More Than a Feeling: Technology-Infused Learning Environments to Support the Development of Empathy

by

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ABSTRACT

This dissertation explores how technology-infused learning environments can be designed to support the development of empathy for others, and contains contributions across the theoretical, design, and empirical dimensions. From a theoretical perspective, *Empathy Development Environments* have been defined as technology-infused learning environments to support the cultivation of empathy. I have also developed a framework called Trajectories of Awareness that can be used as a guide for structuring activities to cultivate empathy through the simultaneous exploration of emotion and identity within a learning environment. This exploration takes place by first focusing on self and eventually moving into an understanding of others. From the design aspect, a model Empathy Development Environment called *Beyond the Looking* has been created in order to operationalize the conceptual foundations. Further, a platform called *Affect as Index* has been envisioned and implemented for supporting conversations around emotion that were previously intangible. Empirically, three iterations of a design-based research study have been carried out as a means to flesh out a set of guidelines for the implementation of Empathy Development Environments. For each of the three iterations, challenges to the implementation were utilized to refine the design of the model environment to progress to the next iteration. These three iterations are analyzed based on a framework proposed for the design and analysis of Empathy Development Environments. Analysis revealed that the environment supported participants in establishing a community that allowed them to practice the skills of empathy.

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Biographical Note

Shaundra's doctoral work with the Affective Computing group involved designing and implementing technology-infused collaborative learning environments that provide people an authentic opportunity to learn about themselves, others, and to gain insight into interpersonal dynamics. Upon arrival at the Media Lab in 2003, Shaundra combined the ideas of constructionist learning and affective computing to create a new system to address the emotional needs of teenaged girls. She designed and implemented an innovative new technology that brought together state-of-the art common-sense machine learning with theories of human learning and constructionism. While building this system, she collaborated with the Future of Learning Group on "The City that We Want" project in which learners build computational models for how they would like to improve their communities. Shaundra also collaborated on RoBallet, which bridged dance and robotics, and created the INNER-active Journal, a digital journal collecting physiological data for future reflection.

Prior to Shaundra's work at MIT, she received a B.S. and M.S. in Electrical Engineering from the Florida Agricultural and Mechanical University - Florida State University College of Engineering. There, she worked on developing algorithms in Matlab for predicting the possibility of student success in entry-level electrical engineering courses. She also designed curriculum for and facilitated Technical OutReach Community Help (T.O.R.C.H.), a program of the National Society of Black Engineers geared toward closing the digital divide. Shaundra has been profiled in the American Association for Advancement in Science website profiling African American Scientists; Engineer Your Life, geared towards encouraging young women to pursue engineering careers; and WGBH's Science City. Trinity Broadcasting Network, Science Update Radio Program, and National Public Radio have also recognized her work.

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Jametta White, circa 1991 ☺. You've been there for me for a long, long time. Even if you didn't know what I was doing, you've always been the cheerleader I needed. I appreciate your patience and love you for being a friend. To Wanda Eugene. From Katie kaboom and pants that were square, to Skype chats that were too far and too few between. Thank you for the sanity checks. Thank you for the venting sessions. Thank you for always being willing to be a sounding board, and challenging me to do and be better.

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Contents

List of Tables

List of Figures

CHAPTER 1. INTRODUCTION

"Many people see the current group of college students -- sometimes called 'Generation Me' -- as one of the most self-centered, narcissistic, competitive, confident and individualistic in recent history." – 2010 Sara Konrath, University of Michigan

1.1 Personal Motivation

As many doctoral candidates have discovered, our passions do not always align with our research. When I entered the PhD program at the Media Lab in 2005, I had two dominant, and seemingly competing, interests. The first, my main research interest, was designing and implementing technology-based learning environments for supporting people in better understanding themselves and others, especially on an emotional level. The second, what I initially thought could only be a side passion, was participating in programs geared toward increasing the numbers of women and minorities in science and engineering. I believed that supporting these types of programs could lead to situations where members of diverse groups could learn to live and work together to solve problems by being placed into situations where they had to do so.

For the latter interest, I participated in and did research on activities and organizations including the National Society of Black Engineers (SB Daily, Eugene, & Prewitt, 2007; Prewitt, SB Daily, & Eugene, 2007), the Academy of Courageous Minority Engineers (Brittain et al., 2007), and Melvin H. King's Learn to Teach: Teach to Learn (AD Millner & SB Daily, 2008) program. Through this research, as well as some of my experiences at MIT, I realized that simply placing people in the same room together does not necessarily lead to harmonious, or even, problem-solving situations.

In parallel with my participation in these activities were three major encounters that affected the direction in which I was headed. The first was my interaction with social psychologists, educators, and sociologists at Harvard University. There, I became intimately acquainted with literature pertaining to attitude and behavior change, social capital, and school reform. As a result of these interactions, my qualifying exams focused on the utilization of technology to support personal change that could lead to higher quality interpersonal interactions.

Upon further research into interpersonal relationships, empathy surfaced as a primary component enabling members of different groups (ethnic, gender, age, etc.) to work together to solve challenges in an increasingly diverse 21st century world (Allred, Snow, & Miles, 1996; Barron et al., 2009; Edens, 2000). The challenge, then, is to enable people to think and see the world differently, to increase their personal and social awareness, and build confidence in working through differences with others. These skills can enable

cooperative problem solving and lead to the development of alliances to build a more just society (Hurtado, 2001a).

The second encounter was having my attention drawn to an international outcry for healing relationships between diverse groups of people, and further, how empathy played a major role in this healing. For example, in a 2006 commencement address for Northwestern University, then Senator, Barack Obama stated, "There's a lot of talk in this country about the federal deficit. But I think we should talk more about our empathy deficit - the ability to put ourselves in someone else's shoes; to see the world through those who are different from us" (Meyer, 2006). Research I studied from politics, to law enforcement, to the classroom, continually addressed the need for all to be able to empathize (E Aronson, Blaney, Stephin, & Snapp, 1978; Ireland J. L., 1999; Zaff & Michelsen, 2002).

The final experience was in the fall of 2007 when my competing interests finally collided in a perfect storm leading to my current dissertation work. During this semester, I met my primary collaborator, Karen Brennan, a Masters student in Lifelong Kindergarten who had a passion for supporting youth understanding of identity and community. At that time, we decided to collaborate on a learning environment that merged both of our interests. Our goal for this environment was to understand how a focus on an individual's emotions and identity in both individual and community contexts could support civic engagement.

As a result of these experiences, I have chosen to focus this dissertation on the evolution of guidelines for the implementation of *technology-infused collaborative learning environments to support the development of empathy.*

By empathy, discussed more in the Background Chapter, I do not mean the "touchy-feely" conceptualizations held by most. Instead, I agree with numerous researchers who present empathy as a robust mechanism that serves as a fundamental function supporting social relationships in human beings and some animals. Empathy, in this research, is based upon a model where, unless prohibited, emotional contagion, helping behavior, cognitive understanding, identification, and guilt emerge as a result of one person perceiving another's state (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Marci, Ham, Moran, & Orr, 2007; Preston & de Waal, 2003). Latent within our empathic capacities is our ability to connect, our facility to interact, and our power to thrive.

In my opinion, developing empathy is fundamental to addressing challenges that exist in our society. I also believe that discovering how digital technologies can support this goal of empathy cultivation can push programs to new heights. In this dissertation, I propose guidelines for the implementation technology-infused learning environments geared toward empathy cultivation as well as a technology I designed and built to support this endeavor. My hope is that the ideas contained in this dissertation will inspire new initiatives that will be used in cultivating empathy that can be studied utilizing rigorous research methods that will point to long term efficacy. Ultimately, I want to support a world where people from all backgrounds work together in meaningful and productive ways.

1.2 Contributions of this Dissertation

The research in this dissertation has drawn from the fields of education, affective computing, social neuroscience, social psychology, and computer science. The resulting dissertation has contributions that fall into three dimensions: theoretical, design, and empirical.

From the theoretical perspective, I have defined Empathy Development Environments as technology-infused learning environments supporting the development of empathy. I have also developed a framework called *Trajectories of Awareness* for cultivating empathy through the exploration of emotion and identity in a learning environment. This theoretical framework was used to guide the development of the materials utilized in the empirical work in this dissertation.

From the design aspect, I present a model Empathy Development Environment called, "Beyond the Looking," which consists of interactions in the real and digital world that engage learners in exploring concepts of identity and emotion on both individual and community levels. I also proffer lessons learned from prior work that informed the design of Beyond the Looking including two proactive emotional health systems: the INNER-active Journal and Girls Involved in Real Life Sharing (GIRLS). The INNER-active journal provided a way for users to reconstruct their emotions around events in their lives, and to see how recall of these events affected their physiology. The GIRLS software environment supported students in the exploration of emotions through storytelling. Both of these

environments supported my understanding of how to utilize technology to support empathy cultivation.

Also in the design vein, I have envisioned and implemented a platform called *Affect as Index*. The goal of this environment is to support dialogue around emotional arousal in a comfortable and objective manner. This platform was used as a part of the Empathy Development Environment evolved during this research and supported conversations around emotion that were previously intangible.

Finally, empirically, I have carried out three iterations of a design-based research study geared toward evolving the design of this environment. In the first iteration, I worked alongside two other researchers to combine the ideas of storytelling, empathy, and technology to explore how a curriculum might look in action. In the second, lessons generated from the first iteration supported the adaptation of the general structure of the environment, the strategies for supporting empathy development, and the evaluation methods. The final iteration was carried out in the same context to further solidify an understanding of the environment and explore a new technology. Through an analysis of these iterations, I developed guidelines for implementation of Empathy Development Environments.

1.3 Approach and Organization

I utilize a design-based research approach to develop guidelines for implementation of Empathy Development Environments. The course of action taken in this design-based research study has followed the approach suggested by researchers in the field of

educational technology (Reeves, 2000). This iterative process includes: Stage 1) Problem Analysis: examination of the literature to identify practical problems; Stage 2) Solution: interrogation of the literature in order to develop a theoretical framwork and a set of initial design guidelines; Stage 3) Implementation: assessment and testing of solutions in a practical setting; and Stage 4) Guidelines: Documentation and reflection to produce guidelines for implementation. Each of these steps can be revisted as the problems, solutions and methods are constantly revisited.

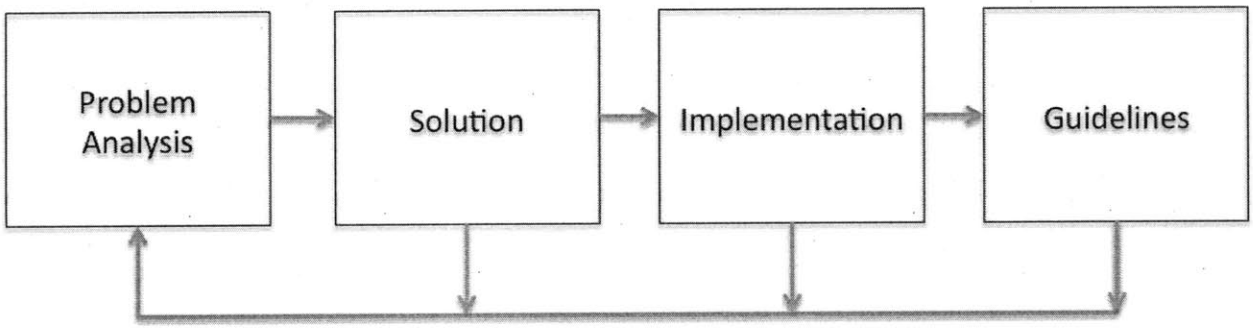

Figure 1: Framework for design-based research proposed by Reeves (2000).

This document is structured to present the trajectory through the framework proposed in Figure 1. As a result, the chapters are organized as follows:

Chapter 1: Introduction begins with my personal motivation for the work implemented in this dissertation. Blended in this narrative is an introduction to larger framing of the "practical problem" I am addressing – namely, the presumed imminent need to cultivate empathy in our society. It also describes the design-based research approach and outlines the contributions detailed in the rest of the dissertation. The introduction concludes with details of the general structure of the work.

Chapter 2: Empathy Development Environments moves into the second stage of the framework for design-based research by defining the concept of an empathy development environment, which is proposed as a solution to the problem introduced. It also provides more clarity on the importance of empathy in relationships, and examines work exploring the use of technology for the exploration of identity and emotion. Finally, this chapter reviews the conceptual frameworks for Empathy Development Environments and summarizes the characteristics drawn from the foundations.

Chapter 3: Research Design presents the major research question as well as the approach utilized in the Implementation stage. Also included is an explanation and justification for the criteria proposed for the design and analysis of Empathy Development Environments.

Chapter 4: Three Iterations: Cycles of Implementation contains details of each of the three iterations of the environment implemented over the course of one and a half years. Included in each description are details of the context, participants, general procedure followed, the flow of activities, and observations of challenges encountered during these implementations.

Chapter 5: Analysis and Discussion utilizes the framework described in Chapter 3 to analyze all three iterations and summarize the guidelines for implementation of Empathy Development Environments elucidated through these implementation cycles.

Chapter 6: Conclusions and Future Directions reviews the contributions of this dissertation and examines future research directions in light of lessons learned.

CHAPTER 2. EMPATHY DEVELOPMENT ENVIRONMENTS

I define an *Empathy Development Environment (EDE)* as a technology-infused learning environment to support the cultivation of empathy. The following four characteristics broadly characterize EDEs:

1. They provide opportunities to practice the skills of empathy.
2. They utilize of technology and narrative to allow participants grapple with emotion and identity.
3. They create opportunities to engage in transformative dialogue.
4. They support the formation of and participation in a group that has its own identity.

These characteristics are general to EDEs; however, the context of this dissertation has been the development of empathy in youth. In this chapter, I provide further details of the nature and importance of empathy. Next, I present an introduction to the theoretical foundations that have informed the characteristics Empathy Development Environments; a framework I developed to guide the implementation path and focus of activities and the constructionist strategy for education. This chapter ends with a summary and description of the primary characteristics of EDEs.

2.1 Empathy Defined

Here I provide an abbreviated historical look at the word empathy to provide context for its conceptualization in this research. The word "empathy," was originated by Titchener as a translation of the German word "Einfuhlung," combining the origins of two words, "fuhlung" or "feeling" and "ein" or "into," meaning to literally project your feelings into what you observe (Montag, Gallinat, & Heinz, 2008).

Much of the study of empathy beyond this initial conceptualization has focused on whether empathy is a cognitive or emotional process. In the affective approach, four different approaches, which are not mutually exclusive, exist. In the first, the observer's feelings are "appropriate" to the person's emotional state (Stotland, 1969). In the second, the "appropriate" feeling is seen as one that matches the person's emotional state (Eisenberg & Strayer, 1990; Hoffman, 2001). In another view, the feeling in the observer is *any* emotional response to another's emotion (Stotland, Sherman, & Shaver, 1971). A final view is that the observer's feeling must be of concern or compassion to another's distress (C. D. Batson, 1991). Conversely, in the more cognitive view, empathy involves *understanding* the other's feelings as exhibited in references such as "mind-reading," "understanding other minds," or "theory of mind" (Baron-Cohen 2001).

In contrast with these dichotomized traditions, a number of researchers have attempted to unify the affective and cognitive understanding of empathy. Davis, for example proposes empathy as multi-dimensional encompassing both affective and cognitive components (Davis, 1996). Similarly, Preston and de Waal's (2003) comprehensive model of empathy as

a process unites many of these scattered conceptualizations, and is the model utilized in this dissertation. Their Perception-Action Model of empathy asserts that, *"attended perception of the object's state automatically activates the subject's representations of the state, situation, and object, and that activation of these representations automatically primes or generates the associated autonomic and somatic responses, unless inhibited."*[1] Table 1 further explains the terminology used in this definition.

Table 1: Preston and de Waal's (2003) table defining terms used in their Perception-Action Model. "Object" and "State" rows have been added for clarity.

object	The individual who experienced the emotion or state first.
state	The individual who observed the object's emotion or state and understood through empathy.
perception-action	From the Perception-Action Hypothesis of motor behavior. Term "response" used in text to refer to a more general class of phenomena.
attended	Refers to the fact that strong empathic responses require that the subject is attending to the state of the object. Differences in empathy across individuals, age groups, and situations are predictable from levels of attention.
perception	Flexible definition that includes direct activation from the object in the external world, indirect activation from associations with external events or objects, and indirect activation through imagination.
automatically	As a matter of course, unless controlled or inhibited. Does not require conscious and effortful processing.
representation	Parallel, distributed patterns of activation that reliably fire in response to a given stimuli. Formed by the combination of developmental tuning biases and connectivity of neurons as well as alterations due to experience.
unless inhibited	Imitative action are inhibited during observation of action, centrally (from prefrontal inhibition), peripherally (with spinal cord inhibition blocking the motor neurons that execute the action), or both.

[1] Preston and de Waal explain that "empathy disorders," as found in autism or persons with brain damage, may cause some impairments to the conception of mental states and expression of emotion.

2.2 *Why Empathy?*

There is a long history of interest in empathy and its role in society. From the Good Samaritan in the Bible to President Barack Obama's call for more empathy in our daily dealings with one another (Meyer, 2006), many have pointed to empathy as a necessity for our survival. But why is empathy important?

Empathy is one of the main factors that mediate positive and effective social relationships in many aspects of our lives (Davis, 1996). From getting along with a boss to collaborating in a team setting, empathy is a key element in being able to understand others and build relationships that are beneficial for both parties involved (C. D. Batson, J. G. Batson, Todd, Brummett, & et al, 1995; Davis, 1983). While the benefits of empathy can be discussed across numerous relationships, here, I briefly focus on two types of relationships: teacher–student, physician–patient. In addition to demonstrating the importance of empathy in relationships, examining these relationships is important in the context of this dissertation since my goal involves the design of a learning environment where the facilitator-student interactions play an important role in the development of empathy in the students.

The ability to maintain a caring and productive relationship between teacher and student has very important consequences for a student's motivation to learn and his academic performance (XD Lin & Bransford, 2005; Teven & McCroskey, 1997; Voelkl, 1995). A teacher who better understands her students is better able to guide them through the learning process (Meltzoff & Decety, 2006). With the understanding that teachers must have the ability to empathize with their students, many researchers have endeavored to

create programs that train teachers in effective empathic strategies (Xiaodong Lin & Kinzer, 2003; Long, 1979; Tschannen-Moran & Hoy, 2001; Warner, 1984a, 1984b).

For example, in practices grounded in Moll's (1992) "funds of knowledge" teachers are sent to the homes of students to meet their parents and find out what sort of activities could be introduced into the teacher's pedagogies. Tenery states,

> *The experience of interacting socially with minoritized families of low socio economic status provides teachers... an appreciation for the individuals and what they have endured. This empathy, or caring attitude, transfers to the classroom, as teachers perceive students within a cultural and historical framework.* (Tenery, 2005, p. 129)"

In the physician-patient relationship, the linkages with empathy have been shown to be similarly as important. Empathy is frequently cited for the role it plays in patient satisfaction, adherence to treatment, and malpractice suits (Frankel, 1995). The more a patient feels empathized with, the more satisfied she will be with the doctor, the more likely she will comply with prescribed treatment, and the less likely she will be to consider litigious actions after an error has occurred (Hojat, 2007; Hojat et al., 2002; Kim, Kaplowitz, & Johnston, 2004).

2.3 Theoretical Foundations

2.3.1 Trajectories of Awareness Framework

In this dissertation, I co-developed[2] a framework guiding the focus (i.e., emotion and identity) and implementation path (sequentially adding perspectives) of activities within the learning environment called Trajectories of Awareness (see Figure 2). This framework

[2] In collaboration with Karen Brennan a student in the Lifelong Kindergarten Group at the MIT Media Lab

encourages the exploration of identity and emotion, from both individual (self) and group (social) perspectives.

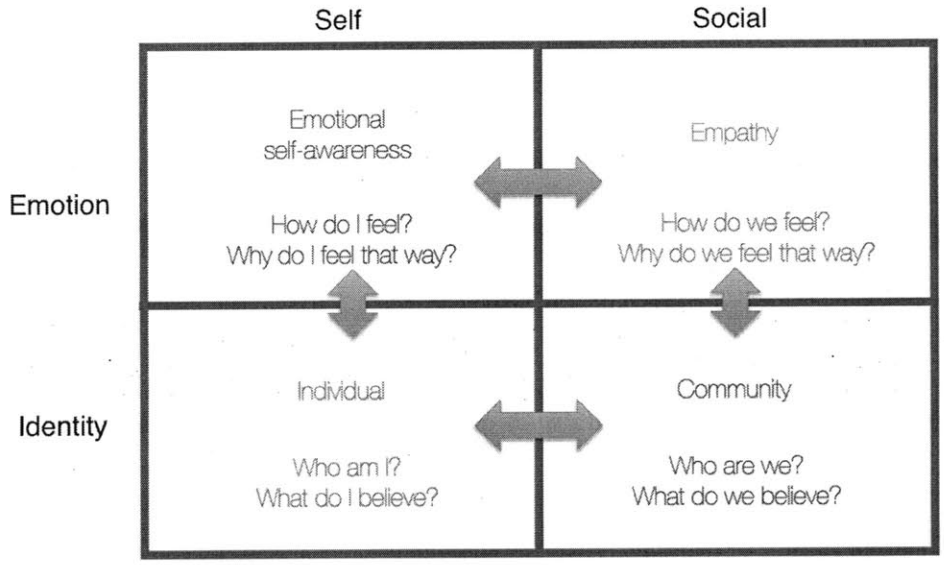

Figure 2: Trajectories of Awareness

The concurrent exploration of identity and emotion (both self and other) is supported by a number of findings in psychological and social psychological literature. First, it is difficult to understand the emotions of others when emotional self-awareness is lacking (Goleman, 2006). Second, both concepts have individual and social aspects. Next, there is a natural relationship between the two concepts via an emotion-identity cycle where emotions can play a role in shaping identity and vice versa. There are instances when emotions arise out of (un)successful performances of identities (Clay-Warner & Robinson, 2008, p. 68). At the same time, an individual's emotions can also serve as one of the motivators in the dynamics of individual identity development. In the following sections, I detail the emotion and identity trajectories.

2.3.1.1 Emotion

Emotional self-awareness is the ability to recognize one's own internal states. It is also referred to as meta-mood, the affective analogue of metacognition (Mayer & Stevens, 1994), mindfulness (Kabat-Zinn, 1994; Langer, 1989), or meta-affect (DeBellis & Goldin, 2006). The awareness of emotions enables one to know strengths and limits as well as appropriate times for asking for help.

Psychologist John Mayer of the University of New Hampshire finds that people attend to their emotions in three distinct ways: they are accepting, engulfed, or self-aware. He claims that accepting people tend to be aware of their feelings but do not try to impact them. They are passive in the sense that recognition does not necessarily call for action. On the other hand, people who tend to be overwhelmed by their emotions are referred to as engulfed. They usually avoid their emotions, and are paralyzed by them if they attempt to act. Mayer asserts that people who are self-aware are said to be in the ideal state. They have a healthy balance between overwhelmed and unaffected by their emotions. They are able to actively reflect and act according to their perceptions. Moving from self-awareness to other awareness, empathy, as defined previously is an automatic response to the attended perception of someone's emotional state.

2.3.1.2 Identity

Identity is a complicated word that takes on a wide array of sometimes-conflicting meanings. For some, it is the essential, inalterable parts of an individual; for others, it is a fragmented, shifting concept that is related to individuals, but that is simultaneously

socially situated (Gay, Evans, & Redman, 2000). Brubaker and Cooper (2000) reframed the word identity into three sets of understandings: identity as disposition for self-understanding (engaging in acts of reflection and cultivating sense of self), identity as process of identification (being able to identify or present oneself as part of a larger system), and identity as awareness of connectedness (seeking similarities – or differences – with/from others).

2.3.2 Constructionist Strategy for Education

In the field of instructional design a number of learning theories guide the development and implementation of environments. Behaviorism, cognitivism, constructivism, and constructionism are covered briefly to provide a basic understanding of some of the different views implemented in other environments. Behaviorism, most often associated with B.F. Skinner, is based on observable changes in behavior. Learning, then, is the acquisition of new behavior through conditioning. Cognitivism is based on the thought process *behind* the behavior. Changes in behavior are observed, and used as indicators as to what is happening inside the learner's mind.

