using synthetic chemicals for agriculture. I have several family members that still own homes and orchards in Mollepata. Some of them have commented to me, without prompting, that frogs that were once abundant, to the point of having been used for medicinal purposes as well as for food, have disappeared from the town and that insect pests have become a real problem in the area, causing poor harvests particularly in fruit-bearing trees.

It is the ultimate goal of the author to address these issues by providing a forum through environmental education at the local school level that addresses and perhaps improves the ability of the community to continue its agricultural practices in a manner that is compatible with environmental protection and long-term sustainability. Short-term, the author wishes to assess whether there is evidence in cognitive and affective gains resulting from local environmental education field trips and support for environmental education on the part of local community members.
CHAPTER 4
RESEARCH DESIGN AND METHODOLOGY

Research Design

I chose a community design for this research as I think it addresses the complex array of human interactions with the environment via cognitive and affective processes. This bottom-up approach focuses on local knowledge, attitudes and perceptions to frame broader environmental problems and the context in which they occur. The quantitative and qualitative analyses applied to this cognitive and affective data are described in detail in the methodology below.

Methodology

In consideration of the types of data collected, science content tests, environmental attitudes surveys, journal writings and interview responses and the kinds of analyses I sought to undertake; the need for a framework by which to evaluate the validity and effectiveness of my methods became apparent. How is the data related and what does it mean for this study and in the broader context of the goals of environmental education?

I chose UNESCO’s (1975) Belgrade Charter goals for environmental education, “to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and prevention of new ones (UNESCO, 1975, p.3)” as the framework for this research as they encompasses cognitive and affective considerations. Additionally, I refer to the work of Schultz (2002) and Brody (2005) and their theories of how humans establish relationships with nature to evaluate and analyze my findings.

Science content test results make up the bulk of my quantitative data and assess the study population’s awareness and knowledge of environmental problems and address environmental problems. This portion of the research speaks to the cognitive
Figure 5. Research Framework for Evaluating Quantitative and Qualitative Data

Considerations previously outlined.

Environmental attitudes survey, student journal writings and interview results make up the qualitative data. Items included in the attitudinal survey, journal writings and interviews address and assess the study population’s awareness and knowledge of environmental concepts and problems and the necessary attitudes, motivations and may indicate commitment to work individually and collectively toward solutions of current problems and prevention of new ones. This portion of the research speaks primarily to the affective considerations previously outlined, with some cognitive aspects addressed via journal writings and interview questions.

**Sampling**

Students from the local public school in Mollepata, enrolled in both of the 5th grade and 6th grade classrooms (for a total of four classrooms) participated in the study, with the total number of students participating being 68. One of the 5th grade classes, and one of the 6th grade classes, was randomly selected by blindly choosing a class roster to participate in an environmental field trip related to basic local watershed concepts and local agriculture (experimental group). The remaining 5th and 6th grade classes received
only classroom instruction based on the same watershed and agricultural concepts (control group). A total of 35 and 33 students comprised each group for the field trip and classroom groups, respectively. Students from all classes were granted written permission in their native language to participate by their parent(s) following detailed explanation of the study’s purpose, objectives and risks according to Institutional Review Board (IRB) guidelines. Parents understood that participation was completely voluntary and that there would be no negative consequences should they or their children choose not to participate. Similarly, they were informed that students may or may not gain anything by participating in the study.

The teachers of the four classes participating in the study assisted me with practical considerations such as scheduling, administration of post-tests and arranging meetings with parents. A pre-test (see Appendix A), was administered to each student prior to the field trip or classroom lessons. Each student, in all but one classroom, also responded to two journal prompts written, by me, prior to my teaching the water unit via the expository method or via the field trip model. The first writing prompt read, “Pretend you are a leaf, insect or piece of litter that has fallen into the water on the Salkantay (mountain). Write about your travels in the water.” The second prompt read, “How can we help the environment?” One classroom did not participate in the pre-journal writing activity because they received a surprise visit from a Department of Education official who administered a surprise test to the class on the day they were to complete the pre-journal writing activity, and hence they were not able to participate in this phase of the project. Two days after the instruction of the water unit and field trip for some of the classes, a post-test identical to the pre-test and identical final writing prompts were administered to all participating students. Two sets of journal writings were eventually eliminated from analysis because one class, mentioned above, did not complete a pre-field trip writing in their journal, and in another class the teacher failed to administer the post-writing assignment. Fortunately, one set of each of the field trip and classroom only groups completed the pre and post writing activity and were suitable for analysis.

The experimental group walked to a local non-profit farm to learn about watershed issues such as water contamination, water filtration by the earth and plant and insect relationships by participating in active, hands-on activities in their natural context. Along
the way, the group also stopped to discuss how water flows over the terrain and to look at local snow-capped peaks which provide the area with the majority of its drinking water. Field trip activities were teacher initiated but allowed time for students to explore the environment, ask questions and seek answers. The control group learned the same academic content, using the same content topics, all within the classroom setting using expository delivery and standard classroom teaching practices. Standard classroom practices include teacher led instruction and questioning, and the use of diagrams, pictures and props to illustrate watershed concepts.

Access to students and their parents was gained through the researcher’s maternal cousin, a teacher at the school who had expressed an interest in participating in the study. Permission to interact with the students and teachers was obtained through the appropriate school officials prior to the beginning of the study, as well as from the children’s parents via written consent documents as per Institutional Review Board (IRB) requirements. All consent and assent documents had been previously composed based on IRB protocol, reviewed and approved by the IRB committee prior to use in the field. All subjects’ privacy has been maintained by the absence of names on interview transcripts, and the pre- and post-tests and journal entries. Pre and post tests, journal entries and interview transcripts were coded with a number and letter system to maintain the privacy of each participant. All consent forms are stored in a locked room and no connection between names on consent forms, interviews and other data are apparent. All data is stored similarly and will be destroyed by shredding once all necessary analysis and conclusions have been determined.

Consent to Participate in Study

A signed consent form for student participation was obtained individually from parents through IRB approved, Spanish language forms following a small group meeting in the students’ homeroom classroom class wherein the study’s purpose, procedures and student expectations were explained in the native language, and questions and concerns were addressed. Contact information, possible risks and how the data will be used, stored and subsequently destroyed was also shared with the parents. Similarly, consent forms for parent participation in individual interviews were obtained at this time.
Quantitative Analysis

Quantitative data was collected through Spanish language, identical pre- and post-tests consisting of 14 content based items including multiple choice, short answer and true or false questions (see Appendix A). The test was administered immediately prior to field trip and classroom lessons and then again two days after the lessons were completed. Originally, the plan was to administer the post-tests immediately following the field trip or classroom lessons, but students go home midday to eat at home and do not return until the following morning. The following day was the next logical choice, but upon arriving at the school, I was informed that school had been cancelled that day due to a transportation strike. Since many of the children that participated in the study use public transportation to travel to school from nearby communities, the principal decided to cancel school that day. The post-test was completed the next day, two days after the completion of the pre-test.

