6-16-2016

Subtext of Decisions: Literacy Practices in the Context of Coding

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Subtext of Decisions: Literacy Practices in the Context of Coding

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Teaching and Learning
College of Education
University of South Florida

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Date of Approval:
May 18, 2016

Keywords: Literacy, Programming, Coding, Digital Media, Multimodal

DEDICATION

It is with love and gratitude that I dedicate this dissertation to my husband and children. Your unwavering support through many nights and weekends of work kept me focused on the completion of my Ph.D. You inspire me to achieve my dreams and fuel my passion to explore inclusive literacy experiences. I look forward to the promise of tomorrow as we prepare for the next step in our journey together.

I also dedicate this dissertation to Carol York. I was ready to leave education when we met during a writing conference at USF many years ago. You encouraged me to stay in the fight for literacy, provided professional development, and mentored me. Because of you, I acquired a passion for literacy and a thirst to learn more. I am one of many lives you influenced and this work is dedicated to you.

ACKNOWLEDGEMENTS

When I reflect upon my doctoral experiences I connect with Dorothy's journey in the *Wizard of Oz*. The yellow brick road I traveled was marked with challenges, unexpected turns, and adventures as I progressed toward earning a Ph.D. Much like Dorothy, I encountered individuals along the way who shared their expertise and provided support as they joined me for the journey. I am forever grateful for their investment of time and expertise these past five years.

The first professor I met while touring the College of Education at the University of South Florida was Dr. James King. From my first experience in the doctoral program you have been with me every step of the journey. I enjoyed our long discussions about literacy and appreciated the varied perspectives you provided. I always walked away thinking about literacy concepts in new and exciting ways. Thank you for all of your support and for sharing your expertise and passion for literacy.

The trajectory of my research changed forever after experiencing a doctoral course focused on multiliteracies with Dr. Jenifer Schneider. I was introduced to Kress, Cope, Kalantzis, Gee, Jenkins, and many other researchers who helped to shape my understanding of multimodal texts, design, composition, and digital media. Thank you Dr. Schneider for never accepting less. You always gave me what I needed, rather than what I wanted. You challenged me to cultivate my knowledge and research skills. I appreciated the hours spent reviewing my work and the development provided.

Dr. Danielle Dennis, thank you for the mentorship and opportunities you provided throughout my doctoral program. You took me under your wing and helped me transition into teacher education. I went from tears the first semester to working as a cohort course lead my final year. During our time together you nurtured my development by providing guidance and leadership opportunities. Your expertise in literacy for early adolescents was a valuable resource as I completed my research. Thank you for sharing your insight as a member of my doctoral committee.

I would also like to thank Dr. Glenn Smith and Dr. Jennifer Wolgemuth for the valuable contributions made as members of my doctoral committee. Dr. Smith, I appreciated your willingness to provide your time and expertise. Your experience in programming added an important perspective, which helped to refine my research. Dr. Wolgemuth, your expertise in qualitative research provided cohesion throughout the dissertation process. I appreciated your quick response to all my questions and willingness to serve as the chairperson for our doctoral committee meetings.

There are two additional individuals I would like to thank for their assistance with this study. Kathleen Alley, thank you for the support provided regarding shared intimate relationships in research. The research completed with your daughter helped to shape the methodology for this study. I appreciated your willingness to answer questions and provide resources. James Welsh, thank you for providing your expertise as I developed a multimodal analytical approach for the content analysis. Your assistance was valuable in the creation of transcription frames for the analysis.

Although Dorothy began her journey to Oz alone, I was blessed to begin my doctoral program with a self-made cohort. Margaret Krause, you are my literacy kindred spirit. Our

conversations and research focused on literacy for diverse learners provided inspiration to keep moving forward. It was such a blessing to learn and work with you. Our adventures presenting research from the East Coast to the West Coast are some of my favorite memories. I hope to continue our work together and most importantly, our friendship. Yvonne Franco, it seems like a lifetime ago since we huddled in our little office working to interpret our statistics notes. Over the years you have been a source of encouragement. I appreciated our many talks that helped to keep me motivated to finish. Margaret Branscombe, you are an inspiration. I enjoyed getting to know you and your family. We even survived a half marathon together! Thank you to my cohort for the friendships, insight, encouragement, and laughs along the way. I look forward to our continued friendship and future adventures together.

      Most importantly, I want to thank my family. Joe Hagge, you are a constant source of strength for me. Your love, support, and patience carried me through the hills and valleys of doctoral work. It was your belief in me that gave me the strength to begin and finish the doctoral program. Thank you for the sacrifices made in order for me to accomplish this goal. I want to give a special thank you to my daughter, Jessica. You invited me into your online world and shared your experiences with me. I was able to learn about an online programming community from your insider perspective, however, I also learned more about you. Thank you for sharing your love of programming and design with me. Thank you also to my sons David and Jeremiah. You always waited patiently for me to finish one more page. Thank you to my mother, sisters, extended family, and friends for your patience and support during this journey.

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ABSTRACT

In this dissertation I present findings from a qualitative case study of five early adolescents engaged in an online programming community. As a researcher, I was interested in how early adolescents designed digital media as they learned how to code within an online programming community known as *Scratch*. My research was guided by two questions: (1) What are the literacy practices and processes embedded in the design and collaboration of products created within an online programming community? (2) In what ways do participants make decisions in the design of their projects created in *Scratch*? The data collected for this descriptive case study included participant created digital media products, interviews, observations, and online community artifacts. Based upon a content analysis of the digital media products and an inductive analysis of the interviews, observations, and community artifacts data, I determined participants demonstrated decisions connected to the design of projects created, decisions focused on the function of projects, and decisions connected with meaning. I created a typography to represent the decisions made by participants as they created projects in *Scratch*. Additionally, participants expressed a sense of accomplishment and expertise in *Scratch* product development. Findings from this research provide a nuanced understanding of the literacy practices and processes enacted by early adolescents as they create digital media in an online programming community via the use of coding.

CHAPTER ONE:

INTRODUCTION

As technology advances, new kinds of modal ensembles become available to many users, which offer new types of meaning representation (Bezemer & Kress, 2008). Leander and Boldt (2012) situated children as powerful when they are not only able to read the modalities of texts, but also are able to use modalities to design their own practices, activities, and texts. Crossing from print to digital modes adds an important layer of complexity to text and knowledge creation (Mills, 2011). Digital texts may range in form from linear, stand-alone, static products to fluid constantly changing, highly interlinked hybridized, and multimodal products (Martin & Lambert, 2015). Digital writing tools foster connections between the writer and audience, integrate modal resources, allow for ongoing revision, and organize content as linked concepts rather than linear text. Martin (2008) argued digital writers need to develop the ability to use digital tools to construct new knowledge, create media expressions, and communicate with others in social contexts in order to enable constructive social action. Building upon Deleuze and Guattari's (1987) concept of assemblage, Dezuanni (2015) viewed digital materials as assemblages not only authored by individuals interacting with them, but also through interaction and negotiation with the hardware and software required to display and manipulate the objects on the screen. Further, the creation and sharing of digital materials is an embodied, material, and conceptual discursive process (Dezuanni, 2015).

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A recent development in the digital composition practices of youth is the use of coding to create digital media. Argued to be the new literacy of the 21ˢᵗ century, coding represents the use of a new tool to create digital media (Burke, O'Byrne, & Kafai, 2016; Rushkoff, 2010). Additionally, a development in online practice is a shift toward children engaged in computer programming online communities (Denner, Werner, & Ortiz, 2012; Moore, 2013). An online programming community provides youth the ability to create digital media, a platform to share digital creations, and opportunities to learn from and mentor community members.