Piaget's theory of constructivism is based on the premise that we all construct our own knowledge through assimilation, the process by which learners extend their existing beliefs to incorporate their experiences, and accommodation, the process by which learners reframe their beliefs based on new experiences Taking this constructivist theory one step further, and turning it into a strategy for education, Papert's constructionism suggests that learning works best when the learner creates something that can be made external. In

describing the difference between the two he states:

> *Constructionism...shares constructivism's connotation of learning as "building knowledge structures" irrespective of the circumstances of the learning. It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe.* (Harel & Papert, 1991)

In addition to putting forth the idea that learning happens best through designing and building artifacts, there are three other key tenets of constructionism including *self-reflection*, the need for *personally meaningful projects*, and the notion of *powerful ideas*. Self-reflection implies that the best learning occurs when people are encouraged to explore their own thinking process and relationship to knowledge. Personally meaningful means that learners have an emotional investment in the artifact they are creating. Finally, the powerful ideas are those that empower the individual by supporting new ways of thinking and putting knowledge to use (Marina Bers, 2001).

Computers, according to Papert can play an important role in engaging with these powerful ideas. As a result, numerous construction kits such as the Programmable brick, to explore the idea of feedback; Logo, to explore differential geometry; and StarLogo, for exploring emergence; have been built (Resnick, 1998). While most of these constructionist tools have focused on math and science, the work of Marina Bers has extended these same tenets into the realm of self. In the section below, I describe how Bers' work and my previous work have employed constructionist strategies and narrative as a tool to think about emotion and identity.

2.4 *Related Work*

2.4.1 *Identity Construction Environments*

Identity Construction Environments (ICEs) are technological tools designed to support young people in developing *personal and moral values* (Marina Umaschi Bers & Cassell, 1998; Umaschi Bers, 2001). Combining theories of positive youth development, identity formation, and moral development, they support the active design and creation of computational artifacts in a community context.

In Storytelling Agent Generation Environment (SAGE), for example, children talk about their lives with a sage who listens and then responds with a relevant tale. They may also add to the library of stories within the sage or design their own storyteller using a visual programming language. Within this environment, children determine the conversational flow and behaviors of the storyteller (Marina U. Bers, 2003). Similarly, Zora integrates personal development with civic education by creating the opportunity for people to develop fluency in the areas of technology, ethics, and narrative. Users of Zora (Figure 3) create personal homes and populate them with objects and interactive characters in a graphical 3-D environment (Marina U. Bers, Gonzalez-Heydrich, & DeMaso, 2001; Marina Umaschi Bers, 1999).

From this work, the ability of technology and narrative to support an understanding of identity becomes evident. Further clarified is the importance of placing youth in real situations where they have to work through challenges. Although Bers found evidence of compassion and willingness to respond to the needs of others, the focus in this work was

on the development of identity and personal values rather than empathy (M. U Bers & Chau, 2006).

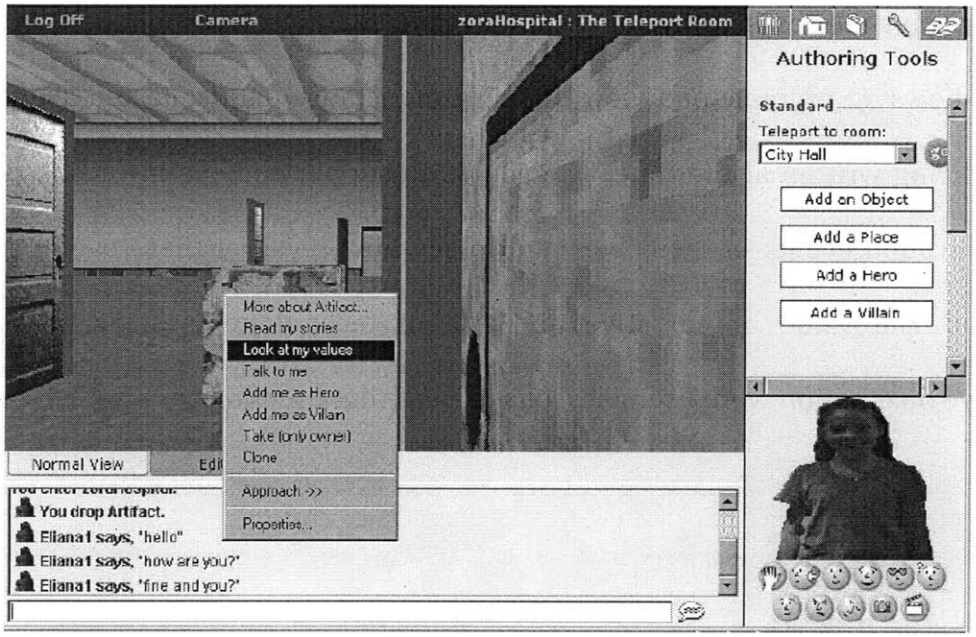

Figure 3: Zora virtual environment developed by Bers to support youth in exploring identity and values

2.4.2 Emotional Health Systems

Much of my previous work including my Master's thesis has utilized technology for emotional development. The Inner-active Journal, for example, (Figure 4) engages people in expressive writing, a task in which the participant is asked to write about extremely emotional events. Profound benefits for both psychological and physical health have been found in studies exploring expressive writing (Shaundra Bryant Daily & Rosalind Picard, 2004; Pennebaker, 1993, 2000; Pennebaker & Chung, 2007).

In the Inner-active Journal (Shaundra Bryant Daily & Rosalind Picard, 2004), measures of

skin conductance, instantaneous heart rate, and a measure of heart rate variability are collected as a person engages in an expressive writing task. Once finished, a person can view and reflect on these unconscious physiological signals using an interface that allows him to pinpoint interesting physiological data and see the corresponding written words. Figure 4 shows an example of a view of skin conductance data collected aligned with the sentence being written at the time. The goal is to support people in reconstructing their emotions around events in their lives and to see how recall of these events affects their physiology. The value of narrative and use of technology in providing a different perspective on emotion were useful lessons drawn from this work.

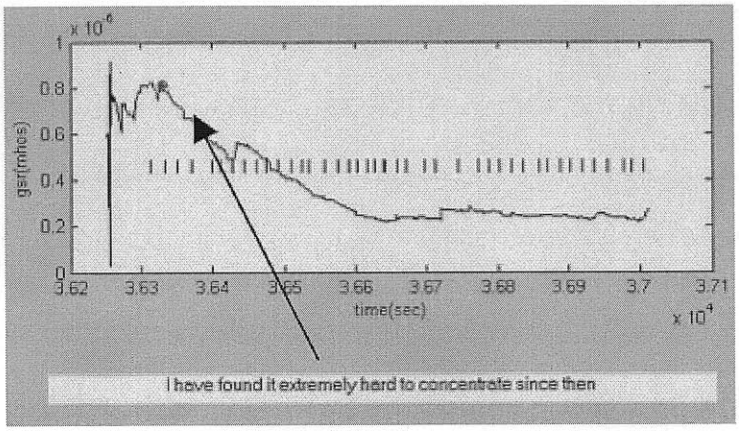

Figure 4: INNERactive Journal. Screenshot of skin conductance data during expressive writing task. Corresponding sentence shown below graph

For my Master's thesis (Figure 5) I developed a proactive emotional health system to support awareness of one's own emotions and those of others. The system, G.I.R.L.S (Girls Involved in Real Life Sharing), allowed students to reflect actively upon the emotions related to their situations through the construction of pictorial narratives (Shaundra Bryant Daily & Rosalind W. Picard, 2007). In G.I.R.L.S., narrative serves as a vehicle for developing an understanding of an individual's emotion.

The software guides girls through a series of windows – memory closet, character selection, pictorial narrative construction, suggestion, and emotional weighting – to produce a set of images, similar to a comic strip, about their story. The system begins with the "memory closet window," a safe space where they can write about events in their lives. The system is set up so that all drafts of a user's story are saved, much like a journal that can be reviewed later. In the next window, called the "character selection window," girls are placed in the director's seat and asked to select the characters that will star in their story. The system is designed with preset images of characters in order to emphasize the process of constructing the story rather than developing images of characters.

Once students have chosen the stars of their stories, they are taken to the "pictorial narrative construction window" shown in Figure 5, where they build scene-by- scene images with captions representing specific incidents in the story. They can choose from a small selection of backgrounds, but they also have the option to use a small paint program to create their own scenes. Additionally, the names of the characters chosen in the character selection window appear in a list box. By selecting a name from the list and then selecting an emotion face, girls can choose the expressions for main characters in the story (excluding the character representing themselves).

The goal of this feature is to encourage students to think about the emotions of the other characters in their stories and to use that reflection to select an expression. To be able to choose an expression for the character representing them, students must submit the

caption to a natural-language-processing toolkit, called ConceptNet, which supports affective textual reasoning over documents (Liu & Singh, 2004).

The system will then try to empathetically suggest emotions that relate to this event in the "suggestion window". To further support this first reflection on her emotions, the student is then taken to an "emotional weighting" window. In this window the student can choose from nine emotions as well as have the option to type in her own emotion. The weighting can range from "not at all" to "a lot", and is ideally based on how much the student felt she experienced the emotion. This reflection is important because this weighting determines how the main character (representing the student) will appear in the pictorial narrative construction window once the user is finished. For example, if the girl weights happy as "a lot", the character will appear with a big smile. Each emotion and weighting is associated with a particular expressive appearance.

In a study conducted on this system with seventeen participants, one group used the G.I.R.L.S. system with emotional reflection support, while the control group used the system without the support. Over three weeks, the group supported with common sense reasoning about emotion increased the variety of emotion words used in their writing; the control group showed no such increase. In both cases, the system enabled girls to express themselves freely in a comfortable and meaningful way.

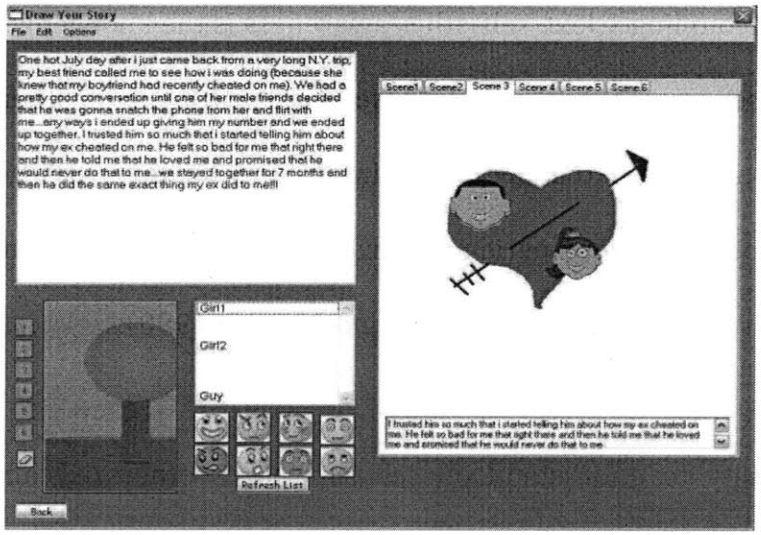

Figure 5: Girls Involved in Real Life Sharing (GIRLS) system developed as a part of my Master's thesis work. Utilized constructionist strategies to encourage reflection around emotions

2.5 Characteristics of Empathy Development Environments

2.5.1 Empathy Development Environments provide opportunities to practice the skills of empathy.

In the brief historical presentation of empathy, I discussed the fact that there are different understandings of the word. Even with these disagreements, however, there are certain components researchers agree are necessary in order to empathize. These components include affective sharing between self and the other, self-other awareness, perspective taking, and self-regulation. In this research, these components are considered skills that can be developed.

The affective sharing component includes shared representations between self and others and relies on the automatic perception and action coupling. In other words, the ability to *perceive* another's state impacts whether or not emotions will activate. Attunement (listening and seeing) as skill is cultivated throughout EDEs in order to impact the

perception action coupling. Next, self-other awareness is the knowledge that self and other are similar, but separate. Often, people base their judgment of other people's feelings, emotions, and attitudes on the own. It is important; however, that people must have, "awareness that others have experiences beyond the immediate situation and their own history and identity as individuals" (Eisenberg & Strayer, 1990).

In EDEs, this ability to understand oneself as well as others is continually developed through the Trajectories of Framework discussed below. Finally, perspective taking is the mental flexibility to adopt the perspective of others. Through narrative and other activities, EDEs support participants in practicing this cognitive empathy. Perspective taking, similar to self-other awareness follows the Trajectories of Awareness in that sessions begin with a more introspective focus, then, as time progresses, broadens to others.

2.5.2 Empathy Development Environments utilize technology and narrative to allow participants grapple with emotion and identity.

Similar to Zora (Marina Umaschi Bers, 1999), the design of the GIRLS software was guided by the constructionist theory of education and narrative therapy (White & Epston, 1990). Narrative therapy emphasizes the development of an individual's self- and shared-understanding by telling their stories or writing them. In EDEs, technology supports the construction of stories containing media such as images, audio, and video, in a way that allows for rich, non-linear narratives. These stories are used as a tool to think about the emotion and identity components of the Trajectories of awareness, as well as opportunities to practice perspective taking.

2.5.3 Empathy Development Environments create opportunities to engage in transformative dialogue.

Dialogue, in the context of an EDE, is a process rather than an exchange of conversation between two people. Drawing on the intergroup dialogue literature, dialogue process is about building trusting relationships, thoughtfully engaging about difficult issues and developing listening skills. It requires a sustained commitment in which participants acknowledge their individuality as well as their group membership. Vasques-Scalera (1999) describes the individual change process that can result from the dialogue process as a "transformative learning process that involves three types of learning: personal (building self-awareness), emotional (dealing with one's own and other people's feelings), and experiential (practicing communication skills, engage in social justice, and learn by doing)" (Hurtado, 2001b, p. 29).

2.5.4 Empathy Development Environments support the formation of and participation in a group that has its own identity.

This characteristic draws from much of the literature cited above. Drawing from the Trajectories of Awareness, EDEs support the process of identification as well as awareness of connectedness. The constructionist strategy puts forward the importance of creating and presenting artifacts in a community setting. Similarly transformative dialogue works toward identification with a community.

2.6 Summary

This chapter elaborated on the importance of empathy, described the theoretical foundations, as well as provided details of each of the broad characteristics of Empathy Development Environments. In the next chapter, the research methods used to develop guidelines for implementation for technology-infused learning environments to cultivate empathy are presented.

CHAPTER 3. RESEARCH DESIGN

3.1 Research Goals

When conducting research, the methods selected must match the research goals. As shown in Table 2, a number of different categories of research goals exist for Instructional Technology research including theoretical, interpretivist, empirical, postmodern, developmental, and action goals (Reeves, 2000). The primary focus of this dissertation is on developmental goals in order to elucidate guidelines for implementation of the design of technology-infused learning environments to support the cultivation of empathy. More specifically, I am interested in the following research question:

What kind of learning environment will support the cultivation of empathy?

In order to move towards this development goal and address the research question, I utilize a design-based research approach throughout this dissertation. This approach is endorsed in educational research in general as well as in educational technology research (Brown & Collins, 1992; Reeves, 2000), and is particularly well-suited for developmental

goals since it is primarily characterized by iterative cycles that support the refinement of a design.

Table 2: Six major research goals pursued by Instructional Technology researchers as identified by Reeves (2000)

Theoretical	Explaining phenomena through the logical analysis and synthesis of theories, principles, and the results of other forms of research such as empirical studies
Empirical	Testing conclusions related to theories of teaching, learning, performance, assessment, social interaction, instructional design, and so forth
Interpretivist	Portraying how education works by describing and interpreting phenomena related to teaching, learning, performance, assessment, social interaction, innovation, and so forth
Postmodern	Examining the assumptions underlying contemporary educational programs and practices with the ultimate aims of revealing hidden agendas and/or empowering disenfranchised minorities
Developmental	Developing creative approaches to solving human teaching, learning, and performance problems while at the same time constructing a body of design principles that can guide future development efforts
Action research	Focusing on a particular program, product, or method, usually in an applied setting, for the purpose of describing it, improving it, or estimating its effectiveness and worth

3.2 Research Approach

Design-based research (DBR) is a paradigm for studying learning in a context through the systematic design and study of instructional strategies. Relying on extensive descriptions; systematic analysis of data; consensus building within the field around interpretations of data; and of mixed methods, DBR utilizes reliable and validated techniques used in other research paradigms to refine *both* theory and practice (Brown, 1992; Design Based Research Collective, 2003). Particular to this dissertation, design-based research offers the following strengths as opposed to a traditional (or controlled) experiment:

1. Research as design is directed primarily at understanding learning and teaching when the researcher is active as an educator (Kelly, 2003). Therefore, rather than considering the interaction of the researcher (e.g., researcher interacts empathetically and therefore indirectly teaches empathy) as a confounding variable that necessitates a control group (e.g., when researcher does not interact empathetically), these interactions are reflected on as a part of the design.
2. Rather than being held to a specific and sequenced intervention, the design of the environment can change as the researcher interacts with participants (Barab et al., 2004). This means the methodology itself can be responsive to emergent features of the design (Collins et al., 2004; Design Based Research Collective, 2003) rather than restricted to an experimental protocol.
3. Two different dialects have been the foci of language of educational researchers: confirmations and descriptions (Kelly, 2003). While "confirmations" tend to rely more on the scientific process of randomized trials and measurable variance, "descriptions" attempt to illuminate arguments about processes using the grammar of ethnographers. With a rich history in blending design and engineering at the Media Laboratory, utilizing a methodology that has adopted the metaphors and methods from both fields offer a natural and rigorous approach.

It is important to note that sometimes lessons that are learned in one context are not necessarily valid across settings. Age, geography, culture, student mix, and facilitators are all contextual factors needing consideration when evaluating the environment. This makes it imperative to be specific about the perspectives considered as well as the contextual

factors influencing the evolution of the work. Throughout this dissertation, I attempt to be as explicit as possible about the nature of my settings. Table 3 provides an overview of the contextual factors in this research.

Table 3: Iterations of the Empathy Development Environment studied in this research

	1st Iteration	2nd Iteration	3rd Iteration
Context	Feb. – May 2008	Oct. – Dec. 2008	Feb. – May 2009
	Cambridge, MA	Birmingham, AL	Birmingham, AL
	Set apprenticeship model	Flexible after-school program	Flexible after-school program
Participants	Six male, Four female	Two male, Three female	Five male, Three female
	Ages: 11-13	Ages: 9-11	Ages: 9-11
	African American, Hispanic, Chinese	African American	African American, Hispanic
Procedure	14 weeks, One 2-hour meeting per week	Seven weeks, Two 2-hour meetings per week	10 week, Two 2-hour meetings per week
	MIT Media Lab	Junos Elementary School	Junos Elementary School

3.3 Criteria for the Design and Analysis of the Empathy Development Environments

This section builds upon the discussion presented in the chapter introducing Empathy Development Environments (EDEs). It provides a detailed description of the important aspects that have to be considered in the design and analysis of technology-infused environments geared toward the development of empathy. In other words, the framework described below provides specific components of the environment that should be addressed when implementing an EDE. These specific components are drawn from the conceptual foundations discussed earlier. Following the suggestion of Collins, Joseph, et al. (2004), the attributes used in the analysis of design based research have been

characterized in terms of independent variables and dependent variables Figure 6. Independent variables are those aspects of the implementation situation that may affect the success of the design, while dependent variables are the elements that can be used to actually define its success or failure (i.e., outcomes).

Collins and colleagues further suggest a number of independent variables (e.g., setting, nature of the learner, technical support, financial support, professional development) and dependent variables (e.g. climate, learning) that can be characterized and analyzed. It is important to note that the use of the language of independent and dependent variables is only meant to capture a distinction between variables that may affect the outcomes and outcomes that should be considered. There are complex interactions between both types of variables, and changes in dependent variable can affect independent variables.

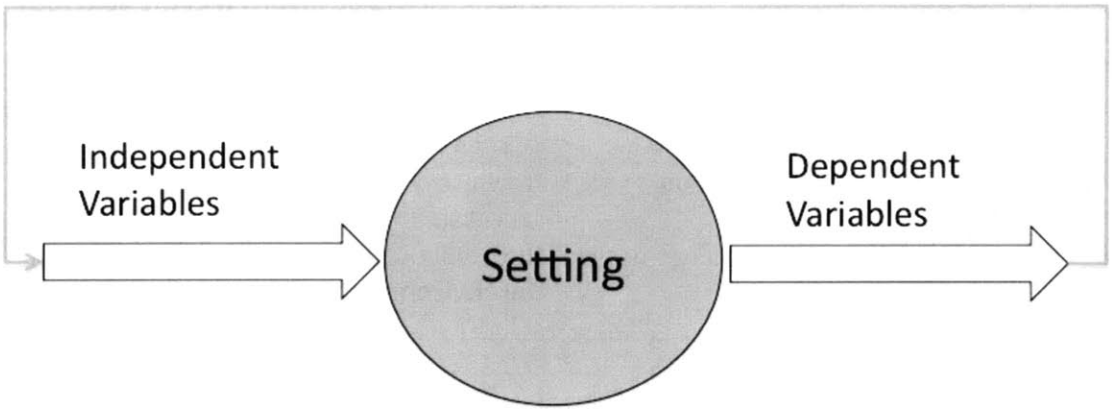

Figure 6: Simplified interaction of independent and dependent variables during the Implementation Stage. Feedback from outcomes of one iteration inform future iterations.

In the proposed framework, independent variables have been divided into four broad categories that consist of sub-categories summarized for clarity in Table 4. In the following

paragraphs, I provide explicit details about the choices to be made when considering questions in each of these independent variable categories and present the decisions made in this dissertation. Then, I will summarize and present the dependent variables.

Table 4: Independent variables to be considered in the design and analysis of Empathy Development Environments

Strategy: describe the approach to thinking about the basic elements of the environment	Activity Attributes	What skills of empathy will be targeted, and how will they be targeted?
	Implementation Path	How will activities be structured?
	Evaluation	How will outcomes be assessed throughout the program?
Setting: characterize the space where the activities take place	Location	Where will the activities take place?
	Space Organization	How will the space facilitate interactions in the environment?
	Food	Will food be provided?
Nature of the Learner: depict the students who are participating in the activity	Attendance Rate	How frequently will participants be asked to come to the workshop?
	Age	What ages will be involved in the activities?
	Dispositions toward Empathy	Will students be targeted for their current empathic capacities? How will differences in abilities be addressed?
Resources: outline the materials necessary to successfully carry out the activities	Facilitation	How many facilitators are necessary to successfully implement the activities?
	Technology usage	How will technology support activities in the environment?

3.3.1 Independent Variables

3.3.1.1 Strategy Variables

Activity Attributes. This variable addresses the question of what skills of empathy will be targeted and how they will be targeted. With respect to the "what" question, Chapter 2

outlines the skills of empathy as attunement, self-other awareness and perspective taking. It is important to make the choice of whether or not all the skills will be addressed. Moving to the "how" portion of the question, many multicultural education programs, diversity training programs, conflict resolution, intergroup dialogue, intercultural training programs, cooperative learning groups, and moral education programs have the development of empathy as either an explicit or implicit goal. A survey of these environments endeavoring to foster emotional understanding between groups yields categories of tactics ranging from those that bring groups together and those that do not (x-axis), to those that actively involve participants in building emotional understanding and those where participants simply receive information (y-axis).

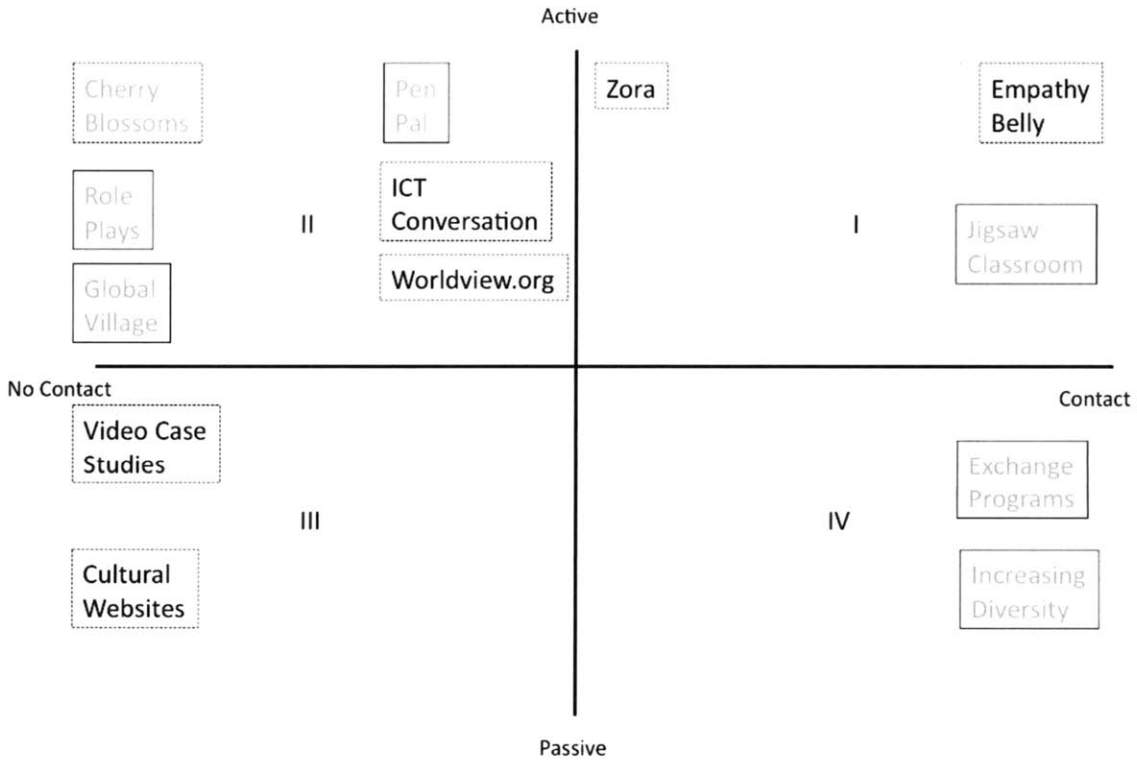

Figure 7: Empathy development strategies

These strategies can be roughly characterized as 1) digital or non-digital, 2) contact, mediated contact, or no contact, and 3) as active or passive. As shown in Figure 7, strategies with dotted outlines utilize digital technology, while those in solid outlines represent non-digital strategies. The horizontal axis in this figure indicates level of contact involved in interaction between groups. The middle of this axis indicates mediated contact via communication technology. The vertical axis indicates level of involvement of groups in the process. Passive involvement provides access to the information but does not necessarily lead groups to reflect on that information. On the other hand, active involvement seeks participation, input, feedback, and reflection. The position of all strategies may change based upon context and participants' motivation to be involved in them.