These tests were graded in a percentage format (rounded to the nearest whole number to facilitate graphic representation) and analyzed as to the significance, if any, in the mean test scores before and after the field trip, and before and after standard classroom instruction. Only tests with complete pre and post results for each student were included in the analysis. For example, some students were absent for the post test and their pre test was excluded. The Pre/Post tests were scored based upon whether the students provided the correct answers. Scores were then compared for the experimental and control groups by calculating percentage correct and statistical significance using unpaired t-tests. The percentage of field trip and classroom students answering the questions correctly for the pre and post field trip or classroom tests for all 14 items questions is presented in the Results and Discussion section below. Eight of these content related items were then selected for further analysis because they best reflect the core information presented during the watershed lessons, and they relate to one of the global goals of EE “to develop a world population… that has the knowledge…to work individually and collectively toward solutions of current problems and prevention of new ones” (UNESCO, 1975, p.3). These items assess basic watershed concepts as well as knowledge of general and local impacts on the watershed by human action. Without a basic understanding of these
concepts, the broader goals of EE within the context of this research, to change the population’s behavior and perception towards the environment, are unattainable.

The following items from the science content test address the groups’ awareness and knowledge and may indicate ability to solve and prevent environmental problems:

What is the origin of drinking water in Mollepata?
How does nature clean water?
What is a watershed?
What are some negative effects of using chemicals and pesticide products?
True or False. Farmers in Mollepata use synthetic chemicals and pesticides.
True or False. People influence changes in the environment.
True or False. The chemicals used in agriculture end up in the water.
True or False. Garbage and the chemicals used in Mollepata reach the Apurimac River.

Qualitative Analysis

Qualitative data were collected through Spanish language, identical pre and post tests consisting of eight attitudinal items in which students selected “I agree,” “I do not know,” or “I do not agree,” for pro-environment statements such as, “I enjoy spending time in nature (see Appendix A, page 2 of 2).” The analysis of these pro-environment statements consisted of calculating the percentage (rounded to the nearest whole number to facilitate graphic representation) by statement of each group choosing each rating. Students who left one or more statements blank or who chose two ratings for one statement were excluded from the analysis. Further analysis consisted of selecting five of the eight statements that best reflect changes that indicate attainment or approximation of UNESCO’s (1975) environmental education goals namely “to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the… attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and prevention of new ones.” Additionally, these items speak directly to Schultz’s (2002) inclusion with nature which encompasses a person’s understanding of his/her place in nature, the value placed on nature and the consideration of how actions impact the natural environment. Brody’s
and UNESCO’s collective values were assessed through calculating the percent per group of post “I agree” selections for the following statements:

- My actions at home affect Mollepata’s water (place in nature, how actions impact the environment).
- I like to spend time in nature (value placed on nature).
- I am motivated to do good things for the environment (motivated to work for the benefit of the environment).
- It is important that people protect and preserve nature (environmental awareness, values placed on nature).
- I would like to learn more about Mollepata’s water (commitment to increase knowledge).

Additional qualitative student data were also collected by analyzing journal responses taken before and after the field trip or classroom activities. Journal responses consist of written and/or illustrated responses to the following prompts: 1) Pretend you are a leaf, insect or piece of litter that fell into the waters of the Salkantay peak, where would you go and what would you see? 2) How can I help the environment? Student journals before and after the field or classroom experience were analyzed to provide support for findings related to post-test results.

Further qualitative data were collected via semi-formal interviews with students’ parents and teachers either at the school or at their homes. Twenty-one adults were interviewed individually to gather a more complete picture of the students’ performance on cognitive, as well as affective learning, and to provide support or opposition for the research’s long-term goal of providing environmental education services to the local school and/or to the community via an NGO, and to gauge the adults’ perceptions of environmental problems in town. Parents and teachers were interviewed using a pre-designed questionnaire (see Appendix B), with survey style and open-ended questions designed to assess perceived environmental problems within the community, if any, as well as to ascertain if there is a perceived link between increased pests and poor fruit harvest and the use of synthetic chemicals in agriculture. Interviews also assess if parents or teachers would be open to their children receiving environmental education curriculum. They were also asked if they desire or expect their children to stay in
Mollepata after completing secondary schooling as this may affect their perceived need for environmental education at the school level. Only one of the four participating teachers was included in the interview process as she too has students attending the local school. Other teachers were not as enthusiastically involved in the study and hesitated in committing to be interviewed. The other teachers also lived in other communities and not within Mollepata itself.

Basic demographic information was collected as well such as the number of years living in Mollepata, number of children in the school, and the parent’s occupation. Which parents were to be interviewed were selected by drawing 30 students’ names (of those participating in the study) of the possible 68. All interviewees were given the opportunity to participate or decline participation by presenting and reading to them an Institutional Review Board (IRB) approved consent form which includes permission to audio record the interviews. A total of 21 parents and teachers participated in the interviews.

Interview protocol included probing questions (not pre-designed) in response to interviewees’ unforeseen responses. Responses to selected questions were organized by major expected themes (for example, when asked about perceived problems in the town, responses may have been coded as follows: water-related, harvest-related, contamination-related and unexpected themes. Because these interviews are qualitative in nature, the themes noted above may or may not be present according to how interviewees answered the questions. A table of common responses to core environmental perception questions is included to substantiate my conclusions and in an attempt to present the data in a way that is meaningful to the reader.
CHAPTER 5
RESULTS AND ANALYSIS

I begin by presenting the quantitative analysis of all 14 content related items for the pre and post tests, and a bar graph of the eight selected core watershed curriculum items that were designated as the most important learning concepts. This is followed by a discussion of the findings related to this data set. Next, all 14 pro-environment statement ratings are similarly presented in a table that includes all pre and post test responses, and this is followed by a bar graph of post “I agree,” selections for five selected statements for both groups. Further qualitative analysis of pre and post journal responses are presented in narrative form, and themes found in adult interviews are presented as tables, and this is followed by a discussion of these findings. The discussion of each analysis is prefaced by a re-stating of the thesis’s research questions.

Cognitive Data: Pre and Post Test Results

The data presented below in Table 1 and Figure 6, as well as Tables 2 and 3 and Figure 6, will assist in determining relationship related to research question #1. As stated in Chapter 4, Research Design and Methodology, Research Question 1 states “Do short-duration field trips increase elementary school student science-related content retention and positive attitudes towards the environment?”