Statement of the Problem

Although research regarding online computer programming communities is replete with literature related to integration of computer science concepts, few studies focus on literacy practices embedded within these communities (Burke et al., 2016). Burke (2012) argued within online programming communities the old literacy of pen-and-paper writing is leveraged with the new literacy of programming. The result is a hybrid of programming-as-writing. As children engage in programming-as-writing, what literacy practices are embedded in these experiences?

Purpose of the Study

The purpose of this study was to examine the literacy practices and processes of early adolescents as they created and remixed multimodal products within an online programming community.

Research questions included:

1   What are the literacy practices and processes embedded in the design and

collaboration of products created within an online programming community?

2   In what ways do participants make decisions in the design of their projects

created in *Scratch*?

Summary of Methodology

I designed a qualitative descriptive case study focused on the phenomenon of

early adolescents engaged in an online programming community. Given the nature of my

research problem and questions, I selected a descriptive case study design (Merriam,

1998). In a descriptive case study, the researcher illustrates complexities of a

phenomenon and presents information from a wide variety of sources and perspectives

(Brown, 2008) using iterative coding and inductive analysis of multimodal text (Nelson,

2006). I considered text analysis a component of the case study due to the socially

grounded nature inherent in multimodal text (Nelson & Johnson, 2014). It was impossible

to separate the analysis of multimodal text from the phenomenon whereby the

participants were engaged (Smith, Tan, Podlasov, & O'Halloran, 2011).

I collected data related to the literacy practices embedded within an online

programming community. These data included screenshots of digital products designed

and redesigned by participants, screenshots of communication between participants and

community members, participant interviews to discuss design practices and collaboration

with community members, and observation video and transcripts. Additionally, I

completed a reflexive journal to log entries related to observations and increase

reflexivity. My objectives for maintaining a researcher journal were to collect anecdotal

evidence and create awareness of subjectivity, which may have influenced my selection and analysis of data. The completion of a researcher journal helped to create awareness of how my researcher values and expectations influenced conduct and conclusions (Maxwell, 2013). My intention was to promote reflexivity and increase awareness of my subjectivity. Entries in the researcher journal included informal comments made by participants in relation to experiences within the online programming community and thoughts regarding subjectivity.

Data analysis was ongoing and recursive throughout the data collection process (Patton, 2002). I used inductive analysis, as described by Hatch (2002), to analyze data collected. I identified frames for analysis, defined as multimodal digital products and community member interaction artifacts, and created domains based upon semantic relationships discovered within frames. I analyzed salient domains within and across determined domains to identify and establish themes, which I operationalized as patterns emerging from my inductive analysis of the data.

Definition of Terms

For the purpose of this study, I define the key terms as follows:

1. Coding: A process of applying a system of signals used to represent letters or numbers by which to govern and modify a computer (Burke et al., 2016).

2. Curate: The use of expert knowledge to select, collect, and present information or items for people to enjoy (McEneaney, 2015).

3. Design: The process of creating a product consisting of modes, media, frames, and sites of display to represent the designer's interests and characteristics of the intended audience (Bezemer and Kress, 2008).

4. Digital media: Any media encoded in a computer-readable format. Digital texts are more flexible and can be easily shared, rearranged, condensed, annotated, or read aloud by a computer (Moore, 2013).

5. Experience: A transaction with digital media that extends upon the imaginary and sensory domains encompassed within the composition of the media (Dezuanni, 2015).

6. Genre: Recurring patterns of communication that emerge in response to similar rhetorical situations (Bazerman, 1994).

7. Intertextuality: The shaping of a text's meaning by another text. Texts draw on the features and genres of other texts in historical chains (Leander & Boldt, 2012).

8. Lexpert: A hybrid term created to represent a combination of "learning" with "expert". The term is intended to connote learning a new concept while positioned as an expert. Additionally, the "lex" in lexpert also denotes the expanding lexicon developed as youth acquire the ability to understand and apply coding to create digital media.

9. Literacy practices: Cultural ways of engagement in literacy experiences, which include construction of knowledge, values, attitudes, beliefs and feelings associated with reading and writing (Barton, 2001; Street, 1984).

10. Multimodal texts: The use of two or more modes to communicate meaning is delineates a multimodal text. Meaning is created in multiple modes and made differently in each of the modes incorporated into text (Kress, 2008).

11. Multimodal semiosis: The process whereby multiple modes work in tandem to create new meaning. More than simply a way to make new meaning, modes work together to create a different kind of meaning situated within the lived practices of sharing ideas, thoughts, and texts with the social world (Domingo, 2014; Hull & Nelson, 2005).

12. Participatory Culture: Defined as an environment with low barriers to artistic expression and civic engagement, participatory culture is an element inherent in the framework of multiliteracies (Jenkins, 2006). Although members are not required to participate, strong support is provided for creating and sharing products with others, members feel a degree of social connections with one another, and members believe their contributions matter (Jenkins & Kelley, 2013).

13. Programming: The process of entering code into a computer that leads to an original formulation of executable programs is considered programming. The purpose of programming is to create a sequence of instructions resulting in an automated sequence to complete an identified task or solve a specific problem. For the purpose of this study, programming pertains to the ability to provide a new language in which children can make computers write text (Papert, 1993).

14. Programming community: A group bound by a focus on the creation of products via the use of programming (Kafai & Burke, 2014).

15. Recontextualization: The re-presentation of meaning materials in a manner appropriate for the new context in light of available modal resources (Bezemer & Kress, 2009).

16. Remix: The reconceptualization of a product whereby multiple modes are redesigned into a different composition (Jenkins, 2008).

17. *Scratch*: Created with the purpose to provide programmability to media-manipulation activities popular in youth culture, *Scratch* is an online programming community designed to encourage young people to learn through exploration and peer sharing with less focus on direct instruction than other programming languages (Maloney, Resnick, Rusk, Silverman, & Eastmond, 2010).

18. Semiotic modes: A mode must be a socially and culturally shaped resource for making meaning. For the purpose of this study semiotic modes include written, oral, visual, gestural, spatial, audio, and tactile modes (Cope & Kalantzis, 2009).

Significance of the Study

Once viewed as a pastime of technology experts, educators and theorists are now recognizing coding as a new literacy (Hutchison, Nadolny, & Estapa, 2016; Kafai & Burke, 2014). Coding offers youth the opportunity to transition from simply reading digital media toward composing innovative digital texts. Further, coding within an online community represents a fundamental and powerful way to work on a computer and establish a presence in an increasingly digital world (Burke et al., 2016).

Historically, online programming environments have been studied within the context of computer science concepts (Lewis, 2010; Fincher & Utting, 2010). In this study I applied a multiliteracies theoretical framework to examine the literacy practices of early adolescents within an online programming community. This research focused on the literacy experiences of young adolescents engaged in an online programming community provides insight into the nature of literacy within a contemporary environment.

In this study I explored the literacy practices and processes of early adolescents as they created digital media in an online programming community. Examination of the literacy practices embedded in an online programming community provides insight into the types of literacies experienced within a new space and with the use of a new tool. Investigation into the literacy practices embedded within an online programming community informs the field regarding how online programming communities can facilitate the acquisition of new media literacy skills required to be fully engaged within a networked public (Jenkins & Kelley, 2013).

This research is relevant to education, as it provides insight into the composition skills and strategies employed by early adolescents as they created digital media via the use of coding within an online community. Brown and Adler (2008) argued for an educational system, whereby creativity and innovation is cultivated by the use of new spaces, tools, and ways of learning to be. This study will support research focused on the use of coding within an online programming community as an extension of literacy instruction.

To become a competent reader, writer, and informed citizen in an ever-connected global economy, children need opportunities to develop functional, critical, and rhetorical literacies in multiple modalities and technologies (Adsanatham, Garrett, & Matzke, 2013). Although computer programming is considered to be the New Literacy of the millennium, few children learn how to program (Burke et al., 2016; Resnick et al., 2009; Rushkoff, 2010). This study provides insight into the development of literacy practices of early adolescents actively engaged within an online programming community. Research focused on literacy practices as participants design and redesign digital products and collaborate with community members provides valuable information regarding literacy experiences using a new language within a new space.