Quadrant IV: Exposure. Beginning in quadrant IV, we see that some strategies rely on exposure. Many of these strategies are based on Gordon Allport's (1979) Contact Hypothesis that increasing contact between members of different groups is the foundation for reducing inter-group hostility. There are certain requirements for this contact including a) conflict removal; b) mutual interdependence; c) equal status; d) positive contact rather than competition; e) typical contact; (i.e., group must not be seen as exception); and f) social norms of equality.

Researchers who have reconsidered the contact hypothesis have noted that even when these conditions are in order, relationships may not improve. For example, Bodenhausen

and colleagues (2000) have shown that there is a certain level of anxiety that accompanies face-to-face contact. This anxiety may make people less likely to notice when out-group members behave in positive, constructive ways. Further, exposure does not necessarily guarantee that groups will have authentic opportunities to learn from, let alone understand one another (Pettigrew & Tropp, 2000; Schwartz, Xiaodong Lin, & Holmes, 2003)

Quadrant III: Information. The exposure strategy demonstrated in quadrant IV is contrasted with quadrant III where information, rather than contact, is used to develop empathy. For example, some websites and videos provide information about different cultures or groups of people. While the persons constructing the website might be actively involved in an activity that could foster emotional understanding, the content, once finished, is usually static and does not incorporate input from the user. Video case studies, used in educating teachers, are also in this quadrant. While case studies do not involve contact, they can involve multiple teachers sharing their perspectives about the scenarios shown. Hence, they are a more active strategy (and closer to the middle of the active-passive axis)(Xiaodong Lin & Kinzer, 2003).

Quadrant II: Experience. Other tactics, shown in quadrant II, do not require contact between groups, but do involve creating a more active experience for groups to develop emotional understanding. For example, in 1968 Jane Elliot, a teacher in a Riceville, Iowa middle school used what she called "discrimination day" in her class full of third graders the year Martin Luther King was shot. During this day, she told her pupils that brown-eyed people were not as good (or as smart) as blue-eyed people. Therefore, she said, brown-eyed people did

not deserve the same benefits that blue-eyed people did. Within the day the students were fighting and viciously making fun of each other. The next day, the roles were reversed and it did not take long for brown-eyed people to treat their blue-eyed classmates the same as they were treated (Peters, 1987).

This role-playing process has enabled children and adults alike to experience first-hand what it is like to be discriminated against. It has brought to light attitudes they did not know existed and, also, affected them emotionally enough to reexamine their attitudes and change them. Similarly, Morgan Spurlock's *30 Days* television show (Spurlock, n.d.), Heifer Foundation's Global Village, and Phi Beta Sigma's (and other organizations') "sleep out for the homeless" activities attempt to give groups the experience of 'standing in the shoes of another' that will hopefully provide them with a deeper understanding into challenges faced by groups different from themselves and foster understanding (Harrington, 2002).

Some mediated contact also resides in quadrant II. In these strategies, the amount of activity depends on the participants. Examples include the exchange of cultural artifacts between groups, distance conversations using information and communication technologies, cultural pen pals, and websites geared toward the exchange of perspectives (Kern, 1996; Takasaki, 2009).

Quadrant I: Active Engagement. In Quadrant one, there can be contact (mediated or not) between groups and active development of emotional understanding. Recall that active involvement seeks participation, input, feedback, and reflection.

A powerful example of this kind of active engagement environment is Elliott Aronson's jigsaw classroom (Elliot Aronson, 2001, 2007; Elliot Aronson & Patnoe, 2010). The jigsaw classroom arose from the Brown versus Board of Education desegregation of classrooms that created a violent situation when students of varying ethnicities were thrown into schools together. The dilemma was how to get these students to interact and create a context for conversation where none existed otherwise. The solution was a cooperative situation where groups had to work together to accomplish a goal.

In this cooperative environment, first tested in Texas, where Hispanic, African American, and Caucasian students were cast into the classroom together, each student had a piece of the lesson plan that he or she was responsible for understanding. When the group came together they had to help the other members of their team to learn the material and succeed on the subsequent test. Having to work together in this way to accomplish a goal creates a situation in which students must become more interdependent to succeed. Becoming more interdependent, however, meant that students had to empathize with one another in order to cooperate. As a result of the jigsaw program, violence significantly reduced in the classrooms (E Aronson et al., 1978).

Similarly, identity construction environments described in the EMPATHY DEVELOPMENT ENVIRONMENTS chapter, such as Zora are, "designed to foster a caring community by having specific design features to engage individuals in developing a sense of empathy" (M. U Bers & Chau, 2006).

Throughout the iterations described in this dissertation, activities use a number of these strategies. In-person contact was used to allow participants the opportunity to establish a community where norms can be defined through a common identity (Cherniss & Goleman, 2001). With these norms established, the environment could be more readily available for positive contact, which, again, is important for dispelling misconceptions (Allport, 1979) and accepting different perspectives. During a number of the activities, information was provided about the individual participants to the larger group. Students had structured activities such as interviews to engage them in learning about one another. Finally, students were actively engaged in consciously constructing their own understanding. The constructionist theory employed helped shape activities to support students in this kind of active and reflective learning.

Implementation Path. What will be the structure of the activities in the environment? The choice of how to implement the activities of the environment in this dissertation is based on the Trajectories of Awareness described in CHAPTER 2.

Evaluation. For this dissertation, evaluation has been considered a strategy variable in order to design suitable strategies to assess the impact of the environment since current methods were not considered appropriate for this environment. Here, the reasons that current instruments were not suitable for this research are discussed. Later, I will present the methods evolved through the course of this research. The latter discussion is deferred since it is better presented after a complete discussion of the independent and dependent

variables.

Most measures of empathy are summative in nature. In other words, if used in a pre- post-fashion the measures could be used to assess the question of "Do the participants have more empathy?" Since this research was developmental, I was not looking for more empathy, I was looking for evidence that empathy could be practiced in the environment. Another reason current measures were not considered suitable is that most address either cognitive or affective conceptualizations of empathy. The Chapin Social Insight Test, for example, presents hypothetical scenarios to subjects and prompts them to choose one of four responses. Another, created by Stotland (1969), relies on self-report and physiological indicators; however, many inconsistencies were found in the data. The Questionnaire Measure of Emotional Empathy was specifically designed to assess an individual's tendency to react strongly to another's experience (Mehrabian & N. Epstein, 1972).

More recently, the Mayor-Salovey-Caruso Emotional Intelligence Test (MSCEIT) was developed to measure emotional perception, emotional facilitation, emotional understanding, and emotional management. This measure of empathy relies upon a more evaluative approach such as identifying emotions in the faces of others and pictorial designs. I utilized the youth version of this test in prior research and found, in part, that the length of the test provided a barrier to getting reliable data.

I believe the way to address these challenges is to rely on more behavioral measures since the Perception-Action Model puts forth that some action result from what's perceived. An

example of a behavioral measure is observing charitable giving of Israeli citizens to Palestinian citizens after an intercultural peace workshop. The assumption in this measure is that empathy has been developed when more money is donated. In section 3.4, I discuss the behavioral measures evolved for this research.

3.3.1.2 Setting Variables

Location. Where will activities be held? Will students meet at a specified location outside of school, or will come together in a space within the school? In this research, activities were conducted out of school (first iteration) and in school (second and third iteration), in a library (second iteration), and classroom (third iteration).

Space Organization. Learning spaces can be arranged in a number of different ways. In some classrooms, desks are arranged in rows all facing the front of the room, while in others, desks are grouped together in small numbers. It is important to consider what kind of organization best fits the goals outlined. In this research, the learning theory and empathy cultivation strategies prescribed that students be in small groups to facilitate collaboration amongst students with a focal point in the front to draw attention to the facilitator as some activities were described.

Further, some activities required space for the group to interact as a whole while being able to stand up and move. The space arrangements were influenced by what one might find in a Computer Clubhouse where students have access to their own computers and, "[a] large green table in the middle of the Clubhouse acts as a type of village common, where people come together to share ideas, visions, information, and even food" (Resnick, Rusk, &

Cooke, 1998, p. 11).

Food. Will food be provided for participants during the workshop? The decision was made to provide food during the workshops in this research in order to make sure that participants could focus on the activities.

3.3.1.3 Nature of the Learner Variables

Attendance Rate. How often do learners need to attend the learning activities? Depending upon the structure of the activities, participants will need to attend at a certain rate in order to maintain fidelity of implementation of the learning environment. For the purposes of the research in this dissertation, the Trajectories of Awareness dictated a somewhat linear or building approach to learning. Attendance at the very beginning and matriculation to the end was desired.

Age. What age will be targeted for the learning activities? How will participants' developmental stage impact interactions within the environment? In this research, I began working with student ranged in age between 11 and 13, believing the entrance into adolescence would present an opportune time to address the very issues they would be grappling with.

Dispositions toward empathy. Will students be excluded or included based on their a priori empathic capacities? Some students will have a natural disposition toward empathy. Research, for example, has found consistent ties between empathy and female gender

leading to more pro-social or helping behavior (Mcmahon, Wernsman, & Parnes, 2006; Zaff & Michelsen, 2002). In many cases, it appears that females are generally more predisposed toward empathy than males. In this research, there was no attempt to "screen" students based on ability.

3.3.1.4 Resource Variables

Facilitation. How many facilitators are necessary to successfully implement the planned activities? The answer to this question is based on a number of factors including the theory of learning, the number of participants, and the means of evaluation. In the current research, the student to facilitator ratio was kept small so that facilitators could have enough one-to-one contact with the students and allow for a more flexible working environment.

Technology Usage. Will technology be used to facilitate learning in the environment? If so, how? Technology has been cited as important to learning environment for a number of reasons including: giving students the tools to make good decisions, expanding students' view of the world, preparing students for jobs, communicating with others, and increasing motivation and attention.

Constructionist theory views the computer as a way to engage with powerful ideas -- ideas that empower the individual by supporting new ways of thinking and putting knowledge to use. In this dissertation technology was used as a tool for engaging with ideas around identity and emotion.

Scratch. Scratch, a programming environment for youth developed at the Media Lab, was the technology chosen to support the construction of stories to facilitate empathic awareness (Maloney et al., 2004; Maloney, Peppler, Kafai, Resnick, & Rusk, 2008; Resnick et al., 2009).

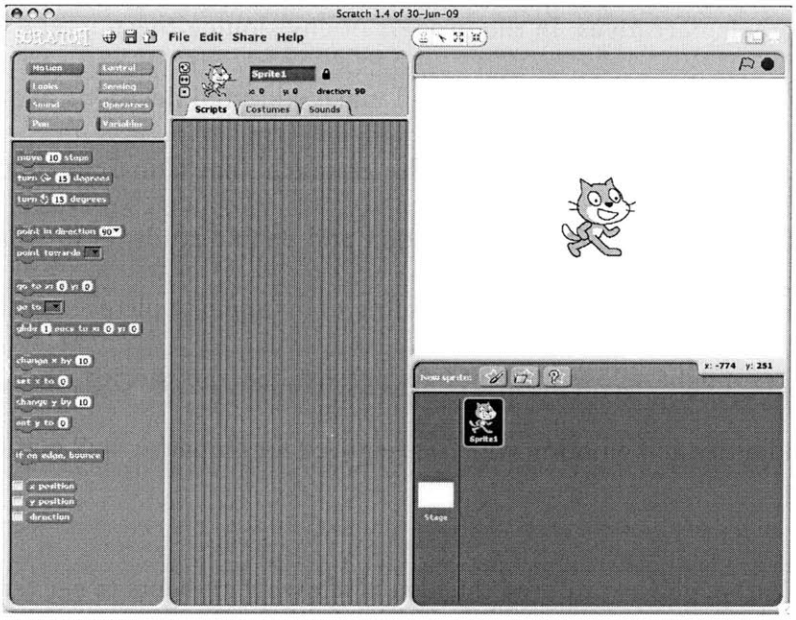

Figure 8: Scratch Programming Environment

Students working with Scratch must coordinate timing and interactions between multiple programmable moving objects. These objects manage multiple forms of media including audio recordings, images, and text. By changing pieces of code that snap together similar to physical LEGO™ blocks, students have the ability to create dynamics and interactive animations and games.

Scratch was chosen as a storytelling environment for a number of reasons. First, learning to program a computer is an authentic learning activity that requires logical and critical thinking to solve problems. Second, the interactive capabilities of Scratch allow for non-linear storytelling, which expands the types of stories students could share. Next, learners create stories that allow youth to physically interact (e.g., button presses to help the stories progress) with their narratives. In the process of envisioning these interactions, they can place themselves in the mind of the user and make educated decisions about what would support a pleasurable experience. Fourth, the graphical blocks in Scratch are made to be readable and sharable to support collaboration and enable students to work together on projects (Resnick et al., 2009). Finally, the ability to manipulate pictures of themselves and their own voices might allow students to personalize the stories and engage in the exploration of identity and emotion which is required for empathic skill building.

Affect as Index. Although I considered the idea of allowing students to see the physiology of their emotions during the first iteration, it was not until the second iteration that I fully understood the value of this possibility. At that time, I designed and implemented a system called Affect as Index to support dialogue around emotion that was used in the third iteration. An important relationship between emotion and physiology that led to the creation of this system is described below.

There exists a relationship between sympathetic nervous system activity and emotional arousal. When external or internal stimuli that are physiologically arousing occur, sympathetic activity increases. The skin, in turn, momentarily becomes a better conductor

of electricity, and this level of conductivity can be measured (i.e., skin conductance (SC). Sensors such as the Handwave, ProComp, Galvactivator, (Scheirer & R.W. Picard, n.d.; Strauss et al., 2005) are used to measure skin conductance by placing two electrodes on the fingers or the palm of the hand[3].

Placing the electrodes on the fingers or palms, however, is not desirable for this research since it encumbers the user and impedes the ability to perform any task that requires the hands (most computer tasks). For this reason, the Affective Computing group at the MIT Media Lab designed the iCalm (Fletcher et al., 2009) system to use electrodes placed on the user's wrist (Figure 9). The wristband form factor of the sensor was designed to maximize comfort while minimizing noise due to motion artifacts (Ming-Zher Poh, Swenson, & Rosalind W. Picard). The sensor is able to accompany users throughout their daily activities—outside of any laboratory. It provides the user with the freedom to move without worrying about restraining wires in a minimally intrusive way.

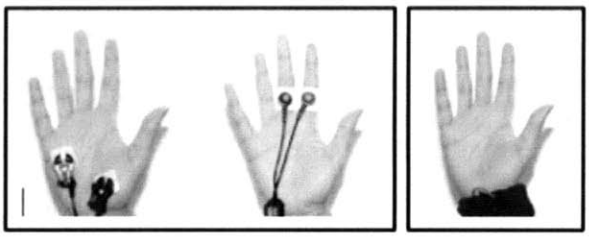

Figure 9: Traditional placements of skin conductance sensor (left box) versus the iCalm placement (right box)

[3] A high concentration of eccrine glands exists at these sites (Boucsein, 1992).

Even though arousal is widely considered to be one of the two major dimensions of an emotional response, it is important to remember that measuring arousal is certainly not equivalent to measuring emotion. Furthermore, although the skin conductance sensor provides information about a person's level of arousal provided that other triggers of increased perspiration have been held constant (e.g., temperature). It will not provide any information as to the specific emotion that is being elicited unless other conscious emotion variables are collected. Numerous events could cause a change in one's skin conductance response. Skin conductance has been used in research experiments focusing on stress and anxiety (Fenz & S. Epstein, 1967), lie detection (Podlesny & Raskin, 1977), and empathy (Marci & Orr, 2006; Marci et al., 2007). This final correlation with empathy was of interest for this research.

By measuring skin conductance simultaneously from patients and therapists during a clinical session, Marci, et al. (2007) found that increased therapist empathy as perceived by the patient correlated with high concordance of skin conductance between the two. In other words, the more empathic the patient felt his/her therapist to be, the stronger the relationship between skin conductance measures. Figure 10 below is an example of high and low skin conductance concordance between patient and psychotherapist.

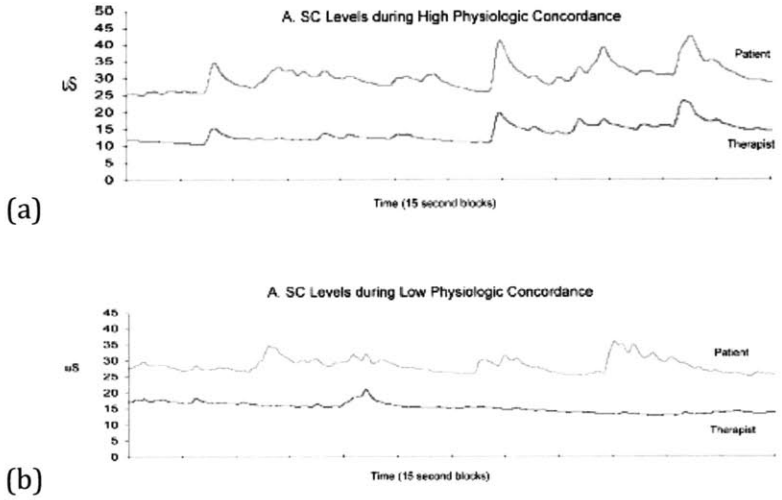

Figure 10: High (a) and low (b) skin conductance concordance between therapist and patient (adopted from Marci, et. al 2007)

For this dissertation, in one of the sessions, students wear skin conductance sensors while watching a set of instructions on a video screen. These instructions include doing jumping jacks, relaxation, watching a brief, humorous movie clip, and other activities geared to activate changes in their skin conductance. Once the activities are complete, students will use a visualization of their data aggregated to discuss differences in reaction to the exercises.

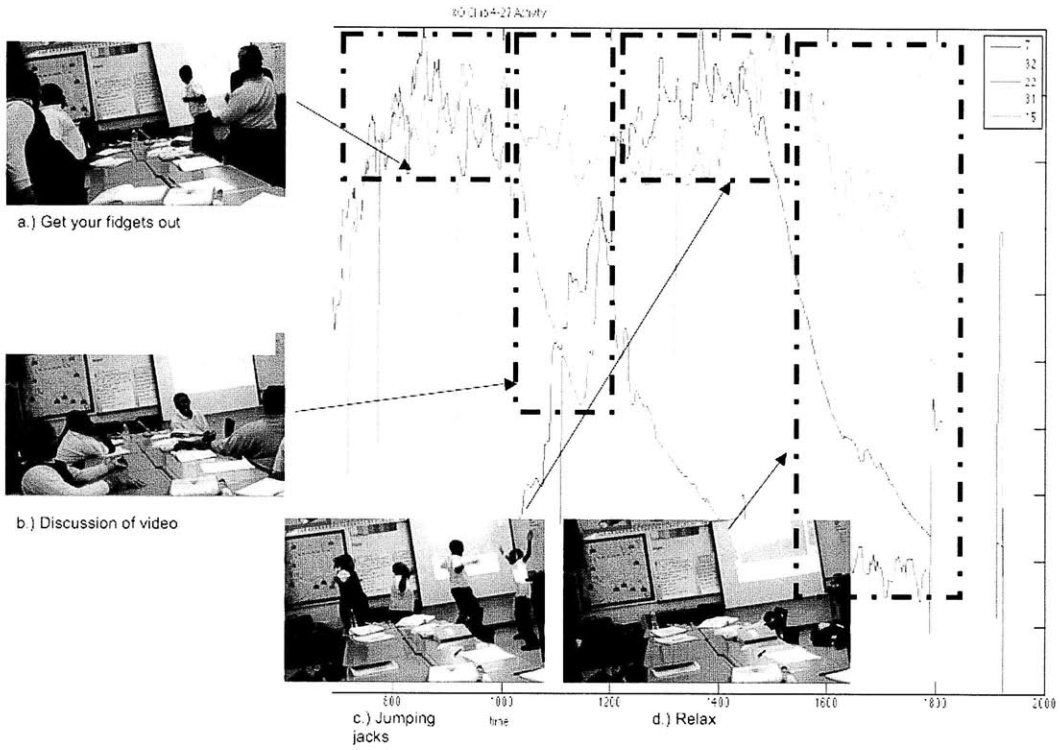

Figure 11: Use of Affect as Index in one session of learning environment. Calibration (first 800 seconds) removed for clarity. (a) Opportunity for students to move around as much as they wanted before the exercise began (i.e., get your fidgets out), (b) Discussion of a video shown to students, (c) Students doing jumping jacks, and (d) Students asked to sit on the floor and relax. The sharp lines extending down in the data are due to noise.

Arousal is used both as a common ground for meaningful discussion and an index into the content being discussed. Discussions could be about the ways that participants' responses to the content were not similar. Using the system, data could also be clustered by groups (e.g., boys and girls or fourth and fifth grade) to look at differing responses through this lens. By allowing students to share as much or as little as they like by keeping the skin conductance data and the reflections anonymous, an environment is created where

participants have the opportunity to have compelling and effective conversations. Appendix I. contains details of the system functionality.

Scratch was used throughout the sessions, and Affect as Index was used during one session (3rd iteration) during this research[4].

3.3.2 Dependent Variables

The dependent variables have been similarly grouped into two categories: 1) Climate variables, gauging the feeling of community within the environment, and 2) Learning variables outlining instances when students were able to practice the skills of empathy.

Table 5: Dependent variables to be considered in the design and analysis of Empathy Development Environments

Climate: gauge the establishment of a community within the environment	Community Establishment	How does the environment impact the development of community amongst participants?
	Helping Behavior	How might the environment impact students' willingness to respond to the needs of others?
Learning: outlining instances when students were able to practice the skills of empathy	Attunement	How does the environment support students in paying attention to others?
	Self-other awareness	How does the environment support students in reflecting on emotion and identity in themselves and others
	Perspective-taking	How do activities support students in understanding the perspectives of others?

[4] Students wore the sensors throughout the third iteration; however, it was only used for discussion during one session.

3.3.2.1 Climate Variables

Community Establishment. How does the environment support the development of a community that will support the sharing and exchange of ideas? As outlined by the Perception-Action Model of empathy, when the subject and the object are interrelated there is a higher probability that subject will not only *attend* to the object's state, but also *respond* based on shared representations. In other words, interrelatedness increases opportunities for an empathic response to a person's distress.

The definition of community, here, sets the stage for putting the proper activities in place during the context of the program. At the onset of this research, community was defined as a feeling of closeness resulting from shared goals. In CHAPTER 6. of this dissertation, I will discuss how paying close attention to stages of group development might support community establishment.

Helping Behavior. How might the environment impact students' willingness to respond to the needs of others? Helping behavior in the Perception-Action Model of empathy, is defined as action taken to reduce the distress of the object. This idea is supported through Batson's empathy-altruism hypothesis that claims, "empathic concern -- an other-oriented emotional response elicited by and congruent with the perceived welfare of a person in need -- produces altruistic motivation -- motivation with the ultimate goal of increasing another's welfare" (C. D. Batson, Ahmad, & Lishner, 2009, p. 417). During the iterations in this research, I looked at how specifically designed activities created opportunities for students to support each other as well as general interactions where students responded to

the needs exhibited by others. While this is only one manifestation of empathy, it is an outwardly noticeable way to understand the general climate being established in learning environment.