Table 1 and Figure 5 indicate that based on mean test scores, students attending the field trip retained topic-specific content better than their classroom peers. The field trip attendee group’s average overall score increased from 47% to 70% showing a higher increase than the classroom group in spite of the fact that the classroom group began at an advantage on the quantitative portion of the pre-test scoring an average of 56% vs. the field trip’s group 47% pre-test score. This change, however, is not statistically significant as indicated by unpaired t-test calculations.

The classroom group increased its percentage of correct responses on 9 of the 14
items. The greatest gains were on items related to the direction of water flow, and why objects float in water. The average correct response percentage increased by 40% and 43%, respectively.

<table>
<thead>
<tr>
<th>Content Related Items</th>
<th>FT PRE</th>
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<td>1 Origin of drinking water in Mollepata (MC)</td>
<td>91</td>
<td>89</td>
<td>85</td>
<td>85</td>
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<tr>
<td>2 Origin of water contaminants (MC)</td>
<td>29</td>
<td>71</td>
<td>64</td>
<td>61</td>
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<tr>
<td>3 Direction of water flow (MC)</td>
<td>77</td>
<td>86</td>
<td>24</td>
<td>64</td>
</tr>
<tr>
<td>4 Why objects float in water (MC)</td>
<td>40</td>
<td>54</td>
<td>30</td>
<td>73</td>
</tr>
<tr>
<td>5 Three states of water (MC)</td>
<td>71</td>
<td>89</td>
<td>100</td>
<td>94</td>
</tr>
<tr>
<td>6 How nature cleans water (SA)</td>
<td>6</td>
<td>9</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>7 Three agricultural products in Mollepata (SA)</td>
<td>97</td>
<td>100</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>8 Knowledge of watershed (SA)</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>9 Negative effects of chemical products and fertilizers .(SA)</td>
<td>11</td>
<td>69</td>
<td>33</td>
<td>21</td>
</tr>
<tr>
<td>10 Mollepatan farmers use chemicals and fertilizers .(TF)</td>
<td>29</td>
<td>94</td>
<td>79</td>
<td>85</td>
</tr>
<tr>
<td>11 People influence environmental changes (TF)</td>
<td>46</td>
<td>86</td>
<td>42</td>
<td>55</td>
</tr>
<tr>
<td>12 Chemicals used in agriculture end up in the water.(TF)</td>
<td>57</td>
<td>63</td>
<td>70</td>
<td>76</td>
</tr>
<tr>
<td>13 Insects beneficial to agriculture may be harmed by synthetic chemical products.(TF)</td>
<td>71</td>
<td>83</td>
<td>82</td>
<td>89</td>
</tr>
<tr>
<td>14 Garbage and chemical products used in Mollepata reach the Apurimac River.(TF)</td>
<td>29</td>
<td>71</td>
<td>73</td>
<td>52</td>
</tr>
</tbody>
</table>

AVERAGE TEST SCORES
n=35(Field trip) n=33(Classroom)

<table>
<thead>
<tr>
<th>FT PRE</th>
<th>FT POST</th>
<th>CR PRE</th>
<th>CR POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>70</td>
<td>56</td>
<td>63</td>
</tr>
</tbody>
</table>

Table 1. Percent Correct on Pre and Post Test for Both Groups

FT=Field Trip  CR= Classroom  MC=Multiple Choice  SA=Short Answer  TF=True or False

When analyzing content items individually, the field trip group increased correct responses on 13 of the 14 items. Surprisingly, a decrease of 2% (from 91% to 89%) resulted on the first item which asks where the town’s drinking water originates. This is surprising because we stopped and looked at the snow-capped peak in question, the Salkantay, during our walk to the field trip site (a local organic farm) and discussed specifically that most of the town’s water comes from the glacier. The decrease may have been caused by the students’ excitement to get to the farm, and because of the novelty of the experience itself (A foreign teacher leading an excursion to a new location and
expecting them to stay with the group, listen, and follow directions). Classroom students saw only pictures of the Salkantay, and 85% of these students answered correctly for both the pre and post test, indicating no change in knowledge for this item. Another reason for the lack of change between pre and post test groups on this question may result from the fact that the students were already aware of the fact that the town’s water came from the glacier, hence, there was less room for increasing the level of knowledge on this topic because the students had already committed this information to memory.

Figure 6. Percent of Correct Post Test Student Responses for Core Content Related Items

When examining eight of the content items that were considered integral to the core understanding of the watershed lessons, the field trip group outscored the classroom group in four of the eight items. The content of the items where the field trip group outscored the classroom group included: content on the origin of the town’s drinking water (multiple choice item, MC), the negative effects of chemicals and fertilizers (short answer item, SA), a true or false (TF) item on whether local farmers use chemicals and fertilizers, and another true or false item on whether people influence environmental changes. Regarding the other four items, where the classroom group outscored the field trip group, the question focused on such issues as “how nature cleans water” and “the definition of a watershed.” These two items required short answer responses, which can
be interpreted as being more challenging. The two other questions where the classroom group outscored the field trip group, were true or false questions. One of these statements was “Chemicals used in agriculture end up in the water” and the other was “garbage and chemical used in Mollepata end up in the Apurimac River.” Correct responses to the questions that were answered by providing a written response (short answer) were low, and equal or nearly equal, for each group at 9% (How nature cleans water) and 11% and 12% (Definition of a watershed), for the field trip group versus the classroom group, respectively. Regarding the true/false questions related to chemicals used in agriculture ending up in the water, and garbage ending up in the Apurimac River, the classroom group’s correct responses were 13% higher than the field trip group’s for the chemicals in agriculture item, and 19% lower than the field trip group’s for the garbage and chemical products item. From my experience as a classroom teacher, short answer questions tend to be more challenging for students, but the data may indicates that my methods of teaching these concepts may have been ineffective in both groups. This can be said for the true/false questions as well where the classroom group outscored or scored equally on this style question. Alternatively, the data, where the classroom group outscored or scored equally on these questions, may indicate that students had not yet had time to assimilate this new knowledge into their current schema. This is referred to as disequilibrium in education theory. New concepts must be tied to previously learned and accepted concepts before being accepted as fact or rejected in a person’s schema (Carter, 2008). Perhaps these two concepts were so outside of their accepted schema, that they had not fully understood and accepted it as fact. These two items form an important knowledge base for forming awareness of environmental problems and the understanding of environmental concepts imperative if one is to meet the goals of environmental education within the context of the watershed lessons. In spite of this, the field trip group did outscore the classroom group both when looking at the average correct on all 14 items (70% field trip and 62% classroom) and on the 8 selected items (62% field trip and 49% classroom).