CHAPTER TWO:

REVIEW OF THE LITERATURE

Exponential growth in technology within the past three decades drives a shift in literacy practices (Burnett & Merchant, 2015; Cope & Kalantzis, 2009; Moore-Russo & Shanahan, 2014; Rowsell, 2013). Hardbound copies of dictionaries are becoming obsolete. A quick Google search or Smartphone spelling app can deliver the appropriate spelling information in a fraction of the time as a dictionary search. Wikipedia and online searches are the new encyclopedias of our age. Friends remain connected via Facebook or Twitter instead of waiting for an annual holiday card. Rather than writing about a science experiment in a class journal, students create blogs to share their results with the rest of the world. Literacy extends beyond the ability to read and write the printed word (Dezaunni, 2015; Ho, Anderson, & Leong, 2011).

My purpose for this literature review is to describe multimodality within the context of multiliteracies, present information regarding the design and composition of digital media, develop background information related to *Scratch*, an online programming community, and literacy practices supported by *Scratch*. Prior to delving into information about *Scratch*, I present a sociocultural framework for understanding multimodal composition.

Semiotic Modes

Jewitt and Kress (2003) describe modes as an "organized set of resources for meaning-making" (p. 1). Although the classification of a mode would seem straightforward, advancements in new media create opportunities to work with modes in new and sophisticated ways, causing the need to reclassify and redefine modes. A model proposed by the New London Group (1996) presented a set of five modes used to communicate meaning (e.g., linguistic, visual, gestural, spatial, and audio). In the wake of increasing multimodality found within new media mix modes, Cope and Kalantzis (2009) separated written and oral language as fundamentally different modes, added a tactile mode, and redefined the contents and scope of the original modes. As new forms of communication emerge, researchers will need to continue to redefine modes as needed (Selman, 2014).

A more theoretical socio-semiotic approach defines modes as what a community decides to use as a mode (Kress, 2010; Selman, 2014). Essentially, if a person or community views something as able to communicate meaning, then it meets the criteria as a unit capable of expression and representation, however, the mode needs to be evident in consistent use by the community (Rowsell, 2013). It is important to note within a socio-semiotic modal theory anything can potentially be a mode and named a mode, however, the mode must be a socially and culturally shaped resource for making meaning (Bezemer & Kress, 2008).

Halliday's (1978) more formal definition of a mode viewed the metafunctions of modes to include ideational (i.e., when modes reflect human experience), interpersonal

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(i.e., when modes enact personal and social experiences), and textual functions (i.e., when modes form and shape meanings). The metafunctions proposed by Halliday extend the definition of mode, "far beyond mere physicality to encompass ephemeral, immaterial qualities that are materialized through physical features such a colour, heft, light, angle, and gaze" (Rowsell, 2013, p. 3).

Historically, linguistic modes (e.g., visual, audio, and gestural) have been privileged over other modes (Miller & Borowicz, 2006; Nelson, Hull, & Roche-Smith, 2008; Shanahan, 2013b). While Halliday's metafunctions focused on language, Kress and van Leeuwen (1996) created metafunctions for visual communication to include representational (i.e., when modes symbolize and idea), interactive (i.e., when modes include interaction and evaluative meaning), and compositional (i.e., when modes include layout, placement, and relative salience of pictures and text) (Shanahan, 2013b). Within the current digital landscape images are increasingly prominent as carriers of meaning (Nelson, 2006; Moore-Russo & Shanahan, 2014; Unsworth, 2014). Bezemer and Kress (2008) argued writing is being displaced by image as the central mode for presentation. When Slough, McTigue, Kim, and Jennings (2010) completed a descriptive analysis of four sixth-grade science texts the researchers noted an increase in the frequency and variety of graphics. From a neurological perspective the visual cortex of the typical adult favors visual input due to stronger, faster and more coherent neural responses as compared to other types of input (Spector & Maurer, 2009). As new media continues to evolve, shifts in the modal resources used to communicate meaning will continue to occur (Kress, 2003; Ho, Anderson, & Leong, 2011).

Multimodality

Multimodal text incorporates the use of two or more modes to communicate meaning. Although modes in isolation create meaning, combining modes increases opportunities to provide nuanced understanding to a wider audience. For example, a film viewed in a foreign language can communicate beyond oral meaning to include gestural, spatial, visual, audio, and written (e.g., closed captions). Conversely, a print-based foreign language novel would contain limited opportunity to construct meaning. The reader would need to be proficient in the language of the text in order to construct meaning. Increased semiotic richness and hybridity serves to increase the possibility of emergent or enriched meaning making (Nelson, 2006). Further, knowledge construction is the result of movement between different modes of representation, which engage different aspects of working memory and lead to enhanced understanding from exposure to multiple modes (Mayer, 2003; McDermott & Hand, 2013).

Alvermann (2004) and Kress (2010) argued the world of meaning has always been multimodal. According to Kalantzis and Cope (2012a) "no matter how hard we may try to separate out the written mode for the purposes of didactic literacy teaching -- learning to read and write -- all representation and communication is intrinsically multimodal" (p. 192). For example, when using written language there are stages of visualizing elements and engagement of inner dialogue related to what is being written. Proficient readers engage in visualization to help represent the text read. Harvey and Goudvis (2007) advocate the use of inner dialogue to promote reading comprehension. Engagement in mode shifting facilitates the representation of meanings in order to communicate and learn (Kalantzis & Cope, 2012a).

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Multimodal texts require a different type of meaning making than previously seen in print-based text (Kress & Domingo, 2013; Nelson, 2006). For example, multimedia configuration of modes found within digital platforms require sequencing of meaning such as layering and looping (Domingo, 2014). Precisely how meaning making differs from print-based text and multimodal texts is still in the early stages of research (Shanahan, 2013b). According to Unsworth (2014), "the reconceptualization of reading comprehension based on the integrative role of language and image remains in its infancy…to date no re-conceptualized model of reading comprehension based on the integrative role of language and image has emerged" (p. 27). Although understanding multimodality and the meaning-making process is still relatively new, researchers continue to discover new information. An analysis of food blogs and other online texts completed by Domingo, Jewitt and Kress (2014) found the construction of linear reading paths are increasingly replaced with more modular meaning making. A study focused on the impact of embedding multiple modes of representation within writing tasks on high school students' chemistry understanding provided data to suggest multimodal experiences have the potential to increase beneficial cognitive activity (McDermott & Hand, 2013).

Although written word is foundational and important to literacy, it is only one way individuals communicate and make meaning (Moore-Russo & Shanahan, 2014). Shanahan (2013b) posited signs other than language could also serve as tools to promote learning if teachers reconceptualize the notion of learning to include writing with all semiotic resources. Being literate now means more than just an ability to read and write the printed word (Ho et al., 2011; Taylor, 2012). Interplay between words and images is a

key aspect of multimodal texts (Bezemer & Kress, 2008; Unsworth, 2014). Moore-Russo and Shanahan (2014) argued, "being literate today includes students comprehending and producing linguistic and visual representations. Just because readers in this generation are exposed to more visual representations than previous generations does not mean they comprehend their meaning intuitively" (p. 531). A study completed by Nelson and Johnson (2014) focused on nine Japanese university English learners collaboratively translating linguistically articulated emotions. The data suggested the process of constructing and deconstructing visual-pictorial texts permitted discovery and creative transformation. Further, visual composing practices can advance the goals of language learning by bringing conscious attention to the complexly layered substrate of linguistic meaning (Nelson & Johnson, 2014).