3.3.2.2 Learning Variables

Attunement. How do activities provide opportunities for students to pay attention to what others are saying? This dependent variable relates to the "attended" portion of the Perception-Action Model. Preston and de Waal (2003) assert that a strong empathic response requires that the subject is attending to the state of the object. In this research, attunement required that the participants were alert and ready to hear and understand something from the person who was speaking.

Self-other Awareness. How does the environment support students in reflecting on emotion and identity in themselves and others? As mentioned earlier, the better able a person is to understand his own emotions, the better he will be able to understand the emotion of others. In this research, to characterize this variable, I looked for evidence that students were able to think about their own emotions as well as how they responded to emotional situations. In this research, identity as self-understanding and identification relates to the Trajectories of Awareness strategy for activity structure. I am particularly interested in how the environment supports participants in reflecting on themselves as individuals and as a part of a community.

Perspective-taking. How do activities support students in understanding the perspectives of others? Decety states that, "mental flexibility to intentionally adopt the perspective of the other... [is an] important component of empathy" (Malle, Hodges, & Decety, 2005, p. 144). Again referring to the Perception-Action Model during perspective-taking, or cognitive empathy, a subject represents the state of the object through a set of top-down processes. For this research, I am interested in ensuring that students have an understanding that people's understanding of the world is different from their own. In other words providing opportunities for students to understand or express a perspective that is different from their own.

3.4 Evaluation

Across the iterations, I evolved my approach to understanding the impacts of the environment. In other words, I assessed the methods employed for this research in parallel with the formative evaluation of the environment itself. Based upon the framework being utilized to analyze the learning environment in this research, evaluation must pay attention to both independent and dependent variables. Recall that the aim in this developmental research has not been to *prove* that (or show *how much*) the design of the EDE works. Rather, the goal has been to develop a deeper understanding of how and why the design could work (Reeves, 2010).

As a result, interim analyses were conducted throughout the research in order to refine the design of the environment. These analyses also informed whether or not the evaluation

strategies utilized were providing the understanding necessary to iterate on the environment design. In the following paragraphs, I describe the methods used to collect data, the procedures for analysis, and the steps taken to ensure validity of the findings.

3.4.1 Data Collection

Across the iterations, a number of data collection methods were employed. I will discuss the changes to the evaluation methods more concretely when I discuss and analyze the iterations; however, I cover them here to provide context for the analyses conducted. For the first iteration, facilitator notes on student-student and student-teacher interactions, participant written reflections, physical construction activities, and Scratch projects were used to evaluate the environment.

During the second iteration, I verbally posed questions related to how students felt about the program and what they were learning to address the terse responses experienced during the first iteration. Next, in order to allow me to pay attention to the interactions in the environment and address them as a facilitator, an outside observer sat through each session and noted general participant interaction and instances where empathy was displayed in the environment. When the observer marked a check, she also made a brief note about the context of the display. Rather than relying solely on the observer, students, in this iteration, also recorded empathy displays as another way to support them in attuning to others and gaining a sense of their ability to recognize empathy in others. Finally, Scratch projects and artifacts created during the program were used in the

evaluation.

During the third iteration, empathy displays were written in student journals that also contained anything created by students. The goal was for students to constantly be in contact with the journals to better support them in remembering to make notes about their observations. Teacher evaluations of students were used at the beginning of the program to understand student baselines with respect to empathy. Finally, a social distance-type of activity was used at the beginning of the program and at the end to see if students felt closer to one another. Table 6 aligns these data collection methods with the dependent variable categories targeted.

Table 6: Dependent variable an associated data collection method utilized for each iteration

Dependent Variables	1st Iteration	2nd Iteration	3rd Iteration
Learning	Facilitator field notes of empathy displays	Add outside observer field notes of empathy displays (Appendix G.); Students note community expectations	Add teacher judgment of student empathy capacity prior to workshop (Appendix H.)
Learning	Physical construction activities	Same	Same
Learning	Scratch projects	Same	Same
Learning and Climate	Participant written reflections	Questions posed and answered aloud; recorded by facilitators.	Added student interviews (Appendix I.)
Climate	Facilitators note understanding of community formation	Add observer noting understanding of community formation	Add students pre- and post- Social Distance activity (Appendix J.)

3.4.2 Analysis

For analysis of the data collected, I utilized NVIVO, a computer-based program. The coding process consisted of both inductive and a priori categories. I utilized inductive coding – codes developed through the analysis of data – in order to identify and refine the categories of independent variables that were important to pay attention to.

Data from the transcripts were coded into categories (or nodes) according to their relevance to a set of a priori categories related to their relevance to the manifestations of empathy -- including helping behavior, listening, and perspective-taking -- as well as emotional self-awareness and awareness of identity. If an interaction was thought relevant to any of the dependent variables, it was coded. If an interaction was related to more than one of the categories, it was associated with this those categories as well.

3.4.3 Validity

There is an implicit incompatibility between standard notions of quantitative validity and that possible in qualitative research. Schofield states:

> The goal is *not* to produce a standardized set of results that any careful researcher in the same situation or studying the same issue would have produced. Rather it is to produce a coherent and illuminating description of and perspective on a situation that is based on and consistent with detailed study of that situation. Qualitative researchers ... do not expect other researchers ... to replicate their findings in the sense of independently coming up with a precisely similar conceptualization. As long as the other researchers' conclusions are not inconsistent with the original account, differences in the reports would not generally raise serious questions related to validity (Schofield, 2002, p. 174).

Nevertheless, it was important to ensure that some confidence could be placed in the findings of this dissertation. A number of other techniques have been identified, to assist qualitative researchers to ensure that their methods, inferences and conclusions are both appropriate and consistent over time. The table below lists these procedures as well as the method of implementation used in this dissertation.

Table 7: Procedures implemented to ensure validity of research findings

Procedure Recommended	Dissertation implementation
Use of triangulation by the use of multiple sources of data	Observations, Interviews, and artifact analysis
Consensual validation, or agreement among other researchers that the description and interpretation of the research are right	• External observer noting instance of empathy seen in the environment[5] • Research proposal reviewed by adviser and committee members as part of University PhD requirements • Literature review, first iteration analysis, and Affect as Index design peer reviewed at conferences (S.B. Daily & K Brennan, 2010; S.B. Daily & Karen Brennan, 2008; S.B. Daily & Headen, 2008)
Obtaining confirmatory evidence from participants themselves	Interviews, social distance activity, and student journals
Looking for negative evidence	Identification of negative instances of empathy displays and consideration of the negative versus the positive displays. Accomplished through both outside observer and facilitator checklist

3.5 Ethical Considerations

Approval from the Massachusetts Institute of Technology Institutional Review Board called, Committee on the Use of Human as Experimental Subjects (COUHES) was obtained before proceeding with the iterations. Included in the procedure were both parental consent and participant assent. In the assent form, students were informed that they would be discussing emotions as well as wearing the sensor used in Affect as Index. They were given the option of not participating in the study. Participants were not offered any

[5] It is important to note that this observer could not be blind to the goals of the environment since the goals are repeated with the students throughout the sessions.

incentive payment to be a part of the research. All freely agreed (Appendix B.), with parental permission (Appendix A.), to take part without recompense. As data was collected, all participants were given a pseudonym bearing no resemblance to their own name for the duration of the research. Access to the any video recorded information as well as transcripts from the interviews were stored on a password-protected computer.

CHAPTER 4. THREE ITERATIONS: CYCLES OF IMPLEMENTATION

This chapter contains in depth descriptions of the three iterations conducted during the course of this research. The model created as a first instantiation of an Empathy Development model was called *Beyond the Looking*. For the three iterations, I describe the context, participants, procedures, flow of activities, and design changes moving into the next iteration. Throughout the iterations, I was actively involved with not only developing the curriculum and technology, but also working with participants to implement the curriculum and incorporate their feedback into the research development cycles. I was almost always present at the sessions. When I was not present, correspondences with my collaborators occurred through email, meetings, and shared web-based notes.

4.1 First Iteration: The Apprenticeship

4.1.1 Context

The context for this iteration was an apprenticeship that was conducted in conjunction

with an organization providing students with after school apprenticeship experiences. By participating in training to learn more about working with students and the organization's policies, community members can share their passions and talents with middle school students in an apprenticeship setting. After nine to fourteen weeks of working with students, there is a culminating event, on either the local or district-wide level. The end of the semester is followed by an awards ceremony.

4.1.2 Participants

In mid-February, we attended an apprenticeship fair held at our appointed middle school, herein referred to as "Kerry Middle School." The fair is used to quickly introduce students to the apprenticeships available to them during that semester. At Kerry, we went to three different classrooms along with other community teachers and presented our apprenticeship. We began by introducing the ideas of programming and being a computer scientist through an activity. In this activity, a volunteer student tried to program another student to walk to the door and open it.

Through this exercise, we explained how a computer could do very little without the help of a human. After this activity, we introduced Scratch as the environment where the students would be learning to program and creating a variety of stories. We also introduced our original plan for the culminating event; that is, students creating a large "choose your own adventure" type of story where there are many different paths to the end of the story. We did not say that the goals of the apprenticeship were related to empathy and working together to avoid self-selection of students already interested in these ideas.

We ended up with six male and four female middle school students ranging in age from 11 to 13 as participants in this apprenticeship. The students all attended Kerry Middle School; however, because of busing programs, their residences are dispersed throughout the city of Boston. Because of this mix of students, there are strong histories of racial and ethnic tension within the school, making the theme of cultivating empathy appropriate.

4.1.3 Procedure

During this fourteen-week apprenticeship, students came to the MIT Media Lab once a week for each session. I facilitated this workshop along with Karen Brennan and Colleen Kaman for two hours each session. We utilized laptops that stayed in the lab, provided "media kits" containing an audio recorder and a digital camera that the students could take home. In an effort to reduce distraction from hunger and provide students with the chance to get to know each other in a relaxed fashion, we also provided snacks for students when they arrived.

4.1.4 Activity Flow

As shown in **Figure** 12, the focus in this iteration was on the perspective-taking component of empathy[6]. Here, perspective taking (sometimes called cognitive empathy) refers to a set of top-down processes where an individual represents the state of another person (Preston & Waal, 2002). The questions were as follows: 1) How can technologies be used to cultivate

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[6] The second and third iterations expanded this conceptualization of empathy

perspective-taking abilities? 2) How can technology support the creation of stories? 3) How can telling multithreaded stories support the development of perspective-taking abilities?

Figure 12: **First iteration conceptualization of empathy development and approach to its cultivation**

With this conceptualization of empathy, and the Trajectories of Awareness guiding the implementation of activities, Figure 13 presents the final flow of activities in our first iteration.

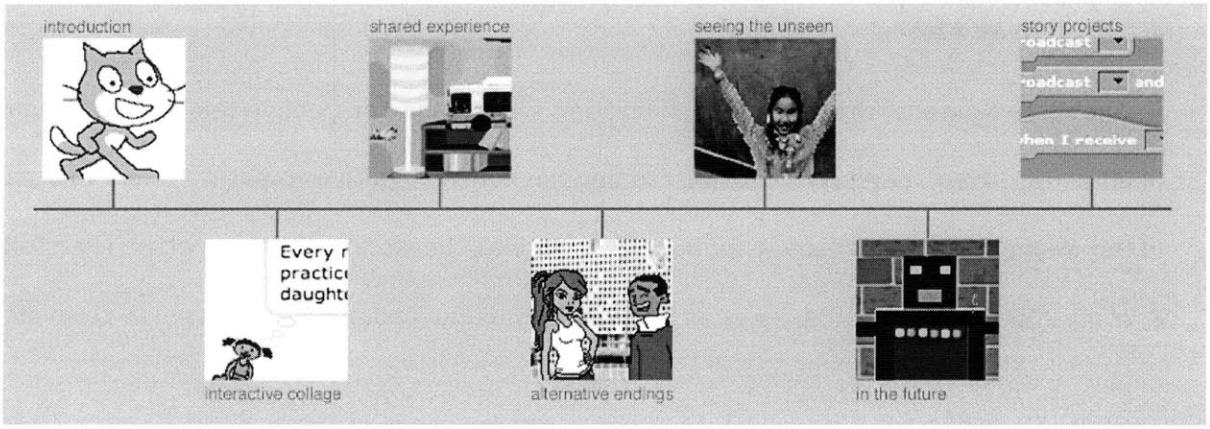

Figure 13: Activity flow for the first iteration. This picture is from an online version of this curriculum as a part of this research. This web-based version (see Appendix D. for full details) has been translated into Portuguese, Mongolian, and Spanish and is being used in another dissertation.

In the first session, we agreed on the ways we would interact as a community (shown in Table 8).

Table 8: Community expectations list generated during apprenticeship

People	Places	Things
1. Respect people	1. Treat the Media Lab with respect	1. Stay focused
2. Be good	2. Do not destroy things	2. Stay in your group
3. Show good manners	3. Don't take things without permission	3. Keep track of stuff, keep stuff in order
4. One person talk at a time	4. Treat places the way you want to be treated	4. Ask before you take things
5. Treat people like your family	5. Clean up after yourself!	5. Don't go to inappropriate sites like games, MySpace, AIM, YouTube, or Google
6. Help people out	6. Be careful with food and drinks in the cube.	6. Keep everything safe
7. Use good language		7. Help yourself to snacks

After asking question such as Who am I? What do I like? What do I dislike?, students were asked to construct a nametag using magazine, construction paper, markers, scissors, and glue. Anything placed on the nametag references something the student cared about (see Figure 14). Once the nametags were created, a Round Robin game was played. During this game, participants stood in a circle to introduce themselves and listed three things important to them. The next person in the circle introduced both himself as well as the prior person. These introductions continued until the final person introduced everyone in the circle. This activity required every participant to pay strict attention in order to successfully accomplish this task. It also provided opportunities for students to help each other in the case where someone in the circle forgot something.

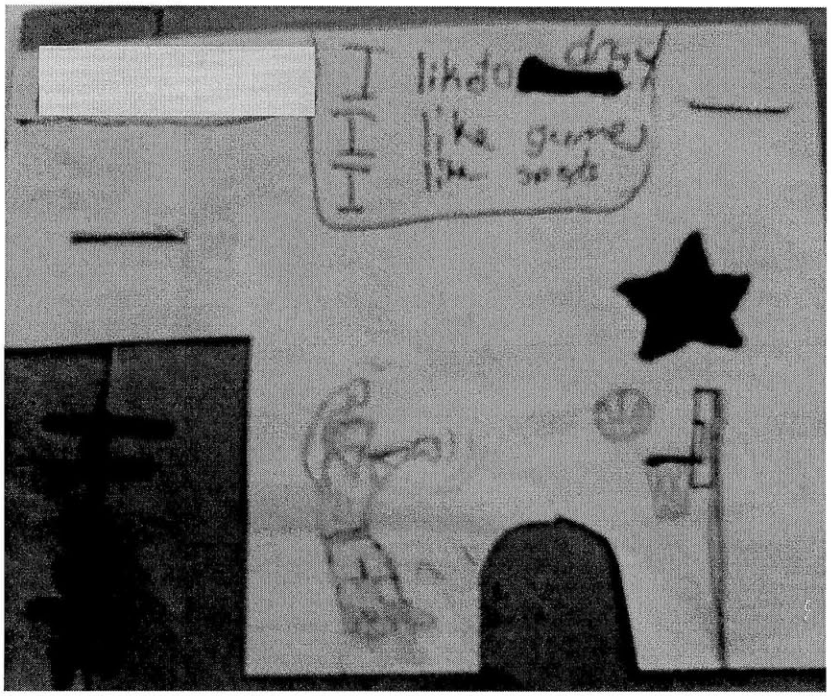

Figure 14: Nametag created by student. Picture is a basketball player shooting a hoop. Student lists drawing, games, and sports at the top as things he enjoys.

In the second session, we delved deeper into aspects of self and thought about culture, media consumption, and career aspirations. The group worked to compare and contrast these domains with each other and worked in pairs to create interactive collages representing a collection of things, people, and ideas cared about, as well as a narrative about them. Additionally, opportunities were provided for students to see each other's collages to see what they have in common, what's different, and what's unique (See Figure 15).

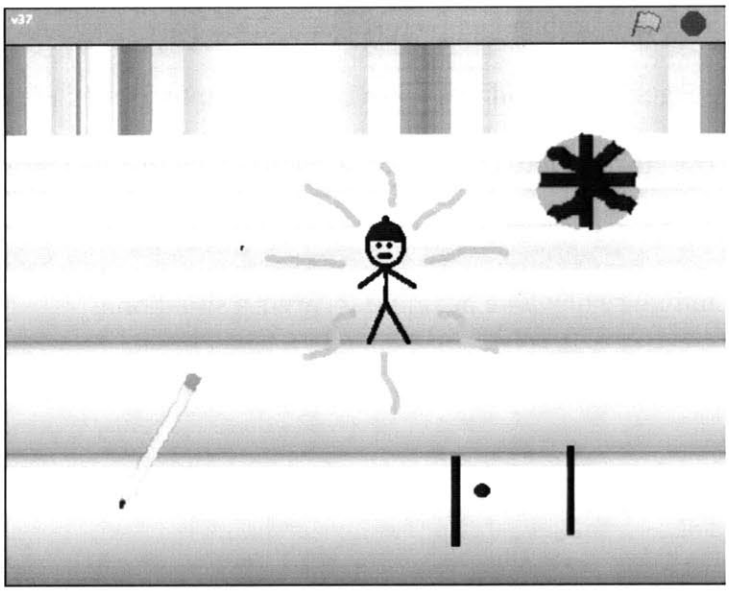

Figure 15: Collage made by student. The basketball represented his love for sports, the pencil writing, and the ping-pong his enjoyment of games

Next, we moved into discussing how other people can interpret our ideas differently than we intend (and vice versa). A shared experience was used to compare how different parties received an event and shared those experiences. Our construction activity involved dividing students into two groups and allowing them to build using identical sets of LEGO™. The idea was to allow students to see that the same event (blocks) could be interpreted in different ways (e.g., building a gas station versus an airport tower) depending on a person's perspective. For the Scratch project, students compared their own experience of the first day of the workshop with that of the supporting teacher, again pressing on the idea of perspectives.

In the next two weeks, we continued to explore the idea of interpretation and multiple

perspectives. On the first day, students worked in pairs to create a three-part story using a worksheet containing two ambiguous pictures of a three-part story and a blank panel for the third part (see Figure 16). Students were broken up into groups of two and given this worksheet. Once the stories were completed, each group shared its story and a discussion of the differing results followed. Emotion and family background were brought up as factors that could influence how one person interprets a situation.

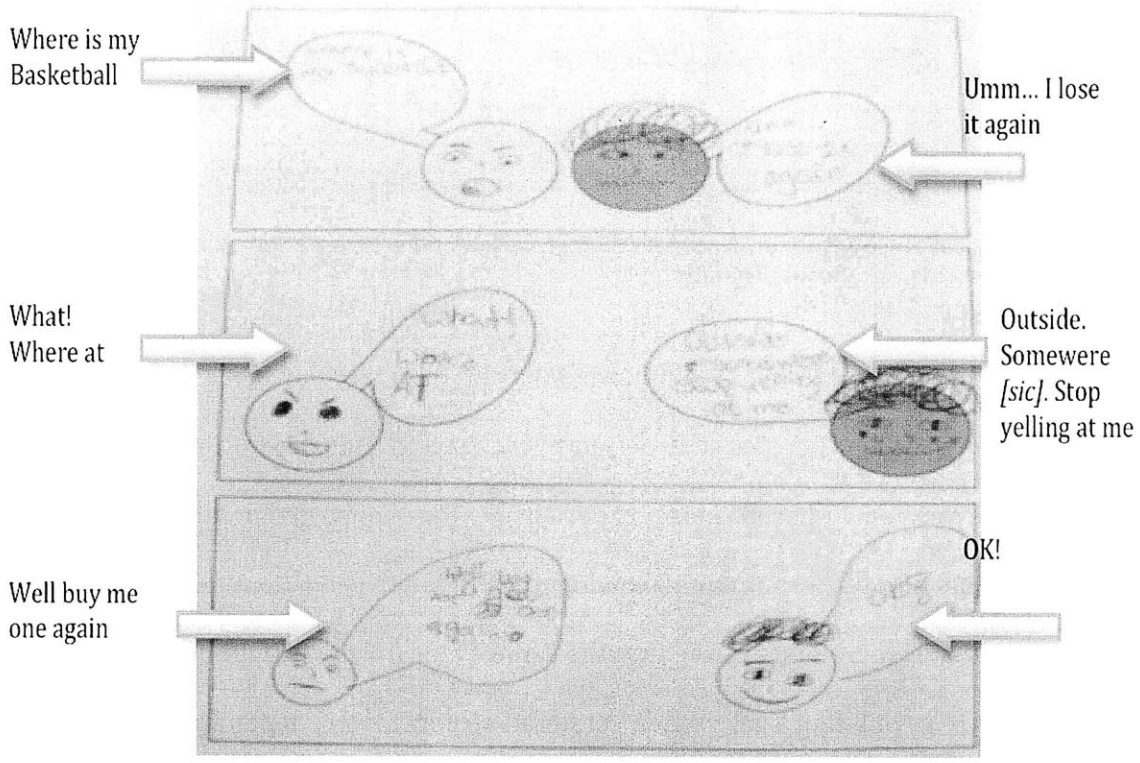

Figure 16: Finish the story activity exploring multiple perspectives. First two panes drawn by facilitators, story line and third pane created by students.

On the second day we made "exquisite corpses," by asking each participant to draw legs on the bottom of a tri-fold piece of paper. The paper was passed to two other people who drew a torso and a head on the middle and top portions of the paper respectively. Only line

placement hints were given to the next person drawing. Elaborate drawings were created as different people interpreted "legs," "torso," and "head" in their own fashion. **Figure** 17 provides an example of one of the pictures drawn.

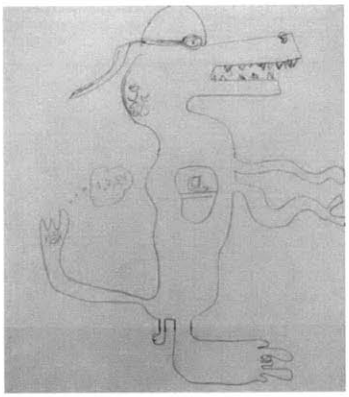

Figure 17: **Exquisite corpse drawn as a part of shared experience activity. Three students draw what they envision "legs," "torso," and "head" to be without seeing what the others are drawing**

For the Scratch project, pairs created the first two parts of another story together and then went to separate computers to finish the story. For reflection, we discussed how the stories turned out differently.

Inattentional, or perceptual blindness and diversity of thought were the foci of our next session. Inattentional blindness is the inability to see things that are actually there. This phenomenon can be the result of having no internal frame of reference to perceive the objects or the result of the mental focus that causes distractions. A video from a well-known study on inattentional blindness conducted by Simons and Chabris (1999) was shown during this session. In this video, there is a team in black shirts and a team in white shirts. The participants in this study were asked to count the number of times the white

shirts pass a basketball. During this task, a gorilla walks across the court, beats on his chest and continues moving – an event that last five seconds. In the experiment only 42% of the participants noticed the gorilla. Next, students were asked to go around MIT and photograph items that they felt others might not see or emphasize on a daily basis.

Figure 18: Updated version of the video used in the Simons and Chabis video that utilizes a bear rather than a gorilla.

Once the inattentional blindness activity is completed, we ended with questions related to things we do not see and things people do not see about us.

In the final structured activity, before the students launched into project work, they were asked to pretend that it was thirty years in the future and that they were recording a message to deliver about what happened to them and their classmates at MIT. In pairs, the students recorded their thoughts about the assignment and then created projects in Scratch using the pictures they had created when they toured MIT. The next three weeks

were spent creating individual projects. Students also came together to discuss the similarities and differences in the themes of their projects. Finally, students invited their families to attend a culminating event where they shared their creations. The facilitators encouraged people from the university community to attend as well.

4.1.5 Design Changes

In the table below, I briefly summarize the design changes made in between the first and second iterations. I present an in- depth discussion in the Analysis and Discussion Chapter.

Table 9: Design Changes made to independent variables between first and second iteration. Table continued on next page.