Affective Data: Pre and Post Test Results
The overall results for pro-environment attitudes do not differ greatly between the field trip and classroom groups when all eight pro-environment statements taken are considered. However, when looking at five of the pro-environment statements that were selected for further analysis, subtle differences emerge. The five statements that were further analyzed are:

1) My actions at home affect Mollepata’s water.
2) I like to spend time in nature.
3) I am motivated to do good things for the environment.
4) It is important that people protect and preserve nature, and
5) I would like to learn more about Mollepata’s water.

These particular items were selected because they most accurately reflect the goals of environmental education, as previously mentioned. Broadly, these goals are to produce a population that is aware and concerned about the environment, that is motivated or committed to work for the well-being of the environment, and that is educated or skilled (UNESCO, 1975). Table 2 depicts the pre and post field trip group’s results for all eight pro environmental statements that they were asked to respond to regarding whether they agree, do not agree, or do not know about the statements. Table 3 presents similar data, but for the classroom group. Figure 7, below, presents the “I agree” percentages for post test ratings for five selected pro-environment statements for both the field trip and classroom groups.

Pro-environment or “I agree” ratings were more frequently chosen by the field trip group consistently for all survey items, with the largest difference belonging to the “I think I could be a scientist,” statement, where 44% more field trip students than classroom students chose “I agree.” This may be indicative of a trend uncovered in Knapp and Barrie’s (2001) research which cites positive field trip experiences as being a common factor reported by persons who chose scientific careers as adults. This wide gap was also seen in the “I would like to be a farmer” statement where 35% more field trip students, than classroom students agreed with that statement. It is interesting to note this increased desire to become a farmer in the field trip group, and the general lack of desire indicated in the parents’ interviews for their children to stay in Mollepata and become farmers.
Most interviewees claimed that they would like their children to, “be better than them” which implies that they desire their children to seek other occupations besides becoming a farmer. In other words, parents would like to see their children become better than a farmer as it is a “hard life.” All adults interviewed are farmers or were raised by farmers. The reality is that most of these students will remain in Mollepata after secondary education because they will not be able to afford to continue their academic education.

Interestingly, though both groups began the pre test with a high percentage of “I
agree,” answers to “I like to spend time in nature:” the classroom group actually decreased by 7% while the field trip group increased by 4%, indicating that the field trip experience was likely slightly more positive than the classroom lessons and that, at least the classroom group, did not make the connection between the topics we covered (water, watershed, agriculture) and nature. Perhaps students don’t consider a farm as being part of nature because it is manipulated by humans and because they’re around them so much of the time. The same may be true for the adults interviewed later who cite environmental problems related to water and agricultural problems related to water, without connecting the two. Results may have also been affected by the fact that I am a family member of one of the participating teachers and students’ subsequent desire to please me. Additionally, some students had the opportunity to casually interact with me on the days prior to the lessons as I was near the town square and as I explored the area on my own.

Analysis of Pre and Post Journal Data

Pre and Post student journals for two of the four classrooms participating were analyzed for changes in their pre and post experience writing. I focused primarily on the inclusion of basic watershed concepts for their pre-activity writing. I expected to see local watershed features such as springs, rivers and the local water reservoir and some mention of contamination such as litter. For post-experience writings, I expected to see an
increase in specific local watershed features, inclusion of distant watershed features such as cities or the ocean, and pro-environment attitudes. Presumably field trip groups will demonstrate a deeper understanding of the local watershed and that water that originates from the Salkantay may eventually end up in other distant watersheds and in the ocean by including more of the expected post-test features in their writings. Only the first journal prompt: “Pretend you are a leaf, insect or piece of litter that has fallen into the waters of the Salkantay. Where will you travel?” was included in this analysis. For unknown reasons, a large number of responses for the second prompt: “How can I help the environment?” were either incomplete or missing altogether. In all, 16 post-writings for the field trip group and 17 from the classroom group were analyzed for the above-mentioned themes for the watershed prompt.

Student 5A-8 of the field trip group writes:

“...chemical products damage everything. When they throw it in the water, it evaporates to the sky. It goes up into the sky, rains and it makes us sick.
One day my aunt threw garbage into the water and my mother said, ‘Take care of the environment.’ My aunt picked up the garbage and threw it into the trash can.
Water is very important to me because I drink it and everyone does too.”

Her writing exemplifies the concepts and ideas that all students would ideally gain as a result of the field trip to the local farm. Earlier in her writing, she also exhibits basic watershed concepts as she traces her leaf’s downhill flow through various nearby towns and later to Mollepata’s reservoir. She goes on to mention that the reservoir is “disgusting,” but she is hopeful even as she sees children playing in garbage as, in her travels to the nearby community of Chuiuroconca, she sees a family picking up litter from the street. Not only does she seem to understand the potential of water from one community to reach other nearby communities, but she has taken a pro-environmental attitude in her tale of advocacy and hope. Her pre-field trip writing only included watershed concepts so somewhere between then and two days following the field trip, she began to develop a consciousness of stewardship and the effects of chemical products on our water cycle which were not present before.
Student 5A-14 began to develop a basic watershed concept in her post-writing and after her litter’s travels to the city of Cusco, approximately 2 hours away, expresses a pro-environment attitude when she writes:

“…also I would like to say that I like the environment.”

When examined as a whole group, the field trip students who totaled 16 for this analysis, demonstrated growth of watershed concepts through 9 students’ writings. Six of the remaining 7 began with a basic concept of their local watershed and some even included the sea in their writing and did not show any further growth.

Compare the field trip groups’ post-writings to the classroom and the results are almost identical: 10 of the 17 demonstrated growth by including additional local and general watershed features and the remaining 7 showed no change in their watershed concepts. The only major difference is that the classroom group included no pro-environment statements about liking nature or picking up litter though among the students that showed no growth, two included mention of water contamination.

When I taught the classroom watershed lessons, I used props and real-world objects and pictures of local watershed features such as the Salkantay to illustrate the flow of water in the local watershed and when discussing the use of chemical products on agricultural crops. Students were engaged and on-task. They were excited to do buoyancy experiments with classmates. Additionally, they were able to spend more focused, organized time with me than the group on the field trip. Though the field trip group technically did spend more time with me and out in nature, they had to be more strictly controlled than the classroom group for safety and to deliver the lessons intended.

This may have caused the classroom group to retain the cognitive watershed information just as well as the field trip group while the field trip students showed growth in pro-environment attitudes as a result of their novel, active experience out of the classroom. Results may have also been affected by the fact that I am a family member of one of the participating teachers and students’ subsequent desire to please me. Additionally, some students had the opportunity to casually interact with me on the days prior to the lessons as I was near the town square and as I explored the area on my own.
Analysis of Adult Interviews Data

The data presented below in Table 4 will assist in determining relationships related to research question #2. As stated in Chapter 4, Research Design and Methodology, Research Question 2 states, “Do parents and teachers in the community recognize any environmental threats and/or consequences of watershed contamination?”