Cope and Kalantzis (2009) make an important point regarding non-parallelism of modes. Essentially, meaning expressed in one mode is unable to be directly and completely translated into another. A movie translation of a book will never be identical to the novel and vice versa. The modes contained within each medium afford different meaning potential. Writing favors the narrative genre by sequencing elements in time. Images display information according to the logic of continuous space, which favors the genre of display. "This paradoxical mix of parallelism and incommensurability between modalities is what makes addressing multimodality integral to the pedagogy of multiliteracies" (Cope & Kalantzis, 2009, p. 180). Limiting instruction to specific modes restricts learners from accessing alternate modes to enhance understanding. One student may prefer to receive a project description as a list of instructions while another student prefers a diagram or flow chart.

After interviewing 30 professional producers of multimodal products, Rowsell (2013) discovered within her data important lessons about working with multimodality. She found working with multimodality is not a solitary act. Rather, multimodality relies integrally on collaboration, participatory structures, and communities of practice. While is it possible to independently create multimodal products, an inherent inclusion of new media practices within multimodality leads to interaction and collaboration with others. Most of the multimodal producers interviewed discussed working with people from diverse perspectives to push their thinking and creativity. Rowsell (2013) also learned working with multimodality is "an entirely human enterprise" (p. 13). Although the participants interviewed dealt with market demands, discipline-specific goals, and design conventions, they were able to produce text that circled back to the storyteller and their agentive role in the making. This agentive property to multimodal composition could serve as a powerful tool in literacy development. Kress (2009) argued for the need of educators to recognize the agency of student multimodality found within nontraditional mediums of learning. Further, "the recognition of the agency – of the significance of the work of those who are not powerful – is a major requirement and a major obstacle: the learners' signs may appear in a medium or in media that I am not used to recognizing as appropriate sites of learning" (Kress, 2009, p. 209). Rowsell (2013) also concluded the processes and practices of multimodality can be generalized and conventions about design and production can be taught and fostered. Numerous researchers argue for pedagogical inclusion of multimodal design and production (Ho et al., 2011; Kalantzis & Cope, 2012b; McDermott & Hand, 2013; Nelson & Johnson, 2014). Rowsell's (2013) research speaks to the dynamic aspects of multimodality.

Due to an emphasis on multimodal representation in new media, multimodality has taken center-stage in educational research. Ho et al. (2011) stated, "the multimodal social and cultural practices of young people liberate youth to creatively fashion themselves in multiple modes as various kinds individuals in the New Times" (p. 2). Findings from a three-year ethnography completed by Domingo (2013) suggested the creation of digital multimodal ensembles by transnational urban youth materialized meaning and social relations for wider communication. Youngjoo (2008) researched multimodal writing practices of an online Korean community. Data suggested the adolescent writers constructed a community of practice in cyberspace as they composed self-motivated multimodal writing activities. Further, the writers were able to express themselves as individuals while they celebrated their diversity within a community of consumers and producers of multimodal text. Unfortunately, education has been slow to respond to increased multimodality in daily communication (Kalantzis & Cope, 2012b; Nelson & Johnson, 2014; Shanahan, 2013a). Rowsell (2013) stated, "while the world forges ahead using visuals, moving images, and haptic texts, teaching and learning in school remains anchored to words, often on printed pages" (p. 3). It is important to note written language is not in danger of becoming extinct. Rather, written language is becoming more deeply intertwined with other modes (Cope & Kalantzis, 2009). Educational researchers have recognized the increasing influence of multimodality and a need for more "nuanced empirically grounded understandings of the pedagogical implications and potentials of different semiotic modes in actual situated interaction (Nelson & Johnson, 2014, p. 50).

Rowsell (2013) argued we are constantly in the flow of multimodality, yet there remains a, "veil of secrecy around what experts in production, design, and multimodality know and do and a discrepancy between that and the conventions that we teach students when they produce texts in school" (p. 1). Scholars have been calling for a reconceptualization of the role of language within the New Media Age (Candlin, 2014; Ho et al., 2011; Unsworth, 2014). Nelson (2006) argued radical adjustments are needed in the domain of language and literacy education to broadly conceptualize how meaning is made in and across developing forms of new text. Coped and Kalantzis (2009) posited, "of all the changes currently underway in the environment of meaning-design, one of the most significant challenges to the old literacy teaching is the increasing multimodality of meaning" (p. 179).

Multiliteracies

Historically, literacy was viewed as a singular, autonomous, and unidimensional construct (Purcell-Gates, 2007). Street (1984) was among the first scholars to argue literacy is always constructed and enacted within, "social and political contexts and subject to the implications of differing power relationship" (Purcell-Gates, 2007, p. 3). Street proposed thinking of literacy as literacies; a set of discursive practices and texts shaped by and interpreted within the sociocultural and sociolinguistic contexts that occur. Individuals navigate multiple literacies across a variety of sociocultural contexts. Gee (2009) further elaborated that literacy should be viewed as embedded in multiple social and cultural constructed practices rather than a "uniform set of mental abilities or processes" (p. 196). The process of communication goes beyond understanding or

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comprehension to include what the recipient represents to themselves as they interpret a message (Kalantzis and Cope, 2012a).

The term "multiliteracies" was first coined in 1996 by the New London Group (Cope & Kalantzis, 2009). The New London Group heralded a shift toward a pedagogy of multiliteracies to better prepare students for citizenship in a globalized world. The "multi" in multiliteracies lies in the multiplicity of modes and multiplicities of socially distinct uses of language (Kress, 2009). Cope and Kalantzis (2009) argued,

> Literacy teaching is not about skills and competence; it is aimed at creating a kind of person, an active designer of meaning, with a sensibility open to differences, change and innovation. The logic of multiliteracies is one that recognizes meaning making is an active, transformative process, and a pedagogy based on that recognition is more likely to open up viable life courses for a world of change and diversity. (p. 175)

Becoming multiliterate means learning how to design meanings by shaping and reshaping the multiple available semiotic modes and how to negotiate skills, experiences, and achievements to fit changing social and economic opportunities.

It is important to note approaches toward literacies continue to be updated by original members of the New London Group. For example, Kalantzis and Cope (2012a) renamed the four approaches to literacies originally identified by the New London Group (1996) to 'knowledge processes' in order to better align with contemporary conditions for meaning-making. In Kalantzis and Copes' 'Learning by Design' formulation 'experiencing' replaced 'situated practice', 'conceptualizing' replaced 'overt instruction',

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'analyzing' replaced 'critical framing', and 'applying' replaced 'transformed practice'. The reframing and building upon the four approaches toward literacies were intended to describe a repertoire of things students can do or create in order to know (Kalantzis and Cope, 2012a). The reconceptualization of the four approaches to literacies represents a focus less on the teachable specificities of meaning-system and more on the heuristics of learners' discovering specificities among a wide variety of relevant texts (Cope and Kalantzis, 2009).

The theoretical framework of multiliteracies provides a context in which to situate multimodal literacy experiences. Linguistic and cultural diversity, along with an expanding variety of text forms associated with multimedia technology caused the New London Group to change the landscape of literacy to include a vision for literacies. (Guo, Cope, & Kalantzis 2009). The intent is to design learning experiences whereby learners develop strategies for reading new and unfamiliar texts in whatever form they appear in addition to creating new texts to communicate meaning (Cope & Kalantzis, 2009).

Design

An important aspect to the framework of multiliteracies is the concept of design (Jacobs, 2013). Bezemer and Kress (2008) defined design as, "the practice where modes, media, frames, and sites of display on the one hand, and rhetorical purposes, the designer's interests, and the characteristics of the audience on the other are brought into coherence with each other" (p. 174). The New London Group (1996) argued, "the concept of design emphasizes the relationships between received modes of meaning (available designs), the transformation of these modes of meaning in their hybrid and

intertextual use (designing), and their subsequent to-be-received status (the redesigned)"
(pp. 304-305). The task of design considers, "what is needed now, in this one situation,
with this configuration of purposes" (Kress, 2006, p. 490). Design is considered one of
the most important aspects of multimodal expression because learners-as-designers
encourages imagination, vision, and problem solving (Albers & Harste, 2007; Rowsell,
2013). New forms of media require proficiency in design practices of a high level to
include the ability to "move" semiotic material from one mode or multimodal text to
another (Bezemer & Kress, 2008, p. 176; Dezaunni, 2015).