1st Iteration	Rationale For Change	2nd Iteration
Strategy Variables		
Activity Attributes		
Perspective-taking	Utilizing a more comprehensive view of empathy	Attunement, Perspective-taking, Self-other awareness
Contact, Active Engagement, Information	-	Same
Implementation Path		
Guided by Trajectories of Awareness	-	Same
First session as both welcome and introductions	Spending more time to allow participants and facilitators to get to know each other	4 sessions doing icebreakers and other activities before first curricular introductions
Evaluation		
Facilitator field notes of empathy displays	Allowing facilitator to better concentrate on interactions; Bringing students into the evaluation process	Add observer field notes with particular focus on displays of empathy (Appendix G); Students note community expectations
Participant written reflections	Limited time to collect data necessary and short responses from students	Questions posed and answered aloud; recorded by facilitators.
Physical construction activities		Same
Scratch projects	-	Same
Facilitators note understanding of community formation	Allowing facilitator to better concentrate on interactions	Add observer noting understanding of community formation

Table 9 continued

1st Iteration	2nd Iteration	3rd Iteration
Setting Variables		
Location		
Media Lab	No structure in place for students to come to another location	Junos Elementary School library
Space Organization		
Tables placed in two groups	Having smaller cohorts of students to increase opportunities for interaction	Desks placed in groups of 4-6
Food		
Food provided at the beginning of each session	-	Same
Nature of the Learner Variables		
Attendance Rate		
Students asked to attend all sessions	-	Same
Age		
Ages: 11-13	Younger demographic to possibly address developmental challenges encountered	Ages: 9-10
Dispositions Toward Empathy		
All students included; Not screened based on empathy dispositions	-	Same

4.2 Second Iteration: XO Magic

4.2.1 Context

In January 2008, Mayor Larry Langford of Birmingham, Alabama purchased 15,000 XO laptops (Figure 19) from One Laptop Per Child with the intent of distributing them to every elementary school child in grades one through five. Highly controversial, and much contested in the school system, only 1,000 laptops were approved for distribution to one pilot school in April of that same year. Fortunately, this school demonstrated positive and promising educational results. By the month of August, the school board approved the distribution of the laptops.

In April, I began collaborating with a learning design firm contracted by One Laptop Per Child to conduct learning workshops in the city. At that time, I had the opportunity to work with the teachers in the pilot school and some administrators from the district. There, I described my use of Scratch in the first iteration and realized that the XO laptop was actually a great platform to carry out our vision for the EDE.

Figure 19: One Laptop Per Child's XO laptop used in second and third iteration

In June, I returned to the city and began planning a summer camp with forty elementary school students. While my intent was to implement the next iteration of my research with these students, the director of Instructional Technology expressed a desire to focus very specifically on math and science concepts. I ended up focusing the program on working with the youth to use the laptop and Scratch to develop healthcare campaigns for their community. Even though this was not my intended use, it was an instrumental opportunity that reinforced my earlier thoughts that the laptop might be a good platform for my own research.

During this time, I established a relationship with the principal of the pilot school, and worked with him to plan to continue to work in his school during the school year in the context of an after school program. In addition to having established relationships and a more flexible context than I had in my first iteration, I also was in a geographical location

that made me feel the goals of the environment were particularly salient. Let me elaborate further.

The history of Birmingham is laden with racial conflict and violence. A center of the civil rights movement in the 1950s and '60s, Birmingham was given the nickname "Bombingham" because of a string of racially motivated bombings. Martin Luther King, Jr. wrote the now famous "Letter from Birmingham Jail" while imprisoned for taking part in a nonviolent protest. King's participation and other tireless protests by activists against the Jim Crow System ultimately led to the desegregation of public accommodations and the Civil Rights Act of 1964.

Even with all of these struggles for desegregation, Birmingham has become geographically segregated. Currently, Birmingham has about a quarter of a million residents, with 73% being African American since many of the Caucasian residents have moved to the surrounding suburbs. Still riddled with crime, the city currently has a murder rate that is 4.6 times the national average and is ranked eighteenth in violent crime. As a result of the mass exodus to surrounding areas, the Birmingham School system currently enrolls 27,525 students, a number that has declined drastically since the 1970s when sixty to seventy thousand students filled the halls.

4.2.2 Participants

I worked with the principal of Junos Elementary School to create an after school program that ran from October 2008 to December 2008. There, about 600 students are African

American and 200 are Hispanic. Further, 98% of the students are offered free or reduced lunches. I began the program with eight students ages 9 and 10 all of African American descent. Over the course of our semester, one student moved away, one decided to play football, and (in the very first session) one student left after a female student hurt his feelings by telling him he didn't smell good. This left me with five participants – three females and two males.

4.2.3 Procedure

I met with students twice per week over the course of seven weeks. In total, we came together eleven times. While more sessions were planned, a mix of school vacation, weather-related school shut downs, and student illnesses did not allow us to complete the whole curriculum. I collaborated with a female Learning Technology Consultant named Michelle. She attended all sessions with me and took extensive observation notes throughout the sessions.

4.2.4 Activity Flow

Table 10 introduces the flow of activities during the second iteration.

Table 10: Flow of activities during the second iteration. The table stops prematurely since unforeseen circumstances forced an abrupt end to the iteration.

Sessions 1-2: Welcome!
Ice breakers
Community Expectations
Machine, Beatbox
Reflection Questions
Session 3-4: Laptop Acclimation
Activity Stations
Reflection Questions
Session 5: Introduction
Nametag creation
Scratch Introduction
Round Robin
Scratch project
Reflection Questions
Session 6: Culture, Media, Career
Activity Discussion
Interviewing Strategy Review
Scratch project
Reflection Questions
Session 7: Catch up
Session 8: Shared Experience
Same shapes (star, circle, rectangle, square)
Interviewing
Note Community Expectations
Session 9: Multiple Perspectives
Exquisite corpse
Reflection Questions
3 part story template
Things effecting how we interpret what we see (background, family, emotion)
Scratch project – Alternative Endings
Reflection Questions
Session 10: Seeing the Unseen
Inattentional blindness video
School photographing
Reflection Questions
Session 11: Catch up

During this iteration, the view of empathy was expanded beyond the perspective-taking component to encompass other skills: self-other awareness and attunement. Perspective taking, again, is a set of top-down processes where an individual represents the state of another person. Self-other awareness is defined as supporting an "awareness that others have experiences beyond the immediate situation and their own history and identity as individuals" (Eisenberg & Strayer, 1990). Next, developing attunement refers to supporting students in better paying attention to each other (i.e., seeing and hearing each other). Since empathy can be thought of as a perception-action mechanism, attending to the state of another is crucial to the ability to empathize. Table 11 connects the activities conducted during this iteration with the skill of empathy targeted by each.

Table 11: Session-by-session activities in Beyond the Looking. Each activity is listed according to its goal.

	Skills of Empathy		
Session No.	**Attunement**	**Self-other awareness**	**Perspective-taking**
Session 1-5	Round Robin; Beatbox, Machine	Nametag creation	Machine
Session 6	Interviewing	Culture- Media - Career	-
Session 8	Interviewing	Shared experience	Shared experience
Session 9	-	-	Exquisite corpse; Three-part story
Session 10	Inattentional blindness photographing	-	-

I continued to use the Trajectories of Awareness framework to guide the flow of activities; however, the first two sessions were dedicated to different types of icebreakers geared

toward familiarizing students with each other in order to better establish community amongst them. For example, in one activity, each student said her name and had a body motion to accompany. Once she said her name, the entire group had to say her name and do the motion three times. Beatbox and Machine were also used as activities to introduce the importance of listening and watching one another.

In Beatbox, each student comes up with a sound using his voice, hands, or feet. One student stands in the center of a circle acting as the conductor and brings each student into the beat. The goal is to achieve a harmonious sound using everyone's beat. The conductor can bring individual beats in and out as necessary and can make louder or softer individual beats. Similarly, in Machine each participant must think of a bodily motion (e.g., pretending to turn a hand crank) and a sound that serves as a part of a larger machine. Each student must attach himself to a larger machine and try to make his motions congeal with the other motions.

In addition to the Community expectations developed for this iteration, I worked with students to come up with a name for our group. After a round of suggestions and voting, students decided on the name "XO Magic." I hoped that having a name would reinforce the community we were trying to establish in order to have students more comfortable with each other. Once we had a name, we developed the community expectations listed below.

- Listen to Each other
- Help each other
- Get to know where we are coming from
- Respect each other
- Be kind to one another

Sessions three and four were utilized to help students become more comfortable using the XO laptops since this was a platform that was new to all of the students. After a general introduction to its features, students were asked to select an Activity (prográm) to learn. After 30 minutes of interaction with this activity, they taught the rest of the group.

During the fifth session, we moved into the Name badge and Round Robin activities also done in the first iteration. In an effort to support students in expressing emotion in a way that would not be too threatening, a new activity introduced during the next session was the creation of emotion badges. Using construction paper, glue, markers, and pens, students were asked to create badges representing the different emotions they thought they might have throughout the workshop.

In session six we did the same culture, media consumption, career activity as in the first iteration. This time, more time was spent on each question to compare responses to help students get to know one another and further support the establishment of a community. We spoke about things we had in common, and talked about how we became interested in different things. Next, rather than dividing up into groups as in the first iteration, we worked all together to talk about the 5 W's plus H (Who, What, When, Why, Where, and How) and thought about how these skills could relate back to our community expectations.

Because students expressed a desire to be able to complete their projects, they were allowed to catch up on projects they had not finished in the next session before moving into Shared Experiences during session eight. A change in this activity was the use of the XO

laptop Paint Activity to create pictures instead of using LEGO ™. After students were placed into two groups, they were assigned different shapes (e.g. star, rectangle, square, circle), and asked to create a picture. Figure 20 is an example of pictures created by students. Once the picture was created, each team guessed what the other had drawn.

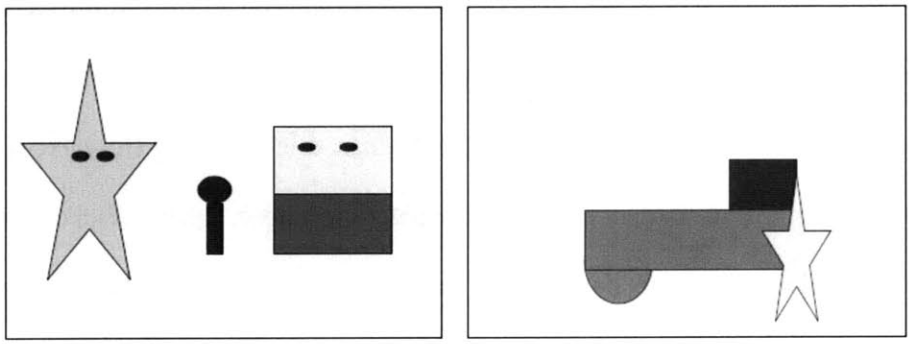

Figure 20: Pictures created by two groups in second iteration. Picture on the left is Nickelodeon characters Patrick and Spongebob singing Karaoke. Picture on the right is a plow.

Another new activity introduced in the next session was the idea of students noting instances where they witnessed other participants demonstrating community expectations. The goal of this was both to work on developing their attunement and to involve them in the process of observing the environment. Next, we discussed different perspectives and the things that might shape them including family upbringing and feelings. During the ninth session, students created a three-part story on paper and in Scratch, similar to the first iteration.

Inattentional blindness was the subject of the tenth session; however, in this iteration, students took pictures of their school. In the final meeting, students had the opportunity to

catch up on their projects as well as an opportunity to recount the activities they had enjoyed the most from all of the sessions[7].

4.2.5 Design Changes

In Table 12, I briefly summarize the design changes made in between the second and third iterations. As with the previous iteration, I present an in-depth discussion in the Analysis and Discussion Chapter.

[7] Recall this iteration ended before I had originally scheduled

Table 12: Design changes made in between second and third iterations

2nd Iteration	Rationale For Change	3rd Iteration
Evaluation		
Add observer field notes with particular focus on displays of empathy (Appendix G); Students note community expectations	Receiving another perspective on student dispositions toward empathy	Add teacher judgment of student empathy capacity prior to workshop (Appendix H)
Questions posed and answered aloud; recorded by facilitators.	More in depth conversations with students in private rather than with the group	Added student interviews (Appendix I)
Add observer noting understanding of community formation	Asking students their feelings	Add students pre- and post- Social Distance activity (Appendix J)
Setting Variables		
Location		
Junos Elementary School library	Library not available	Junos Elementary School classroom
Resource Variables		
Technology Usage		
Emotion badges	Not a natural integration with workshop activities, no emotion vocabulary to produce	Affect as Index

4.3 *THIRD ITERATION: XO CLUB*

4.3.1 Context

For this iteration, I continued to meet with students from Junos Elementary School in Birmingham, Alabama, the same school from the prior iteration.

4.3.2 Participants

For this iteration, I worked consistently with three female and five male students ages 9-11. I originally had six female and eight male students signed up for the program; however, students hearing about the program came at different times. During the course of this iteration I had twenty participants who came at one time or another. Two of the female students were Hispanic, and the rest of the students, male and female, were African American.

4.3.3 Procedure

We met in a classroom after school over the course of ten weeks. In total, we met for fifteen two-hour sessions and concluded with a culminating event where students presented their projects to parents and friends.

4.3.4 Activity Flow

Table 13 briefly describes the flow of activities during the third iteration.

Table 13: Flow of activities during the third iteration

Sessions 1-3: Welcome!
Nametag Creation
Round Robin Discuss
Community Expectations
Machine Reflection Questions
Session 4: Laptop Acclimation
Introduce iCalm Activity Stations Reflection Questions
Session 5: Introduction
Scratch Introduction Scratch project Reflection Questions
Session 6: Culture, Media, Career
Activity Discussion Interviewing Strategy Review Scratch project Reflection Questions
Sessions 7-8: Shared Experience
Same shapes (star, circle, rectangle, square)
Pictionary ™ Group 2: Interviewing Exquisite corpse Scratch project – Interview Reflection Questions
Session 9: Catch up
Session 10: Multiple Perspectives
3 part story template Things effecting how we interpret what we see (background, family, emotion)
Scratch project – Alternative Endings Reflection Questions
Session 11: Seeing the Unseen
Inattentional blindness video

School photographing
Reflection Questions
Session 12: Emotional Perspectives
Beatbox
Affect as Index
Reflection Questions
Sessions 13-15: Final Project Work
Scratch Day

Again, the first four sessions were dedicated to "getting to know" you and XO laptop activities as well as generating a name, "XO Club," and a list of community expectations that included:

- Treat others the way you want to be treated
- Keep your hands and feet to yourself
- Respect others
- Watch your English
- Be gentle
- Be positive
- Be polite
- Help each other out
- Cooperate with others
- Care about others
- Be honest to others always
- Take turns
- Be fair
- Be the best you can be!
- Share
- Listen to each other

Further, two new activities were introduced. First, although the goals of the program were mentioned in the prior two iterations, a longer more in depth discussion about empathy and emotion was held where students had the opportunity to provide their opinions and give feedback. This discussion included an emotion charades game where students were asked to act out an emotion that other students were to guess. The purpose of this discussion was to better support student vocabulary around emotion (a challenge found in the previous iterations), and present a fun way to practice paying attention to their peer emotions.

Second, students were introduced to the iCalm platform and skin conductance. We did not use student skin conductance for discussion until a later session; however, I wanted them to be acclimated to wearing the wristband.

During the fifth session, students began wearing the iCalm platform and created Scratch projects out of their nametags. The Culture – Media – Career activity was the focus of the sixth session. In addition to the structure used in the previous sessions, students were asked how they *felt* about the things they listed in order to continue to direct student attention to the theme of emotion. In session seven, pictures were again drawn on the XO laptops using five shapes, and discussion followed about perspectives.

A Pictionary ™ like game was played during the eighth session. During it, students drew a picture for their respective team and students had to individually guess what they were seeing. This activity was added, to present a different way to talk about differences in perspectives. Later, students were paired to interview each other about their experience of a Pep Rally held at the school a week before.

Session nine consisted of catching up on projects, while session ten covered multiple perspectives through the three-part story. The eleventh session consisted of the inattentional blindness activity in addition to a sequences of exercises to generate arousal data for use during the twelfth session where Affect as Index was used to discuss emotion and arousal.

The final three sessions were dedicated to final projects. The culminating event was held in conjunction with Scratch Day, a global event for people interested in utilizing Scratch.

4.4 Summary

In this chapter, I have presented the model environment developed to embody the overarching characteristics of EDEs. Each of the three iterations on this environment were then presented in order set the stage for the analysis discussed in the next chapter.

CHAPTER 5. Analysis and Discussion

In this research, I set out to answer the question: *What kind of learning environment will support the cultivation of empathy?* As seen by the framework described in the Research Methodology Chapter, Empathy Development Environments (EDEs) can be analyzed according to a series of independent and dependent variables that can be grouped into six main categories. These characterizations will support an understanding of the research questions and elucidate a set of guidelines. The independent and dependent variables include the following:

1. Independent Variables
    a. Strategy variables, describing the approach to thinking about the basic elements of the environment.
    b. Setting variables, characterizing the space where the activities take place.
    c. Nature of the learner variables, depicting the students who are participating in the activity.
    d. Resource variables, outlining the materials necessary to successfully carry out the activities.
2. Dependent Variables
    a. Climate variables, gauging the establishment of a community within the environment.
    b. Learning variables, describing student self-awareness as well as tendency to

a. Climate variables, gauging the establishment of a community within the environment.
b. Learning variables, describing student self-awareness as well as tendency to display empathy when participating in the environment.

In this chapter, I use this framework to analyze and discuss the three implementations of *Beyond the Looking* presented in the previous chapter.

5.1 Independent Variables

5.1.1 Analysis of Strategy Variables

5.1.1.1 Activity Attributes

Activity attributes are related to *what skills are being targeted* and *how these skills will be targeted.* During the first iteration, the skill focus was on the perspective-taking component of empathy. As I continued to develop my understanding of empathy from a neuroscience perspective, I expanded in the second and third iteration to the other components of empathy. Table 14 situates the activities developed and aligns them with each skill they targeted. Since empathy is a multidimensional phenomena, addressing all of the skills can increase probability that students will learn how to empathize.

Table 14: Session-by-session activities in Beyond the Looking. Each activity is listed according to its goal.

Session No.	Attunement	Self-other awareness	Perspective-taking
Session 1	Round Robin; Beatbox, Machine	Nametag creation	Machine
Session 2	Interviewing	Culture- Media - Career	-
Session 3	Interviewing	Shared experience	Shared experience
Session 4	-	-	Exquisite corpse; Three-part story
Session 5	Inattentional blindness photographing	-	-
Session 6	-	Affect as Index	-

The "how" question is related to the strategies from the four quadrants (see page 53) including contact, information, experiences, and active engagement. While experience was not employed directly as a strategy, the other three strategies were embedded throughout. Contact was used throughout the sessions. The collaboration exchanges, when students worked with a new partner each week, ensured that students had opportunities to have contact with everyone in the program. Although students had challenges with these groupings, they all said when interviewed that these groupings supported our goal of learning how to work with others in the group since they had to get to know different people.

Information was a way for facilitators, throughout the iterations, to support students in understanding empathy as a concept and learning about others in the group. The culture-

media-career activity provided facts about students and facilitators in the group. At the same time, the culture-media-career activity developed active engagement qualities in the second and third iteration as I asked students to reflect on the similarities and differences as well on the emotional aspects of how they felt about the things that were listed.

5.1.1.2 Implementation Path

The developmental stage of the youth plays an important role in how the activities should be organized. Utilizing the Trajectories of Awareness (i.e., focusing on self before the other) during the iterations proved valuable since, in all three iterations, we were working with youth at a relatively egocentric stage in their lives. Therefore, having opportunities to better understand themselves supported exploration later of others. During the third iteration, for example, when students entered late in the sessions, they had not played the emotion charades game. This meant when we were discussing emotion, they didn't have the same scaffolding for vocabulary around emotion, and still used words such as "crazy" to describe emotion.

5.1.1.3 Evaluation.

Evaluation is considered a strategy variable since the methods chosen have a direct impact on the interactions occurring within the environment. Across the iterations, I evolved my approach to understanding the impacts of the environment. In other words, I assessed the methods employed for this research in parallel with the formative evaluation of the environment itself.

For the first iteration, facilitator notes on student-student and student-teacher interactions, participant written reflections, physical construction activities, and Scratch projects were used to evaluate the environment.

Moving into the second iteration, I adapted the evaluation strategies, in part, by verbally posing questions related to how students felt about the program and what they were learning to address the terse responses experienced during the first iteration. Next, in order to allow me to pay attention to the interactions in the environment and address them as a facilitator, an outside observer sat through each session and noted general participant interaction and instances where empathy was displayed in the environment. When the observer marked a check, she also made a brief note about the context of the display. Rather than relying solely on the observer, students, in this iteration, also recorded empathy displays as another way to support them in attuning to others and gaining a sense of their ability to recognize empathy in others. Finally, Scratch projects and artifacts created during the program were used in the evaluation.

During the third iteration, empathy displays were written in student journals that also contained anything created by students. The goal was for students to constantly be in contact with the journals so they might remember to make notes about their observations. Teacher evaluations of students were used at the beginning of the program to understand student baselines with respect to empathy. Finally, a social distance-type of activity was used at the beginning of the program and at the end to see if students felt closer to one another.

Using these added measures in the third iteration supported a more comprehensive way to understand the affordances of the environment. In general, when evaluating EDEs multiple ways of understanding interactions should be utilized.

Table 15: Comparison of Strategy variables across the three iterations. Table presents the approach in each of the three iterations and the rationale for change between them. Table continued on next page.

1st Iteration	Rationale For Change	2nd Iteration	Rationale For Change	3rd Iteration
Activity Attributes				
Perspective-taking	Utilizing a more comprehensive view of empathy	Attunement, Perspective-taking, Self-other awareness	-	Same
Contact, Active Engagement, Information	-	Same	-	Same
Implementation Path				
Guided by Trajectories of Awareness	-	Same	-	Same
First session as both welcome and introductions	Spending more time to allow participants and facilitators to get to know each other	4 sessions doing icebreakers and other activities before first curricular introductions	-	Same
Evaluation				
Facilitator field notes of empathy displays	Allowing facilitator to better concentrate on interactions; Bringing students into the evaluation process	Add observer field notes with particular focus on displays of empathy (Appendix G); Students note community expectations	Receiving another perspective on student dispositions toward empathy	Add teacher judgment of student empathy capacity prior to workshop (Appendix H)
Participant written reflections	Limited time to collect data necessary and short responses from students	Questions posed and answered aloud; recorded by facilitators.	More in depth conversations with students in private rather than with the group	Added student interviews (Appendix I)
Physical construction activities		Same	-	Same
Scratch projects	-	Same	-	Same
Facilitators note understanding of community formation	Allowing facilitator to better concentrate on interactions	Add observer noting understanding of community formation	Asking students their feelings	Add students pre- and post- Social Distance activity (Appendix J)

5.1.2 Analysis of Setting Variables

5.1.2.1 Location

The location in this research had an immediately noticeable effect on the interactions within the learning environment. During the first iteration, students were away from their school and, for the most part, were not restricted to the expectations of the school environment. The presence of the Community Teacher, and resulting import of those disciplining structures, probably restricted how "free" from the school environment the students could be. The second iteration was held in a school; however, most of the sessions were held in the library. This location, again, seemed to allow student to relinquish some of the classroom expectations. For example, they freely moved about the space, asked each other questions when necessary, and felt comfortable pushing back on me when they disagreed with something. All of these things are not allowed in their normal class environment.

In general, students should be able to have a space where they can be invited to participate in the creation of the environment and set their own expectations for interactions. In school settings might not be optimal, in that the events and rules from classroom activities during the day may carry forward into the activities of the EDE (assuming after school program).

5.1.2.2 Space Organization

There were a number of whole group, small group, and individual-based activities within the sessions. Situating the tables in such a way that students could easily collaborate, yet work on their own, was important with respect to time and not having to interrupt activities. It was also important to provide a focal point to draw students attention when all needed to know the same information. This kind of space organization will contribute to more fruitful interactions within the environment.

5.1.2.3 Food

Food was crucial for the very active, and therefore, very hungry students participating in this research. At the same time, food played a somewhat unexpected role during the iterations. In the most awkward of situations, food (and sometimes the weather) can be a fabulous conversation starter as well as an opportunity for students to exercise perspective taking in an unstructured setting.

In all three iterations, youth participants were able to visit the snacks table prior to the beginning of the activities. When snacks were limited, they had opportunities to practice self-restraint to allow others to also eat. In fact, during the third iteration, there was a lengthy discussion about sharing snacks and why it might be important to make sure others could eat when one student complained that he couldn't participate because his stomach was hurting from hunger.

Food should be provided throughout, as it can be utilized to support community establishment and in roads to deeper dialogue.