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Answer</th>
<th>Frequency</th>
<th>Extended Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there environmental problems?</td>
<td>Yes</td>
<td>16</td>
<td>Water-related Privatization</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Harvest-related</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Burns</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Contamination</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>How is the water quality?</td>
<td>Very good</td>
<td>5</td>
<td>A lot comes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>It’s chlorinated.</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular</td>
<td>3</td>
<td>Not salty</td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very Bad</td>
<td>1</td>
<td>Insects and worms</td>
</tr>
<tr>
<td>Why are there no frogs in Mollepata?</td>
<td>Rats ate them.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insecticides/Fumigation</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No answer</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Car emissions</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Snakes</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mistreating environment</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water scarcity</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Climate Change</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burning of forests</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Too much sun</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Are there agricultural problems?</td>
<td>Yes</td>
<td>15</td>
<td>Insects or illness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemicals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rain</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Too much sun</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Small crops/Low yield</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hail</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Interview Responses for Selected Interview Questions (n=21)  Unexpected items italicized

Interview responses were analyzed to answer the research questions regarding environmental perceptions and the group’s willingness to accept environmental education.
from an outside group or agency. Responses to additional interview questions are included in Appendix C.

Table 4 demonstrates that 16 adults interviewed (76%) recognize some type of environmental problem in Mollepata. In general, it appears that adults are aware that problems exist with water, harvests, burns and contamination. Ten of the 21 interviewed (48%) perceive some sort of water-related problem. Water-related terms mentioned in response regarding environmental problems include reabsorption of dirty water, septic tanks, springs, snow-capped peaks, rain, canal, drainage, drought and hail. Interviewee 17 demonstrated the most comprehensive understanding or at least consideration of environmental problems in Mollepata. He states:

“Nowadays, we’re seeing, we’re living it, so many things, since I was a boy, growing up here....There were springs all over the place and...the water flowed...Now there’s not even a drop of water. It’s dry. Imagine, for example, you could go all around this town and it was surrounded by snow-capped peaks. It looked all white. Now, you aren’t going to see that...The Salkantay is going down too. Salkantay was covered in snow. It was pretty. And it always had a cloud over it but now you can see it clearly and I think, I imagine, that the contamination, since plastics appeared, disposable bottles...I think all of that, according to my conversations with other people or that come from other countries...According to what that man commented to me...Can you believe this? He says that a disposable bottle...melts one square meter a day...When you throw the disposable bottle, with the reflection of the sun’s rays...It heats up quickly and it melts more rapidly.”

He goes on to recount how, in his youth, farmers knew exactly when to plant almost to the day in expectation of rain. Now, the rain is sporadic or may not come at all or, perhaps, too much will come and drown out the crops. In his discussion, he mentions that the newer aluminum roofs are also contributing to the snow caps melting, that privatization of water may be a reality soon and expresses what I would label as an animal rights ethic against hunting. As an aside, this interviewee transports tourists and has the opportunity to interact with many non-Peruvian travelers so his perspective may
have been expanded due to his interactions with varied ideologies regarding the environment.

I expected to hear water, harvest terminology most frequently, but was surprised by the mention of water privatization by 3 people. It appears that the government is considering privatizing the local community’s water resources, which include thermal springs and rivers, to turn a profit from these resources. The community’s dependence on melting snow is substantial and during the dry, winter months (during which the interviews occurred) water is often scarce in high altitude Andean communities. Interviewees mentioning privatization were appalled by the thought of having to pay for water that already belongs to them.

The next two most mentioned expected environmental problems were problems with plastic and garbage contamination (29%) and harvest problems (10%). Other terms discussed by interviewees included reference to the need for government action, illness among farm workers, climate change, hunting, the disappearance of wildlife, population increase and poor soil for crop production. Sixteen interviewees contributed at least one term when posed with this particular question though 3 interviewees needed examples of the term environment prior to answering. Five interviewees answered no to this question. This may have been more of a problem with defining “environment” or of a language barrier, as many speak Quechua as a first language and learn Spanish in school, than with the perception of environmental problems. For example, one woman interviewed asked, “Environmental means what?” After I explained by using terms such as water, land, forests, she offered that there are problems because water often arrives dirty to the home and people don’t know how to take care of things because there’s garbage all over.

Water quality is perceived by (57%) as “Very good” or “Good” because of its abundance, freshness and because it is chlorinated. For those answering “Bad” or Very bad, ” or “Regular (not good or bad),” the reasons given included worms or insects sometimes found in the water, finding dead animals in the town’s reservoir and that water is not chlorinated sufficiently or consistently. No mention of contamination by agricultural chemicals or fertilizers was recorded for 20 of those interviewed though 5 of them did, in a later question, cite having to use these chemicals as an “agricultural” problem. One woman answered that there were environmental problems with the
agricultural products because they do not produce. According to her, the terrain is poor and no longer yields crops.

Having to use chemicals such as fertilizer and insecticides in agriculture was cited as a problem because crops did not produce unless these were used. Interviewees also answered that non-beneficial insect pests and plant-borne illnesses as affecting crop yield to be problems. These, however, along with too much rain, drought and too much sun, were not mentioned as “environmental” problems but belonged strictly to the realm of agriculture.

Another question used to indicate perception of environmental problems in town referred to the frequency with which the interviewee sees frogs or toads. All interviewees agreed that they had not seen any of these animals since childhood (most interviewees were in their 30s or early 40s) and that they seldom heard their calls in the evenings or after rains. When asked for reasons for the amphibians’ disappearance, answers varied from someone telling them that rats had invaded the town and eaten them to the more plausible ideas that they had been killed by the use of insecticides and that they either ingested poisoned insects or were directly killed by these chemicals. The relatively recent increase of car emissions was also a suspected culprit in the animals’ avoiding Mollepata as were snakes, mistreatment of the environment, water scarcity, climate change, burning of forests and too much sun. Each of these terms was stated once, sometimes by the same interviewee. I was especially surprised to hear the terms “climate change” and “mistreatment of the environment” although this rural population does have internet access and frequent contact with foreigners which may account for their varied responses.

The discussion below illuminates the relationships associated with research question #. As stated in Chapter 4, Research Design and Methodology, Research Question 3 states, “Are parents and teachers likely to support efforts to increase environmental awareness in their children via outside sources working with the school?”

All interviewees, except for one, claimed openness to accepting an outside environmental education organization both at the school and community level though I suspect his answer was more a reaction to having outsiders providing services than an actual objection to increasing environmental education in the town. It may also have been a language problem as his wife had to interject translations to him in Quechua during the
interview. They all agreed that education in general is “very important” because it will open up new possibilities to their children such as leaving Mollepata to pursue a career and having easier lives than they have had. The desire for children to not “end up like” their parents and “be better than us” though geared more towards them leaving the town to pursue a profession or higher education, can broadly be interpreted as parents wanting more opportunities for their children, period. Environmental education, if successfully implemented, has the potential to solve many of the environmental and agricultural problems cited by interviewees, to create jobs in the pursuit of this and to make farming a more viable and valued career choice.