Integral concepts connected to the design of texts are hybridity and intertextuality
(Leander & Boldt, 2012). Hybridity is defined as communicating in new ways and
cutting across boundaries of expression to create new discourse. Bakhtin (1981) theorized
hybridization in texts occurs intentionally and unintentionally and the result is always a
new discourse rather than a combination of texts. Drawing upon Bakhtin (1986) and
Kristeva (1986), the New London Group (1996) positioned intertextuality and the
production of hybrid identities as important components toward discursive change.
Intertextuality draws upon the features and genres (i.e., concept; rhetoric; ideology) of
other texts as new texts are created (Leander & Boldt, 2012). Inherently, all texts contain
an implicit or explicit degree of intertextuality (Leu at al., 2009).

Interestingly, Shanahan (2013a) found student understanding of design exceeded
teacher understanding. Close analysis of a fifth-grade multimodal class project revealed
while students were designing, their understandings about ways to communicate via
various modes exceeded the knowledge of the teacher observed, however, their final
projects illustrated compliance with the cultural norms. Shanahan (2013a) posited student

compliance demonstrated how specific tools (e.g., digital technologies, software program) are, "used within a cultural context that defines the tool" (p. 100). The cultural context influenced how the modes (tools) were used to communicate meaning (Vygotsky, 1978). Shanahan's findings support a premise inherent in a multiliteracies theoretical framework, which is meaning and design are socially and culturally constructed practices (Gee, 2009).

Genre and New Media

Genres are understood as recurring patterns of communication, which emerge in response to similar rhetorical situations (Bazerman, 1994). As people try to understand each other to coordinate activities and share meanings for practical purposes, genres arise within the social processes (Bazerman, 2004). Proponents of genre theory argue children must learn to write in genres, "that will enable them to function and exert agency in a society that gives preference to those who have mastered the genres of power such as scientific or informational genres" (Schneider, 2003, p. 334). Miller (1984) famously pushed genre theory toward understanding genres as forms of social action. Essentially, Miller (1984) argued the emphasis for studying genres should be on typified use rather than particular forms. Genre is considered an integral element in the design of multimodal texts as genre informs design. All multimodal texts contain multiple genres simultaneously (Kress 2003). Graham and Whalen (2008) posited design brings together genre theory and new media design.

In response to the, "burgeoning discursive and communicative activity of the web, with its new media platforms, new audience and producer, new communicative

interactions, new exigencies, and new genres" Miller (2014) revisited the genre theory

she revolutionized (p. 60). Miller (2014) posited, "genre has become a much more

complex, multidimensional social phenomenon, a structurational nexis between action

and structure, between agent and institution, between past and future" (p. 69). The

internet creates a new arena with less control and regulation than academic disciplines

due to voluntary activity, user-generated content, emergent communities of practice and

an emphasis in experimentation and play (Miller, 2014). Consequently, Miller (2014)

rewrote genre as social action where genre is now the social action while in a digital

environment. Meaning, genre transcends textual products in response to new media and

the texts are artifacts of social interaction online.

A case study (Graham & Whalen, 2008) focused on the practice of a professional

new-media designer illustrates the advancement in genre theory proposed by Miller

(2014). As a professional new-media designer completed digital products, the design

practices were observed and analyzed within the framework of new media and genre

theory. Based upon their findings Graham and Whalen (2008) concluded, "current genre

and new-media theory underestimates the complexity of the dynamic and nuanced

articulations between mode, medium, genre, and rhetorical exigencies" (p. 74). Further,

Graham and Whalen (2008) posited the discovery of a new type of genre hybridity they

coined "gestalt-shift genre" (p. 89). A product created during the observation was an

interactive holiday employee e-card developed for the Ryzex Corporation. In addition to

a holiday greeting the e-card contained a shooting gallery game featuring Ryzex UPC

scanners as guns. The e-card fulfilled the rhetorical purpose of communicating a holiday

greeting to Ryzex employees. Graham and Whalen (2008) posited upon receipt, the users

of the e-card must undergo a gestalt-switch to begin playing the card. The card becomes the game. The gestalt-shift genre proposed by Graham and Whalen (2008) is representative of the structurational nexis between action and structure posited by Miller (2014).

Composition of Digital Media

Ever expanding and changing digital technologies provide new kinds of modal ensembles to a wide variety of users, which offer new types of meaning representation (Bezemer & Kress, 2008). Children are situated as powerful when they are able to expand upon reading the modalities of texts to use modalities in the design of their own practices, activities, and texts (Leander & Boldt, 2012). Mills (2011) posited an important layer of complexity is added to text and knowledge creation when crossing from print to digital modes. Digital texts vary from linear, stand-alone, static products to fluid constantly changing, highly interlinked hybridized, and multimodal products (Martin & Lambert, 2015).

The digital writing tools used in the composition of digital texts foster connections between the writer and audience, integrate modal resources, allow for ongoing revision, and organize content as linked concepts rather than linear text. Martin (2008) argued that in order to enable constructive social action, digital writers need to develop the ability to use digital tools to construct new knowledge, create media expressions, and communicate with others in social contexts. In his discussion regarding the knowledge and skills students develop when they engage in digital composition, Dezuanni (2015) viewed digital materials as assemblages authored by both the

individuals interacting with them and through interaction and negotiation with the

hardware and software required to display and manipulate the objects on the screen.

Essentially, the creation and sharing of digital texts is an embodied, material and

conceptual discursive process.

Within a multiliteracies perspective of writing multimodal texts, Bernstein's

(1996) notion of recontextualization is important to consider. Bezemer & Kress (2008)

defined recontextualization as, "moving meaning material from one context with its

social organization of participants and its modal ensembles to another, with its different

social organization and modal ensembles" (p. 184). The remix of meaning material is

constructed within the context of the new social organization via the use of available

modal resources. Everything in the originating text may not be relevant in the new

context. The designer determines the content to include and the modal resources to

employ, which is also influenced by the designer's rhetorical purpose. A social and

semiotic perspective of representation can affect interpretation of meaning.

Recontextualization results in the transference and transformation of a text from one

context to a text framed within another context (Mantynen & Shore, 2014). Satire is a

genre of literature in which recontextualization is used to make fun of an individual or an

aspect of society. An example of recontextualized text is Mad Magazine, a well-known

and long-running satirical magazine. Each issue features a recontextualization of text to

provide a satirical response regarding current cultural phenomenon.

Inherent within the composition of digital texts are decisions made by the

designer. McLean and Rowsell (2013) posited designers of text cultivate dispositions that

allow them to select the appropriate modes or resources for meaning making to

communicate the intended meaning. A design-based perspective of digital composition views design as an iterative process incorporating revisions, consultations, collaborations, modifications, and applications (McLean & Rowsell, 2013). Additionally, an awareness of audience and context shape the design process (Dezuanni, 2015). An integral part of the design process is playing, experimenting, and trying out modes and technology for fit. Sheridan and Rowsell (2010) described the disposition of designers as needing to engage in trial and error before finding the 'right' decision.

Aligned with Miller's (2014) revised genre theory, Martin (2008) argued digital writers need to develop,

> the awareness, attitude, and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expression, and communicate with others in the context of specific life situations in order to enable constructive social action. (pp. 166-167)

Learning to compose digital texts includes familiarity and ability to use tools, genres, discourses, and interactional conventions associated with digital writing environments to plan, compose, revise, and publish digital texts in order to create social action (Martin & Lambert, 2015).