Table 16: Comparison of Setting variables for the three iterations

1st Iteration	Rationale For Change	2nd Iteration	Rationale For Change	3rd Iteration
Location				
Media Lab	No structure in place for students to come to another location	Junos Elementary School library	Library not available	Junos Elementary School classroom
Space Organization				
Tables placed in two groups	Having smaller cohorts of students to increase opportunities for interaction	Desks placed in groups of 4-6	-	Same
Food				
Food provided at the beginning of each session	-	Same	-	Same

5.1.3 Analysis of Nature of the Learner Variables

5.1.3.1 Attendance Rate

Students during the first and second iteration attended sessions about 90% of the time. During the third iteration there was a lot of students flowing in and out of the program.

At the beginning of the third iteration, we had fourteen students signed up for participating in the program. Eight of these students were enrolled in the after school program, which consisted mostly of playing in the gym or playground and tutoring. As a result, some students would choose these other activities over attending XO Club. Additionally, word about the program spread and other students wanted to be a part. In an effort to not exclude interested students, two new students began in the fifth session and one new student began during the seventh session. At the end of the third iteration, about 10 students attended 85% of the time.

This "revolving door" was, in some ways, disruptive to the flow of activities. For example, Cindy had a tendency to playfully hit other students when they disagreed. When she hit Allan, he immediately reported that she wasn't following the second community expectation (Keep you hand and feet to yourself). Cindy was very confused by this even though we had covered the expectations with her. While this presented an opportunity to revisit the expectations and challenged the group as a whole to think about why they existed, we had to do this every time a new person would decide to drop in on XO Club.

Similarly, when students had missed opportunities to learn about Scratch, we would have to cover material to catch them up.

While I desired to remain as open as possible and include as many students as possible, linear nature of the activities and the need to establish a cohesive community makes it very important those students attend regularly and that students are not entering half way into the program. This implies that students should be asked to attend from the first session and come as frequently as possible.

5.1.3.2 Age

Hector, a thirteen-year-old Hispanic male, preferred to work with Julian, an eleven-year-old African American male, and Joaquin, a twelve-year-old Hispanic male. Since we only had one session dedicated towards getting to know one another, we began pairing students in groups with people with whom they might not normally choose to work. Isabel and Hector were paired to make a three-part story, and together they had to decide what the story would be about, before creating the third part individually. Hector had his own ideas about the story and refused repeatedly to share them with Isabel. More than once he hid his computer from Isabel and wouldn't allow her to collaborate with him. Isabel, frustrated by this interaction, finally started making a story on her own. Later, she told us that working with Hector was the thing she enjoyed the least about the program.

During the first iteration, even though we were able to expose students to people they may not normally find themselves with, their age posed challenges to supporting self-other awareness. Adolescents (11-13) are at an age where they are really grappling with issues of

identity, and they are doing so at a time when they are overwhelmingly interested in how they are perceived by others. Younger (9-10) youth are beginning to grapple with issues of identity; however, they may not be dealing with the peer and social pressures experienced by adolescents. Two important theorists –Erik Erikson and Martin Hoffman – provide insight into the differences in dynamics found in the environment.

Erikson describes the physical, emotional and psychological stages of development, and relates specific issues to each stage. In his theory, school-aged children (6-11) are possibly in stage 4 called Industry versus Inferiority, where the child tries to develop a sense of self-worth by refining skills, while adolescents (12-18) are in stage 5 called Identity versus Role Confusion, where the child is trying to integrate many roles into a self-image under role model and peer pressure (Erikson, 1994).

Hoffman's five-stage model for empathy development suggests stages including global empathy, egocentric empathy, quasi-egocentric empathy, veridical empathic distress, and (full blown) empathy. Veridical empathic distress begins to emerge around age six or seven – prior to this, empathy is more reactive or based off mimicry. At this age, he suggests, children feel what is appropriate to another's situation, but they do not consciously realize that their distressed feeling was caused by the other's situation. It is during adolescence (stage 5 of Erikson) that full empathy emerges. This age marks an important point since this is also where the metacognitive ability to distinguish "self" from "other" becomes more prominent (Hoffman, 2001). Based on this information, pre-adolescence might be an ideal

time to work with youth in Empathy Development Environments. This guideline does not exclude working with other ages.

5.1.3.3 Dispositions toward empathy

Some students will naturally start out with more inclination towards displaying empathy. For example, Alia, a twelve-year-old African American girl (iteration 1) whose parents were from Haiti, was a student who was inclined to help others from the very first session. After spending about 10-15 minutes working on the nametags, we gathered together in a circle and took turns introducing ourselves. Once the first person said her name and described what she had put on her badge and why, the next person introduced himself in the same way and then re-introduced the person before him. This continued until the last person introduced everyone in the circle.

During this activity, Alia, who went fourth in the circle, noticed that people after her were having trouble remembering everything about those prior to them. In response, she started giving hints to other students to spark their memories. Similarly, during pair interviews in session two for the culture, media consumption, career aspirations activity, Alia worked with Isabel. Isabel struggled to understand how to ask questions of her partner. Recognizing this, Alia began coaching Isabel by seeding her with questions she might ask and helping her to cover the 5 W's (who, what, where, when, and how).

Across the iterations, having students with varying levels of empathy allowed for two things: 1) students with more dispositions toward empathy served as models to other students, challenging their interactions, and 2) the environment in general was populated

with students who, most of the time, interacted with others in empathetic ways.

Table 17: Comparison of Nature of the Learner Variables for the three iterations

1st Iteration	Rationale For Change	2nd Iteration	Rationale For Change	3rd Iteration
Attendance Rate				
Students asked to attend all sessions	-	Same	-	Same
Age				
Ages: 11-13	Younger demographic to possibly address developmental challenges encountered	Ages: 9-10	-	Same
Dispositions Toward Empathy				
All students included; Not screened based on empathy dispositions	-	Same	-	Same

5.1.4 Analysis of Resource Variables

5.1.4.1 Facilitation

For the first iteration, including the support teacher from our partnering organization, we had a total of four facilitators with ten students. While we found this ratio appropriate for our first attempt, this would not be a scalable model for future iterations. Another facilitation challenge during this iteration was the support teacher who was a part of our weekly interactions with the students. Support teachers are used to being very involved with designing the curriculum for the community teachers. However, Ms. Brennan has a degree and years of experience in curriculum development and I had experience in curriculum development as well, we did not need this type of support. This made it sometimes difficult to interact and find a meaningful role outside of disciplining the children with our support teacher, who was having trouble finding her place in the apprenticeship. Since she was busy with school and other commitments and could not participate in our session planning, the solution we evolved was to plan specific roles for her in the curriculum.

The Community Teachers organization (1st iteration) had established ways of handling discipline, rewards, and other ways of interacting with the students. For example, apprenticeships were expected to select students each week to receive stars labeled "pride," "joy," "respect," "courage," "perseverance," "tenacity," or "teamwork." Although the method of selecting students was flexible (i.e., community teachers can select or support

teacher selects), the fact that the stars had to be distributed is not. We requested that the stars not be given out, but were told this was not a possibility. The result was extrinsic motivation for students to interact in positive ways. While we hoped activities within our environment would support positive interactions, we did not have this kind of extrinsic motivation as a part of our strategy.

As a facilitator in the environment, beyond guiding students through the activities I paid very close attention to how I modeled empathy (e.g., listening to students, helping them, trying to understand where they were coming from an responding appropriately). I also tried to use unplanned opportunities to continue to scaffold students through difficult interactions. Recall that student worked with a different partner each week. This meant that in addition to creating projects, students had to figure out how to work with a new partner. As demonstrated by the story of Hector and Isabel (121), this was a difficult task. When I encountered challenging moments like this I supported students first by referring to the community expectations and talking to them about the difficulty they were having. I also tried to help them talk through the interaction and discuss how they could have handled the moment differently. This kind of scaffolding is something I, personally, became better at as the iterations progressed.

5.1.4.2 Technology Usage

The media packets during the first iteration contained an inexpensive digital camera and an audio device. Much to our dismay, the camera proved unusable since it would erase its memory contents if the battery died. Additionally, even if we managed to keep the pictures

they were irretrievable with the given software. While the audio recorder faired somewhat better, the difficulty of integrating it with Scratch made it less usable. Further, we found that students used it more to record music from home rather than what they were permitted to listen to during the apprenticeship so they could "secretly" hear their own musical selection rather than the music we provided. We needed a more efficient and reliable media package if we were going to accomplish our goals. The move to the XO laptop solved a lot of the issues encountered, and allowed technology to facilitate rather than inhibit the learning goals.

Emotion and identity can be somewhat intangible. While we know *that* we feel, it is not always obvious *what* we feel or *why* we feel the way we do. Similarly, identity is a dynamic and changing and not necessarily easy to comprehend. The work of Marina Bers showed concretely that technology can be a tool to think about identity with, and my previous work provided some insight into that role of technology with respect to emotion. In this dissertation research, technology proved useful as a tool to think about emotion and identity. I discuss the specifics of this in the "Learning variables" section below. Here, I describe the utility of Scratch and Affect as Index in the learning environment.

Scratch as a storytelling environment proved valuable for a number of reasons. First, the interactive capabilities of Scratch allow for non-linear storytelling, which expanded the types of stories students could share. Second, learners could allow users to physically interact (e.g., button presses to help the stories progress) with their narratives as much or as little as they desired. In the process of envisioning these interactions, they had to place

themselves in the mind of the user and make educated decisions about what would support a pleasurable experience.

Next, the readability of the graphical blocks and the ease of exporting specific Sprites (programmable objects in Scratch) for sharing supported students working together (Resnick et al., 2009). Finally, the ability to manipulate pictures of themselves and their own voices allowed them to personalize the stories and fully engage in the exploration of self. Although Scratch was a powerful tool for thinking about identity, using it as a tool to think about emotion was not as straightforward, unless student stories explicitly dealt with the topic.

The emotion badges used in the second iteration were an attempt to address the issue of discussions around emotion; however, it wasn't until the final iteration that discussions occurred in a meaningful fashion. Affect as Index allowed students to see visual representations of their skin conductance after a series of exercises (e.g., watching funny video clip, doing jumping jacks, solving math problems). This graph served as a basis to generate stories.

As students looked at the graph, they imagined which part of the graph represented the different parts of our exercises and started telling stories about *why* the graph looked the way it did. Terrence, for example, saw one graph decrease while others remained the same. He imagined the person was not interested in the activity and guessed that this point in the graph must have been related to another student sitting down. The arousal levels

were more objective in this way and made conversations about feelings emerge with less hesitation than was experienced in other iterations.

Table 18: Comparison of Resource variables for the three iterations

1st Iteration	Rationale For Change	2nd Iteration	Rationale For Change	3rd Iteration
Facilitation				
3 facilitators plus support teacher	Ratio of facilitators to students too high to support future sustainability	1 facilitator plus support teacher	-	Same
-	Need to use all moments of interactions to support students	Using unplanned opportunities to highlight program themes	-	Same
Technology Usage				
Media Lab computers with inexpensive audio recorders and digital cameras	Individual pieces of technology continuously malfunctioned	XO laptop computers that have integrated audio, camera, and video	-	Same
Scratch	-	Same	-	Same
No specific activities for emotion sharing	Need to share emotions to support understanding of others	Emotion badges	Badges not a natural integration with workshop discomfort with sharing	Affect as Index

5.2 Dependent Variables

5.2.1 Analysis of Climate Variables

5.2.1.1 Community Establishment

In order to establish community amongst participants, all of the youth involved in the program are asked to attend all of the sessions. Further, at the beginning of the program, facilitators and students work together as a group to create a list of community expectations, and during the second and third iteration a group name. The final strategy used for establishing community is collaborative groupings. At each session, students work with someone in the program with whom they have never collaborated. Since students must create small projects, they must figure out how to work together in order to accomplish this goal.

Students had interesting perspectives on community expectations. By and large, community expectations were seen as different from rules that one might find in a regular classroom. As one student put it, "Rules you have to do, like the law. Community expectations are something that you are expected to do because you made them up." This student, and others, seemed to feel ownership over the community expectations. At the same time, seeing expectations as flexible meant that "obedience" was optional.

Students who saw community expectations as more rule-like tended to use them as opportunities to tattle on other students. Often, I would hear, "Number 2, Ms. Shani! She

broke Number 2!" This number referred to the community expectations that were numbered as they added to the list. When I asked one student why he chose to tattle on others, he said it was usually retribution for an earlier event during school time that made him feel like he was being picked on.

Most striking about the community expectations was a teacher who decided to adopt the idea into his own classroom. Although he had previously told me they were a good idea, it wasn't' until I went into his classroom and saw them posted that I understood his investment in them. He thought expectations were a key way to ground students in productive ways of working together.

While student interactions in the first and second iterations seemed to allude to the fact that a sense of community was being established, the social distance activity and interviews during the third iteration were most telling in this respect. Students who knew each other prior to joining the program (i.e., "I have met him/her before, but we don't hand out very often" or "I know him/her from class") felt at least like friends with others, but sometimes felt "very close" to one another. Students felt like XO Club was a place where all of them could get along even if they didn't outside of the program. As one 10-year-old female student stated, "You can make new friends [in XO Club]. If anybody like gets in trouble or is mean to you and you see them in XO Club you can talk it out and straighten it out. Next day at XO Club, you can still be friends... Usually people don't wan't to *[pause]* those people out there don't talk to me."

Even though students began to feel like a more cohesive community, during the second and third iterations (when I had a predominantly African American group rather than mixed as in the first), the tradition of "playing the dozens" surfaced frequently. Here is an example:

> *Anderson: Man, I am so attractive!*
> *Jonathan: Naw, you ain't all that*
> *Anderson:You're just jealous because you look more like a tractor than you are attractive (making tractor and attractive rhyme)*
> *All students Laugh*

Embedded in African American culture is a tradition of verbal insults (Kelley, 1998) referred to as "jonesing," "joshing," and "Yo mama jokes." While most of the time these jokes were considered by most as playful, students would often get offended and try to find a way later to retaliate. Retaliation did not always mean resorting to violence; however, a back and forth of jonesing almost always followed. The question for this research about jonesing was whether or not to consider these insults as counter to the expectations of the environment we were trying to establish.

After much consideration, I believe that in order to establish a "new normal," or different ways of interaction that it might be necessary to find ways to put a positive spin on these jokes or even cut them out all together. Although there is an understanding in the culture (even in my own family) that everything is in jest, students cannot be afraid that sharing any weaknesses can leave them open to being the object of someone's joke.

In general, when trying to establish community, paying attention to the stages of group development might help with the timing of activities. Tuckman and Jensen's (1977) model suggests five stages for groups including: forming, storming, norming, performing, and

adjourning (**Figure 21**). The first set of activities used with the group will set the stage for the forming stage in which behavior is driven by a desire to be accepted by the others, and avoid controversy or conflict.

Serious issues and feelings are avoided during this stage. During storming, issues and sometimes conflict arise. These challenges present good opportunities moving into the norming stage when the group decides how it will work together and begins to open up and discuss differing perspectives. In the context of EDEs, this stage is a good time to define community expectations. With respect to the jonesing challenged mentioned above, this is also a good time to decided the appropriate nature of interactions that will support the group in the performing stage.

The performing stage is characterized by the ability to produce and work together. Since the goal of EDEs -- to develop empathy in youth so they can better work together – is somewhat akin to this performing stage, youth might stay in the earlier stages as they continue to grapple with the concepts. In other words, rather than following the more linear process suggested by Tuckman and Jenson, storming, norming, and sometimes performing might be revisited.

Figure 21: Stages of group development suggested by Tuckman and Jenson. In the context of EDEs, youth may revisit stages depending upon events in the environment.

5.2.1.2 Helping Behavior

Throughout this research students assisted each other in various ways. These instances included helping others by setting up for the day's activities, fixing technical issues, saving Scratch projects on the computers, sharing when another student did not bring a computer, bringing extra snacks to make sure everyone could eat, and carrying or picking up things to help me[8].

The most interesting instances occurred when students endeavored to help the facilitation process by asking other students to pay attention to the community expectations. For example, during the second and third iterations, if students had a long day during school (e.g., during testing), time during after school was needed to unwind. While I tried to support opportunities for students to relax a bit, it was very difficult for them to focus and participate. When students were unable to settle down, very often another student would step up and remind them that it was expected that we listen to each other.

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[8] I was pregnant during the second and third iterations, so students recognized that I might need extra help.

5.2.2 Analysis of Learning Variables

5.2.2.1 Attunement

Students listened most frequently when they had targeted opportunities. During week eight (iteration 1), for example, the opening ritual involved a storytelling activity where the students selected three slips of paper with an object, a person, or a place written on each. Each student was asked to use one of the chosen items and begin telling a story. Once the story had begun, the next student in line used one of the words in his hand to continue telling the story. This continued until all of the students had contributed to the story. Students, then, had to listen very closely in order to successfully create a coherent story. Similarly Beatbox and Machine placed students in positions to listen in order to accomplish the task.

5.2.2.2 Self-other Awareness

Emotion. Supporting students in engaging in discussion around emotion was a challenge throughout this research. First, as demonstrated by the vignette below, a lot of discomfort associated discussion about emotion.

We continued our discussion about interpretations by asking each student about a time that he or she may have been misunderstood because someone else interpreted something said in a different way. After Sarah, an outspoken eleven-year-old African American female told her story, I asked her how she felt about being misunderstood. She quickly shrank back in her chair, looked around at the rest of the students, and replied, "I don't know." As I tried to ask her more questions about her feelings to clarify, she remained timid in her response.

During the second and third iteration, there was more focus on discussing emotion. It became evident very quickly, however, that emotions, for many, are far too personal to share. Even though there was more effort to establish a feeling community for discussions, students still needed support for this level of sharing that made emotions more objective. Affect as Index was a direct response to this observation, and helped to make these conversations more accessible.

In addition to the discomfort associated with the subject matter itself, as demonstrated in the next vignette, describing emotions was a challenge for students.

We sat down in front of construction paper, glue, markers, and pens. After a brief discussion of our time, students were asked to create badges representing the different emotions they thought they might have throughout the workshop. Students were having trouble identifying specific emotions, so Michelle brainstormed with them about commonly known emotions. Students first suggested things like fantastic, rambunctious, and crazy. Michelle prompted them with emotions such as happy, glad, or sad, to clarify what we meant by emotion. Frustrated, mad, confused, and frightened were emotions students then came up with. Even with a somewhat different vocabulary, though, students found it difficult to share their feelings with each other.

Activities were needed to help students build the vocabulary needed to support dialogue. The emotion charades activity introduced in the third iteration provided an opportunity to

practice emotional vocabulary. For example, Allan, a 10-year-old Caucasian male, guessed that Jordon, a 10-year-old African American male (3rd iteration) was angry during his turn to display an emotion. Others thought that he was expressing that he was sleepy; however, Allan said that he knew, from seeing this emotion in class, that anger was being expressed. In addition to being able to talk about the difference between states (e.g., tired, confused) and emotional states, this was a great opportunity to talk about how knowing someone helps you to better understand their emotions. This kind of basic introduction needed to be woven throughout to continue to equip students.

Identity. The complex interactions and relationships that existed within the environment either supported or disrupted our goal of cultivating self-understanding. These factors are presented as five clusters in relation to each learner: *individual*, *peer*, *learning environment*, *family*, and *society*.

As *individuals*, learners brought multilayered and nuanced understandings of themselves to the learning environment. We saw these understandings interact with the identity activities in various ways, often in relation to the learners' own comfort with notions of self-understanding. Alia, for instance, felt very comfortable with articulating her interests and preferences, while Joshua's discomfort with sharing his interests and being reflective was expressed as deep frustration and anger.

The *peer* influence among the learners contributed to their willingness to participate in activities. There was a general vulnerability among the learners about sharing their feelings

with one another; it was not enough that we (as session facilitators) were interested in and caring about their contributions. The other learners alternated between being catalysts and inhibitors to learners opening up to each other. Peer perception of an individual's identity contributed to the ways in which self-understanding was then enacted. For example, others' perceptions of Hector (1st iteration) as the edgy, cool kid reinforced an expectation of disruptive behaviors, which he then often demonstrated.

In our analysis, we interpreted the multiple ways in which the level of formality in *learning environments*, such as the learners' schools and our program, impacted their notions of identity. A constant tension persisted between our learning environment and the comparatively formal school environment, reinforced by the supervising teacher who was to provide insight into our learners' "student identities" (i.e. their identity at school). While she helped us to better understand our learners, her presence contributed to the inability of learners to experiment with new framings of identity in our environment.

As students were either unwilling or disinterested in discussing their home lives, we did not fully understand the role of *family* on the development of identity until the culminating event, when we had the opportunity to meet many parents. Through conversations with the parents, we saw the ways in which participation reframed learners' self-understandings. For example, although teachers described him as belligerent and anxious when he entered the program, Joshua's (iteration 1) mother described his transformation into someone who was passionate and committed to artistic self-expression at the culminating event. Similarly, Ming's mother described how she saw her daughter as

outgoing at the end of the program, though teachers, when she entered the program, perceived her as debilitatingly shy.

Finally, broader expectations and projections from *society* influenced the perceptions and self-understandings of the learners. Many self-constructions, through a social lens, connected to themes of discipline and devaluation. For instance, when asked to create a set of guidelines for belonging to and participating in the sessions, the students uniformly phrased guidelines as things not to do – limiting bad behavior rather than supporting or reinforcing positive interactions. This negativity was more explicitly articulated by the students during an activity in which we discussed the things that we hoped people would notice about us. Many learners described a sadness about being misperceived as dangerous or unkind, and a strong desire to change these broader social perceptions of themselves, their families, and their communities.

Even with these challenges, there was evidence that students were able to explore their self-understanding. Scratch as a tool across the iterations was useful for supporting self-awareness, in that students often used it as a tool for *self-expression*. They felt that their stories were important and expressed pride in them. One student stated, "Scratch is a tool that lets you express yourself." This same student drew anime and took pictures of them to put in his Scratch projects.

Figure 22: Student's drawing brought in from home and scanned into Scratch

These stories served as opportunities to think about themselves. In general, student projects explored *their desires* for the future, the kinds of things they were *passionate about* (e.g., dancing, clothes, cars, books), and how they *see themselves* in the future.

5.2.2.3 Perspective-taking

The act of storytelling supported students in practicing perspective taking. When students created fictional and non-fictional plots, they often placed themselves inside of the characters' shoes to determine their reactions within the story. In Elaina's final project for the culminating event, she wrote a story about a girl who must make a decision about whether or not to steal in order to make new friends. During the course of the story, the main character, Giana has a friend who tells her that she has to make the "right" decision or they can't continue to be friends (see Figure 23).

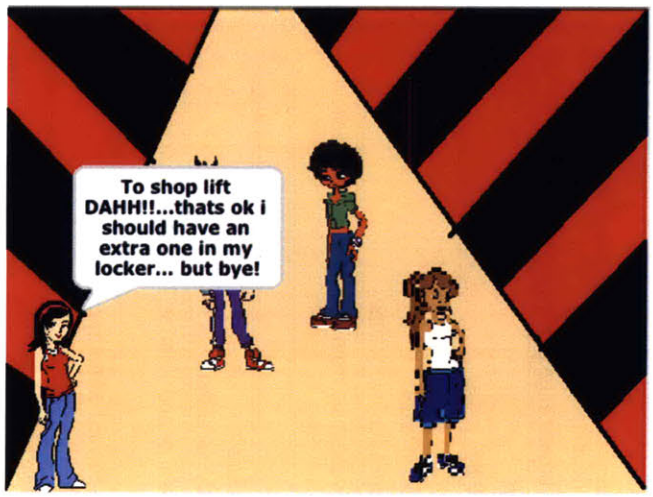


Figure 23: Frame of Elaina's final project where main character is being asked to shoplift in order to be a part of the popular crowd at school

5.3 Guidelines for Implementation

As mentioned in Chapter 2, the characteristics of an Empathy Development Environment include the following:

1. They provide opportunities to practice the skills of empathy
2. They utilize technology and narrative to allow participants grapple with emotion and identity
3. They create opportunities to engage in transformative dialogue.
4. They support the formation of and participation in a group that has its own identity.

Through an analysis of the iterations of Beyond the Looking, a series of guidelines have emerged that should support EDEs in having these characteristics. On Table 19, I summarize some guidelines that can be used in the design of Empathy Development Environments.