Discussion

After the field trip and classroom lessons were completed, I fully expected, contrary to my original hypothesis, for students in the classroom setting to have a greater increase in their cognitive gains because they were, by and large, engaged and interacting with me and discussing the content. Some native plant props were brought in for them to handle (kiwicha, tara, water, soil) but yet no better retention was observed. While it may have been expected that the novelty of my teaching the lessons rather than their classroom teachers may have proved to be a “key experience,” the results do not indicate such growth. Therefore, I reject this notion, though my presence as a newcomer from another country may have been enough of a distraction to cause poor cognitive gains. However, this is not the impression I had while teaching the lessons. I recall one student in particular being wildly enthusiastic about the concepts we were discussing and about becoming a scientist in particular.

In light of the existing body of literature on the effects of out-of-school experiences on cognitive and affective learning, I expected that the experimental group participating in the environmental education field trip would outperform its control group peers by scoring higher on related science content items on the pre and post test and by demonstrating marked positive environmental attitudes and feelings as indicated through pre and post test quantitative and qualitative items, respectively. Furthermore, it was expected that, being a rural community whose economic base is highly dependent on agriculture; parents will have perceived the relatively recent negative environmental
consequences in connection to changes in agricultural practices. Additionally, I expected that they would look favorably on providing environmental education opportunities to their school age children as a means to remedy the negative effects and to return to traditional or at least sustainable agricultural methods.

Examining all of the selected data in the broader context of my original research questions, it appears that insignificant cognitive gains occurred, contrary to what was expected in the field trip group over the classroom group when analyzing the 8 core content items. Similarly, when looking at the qualitative items assessing pro environment attitudes, there was virtually no difference between the groups. Students were prompted to choose “I agree; I don’t know or I don’t agree,” to each of the statements. Both groups responded almost identically with a general decrease in “I agree” responses to desirable pro environment attitudes such as “I am motivated to do good things for the environment.” Many of the post-test decreases in “I agree,” responses were allocated to “I don’t know,” in both groups. Possible explanations for the lack of affective gains in both groups may be attributed to the short-duration of the experiences (both only a few hours) as well as to classroom teachers’ lack of involvement in the instruction and management of the groups.

Lack of positive affective changes may be attributed to the need for positive and repeated interactions with nature for identification to take place (Schultz, 2002 p.68). Even though the single most cited reason for persons who chose science careers was a field trip experience in one study (Knapp and Barrie, 2001), one day does not build a relationship with the environment. Also, the structure and organization of the field trip are important considerations (McLoughlin, 2004). I found it difficult to keep students from running ahead and to keep them from distractions even though we had discussed expectations prior to taking the trip. Admittedly portions of the field trip took on more of an expository style pedagogy as the farm technician worked to explain some basic concepts to the students as they did not normally host student groups. Teachers did not attempt to help in this regard until well into the field trip at the farm and hung back in the group. The novelty of the experience, as students are able to enjoy only one field trip a year may have been enough to cause the behavior I observed; though I suspect that this was due to a combination of their general independence in the natural setting (walking to
school a great distance on their own, running errands for the family) and the loose organization and discipline observed in some of the classrooms. Additionally, the lack of affective gains could also indicate that the experience was not a generally positive one though students continued to claim that they enjoyed time in nature on post test qualitative items. However, this may be an indication that their ideas about what nature is are not comparable to the places we visited or passed along the way.

This is reminiscent of some of the interviews in which the term “environment” had to be defined to interviewees. All but 3 participating students indicated in the pre test that they enjoy spending time in nature so one would assume that a relationship had already been established. However, if an outsider, such as myself, steps into this relationship and attempts to control their behavior while they are interacting with nature, this may have been enough to turn some of the students (namely the boys who were the majority of the ones running ahead and becoming distracted) off to new information. I recall one of the most instrumental and helpful teachers mentioning that field trips are largely frowned upon because most teachers agree that it is a waste of time due to students’ inattention and the lack of structure.

Perhaps the fact that field trips have been disorganized and unstructured in the past, with little expectation of academic gains on the part of students, lead the students to regard this experience as a day off rather than a learning opportunity regardless of the discussed expectations. The novelty of the experience, despite the aforementioned teacher’s enthusiasm and passion in discussing watershed topics while at the farm, may have played a much greater role than previously expected. Additionally, students tend to recall information more readily the more unique an experience (Nundy, 1999). Perhaps the field trip itself was not such a unique experience since students in this rural community have daily and nearly unlimited opportunities to walk, explore and connect with nature.

Future Considerations

Further work using the instruments or content developed here should consider using one standard format for all cognitive testing (for example, all multiple choice items) so as to make no one item more challenging to answer than another. Additionally, teaching the
field trip group the same classroom lessons and then following it up with the field trip while the classroom group gets follow-up classroom lessons would more accurately measure cognitive gains and better compensate for some of the distractions encountered during the field trip. Researching differences between girls’ and boys’ cognitive and affective performance may illuminate the teaching style most favoring gains within each group. Repeated experiences to field trip locations to include a day to explore and prepare with few teacher-lead activities may counter-act the negative effects of novel situations in which students are more concerned with exploration than content learning. A follow-up day in the classroom and then a second field trip to establish expectations and purpose for subsequent visits is also good practice.

Future research in the effects of field trips should examine the role of a novel instructor’s versus the regular classroom teacher’s impact on cognitive and affective outcomes. Long-term cognitive and affective effects of this short-duration study would further offer an interesting and necessary facet to the current available research. Similarly, linking parents’ interview responses to student cognitive and affective data may assist in differentiating the influence of experiential school-based experiences on cognitive and affective gains versus the influence of parental knowledge and attitudes.