Participatory Culture

An element inherent in the framework of multiliteracies is the construct of participatory culture. Jenkins et al. (2006, p. 7) defined participatory culture as one:

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1. With relatively low barriers to artistic expression and civic engagement,

2. With strong support for creating and sharing creations with others,

3. With some type of informal membership whereby what is known by the most experienced is passed along to novices,

4. Where members believe that their contributions matter

5. Where members feel some degree of social connection with one another (at the least they care what other people think about what they have created).

Although members are not required to participate, the community provides freedom to contribute only when members are ready and all participants know their contributions will be appropriately valued. Strong incentives for creative expression and active participation are embedded within the community itself (Jenkins et al., 2006).

Increased development of and access to online communities provides opportunities for individuals to participate in a sociocultural exchange of multiliteracies. Participatory culture inherent in online communities is posited to increase user-created content (Burnett & Merchant, 2015; Chisholm & Trent, 2013; Jenkins, 2006). Just because technology users interact with technology does not mean they know how or are motivated to create products within the given type of technology. A review of weblogs on the Internet found that fewer than seven percent of Web users created Weblogs (Ondrejka & Lab, 2008).

A participatory culture provides an environment whereby users with similar interests engage in a sociocultural exchange of information and products. For example, sixty-seven percent of members of *Second Life*, a 3D virtual world, created at least one

program using the scripting language connected within the program. Ondrejka and Lab (2008) argued the simultaneous collaboration model of virtual worlds results in, "a striking alignment between play and authorship in virtual worlds" (p. 241). In a study focused on the power of participatory culture within an online role playing community, Alley (2013) discovered community members worked together to solve problems, were committed to continued play, and created and used assets in their community, leading to the creation of culture for role-play interaction that produced collective narratives. Alley (2013) described the experience of an adolescent member who joined the community with weak writing skills as compared to the established members of the online community. In response to the participatory culture embedded in the online community, the new member developed her writing skills via the opportunities to collaborate with others, produce texts, and receive feedback from community members.

A Shift Toward Programming

Digital technology offers new possibilities for users to play, express themselves, learn, and communicate (Dezaunni, 2015; Schrader & Bastiaens, 2012). Although children frequently interact with digital media, few can create their own games, animations, or simulations (Resnick et al., 2009). Brennan, Monroy-Hernandez and Resnick (2010) posited, "being a creator of interactive media enables broader understandings of how these artifacts are created and function, understandings required for full participation in and negotiation of a technologically saturated society (p. 76). Recently, there has been a shift from learning to code programs at the university level toward providing environments to engage young children in programming (Burke et al., 2016; Fincher & Utting, 2010).

Rushkoff (2010) argued programming is the new literacy of the millennium. The old literacy of pen-and-paper writing is leveraged with the new literacy of programming, and the resultant hybrid, programming-as-writing (Burke, 2012). When programming was first introduced to children in the early 1990s, Papert (1993) intended programming to not only introduce children to the concepts of programming, but to provide an entirely new language in which children could make computers "write" text (Burke, 2012). Programming could be viewed as a language, which produces a variety of modes to communicate meaning. A simple created program could contain linguistic, visual, gestural, spatial, and audio modes.

Further, computer programming enhances problem-solving, logical thinking, planning, and organization skills (Burk et al., 2016; de leng, Domans, Jobsis, Muijtjens, & van der Vleuten, 2009; Lee, 2011). Data from a quantitative study focused on the impact of digital game authorship on seventh-grade students' concentration, critical thinking skills, and academic achievement suggested the experimental group demonstrated significant improvements in critical thinking skills and academic achievement (Yang & Chang, 2013). The researchers posited digital game authorship promoted greater learning retention through students' empowerment as designers and authors of authentic digital games.

A Constructionist Approach Toward Programming

Although young people spend time engaging in forms of digital media (e.g., online games; *YouTube*), they are typically engaged as consumers rather than producers of interactive media (Brennan et al,, 2010). Jonassen, Peck, and Wilson (1999) argued,

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"students-as-producers-of-technologies engage in much more meaningful learning than students-as-receivers-of-technologies" (p. 112). The theory of constructionism provides a framework for much research on how and what children learn as they work on a computer (Denner, Werner, & Ortiz, 2012).

A constructionist approach toward computer programming posits that learning occurs when people are actively engaged in the creation of a meaningful product (Kafai, 2006). Individual cognitive processes are combined with social and cultural contexts in which learning takes place within a constructionist theoretical framework (Kafai, 2006). Programming games for and with other individuals creates a constructionist learning environment, which extends beyond the simple act of making games (Denner et al., 2012).

Scratch

"You needn't only take what you're given, you can make your own!" (Utting, Cooper, Lolling, Maloney & Resnick, 2010, p. 5). The preceding mantra permeates the culture of *Scratch*. User generated content is becoming an integral component of digital media for youth (Beals, 2010; Dezaunni, 2015). In response to a plethora of technologies that try to create an experience or deliver information to kids, *Scratch* was created to provide technology in terms of a material kids can create products with (Traylor, 2008). *Scratch* is intended to function as a creativity tool to help facilitate expression, communication, concepts in interactivity and programming, presentation development, and community-based learning (Traylor, 2008).

The *Scratch* project began in 2003 by the Lifelong Kindergarten Lab housed in the Massachusetts Institute of Technology (MIT). Launched publicly in 2007, the *Scratch* website is an active online community with participants designing, sharing, discussing, and remixing one another's projects. *Scratch* has been called "the *YouTube* of interactive media" (Resnick et al., 2009, p. 60). Created to be a social product, *Scratch* was influenced by an implicit belief that if learners can share and show off their accomplishments, they will learn well and learn more (Fincher & Utting, 2010). The ability to easily share products within the active user community provides motivation and opportunities to learn from others (Maloney, Resnick, Rusk, Silverman, & Eastmond, 2010; Lee, 2011). Keyword tags are used to foster collaboration, which enables members to quickly find high-quality *Scratch* products posted by others (Lee, 2011).

Since its public launch, *Scratch* has helped to introduce integral programming concepts, while providing an online community to create and share their own digital media (Burke, 2012). The core audience of *Scratch* is between the ages of 8 and 16, with a peak at age 12 (see Figure 2.1 below). Initially used in informal learning settings (e.g., after school computer centers; home environments), *Scratch* is increasingly used in schools (Maloney, 2010). Burke described his use of *Scratch* to introduce programming-as-writing in a middle school classroom. He set up writing workshop sessions using *Scratch* as in introduction to programming language. Every writing workshop opened with a mini-lesson emphasizing a specific element of effective composition (e.g., characterization; foreshadowing), which was connected to learning a particular coding procedure in *Scratch* (e.g., using the broadcast feature to establish dialogue; importing external images). Burke posited:

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Digital storytelling in *Scratch*, particularly in terms of the workshop's focus on

characterization and plot analysis, offers a new medium through which children

can exercise the composition skills they learned within traditional literacy

classrooms while also offering the mutual benefit of introducing coding at earlier

ages. (p. 131)