Independent Variables			
	Strategy	Activity Attributes	• Pay attention to the multidimensional nature of empathy • Support opportunities to construct artifacts • Contain activities designed for participants to practice one or more of the skills of empathy • Allow the use of narrative • Incorporate specific opportunities to build emotion vocabulary • Use a variety of strategies including contact (mediated or non-mediated), information, experience, and active engagement • Present non-threatening ways to discuss emotion • Provide opportunities for reflection
		Implementation Path	• Provide adequate time to work through early stages of group development • Begin with opportunities for introspection before moving into other-centered perspectives
		Evaluation	• Utilize more behavioral measures to evaluate empathy displays • Incorporate ways for participants to provide feedback on progress
	Setting	Space Organization	• Group tables or desks to allow ease of collaboration • Have open space where participants can come together to perform tasks • Use focal space to draw student attention together during independent work time
		Location	• Allow students and facilitators to create an environment that is set apart from other in and out of school activities and has its own set of expectations
		Food	• Provide food for students during the course of sessions
		Attendance Rate	• Ask participants to commit to attending all sessions that are possible • Impress on participants that regular attendance will enhance the workshop
	Nature of the Learner	Age	• Involve participants that are old enough to explore issues of identity and emotion, but young enough to avoid some of the throes of adolescence.
		Dispositions toward Empathy	• Create opportunities for participants with natural dispositions toward empathy to work with participants who might not exhibit natural inclinations
		Facilitation	• Look for opportunities outside of planned activities to use as teaching moments • If partnering with another organization, make sure goals are aligned • Have enough facilitators to allow participation in activities, while not preventing in depth observation of interactions
	Resource	Technology Usage	• Use to discuss emotion in nonthreatening ways • Use to support artifact construction • Use to support storytelling
			• Use to support post-hoc reflection on experiences

CHAPTER 6. CONCLUSIONS

Throughout this research, I endeavored to elucidate a set of guidelines for technology-infused learning environments to support the cultivation of empathy that would be of interest to researchers and educators. Researchers, I hope, will be able to use the guidelines developed in order to further develop activities and conduct efficacy studies on programs of their own. On the other hand, I hope that educators will be able to use *Beyond the Looking* in its current form and see impact within their own classrooms. For example, the principal of the school in Birmingham is very interested in continuing the program.

As I worked to uncover these guidelines, a number of contributions have arisen on the theoretical, design, and empirical levels. From a theoretical perspective, I have defined *Empathy Development Environments*, to describe technology-infused learning environments to support the development of empathy. I have also developed a framework called *Trajectories of Awareness* that can be used as a guide for structuring activities to cultivate empathy through the exploration of emotion and identity within a learning environment. This exploration takes place by first focusing on self and eventually moving into an understanding of others.

From the design aspect, I created a model EDE called "Beyond the Looking." Beyond the Looking consists of interactions in the real and digital world that engage learners in exploring concepts of identity and emotion on both individual and community respects. The Scratch programming environment served as one tool for digital interactions. The Scratch activities used in Beyond the Looking have been translated into Spanish and Portuguese by outside parties who took interest in the project.

Also on the design level, and a second technology used in this research, I have envisioned and implemented a platform called *Affect as Index* which supported conversations around emotion that were previously intangible. During the development of Affect as Index, I created signal-processing algorithms for filtering and aggregating group skin conductance data. Affect as Index was a key breakthrough for supporting discussion around emotion. In prior iterations, either lack of vocabulary or levels of discomfort prevented us from fully exploring ideas around emotion. Affect as Index served to take emotions, which are extremely personal, and make them more objective. While the platform was only used in the final iteration of the environment, use of it showed promise for future work.

Empirically, I carried out three iterations of a design-based research study utilizing Beyond the Looking as a means to define guidelines for the implementation of Empathy Development Environments. For each of the three iterations, I focused on challenges to the implementation in order to refine the environment structure as I progressed to the next

iteration. Beyond these contributions, I imagine a number of directions the research can take along these same dimensions.

6.1 Future Directions

6.1.1 Theoretical

Moving forward with this research, I would continue to rely upon the Trajectories of Awareness to guide the focus of and implementation path of activities. I would also add experience to the mix of strategies used in the environment. Recall Jane Elliot, a teacher in a Riceville, Iowa middle school who used "discrimination day" to support students in standing in the shoes of others. While I did not focus on experience as a strategy, I think that this kind of exercise leaves a lasting emotional impression that may not have been as present in the current environment model. In other words, we were thinking about and discussing emotion as well as creating personally meaningful artifacts; however, there were no activities to evoke the emotional memory of actually feeling as someone else.

6.1.2 Design

6.1.2.1 Affect as Index

While the primary use for Affect as Index in this work was supporting student dialogue around arousal, there are a couple of other envisioned scenarios of use for this system.

Autism Spectrum Disorder. Often in classroom situations, a person with autism may appear settled on the outside, but may be over-stimulated on the inside. If a teacher does not have this information, he or she may be caught by surprise if a student begins an outward rage

or begins injuring himself. Using the iCalm sensor platform, the teacher could have access to both individual and aggregated data on her students that can be used to give her a warning when a student is not as calm as his outward appearance would lead one to believe. Further, teachers could be taught how to better handle such situations before they escalate into extreme frustration, anger, or injury.

Educational Video Analysis. Affect as Index could be used as a tool for educational researchers who are consistently looking for pedagogy that will engage students and enable them to both remember and apply what they have learned. While testing and self-report measure can give insight into the effectiveness of teaching strategies, having affective data related to arousal, which correlates with memory and attention, could change the way teachers evaluate their pedagogy. Similar to the use of the platform described above, teachers or researchers could have real-time data that gives insight into how engaging the pedagogy is and adapt appropriately. Further, if the lesson is videotaped, a teacher (or researcher) could revisit the situation and correlate high arousal points with moments in her teaching.

Facilitating Individual Interviews or Focus Group. Affect as Index can be used for indexing group responses to any kind of content including videos, products, or websites. Imagine a group watching an emotionally charged movie or interacting with a product. During this activity, iCalm gathers their skin conductance data. At the end of the activity, each person can view his or her data. As he clicks on the different peaks and valleys of the graph, he is

shown which part of the activity the arousal corresponds to. This reflection could be used to conduct an interview, or be aggregated and shown to a larger group for discussion.

Physician Education. Physician-patient relationships were previously used to underscore the importance of empathy. Also discussed were the findings of Marci, et al. (2007) who showed that patient perceived empathy correlated to concordance in skin conductance between physicians and patients. Affect as Index could be used to support physician education. Even without the necessity for aggregation, a doctor in training could tape an interaction with a patient and the shown points of high and low concordance. This information could be used to help the doctor refine her methods with patients.

6.1.3 Empirical

In the next iteration, I would work in a classroom with a teacher. I am very interested in understanding whether or not extending into the classroom will support the environment I observed in this research in generalizing beyond our XO Club community. With a focus on 21st century skills that include collaboration and logical thinking, the model is immediately appropriate for classroom use since working together to solve problems and solving challenges in Scratch are a part of the interactions. Interacting with a teacher would also help me continue to understand the qualities of a facilitator that are necessary to implement the model with fidelity. Reflecting upon my own interactions, I saw the need to model empathy and scaffold students in their interactions, but there may be other qualities

about my interactions that I have taken for granted. These would become more obvious watching someone else acting as facilitator.

For the next iteration, I would also continue to refine my evaluation methods. Even as I observed and compiled my notes with the observer, capturing interaction data was challenging. Video could be a way to collect this interaction data; however, there is an immense amount of information necessary to accurately capture interactions. A bird's eye view of the environment will only provide a sense of the interactions in general. The fullness of student-student and student-facilitator interactions will be lost without focusing on dyadic interactions. To decrease the amount of video information, Affect as Index could be used during each session. Then, when sorting through the videos, arousal points could be used to draw attention to possible key points in the interactions.

For evaluation, I would also add a second autobiographical representation (see Interactive Nametag) at the end of the sessions. This artifact could provide information related to changes in self-perceptions of students.

6.2 Conclusions

From birth, all of our experiences shape how we see, interpret, and, therefore, understand the world. While these experiences are rich and contribute to who we are as individuals, they can also be limiting in the sense that it is often difficult to see beyond our own worldview. Miscommunication and misunderstandings can inhibit us from working with people who are different from ourselves. Empathy is a core ingredient of caring and

successful relationships that can speak to the challenges associated with mismatched worldviews. The ability to perceive and respond to another has profound implications for a variety of relationship dynamics and can contribute to reducing violence, enhancing collaboration, and supporting innovation. This research provides a theoretical framework, a set of technological tools, an example environment developed over the course of two years, and a series of guidelines that can be utilized in the design of Empathy Development Environments that can be a stepping stone toward addressing these challenges.

APPENDIX A. INFORMED CONSENT

PARENTAL CONSENT TO PARTICIPATE IN

RESEARCH PROJECT AT THE MEDIA LAB

We are inviting your child (along with other members at the Citizen Schools Media Lab Scratch Apprenticeship) to participate in a research study conducted by Professor Mitchel Resnick and his colleagues, from the Media Laboratory at the Massachusetts Institute of Technology (MIT). You should read the information below, and ask questions about anything you do not understand, before deciding whether or not to allow your child to participate.

PARTICIPATION AND WITHDRAWAL

Your child's participation in this study is completely voluntary, and your child is free to choose whether to be in the study or not. Your child can decide to withdraw from the study at any time without penalty or consequences of any kind. The investigator may withdraw your child from this research if circumstances arise which warrant doing so.

PURPOSE OF THE STUDY

The MIT Media Laboratory has developed new computer software, called Scratch, to help young people express themselves creatively with new technologies. As part of this project, MIT researchers will study how young people use Scratch to create digital-arts stories and what they learn in the process.

PROCEDURES

MIT researchers work with Citizen School apprentices once a week for ten weeks to help apprentices learn to use Scratch software, and to study how and what members learn as they use the Scratch software.

As part of this process, MIT researchers will periodically interview apprentices (sometimes on audiotape or videotape), asking questions such as:

- How did you come up with the idea for your project?
- What was the most difficult part of the project?
- If you could change the Scratch software, what changes would you make?

POTENTIAL BENEFITS

By participating in this project, your child will learn to use computers more creatively. In particular, your child will learn to program a computer to create artistic projects, using innovative new software developed at MIT.

CONFIDENTIALITY

All information and data (handwritten notes, audiotapes, videotapes) obtained in connection with this study and that can be identified with your child will remain confidential and will be disclosed only with your permission or as required by law.

In any external documents (research reports, journal articles, etc.), participants will be identified only by pseudonyms. Audio and video tapes of participants will not be available publicly without written consent from the participants (and their legal guardians). All audio and video tapes will be archived in project files at MIT (and not accessible to any outside parties).

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact Professor Mitchel Resnick at 617-253-9783 or mres@media.mit.edu, Karen Brennan at 617-253-6739 or kbrennan@media.mit.edu, or Shaundra Daily at 617-253-6341 or sbryant@mit.edu, or Colleen Kaman at colleen.kaman@gmail.com

RIGHTS OF RESEARCH SUBJECTS

Your child is not waiving any legal claims, rights, or remedies by participating in this research study. If you feel your child has been treated unfairly, or you have questions regarding your child's rights as a research subject, you may contact the Chairman of the Committee on the Use of Humans as Experimental Subjects, MIT, Room E25-143b, 77 Massachusetts Ave, Cambridge, MA 02139 (or phone at 617-253-6787).

SIGNATURE OF PARENT (OR LEGAL GUARDIAN)

I understand the procedures described above. My questions have been answered to my satisfaction, and I give my consent for my child to participate in this study. I have been given a copy of this form.

_____

Name of Subject

Name of Parent (or Legal Guardian)

Signature of Parent (or Legal Guardian) Date

SIGNATURE OF INVESTIGATOR

In my judgment the parent (or legal guardian) is voluntarily and knowingly giving informed consent and possesses the legal capacity to give informed consent for his/her child to participate in this research study.

Signature of Investigator Date

APPENDIX B. ASSENT FORM

ASSENT TO PARTICIPATE IN RESEARCH

Cultivating Empathy: Incorporating Social and Emotional Learning in a Technology-based Curriculum

1. My name is Shaundra Bryant Daily. I'm a graduate student at the Massachusetts Institute of Technology. As you know, I'm doing a program at your school to help you learn to program computers and work on your interpersonal skills.

2. I'm asking you to take part in this study because I'm interested in what kinds of stories you and other kids make with the Scratch activity on the XO laptop, and what you learn about each other in the process.

3. If you agree to be in this study, you will use Scratch activity to create projects that talk about yourself and others. You will also work on group projects.

4. I will videotape and audiotape all of our sessions, but I will keep all of this information private. I will use what I collect to help me make this program better for other kids in the future.

5. You will also wear a sensor that lets me know when you have an emotion like happiness or anger during our session. I won't be able to tell what that emotion is, nor can I tell what you are thinking. If at any session you don't want to wear the sensor, that is okay. If you are wearing it, and it causes any sort of discomfort you can take it off.

6. I am going to ask your parents to give their permission for you to take part in this study. But even if your parents say "yes" you can still decide not to do this.

7. If you don't want to be in this study, you can stop being in it at any time. Even if you decide not to be in the study at any time, you can still be in the program. Being in this study is up to you and no one will be upset if you don't want to participate or even if you change your mind later and want to stop.

8. You can ask any questions you have about the study now. If you have a question later that you didn't think of now, you can call me at 617-304-6500 or ask me at the next meeting.

9. Signing your name at the bottom means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

_____

Signature

_____

Print Name

_____

Date

APPENDIX C. BEYOND THE LOOKING SESSION STRUCTURE

Activity	**Description**
Welcome & Snack Time	Students, who often arrived to the apprenticeship hungry, had an opportunity to eat and relax for a few minutes before starting the week's activities.
Opening Ritual	Activity introducing the theme for the week. Most often involved physical construction of artifacts.
Activities	Section consisting of one to three structured activities with at least one involving Scratch to facilitate exploration of week's theme.
Reflect & Project	Circle time where students were asked to think more deeply about the week's activities and share their opinions.
Teach Back	A series of questions to which students responded by posting their answers on a board. Allowed facilitators to receive ongoing input from students about the apprenticeship.

APPENDIX D. BEYOND THE LOOKING WEB VERSION

This can be found at: http://web.media.mit.edu/~kbrennan/beyond/

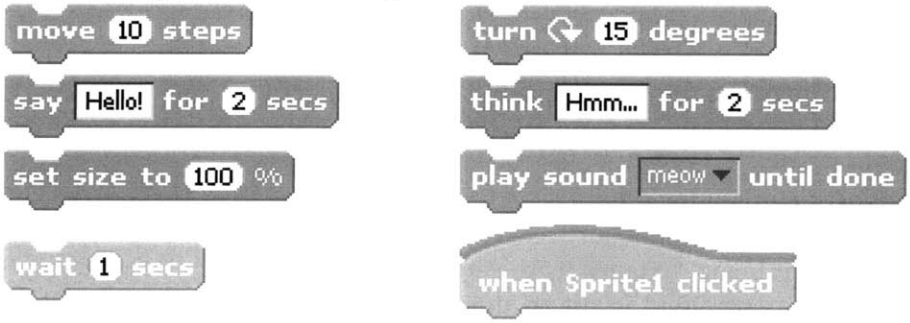
Session 1 – Introduction

Goals

In this session, participants will:

- identify things that are important to their concepts of identity
- learn about one another

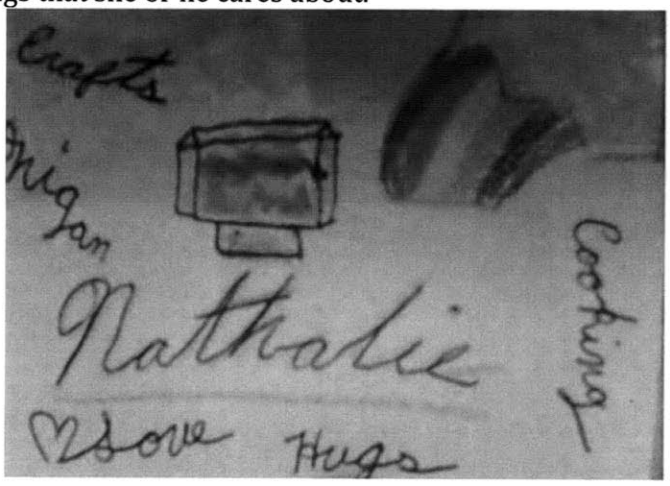
They will explore the following Scratch blocks and ideas:



negative numbers random sprites

Introduction - my id

Given a collection of craft materials, participants will create an identifier, such as a nametag, place card, or button. The identifier should show the participant's name and highlight some things that she or he cares about.



Activity 1 - hello, my name is...
The purpose of this activity is for participants and facilitators to learn about one another. In turn, each person will introduce themselves and show the identifier that they constructed in the introductory activity, selecting one aspect that they think is particularly important.

Participants should try to repeat the name and important aspect of every person that spoke previously. The activity should continue until everyone has been introduced.

Activity 2 - exploring Scratch
Facilitators will provide a short demonstration of Scratch, showing the user interface and at least one workshop-themed sample project. Participants should then have the opportunity to collectively create a project using the Scratch blocks listed above.

For example, a project could be shown on a screen at the front of the room. Each student, in turn, could come to the front of the group, add a sprite, and animate it with blocks. The final result might look like the project shown below:

Click each sprite to see the sprite respond with sound and motion.

Reflection
Some questions for reflection might include:

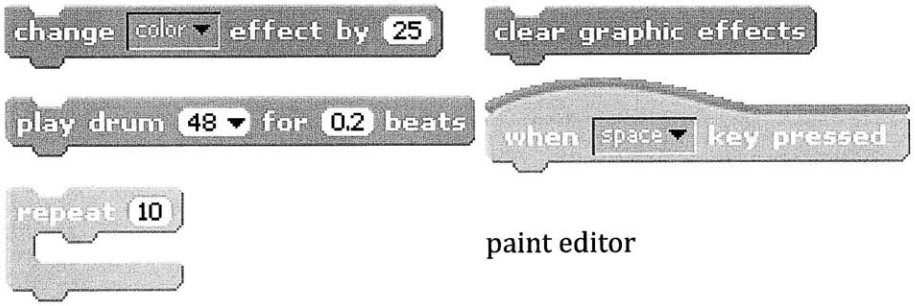
- What was something I learned that surprised me?
- What is something that I want to learn by the end of the workshop?
- What is one thing that was important to the person who introduced themselves before me?

Session 2 - Interactive collage

Goals
In this session, participants will:

- explore asking questions and listening actively
- identify and describe people, places, things, and ideas that they feel are important to them

They will explore the following Scratch blocks and ideas:



paint editor

sprite libraries

sound libraries

Introduction - culture, media, career
Each participant will receive three cards, which they will use to construct physical representations of facts about themselves. On the back of each card there is a question to answer and on the front of each card is a space for responses in images and/or text. The three questions are:

- **Culture** - Do you speak a different language?
  - If so, which language?
  - If not, which language would you like to know?
- **Media** - Do you watch sports on television?
  - If so, what is your favorite sport to watch?
  - If not, what is your favorite thing to watch on television?
- **Career** - Do you think that you could be an engineer?
  - If so, what would you want to study in science or engineering?
  - If not, what else would you like to do or be?

After responding to the questions, participants will attach their response cards to corresponding chart papers (one each for *culture, media, career*) and spatially organize their responses by commonalities.

Activity 1 - interview practices
Participants will be introduced to strategies for conducting successful interviews. Facilitators should review the strategies and remind students of the importance of the 5 basic W's, with an emphasis on asking open-ended questions and gathering small details.

Facilitators should introduce an audio recording method to use during the activity and distribute notebooks to each participant. In pairs, participants will take turns interviewing each other, recording questions and responses in the notebooks. The interviews will be focused on creating a story around one of the three opening ritual questions (culture, media, career).

Activity 2 - interactive collage
Facilitators will introduce interactive collage as one possible way of representing an interview. Key features of the collage include:

- a representation of yourself
- a collection of things, people, and ideas you care about
- a narrative about those things, people, and ideas

Individually or in pairs, participants can work on creating an interactive collage. The collage might have:

- drawings or pictures of the participants
- sprites from the Scratch media library or drawings of things that participants identified as important through the interview
- interactivity with the pictures and drawings, using the motion, looks, and sound blocks

Activity 3 - gallery walk

Participants can tour through the group for demonstrations. Some participants might provide demos while others visit. Afterwards they can switch, so that everyone has an opportunity to demo and tour.

As a group, participants and facilitators might discuss what was noticed about the collages:

- Which interests do we have in common? Which are unique?
- What similarities or differences are there in how Scratch was used for the collages?

Reflection

Some questions for reflection might include:

- What is something that I learned about interviewing?
- What is something that I learned to do with Scratch today?
- What shared interests do we have in the group?
- What am I excited to do in a future session?

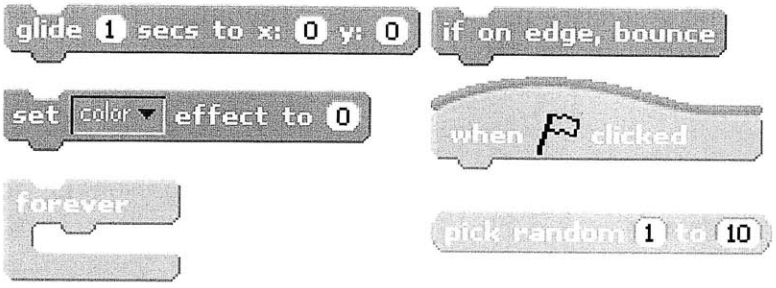
Session 3- Shared experience

Goals

In this session, participants will:

- explore ideas around shared experience and perspective
- practice respectfully representing another's perspective

They will explore the following Scratch blocks and ideas:

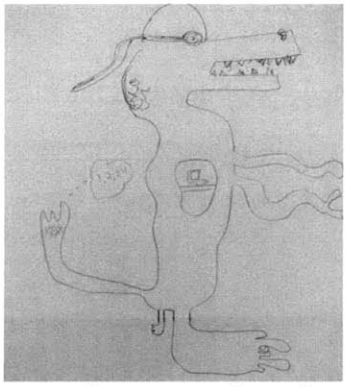


editing pictures setting backgrounds

Introduction - rotating bodies

Each participant will receive a tri-folded page:

- Participants should start at the bottom and draw "legs". Based on the position of the legs, participants should provide a hint for where to start the torso, and then pass the drawing to the next person.
- Without peeking at the legs, participants should draw the "torso" (and hint), and then pass the picture to the next person. Repeat once more for the "head".
- Once all drawings are complete, participants can unfold the pages to reveal the rotating bodies.



At this point, facilitators might start a discussion about how other people can interpret our ideas and actions differently than we intend.

Activity 1 - investigating the experience

In this activity, participants will document perspectives from the first workshop session, as shared by facilitators. Participants will interview a facilitator, and record the interaction for use in the next activity.

Large groups might be split up into smaller groups for this activity, in order to provide a more individualized interview experience. While one group interviews a facilitator, other groups might:

- practice interviewing skills
- review Scratch skills
- review AV equipment skills

Activity 2 - documenting the experience

Participants can use Scratch to create a representation of the interview from the previous activity. Emphasis might be placed on creating a story that respectfully represents what participants heard from the facilitators, as well as any personal impressions from the participant.

The facilitator could create a personal version of what he or she remembers happening the first day of the workshop. Projects might include:

- a picture or audio from an interview
- additional materials that represent people, places, and things
- interactivity with pictures and drawings

Activity 3 - sharing stories

Participants can share their story with a nearby participant. Facilitators and participants can then discuss what was noticed about the stories and the process of creating the stories:

- What surprised you about the facilitator's recollection of the events versus your own?
- What elements did the stories have in common?
- What similarities or differences are there in how the participants used Scratch to express the stories?

Reflection
Some questions for reflection might include:

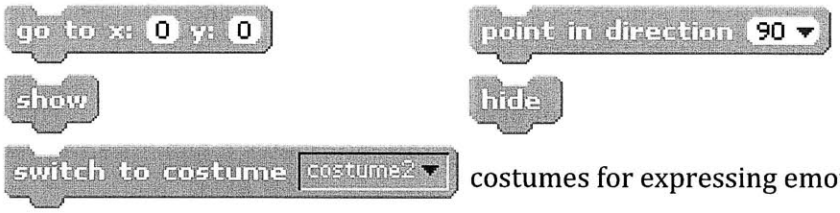
- What is something I learned about my own recollection or preconceptions about the workshop?
- What is something new I learned to do with Scratch today?
- What is something I learned about what we have in common as a group?
- What is something the person next to you did that was helpful or interesting?

Session 4 - Alternative Endings

Goals
In this session, participants will:

- think of stories as being composed of three parts (introduction, crisis, resolution)
- explore multiple outcomes or alternative endings to stories and interactions

They will explore the following Scratch blocks and ideas:



costumes for expressing emotion

Introduction - alternative endings

Participants will receive a sheet that contains a template for a three-panel story. The first two panels will be partially filled in, and the third panel will be empty.
Working in groups of two or more, participants should agree on how to complete the first two panels, which represent some introduction/setup and a crisis point. Then, working individually, each participant should imagine an ending to the story and fill in the third panel.