Given more time and financial resources, I would have interviewed more parents and other sectors of the community to get a better understanding of their collective environmental consciousness, taken students on a pre-field trip visit, taught the same lessons to both groups within the classroom setting as well as provided follow-up lessons on basic watershed and agricultural concepts. Additionally, I would have spent more time with students in the classroom and outdoor settings in an attempt to decrease any biases in results due to a novel teacher or of being related to one of the teachers. I believe that providing repeated experiences over a longer period of time would also lead to greater gains in cognitive and affective learning.
CHAPTER 6
CONCLUSIONS

Schultz’s (2002) work on inclusion with nature comes to mind when drawing broad
conclusions on the interconnectedness of the data collected. To repeat, commitment
cannot occur in the absence of caring. Caring cannot occur in the absence of
connectedness. Commitment cannot occur in the absence of caring and connectedness
(p.70). This is how the quantitative and qualitative data in this research complement and
support each other. When a researcher uses only quantitative data to assess the
effectiveness of an environmental experience, she neglects the complex array of affective
(value placed on nature, caring for nature, one’s place in nature, motivation to act to
benefit nature) and intellectual (awareness of environmental problems, skills and
knowledge to address and prevent problems, commitment to act to benefit nature)
considerations that make a person a whole human being. Humans form relationships with
each other similarly to how we form them with nature. We consider our feelings, our
thoughts and our actions as natural parts of our interpersonal relationships as well as
when considering the strengths and viability of a relationship. Why should it be any
different when our relationship with nature is in question?

I conclude that the quantitative and qualitative components of my data do successfully
encompass the diversity of human interactions and address UNESCO’s goals of
environmental education though I would include uniform test items in future tests. For
example, use all multiple choice or all true or false, for ease of comparing answers to like
answers. Specifically, items in the pre and post science content tests as well as the
journals, address skills and knowledge necessary for a basic understanding of Mollepata’s
local watershed and agricultural problems. That result were not as dramatic for the field
trip group when compared to the classroom group may indicate that, indeed, for true and
meaningful environmental education to occur through positive cognitive and affective
growth, a relationship with nature must be established over repeated positive experiences
over an extended period of time (Brody, 2005). Like any relationship, identification with
and concern for nature must be nurtured and encouraged through the mind AND heart if
we are to expect a population that is aware, committed and active in the solving of
current as well as future environmental problems. Without nurturing the feeling, caring
aspect of nature relationships, which is at the core of environmental education; and without taking a serious look at the governing and pedagogical constructs that breed conformity, we deny human beings the power to make meaningful changes in their world and to deny them the ability to engage in creative, innovative problem-solving (Freire, 1993) to equitably share and care for the Earth’s resources.

This research adds to the growing body of knowledge regarding experiential learning via environmental education field trips. Although cognitive test results do not show a statistically significant difference between field trip and classroom groups, the data does demonstrate that some growth occurred in the field trip group over the classroom group both in cognitive and affective terms. One may reasonably conclude that this research supports the notion that students who are exposed to active, authentic and novel experiences on a more frequent basis and over longer time periods, may demonstrate increased cognitive and affective gains. This, in my opinion, may also reasonably support the practice of increasing the frequency and quality of field trip experiences available to elementary aged students.

Additionally, this research explores a seldom-studied rural, Andean population in the context of experiential learning and environmental perceptions. I believe communities such as the one in Mollepata are important research centers as these are the communities that feed growing city populations. Without the long-term protection of water and agricultural resources of this and other similar communities, we will lose essential natural processes such as water purification and melt-water from snow-capped peaks, resources for both sustenance and enjoyment and the rich cultural traditions that sustain them. Results from this population may be reasonably applied to other populations, as the expository pedagogical style discussed in this work, is common in Latin and North America, as are severely limited field trip experiences in formal education settings.

The research questions answered through this research are:

1. Do short-duration field trips increase elementary school student science-related content retention and positive attitudes towards the environment?

Research question #1 was successfully answered through pre and post science content tests to quantitatively measure cognitive gains; and pre and post environmental attitude
surveys and student journal writings to quantitatively and qualitatively measure affective gains for both groups. Content retention did increase for the field trip group over the classroom group on post test measures though statistically this difference does not constitute a significant change. Greater positive affective changes towards the environment are also documented for post pro-environment statement ratings for the field trip group.

2. Do parents and teachers in the community recognize potential environmental threats and consequences of watershed contamination?

Research question #2 was successfully answered through quantitative and qualitative analysis of structured, open-ended one-on-one interviews with a small group of parents whose students attended I.E. David Samoza Ocampo elementary school in Mollepata. Subjects were interviewed on demographic, social, educational and environmental topics to assess their perception of environmental problems within the community and specifically to assess the consequences of watershed contamination. From this research, it is reasonable to conclude that those interviewed recognize a variety of environmental problems in Mollepata and that they do not recognize the consequences of watershed contamination. Eleven of the 21 adults interviewed cited water-related terms when asking about environmental problems in town. The remaining interviewees cited trash or plastic contamination (6 of 21); the burning of forests, garbage and the resulting smoke (3 of 21) and harvest-related problems (2 of 21). However, none related any of these terms to broader watershed contamination issues nor demonstrated an understanding of basic watershed principles in their discussions.

Similarly, when asked about the disappearance of frogs and toads in Mollepata, many varied, plausible and somewhat implausible reasons were offered though only one considered the scarcity of water. The use of chemicals such as fertilizers and insecticides were repeated by several but no indication as to broader implications of these chemicals’ usage or of the amphibians’ disappearance were offered.

3. Are parents and teachers likely to support efforts to increase environmental awareness in their children via outside sources working with the school?

Research question #3 was successfully answered through quantitative and qualitative analysis of structured, open-ended one-on-one interviews with a small group of parents
whose students attended I.E. David Samoza Ocampo elementary school in Mollepata. All but one interviewee claimed to welcome environmental education via an outside group for both school children and the community in general. Additionally, all interviewed regarded education as “very important” or “important” in the lives of their children. Mollepata has had a history of receiving training and assistance from private as well as government sponsored programs and it is my belief that they would welcome any opportunity that may result in increased employment and/or opportunities for their children based on their interview responses.

The overall objectives met by this research are:

1. To determine if students participating in an out-of-school environmental education field trip score better on cognitive content-related items and have a positive change in attitude towards the environment over their peers receiving only standard classroom curriculum;
2. To determine if parents and teachers of the students in the study perceive any environmental problems with regard to watershed issues and if they would look favorably on increased environmental education opportunities for their children via local community excursions;
3. To determine if parents and teachers would also welcome an outside group (for example, a non-governmental organization) providing the above mentioned educational experiences to their children.

When comparing the interview responses to UNESCO’s goals of environmental education, a need for further education, related skills, and awareness was apparent. While interviewees all mentioned some type of environmental problem, the vocabulary of environmental education does not yet commonly exist in the sample interviewed. For example, when asking about environmental problems in Mollepata, three interviewees did not know what I meant by “environment” and were only able to come up with a problem after being prompted with words such as “natural resources, water, soil, air.” However, once I used these terms, they were able to discuss specific water, harvest and contamination related topics.
It is reasonable to conclude that students in a rural Andean, environment may benefit from a combination of classroom and field trip experiences over an extended period of time to provide opportunities for students to explore independently and to identify with nature before measuring cognitive or affective gains. Adults in the community would similarly benefit from repeated experiences perhaps alongside their children to develop the knowledge and ethics previously mentioned by UNESCO (1975). Addressing cognitive and affective growth will collectively contribute to developing a world population that is aware and concerned for the environment and that has the knowledge, skills, attitudes, motivation and commitment to work towards solving and preventing environmental problems.
References


Fuchsloch, Maria Elena (2005) Resena Historica de Mollepata. Via email communication.