Although *Scratch* was designed for informal environments, the application is increasingly

used in educational settings (Kafai & Burke, 2014).
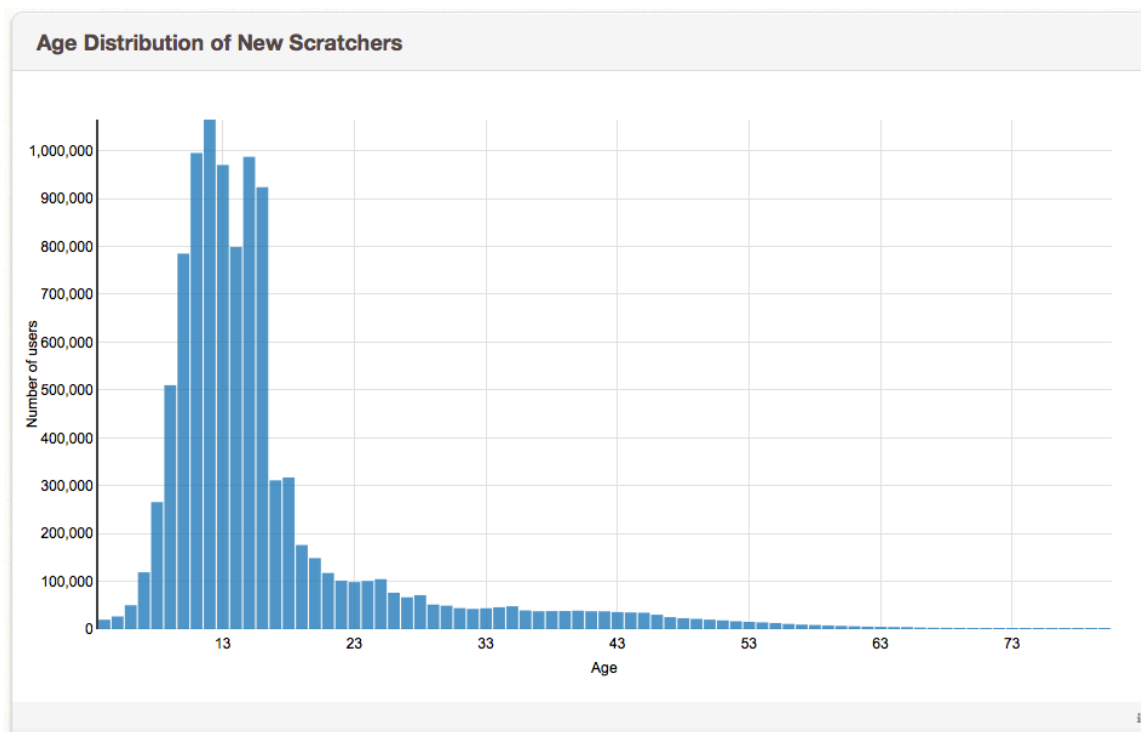
Figure 2.1. Age distribution of New Scratchers (retrieved 3/28/16).

The recent addition of ScratchEd (http://Scratched.gse.harvard.edu) provides an

online community for educators to share stories, exchange resources, ask questions, and

find people, thus scaffolding integration of *Scratch* into classroom environments. *Scratch*

takes advantage of networking and shared development to increase the effectiveness of

individual teachers (Fincher & Utting, 2010). It is important to note explicit instruction should be provided when attempting to integrate course content into *Scratch* experiences. Moore (2013) provided an example of a teacher with an ambivalent experience encouraging fifth and sixth grade students unfamiliar with programming to develop their own video games while integrating current events. Upon reflection, the instructor believed his lesson was too unstructured and the resulting learning experience was uneven for students. Although *Scratch* is intended as an entry point for children to learn programming, educators need to provide explicit instruction related to application of course content into *Scratch* programs.

Purpose of *Scratch*. A key goal of *Scratch* is to introduce coding to users with no previous programming experience. To increase accessibility to coding concepts, the creators of *Scratch* wanted to "lower the floor" and "raise the ceiling" for programming in order to get children started earlier (Papert, 1980; Utting et al., 2010). The core principle behind "lower the floor" is to limit the coding schema required to engage in the design of products in the online community. The aim is to remove or hide accidental complexities in order for users to begin designing products. To "raise the ceiling" is prompted by the intention to provide an environment whereby, producers experience decreased constraints regarding the types of products created. Additionally, *Scratch* creators believed programming languages need "wide walls". It was important to support numerous types of projects in order for people with different interests and learning styles to become engaged (Resnick et al., 2009). Programs can potentially be developed for any subject, at any difficulty level, in any language (Yang & Chang, 2013). Additionally, the environment allows users to learn entirely through play (Utting et al., 2011). The result is

a plethora of media-rich products designed and redesigned by community members (Maloney et al., 2010). According to the *Scratch* website (http://Scratch.mit.edu/statistics/), 11,020,750 users are registered and 13,819,511 projects have been shared (see Figure 2.2 below).

Community statistics at a glance

- 13819511 projects shared,
- 11020750 users registered,
- 72447912 comments posted,
- 1385920 studios created
  ...and growing!

Figure 2.2. Number of *Scratch* users and projects created (retrieved 3/29/16).

To promote self-directed learning, the online *Scratch* environment was designed to encourage scripting, provide immediate feedback for script execution, and make execution and data visible (Maloney et al., 2010). The visual programming paradigm embedded within *Scratch* dramatically reduces barriers to computer programming, which enables children to easily develop sophisticated computer programs (Lee, 2011). The system is always live with no run/edit switch, which means commands or code snippets can be run with a click. Additionally, graphical feedback shows execution and variables and lists have concrete visualizations, so the effect of data operations can be immediately viewed (Maloney et al., 2010)

The creators of *Scratch* argue the ability to program greatly expands the range of what can be created and self-expressed, while also expanding what can be learned (Resnick et al., 2009). A core belief embodied by the *Scratch* creators is "learning to code and coding to learn". Essentially, "programming supports the development of 'computational thinking', helping you to learn important problem-solving and design strategies (such as modularization and iterative design) that carry over to non-programming domains" (Resnick et al., p. 3). Conceptually, *Scratch* could be used to promote unlimited learning.

Another feature of *Scratch* is the ability to remix designs. A remix occurs when someone takes a previously created project, adds modifications to it, and then uploads it to the site as their own version. Members are encouraged to remix programs shared within the community. In fact, more projects are remixed than the amount of new projects created (see Figure 2.3 below).
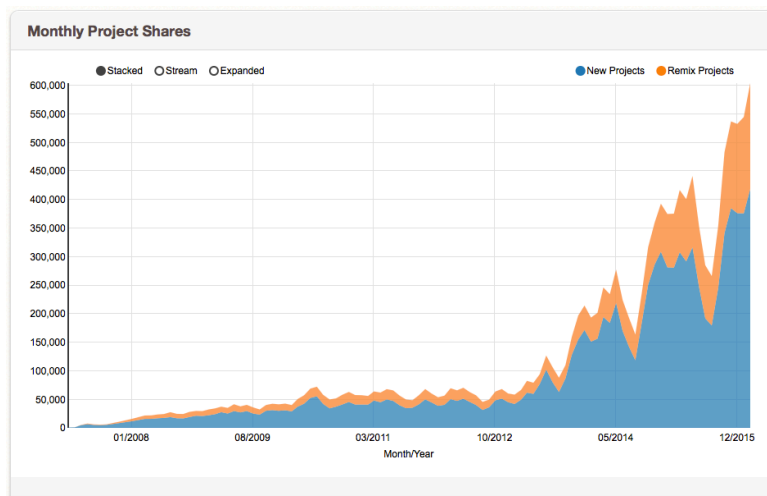
Figure 2.3. Amount of new and remixed projects (retrieved 3/28/16).

Core design principles. To accomplish the purpose of *Scratch*, three core design principles were established. The creators wanted to make *Scratch* more tinkerable, more meaningful, and more social. The name of *Scratch* itself originated from the Scratching technique used by hip-hop disc jockeys, who tinkered with music by spinning vinyl records back and forth with their hands and mixing music clips together in creative ways (Resnick et al, 2009). The method of "Scratching" records connotes the idea of tinkering. "In *Scratch* programming, the activity is similar: mixing together graphics, animations, photos, music, and sound" (Resnick, p. 63). *Scratch* employs an intuitive block system to create programs. The block system makes programming easy to change before, during, and after program execution.