Each participant can briefly describe their story to the group. A discussion of story influences might involve:

- identifying factors that contribute to different interpretations
- sharing situations in which different perspectives were manifested

Activity 1 - alternatives with Scratch
Participants will work in groups to repeat the introductory activity, but in a digital format using Scratch. Each group should collaborate on a Scratch story that contains a setup and crisis point. Then, individual participants can make a copy of the Scratch story and each complete their own unique ending for the story.

Activity 2 - discussion

After demonstrating the projects, participants and facilitators might engage in a discussion around the following points:

- How were the stories different?
- If you think about an event in your life, are there times when you perhaps interpreted something incorrectly?
- Are there times when people have interpreted something you said or did incorrectly?
- Why do you think that happened?
- How might you try on a day-to-day basis to think about different explanations for what happened? Have you done this before?

Reflection

Some questions for reflection might include:

- What is something new that you learned in Scratch today?
- What is something new that you learned today outside of Scratch?
- Can you think of some things that we didn't talk about that could shape the way you see things?

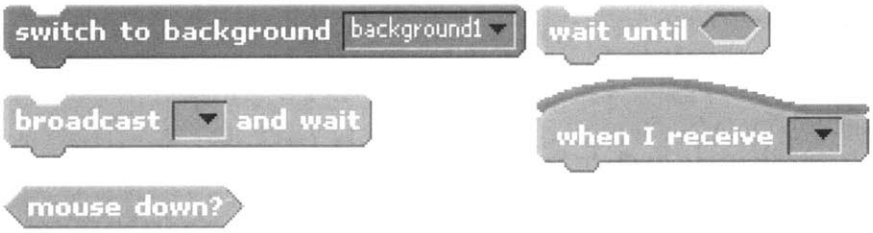
Session 5 - seeing the unseen

Goals

In this session, participants will:

- experience and identify inattentional blindness
- encourage their own diversity of thought

They will explore the following Scratch blocks and ideas:



Introduction - the basketball game

Participants can be shown a 15 second video in which kids pass basketballs around. Participants should count the number of times that the basketballs are passed, but should try to avoid saying anything until the video is finished.

When the video is finished, participants should record the number of passes. A discussion might include the following questions:

- How many passes did you see?
- What did everyone think of the gorilla that strolled through the video?
- Some participants did not see the gorilla. Why do you think that is?

Activity 1 - attention placement

Sometimes we can be so focused on one aspect of what we are looking at that we can miss very important details (inattentional blindness). In small groups, participants might discuss the following questions:

- What are you not seeing on a day-to-day basis?
- What are the things you take for granted?
- What do we try to avoid noticing?
- What are people not seeing about you and your community?
- What is the problem with that?

Activity 2 - seeing the unseen

In this activity, participants will try to capture things that aren't normally seen, either by themselves or by others. Using audio recorders and/or digital cameras, and possibly working in groups, participants should go out into the world and record things that often go unnoticed.

Activity 3 - expressing the invisible

Participants can use Scratch to share the content that they collected in the previous activity.

Activity 4 - discussion

After sharing their Scratch projects, participants and facilitators might discuss the following questions:

- What were the similarities and differences between what participants noticed in the world?
- What was easy to see? Why?
- What was less easy to see? Why?

Reflection

Some questions for reflection might include:

- What does broadcast allow me to do in Scratch?
- What am I good at noticing?
- What is something I wish people saw about me?

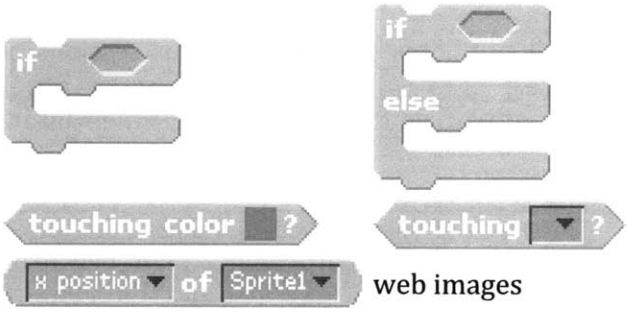
Session 6 - in the future

Goals

In this session, participants will:

- explore collaborative story building
- consider how current beliefs influence perceptions of future action and experiences

They will explore the following Scratch blocks and ideas:



conditionals

web images

keyboard control

Introduction - story seeds

Facilitators begin by asking participants to pull one item from each of three containers: a *place* container, a *thing* container, and an *action* container. A facilitator could lead the activity by telling the group a story that makes use of the elements pulled from each container. Once the facilitator has described a story that involves the three elements, the next person continues the story by introducing at least one of their own elements.

For example, the facilitator might pull 'restaurant,' 'watch,' and 'skip' and so she or he would need to create a story that makes use of these three elements. The next participant could change the story by keeping two of the facilitator's elements and replacing the third. If the participant decided to replace 'watch' with 'cat', imagine how this would change the story!

At the end of the exercise, participants might be asked:

- How did you change or maintain the story?
- How can people contribute to making the story interesting and coherent?

Activity 1 - imagining you in the future

Participants will pretend that it is thirty years in the future. In lieu of a reunion, participants will create messages to deliver to other members of the group that describe what has happened in the thirty years since this workshop. Some questions that might be addressed in the message include

- What do you imagine you will be doing?
- What are at least two things that you imagine will have happened to you?
- What are at least two things that you imagine will have happened to your workshop colleagues?
- What will the future look like? What will you eat? How will you travel around? What might you do?

Participants can work in groups to explain their visions of the future to one another and to practice audio recording skills. Participants should think about how they wish to structure the message (e.g. monologue? interview format?) and spend a few minutes writing down what they might say.

Activity 2 - you in the future
Using the audio that was just recorded as well as photos taken in previous sessions or public domain content from the Internet (e.g. http://search.creativecommons.org/), participants can use Scratch to construct a navigable world that communicates their future messages.

Activity 3 - discussion
After sharing future messages with the group, facilitators and participants might engage in a discussion around the following questions:

- What did you find challenging about imagining the future?
- How did your current beliefs influence your beliefs about the future?

Reflection
Some questions for reflection might include

- What was one thing you learned about your expectations for the future?
- In the previous session, you were asked what you wished people saw about you. How do you imagine this has changedin thirty years?
- What challenges did you encounter when trying to create a navigable virtual world with Scratch?

Session 7 - story projects

Goals
In this session, participants will:

- review programming, storytelling, and perspective-taking concepts
- brainstorm and plan ideas for a final project
- create a final project that draws on the themes and technologies from the workshop

Introduction - mind map
In order to prepare participants for the final project, facilitators could begin the session with a review of the technologies and methods that were covered in the six previous sessions.

A mind map might be used to facilitate a playful review. A set of cards could be supplied, each bearing the name of a Scratch block, interview technique, or skill/idea from the course. The participants would collaborate to spatially re/arrange the cards according to perceived relationships among the concepts.

Activity 1 - planning
Participants will split into small groups to brainstorm topics for their final projects. Facilitators might visit the groups to participate in the brainstorming.
Participants could use storyboarding to sketch out the structure of their final projects.

Activity 2 - implementation

Participants can implement their final projects using the storyboarded content from the previous activity. In creating their final projects, participants should endeavor to draw upon the broad range of technologies and ideas discussed in the workshop.

Activity 3 - demo and discussion

As final projects are being prepared, they should regularly be shown to the group and receive feedback. Feedback discussion among participants and facilitators might involve the following questions:

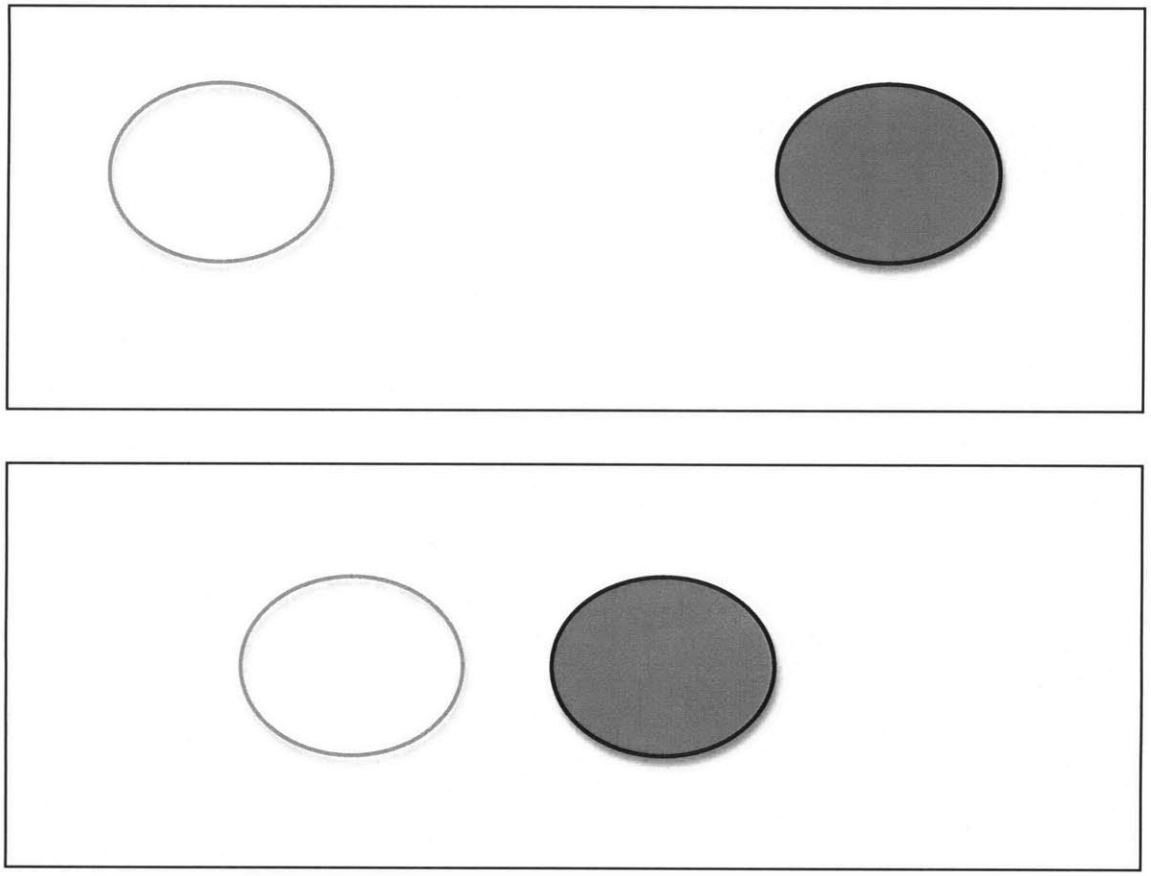
- What are the connections between the final projects?
- How do the projects draw upon the ideas from the workshop?
- What do we appreciate about the projects?
- How could the projects be further developed and extended?

Reflection

Some questions for reflection might include:

- What did you enjoy most about the workshops?
- What are some things that you learned about yourself and others?
- How might you use what you've learned after the workshop?

APPENDIX E. THREE-PART STORY TEMPLATE



APPENDIX F. FINAL PROJECT CONNECTIONS, FIRST ITERATION

My Name:_____ Partner's Name:_____

theme

characters' feelings

characters

setting

message/moral

other

APPENDIX G. OBSERVER CHECKLIST

	Perspective-taking	Helping Behavior	Listening	Not Empathy
Name 1				
Name 2				
...				
Name N				

Notes:

APPENDIX H. THIRD ITERATION TEACHER EVALUATION

Your student is participating in the XO Club. We are trying to get to know each student both inside and outside of the after school program. Please take a couple of minutes to give us a better sense of your student's interactions with others.
Thanks in advance!!

Student Name_____

This student...	1 = Strongly Disagree	2 = Disagree	3 = Neutral	4 = Agree	5 = Strongly Agree
Interacts with others well					
Listens to others well					
Is empathetic to other students					
Works well with others					
Understands his/her emotions					
Manages his/her emotions well					

This student...	1 =Never	2 = Rarely	3 = Sometimes	4 = Very often	5 = Always
Helps others					
Is aggressive towards others					
Has detention					
Misses school					
Completes his/homework					

APPENDIX I. THIRD ITERATION INTERVIEW PROTOCOL

(adapted from work of Brigid Barron, Stanford University)

Name

Age

Grade

Teacher
Do you remember what the purpose of the program was?

Do you think we accomplished any of that?

Empathy

How would you tell someone about empathy?

Do you remember what we discussed about inattentional blindness?

What influences how people think and feel?

Do you remember how we came up with the community expectations?

Do you think they worked?

Do you think there is a difference between rules and community expectations?

What was it like to record community expectations?

Sensors

What was it like wearing the sensors?

Do you remember what sensors were for?

What was it like to see other people's reactions?

Do you think you found out anything new about people?

Have you ever seen anything like it?

Collaboration

What was it like working with a different person each session?

Did it help you learn more about people? How so?

Did the Scratch projects help you learn more about yourself or others?

Go through each exercise throughout the curriculum. What did you learn from this activity?

Can you tell me about a time when you and your team really had trouble working together (had a disagreement)? Why do you think it was hard? What happened? How did it end up? Did you think about doing something about the problems you were having? Did you choose to act on what you were thinking?

Can you tell me about a time when you and your team worked really well together? Why do you think it worked well at that time?

What advice would you have for a project team just starting out?

Have you worked on other teams before? Was this experience different? Have you ever worked to develop your own project ideas?

Rank Collaboration from different dates. (scale 1 – 10; 1 = best, 10 = worst)

Technical Skill

Project history and meaning: What is this project?

How would you describe your project?

How did you come up with the idea for this project?

Learning processes and outcomes: How was the project developed? What learning occurred?

Planning. Can you tell me about how you started to build this project? Did you ever draw things out on paper before doing it on the computer?

Prototyping. Can you tell me if your project changed once you started building it in Scratch? If so, what made you want to make these changes?

Learning to build. Did you know how to use the Scratch before you started working on this project? How did you go about learning the Scratch? *Prompts*: people (friends, teachers, parents, relatives), tutorials, online discussion boards/communities, websites, help menus, books, magazines.

Can you describe to someone who didn't know much about Scratch how you made the project?

General

How would you describe XO Club to someone?

What did you think about XO Club?

What is something that you would change?

What would you keep the same?

What is the biggest thing you think you learned?

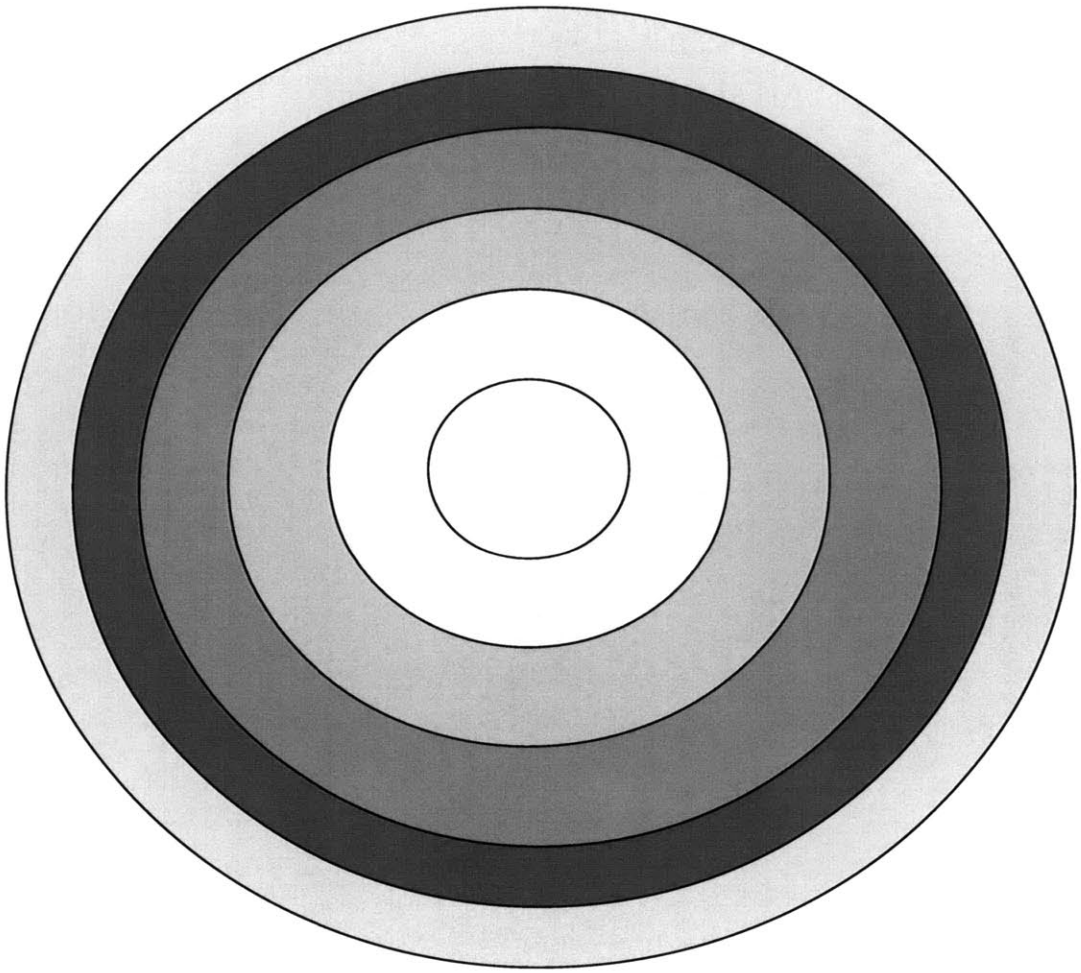
Is there anything else you want to tell me?

APPENDIX J. THIRD ITERATION SOCIAL DISTANCE ACTIVITY

Your Name_____

How close are you to people in the XO Club? For each person in the XO Club, put his or her name in one of the circles based on how well you know him or her.

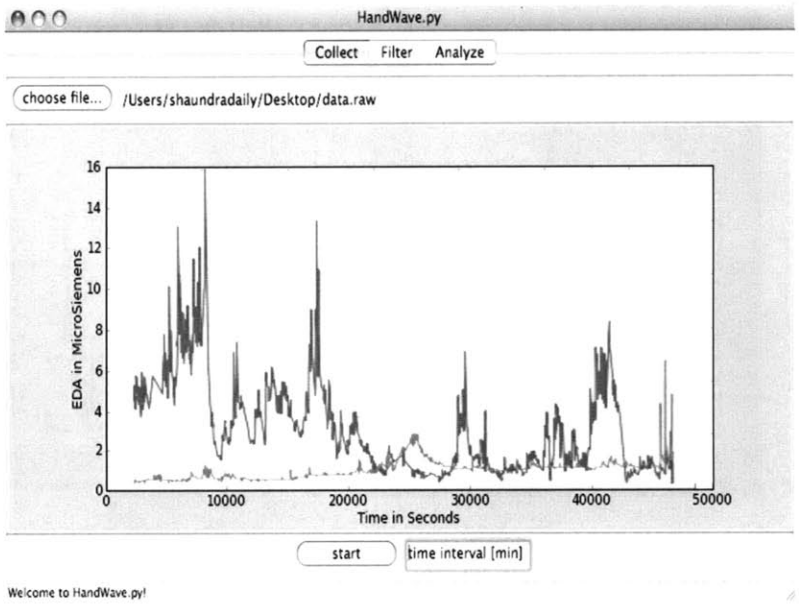
Yellow	Family
Green	Close like family
Purple	Very close friends
Pink	Friends, but not very close
Plum	I know him/her from class
Gray	I have met him/her before but we don't hang out very often
Outside	Don't know at all



APPENDIX K. AFFECT AS INDEX SYSTEM FUNCTIONALITY

The Affect as Index software was developed using Python. It contains a series of screens described below to collect, filter, and analyze skin conductance data. Figure 24 contains screenshots of the program in action. Utilizing the iCalm platform, a user can collect skin conductance data from up to 20 wearers. In the "Collect" screen of Affect as Index, the data can be viewed at different time intervals (e.g., 1 minute or 10 minutes) for varying perspectives on the arousal data being collected.

(a)



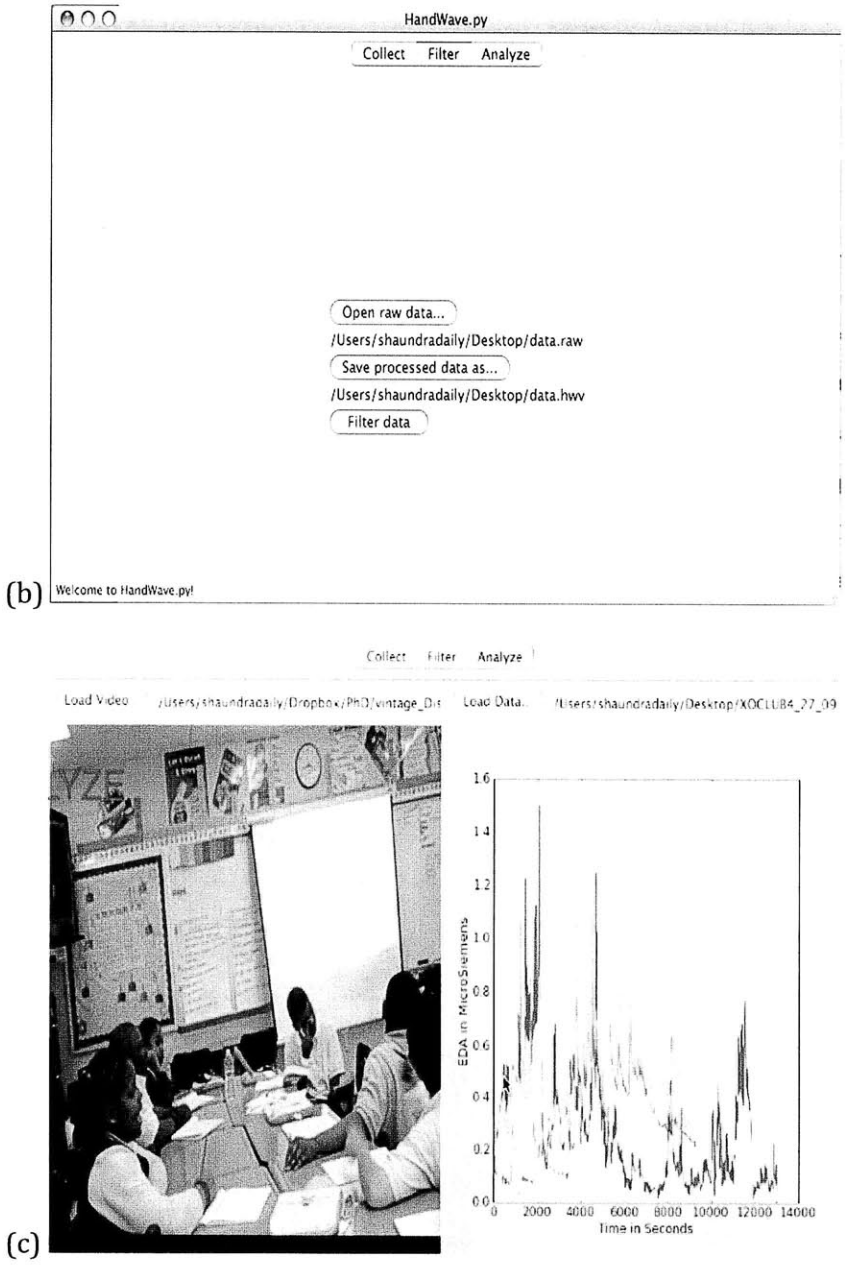


Figure 24: Screenshots of data collection (a) filter (b) and data analysis (c) screens[9].

[9] Data from filter screen was created for demonstration, rather than a classroom setting. Therefore, the data in analyze screen is on a different vertical scale since it is actual data

On the "Filter" screen, the software implements the following algorithm:

- Use linear interpolation for gaps in the data that are less than two seconds
- Leave any gaps that are greater than two seconds and do no further processing on them
- Employ a 5-point Blackman filter with coefficients [.13,.63,1,.63,.13] to smooth the data
- Normalize data between zero and one

Once the data is filtered, it can be viewed on the "Analyze" screen. This screen allows a user to load selected data as well as choose a video file to sync with the data. Once the data and video are loaded, a user can click using the mouse on different portions of the graph and be automatically taken to a corresponding portion of the video. At the bottom of this screen, each sensor that is in the data file can be seen and selected so that multiple sensors can be seen at once. Finally, the software enables users to choose different sensors to aggregate. Data is aggregated according to the following:

- For each sensor selected, add the skin conductance value at each time data was collected
- Find the average of the value of the data added. Where data points are missing from one or more sensors, reduce the divisor when computing the average
- Normalize this between zero and one

Once sensors are chosen, the graph will be redrawn to showcase the new data.

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