Instituto Nacional de Estadística e Informática. *Perfil sociodemográfico del Perú*. 54


Tamayo, Dario (2005) Via telephone communication.

Tamayo, Roxana (2009) Via email communication.


World Climate www.worldclimate.com
Appendices
Appendix A: Pre and Post Test

Group_________                               Date________________

1. Where does most of the drinking water in Mollepata come from?
   a. Rain               b. Snow capped peaks    c. Beneath the earth

2. Water pollutants may be:
   a. Natural             b. Human-made              c. Both

3. Water flows:
   a. From a lower to a higher elevation   b. from a higher to lower elevation

4. Things float in water depending on:
   a. Their weight.      b. Because they have air inside. c. what they are made of.

5. Water exists in three states. They are:
   a. solid, liquid, gas   b. ice, water, steam cold     c. cold, warm, hot

6. How does nature clean water?

7. List 3 Mollepata agricultural products.

8. What is a watershed? Do you live in one?

9. What are some negative effects of using chemicals and pesticide products?

10. Farmers in Mollepata use synthetic chemicals and pesticides. True or False

11. People influence changes in the environment. True or False

12. The chemicals used in agriculture end up in the water.
    True or False

13. The insects that benefit agriculture may be damaged with the use of synthetic chemicals.

14. Garbage and the chemicals used in Mollepata reach the Apurimac River.
    True or False
Appendix A: (Continued)

<table>
<thead>
<tr>
<th>Put an X in the box that most closely expresses your opinion.</th>
<th>I agree.</th>
<th>I do not know.</th>
<th>I do not agree.</th>
</tr>
</thead>
<tbody>
<tr>
<td>My actions at home affect Mollepata’s water.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like to spend time in nature.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think that I could be a scientist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like science.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am motivated to do good things for the environment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is important that people protect and preserve nature.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to be a farmer.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to learn more about Mollepata’s water.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Appendix B: Interview Questions for Parents and Teachers

(All questions were read to participants and recorded on cassette following Consent to Participate.):

1. HIST Where were you born?
2. HIST How long have you lived in Mollepata?
3. DEM What do you do for a living?
4. HIST What did your parents do for a living?
5. ENV Are there any environmental problems in Mollepata? If so, what are they?
6. ENV How is the water quality in town? Very Good, Good, Bad, Very Bad
7. ENV How important are trees and plants in Mollepata? Very Important, Important, Somewhat Important, Not Important
8. ENV How often do you see frogs in the community? Once per year, Once per month, Once per week, Daily, Never
9. AG What products are farmed here? Which ones are native to this region?
10. AG Are there any problems with crops/agriculture? What are they?
11. DEM How many of your children go to I.E. David Samoza Ocampo? Their ages?
12. EDU What do you see as the most important thing in your child’s education? How important is your child’s education to you? Very Important, Important, Somewhat Important, Not Important Why?
13. SOC Would you like your child to stay in Mollepata into adulthood? Why or why not?
14. SOC Are there any social services needed in Mollepata? What are they?
15. SOC Are you a member of any organizations in town? Is so what are they? What kind of organization is it?
16. EDU How important is it to you that environmental education be offered at the school? Very Important, Important, Somewhat Important, Not Important Why?
17. EDU How important is it to you that environmental education be offered to the community? Very Important, Important, Somewhat Important, Not Important Why?
18. EDU Would you be open to an outside organization providing environmental programs at the school? In the community?
19. OPEN Is there anything else you would like to talk about or that you’d like to share with me about the community, agriculture or the school?

HIST= HISTORY  DEM= DEMOGRAPHIC
ENV= ENVIRONMENT  AG= AGRICULTURE
EDU= EDUCATION  SOC= SOCIAL
## Appendix C: Interview Responses for Selected Questions

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Answer</th>
<th>Total Responses</th>
<th>Terms Used by Interviewee</th>
<th>Total Times Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Are there environmental problems?</td>
<td>Yes</td>
<td>16</td>
<td>Water (rain, canal, drainage, drought, hail, snow peaks)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Harvest (products, crops)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Burns (forest, garbage, smoke)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>5</td>
<td>Contamination (trash, plastic)</td>
<td>5</td>
</tr>
<tr>
<td>6. How is the water quality?</td>
<td>Very good</td>
<td>5</td>
<td>A lot comes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>It’s chlorinated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>It’s fresh.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very Bad</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Why are trees important?</td>
<td>Money</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Food</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shade</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Fire</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medicinal</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Furniture &amp; Homes</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oxygen</td>
<td>5</td>
<td>“Lungs of the Planet”</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix C: (Continued)

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Answer</th>
<th>Total Responses</th>
<th>Terms Used by Interviewee</th>
<th>Total Times Used</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8. Why are there no frogs here?</strong></td>
<td>Rats</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemicals</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NoAnswer</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Car emissions</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Snakes</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mistreating environment</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water scarcity</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Climate Change</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burning forests</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Too much sun</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>9. Are there agricultural problems?</strong></td>
<td>Yes</td>
<td>Insects or illness</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemicals (fertilizer, insecticide)</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Too much rain</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Too much sun</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of rain</td>
<td>7</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Small crops, Low yield</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hail</td>
<td>1</td>
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Appendix C: (Continued)

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Answer</th>
<th>Total Responses</th>
<th>Terms Used by Interviewee</th>
<th>Total Times Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. How important is your child’s education?</td>
<td>Very Important</td>
<td>14</td>
<td>To find work or be a professional</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Important</td>
<td>7</td>
<td>Don’t want them to “end up like us.” They should be “better than us.”</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Somewhat Important</td>
<td>0</td>
<td>“Not be a farmer.”</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Not Important</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. What else you’d like to share with me about the community, school or agriculture?</td>
<td>Need for Education</td>
<td>10</td>
<td>Environmental</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Agricultural</td>
<td>2</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Adult</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Values</td>
<td>1</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Sex</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Special Needs</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Need Jobs</td>
<td>3</td>
<td>Tourism</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No answer</td>
<td>8</td>
<td>Women</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix D: Additional Photographs of Study Area

View of Mollepata’s Town Square

Typical Street View
Appendix D: (Continued)

Panoramic View from Neighborhood Street

Local Elementary School’s Main Entrance
Appendix D: (Continued)

View from Aprodes Farm Visited by Students

Student’s Depiction of Local Watershed from Journal Writing