Creation of products on *Scratch*. *Scratch* added programmability to media-manipulation activities popular in youth culture in order to encourage children to learn via exploration and peer sharing, with a decreased focus on direct instruction compared to other program languages (Maloney et al., 2010). The three major components within a *Scratch* program consist of Stage, Sprite, and Script. Development of a *Scratch* program is conceptually similar to directing/producing a performance (Lee, 2011). A Stage serves as the backdrop to all *Scratch* programs, complete with background images, music, and sound. A Sprite serves as the two-dimensional actor in the "real-world show" (Lee, 2011, p. 27). Although a variety of Sprites are available, users can easily create their own Sprites with the use of a built-in-paint tool or importing an external graphic file. The Sprite can sing, dance, and even change appearance. Lastly, the Script is a set of programming blocks, which are associated with either Sprite or Stage to control behavior. An intuitive user interface makes programming easy and enjoyable for young children

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(Lee 2011; Resnick et al., 2009). Images and sounds can also be imported or created using the built-in paint tool and sound recorder.

The most prominent feature in *Scratch* is the ability to create sophisticated computer programs by snapping together visual programming blocks with the use of a computer mouse, rather than typing programming language constructs on a keyboard (Lee, 2011). Products are created by snapping together digital programming elements, which appear as blocks. Similar to building with LEGOs, the programming blocks snap together to interlock (see Figure 2.4 below). The programming block menu provides nine categories of color-coded blocks to control the behavior of Sprites or Stage. Each color represents a motion, appearance, or sound (see Figure 2.4 below). Further, users can create a new block or add an external extension (e.g., LEGO WeDo; PicoBoard) to create enhanced programs. Projects can be saved to a file system or shared on the *Scratch* site.
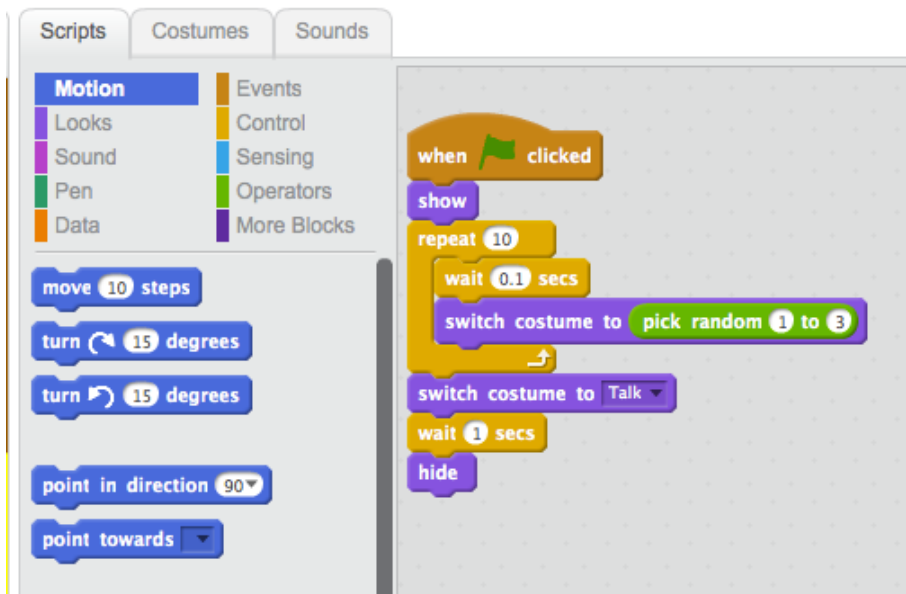
Figure 2.4. Color-coded programming block sample.

Although the intuitive programming blocks used within *Scratch* limit the coding schema required for children to create projects, a key goal is to increase accessibility to coding concepts (Utting et al., 2010). Children engage in a concurrent process by which the complexity of coding concepts employed, develop as they create more sophisticated projects (Kafai & Burke, 2014). Essentially, children learn programming concepts and skills as they develop increasingly complex projects. Additionally, the language used to express coding concepts becomes more explicit as coding skills develop. *Scratch* members learn problem-solving and project-design skills (e.g., logical reasoning; debugging problems), along with specific programming concepts (e.g., sequence; looping, conditional statements; variables; arrays; Boolean logic) as they create digital media in *Scratch*. See Appendix A for a complete list, explanation, and example of programming concepts supported in *Scratch*.

Examples of products. The *Scratch* application is used to create a wide variety of projects containing media and scripts (Maloney et al., 2010). Types of products created include animated stories, games, online news shows, book reports, greeting cards, music videos, science projects, tutorials, simulations, sensor-driven art and music projects. In research focused on the use of *Scratch* with young gifted learners, Lee (2011) provided an example of a student in first grade who was able to recreate a storybook in *Scratch*. The student first wrote a storybook about his favorite animal in writing class**.** After learning basic *Scratch* coding, the student was able to create a digital storybook animating all the things he described his animal doing in the original written story. The student found his experience enjoyable and he went on to create more sophisticated

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Scratch programs, whereby the student demonstrated understanding of Boolean logic and conditional statements.

The development team of *Scratch* shared the experiences of a Scratcher named BalaBethany (Resnick et al., 2009). BalaBethany enjoyed drawing anime characters and began her *Scratch* experiences programming animated stories featuring anime characters. As she began sharing her stories in the *Scratch* community other members responded favorably and began to ask her specific questions about how she achieved certain visual effects. In response, BalaBethany began to produce new *Scratch* projects on a regular basis, similar to episodes in a TV series. Inspired to involve the community in her designs, BalaBethany created a contest asking members to design a sister for one of her characters. She received a comment from a member who wanted to participate in the contest. However, she didn't know how to draw anime characters. BalaBethany responded by producing a step-by-step tutorial, demonstrating a 13-step process for drawing and coloring an anime character. Over the course of a year BalaBethany programmed and shared more than 200 *Scratch* projects covering a wide variety of project types (Resnick et al.).

As community members began to interact on *Scratch*, collaborated projects appeared. A group of 4 kids from England, Ireland, Russia, and the United States formed a company titled "Crank Inc" (Traylor, 2008). The company was created to make games together where each member made different parts of the game. A girl in Ireland began to offer consulting services (Traylor, 2008). She provided the use of her characters and even offered to create new characters upon request. Members simply needed to send her a

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message with their request. A wide variety of independently and collaboratively designed programs are available to view and remix in the *Scratch* community.

Literacy Practices Supported by *Scratch*

Within the past decade there has been a shift among educators to view literacy beyond a physical product toward a composite of digital literacy practices (Burke et al., 2016; Dezuanni, 2015; Hobbs, 2010). No longer constrained to traditional paper and pencil, literacy now extends to digital text and multimodal means of communication. Although *Scratch* was intended to teach children about mathematical and computational ideas through artistic, open-ended play (Resnick et al., 2009), the online programming application also supports literacy practices including reading, writing, and digital storytelling (Burke & Kafai, 2010; Burke, 2012; Garthwait, 2007).

To examine literacy practices supported within the *Scratch* programming community I completed a review of research focused on the study of literacy and *Scratch*. Literature pertaining to *Scratch* is more focused on digital media creation (Blau, Zuckerman, & Monroy-Hernandez, 2009; Peppler & Kafai, 2007; Moore, 2013), than specific reading practices utilized within *Scratch*. I began the literature review with an online search via EBSCO and Google Scholar for peer-reviewed articles focused on *Scratch*. Terms I used to search for articles included "Scratch", "MIT", "Reading", "Writing", "Literacy", "Multimodal", and "Digital Storytelling". Since *Scratch* was launched approximately four years ago, no search parameter was established for publication date. In total, I found 26 articles directly connected to *Scratch*. I grouped the reviewed articles by the primary emphasis or focus of each article. As shown in Table 2.1

(below), the majority of articles focused on computer science concepts, including programming and coding. Only one article focused on the use of *Scratch* to support writing (Burke, 2012) and one article (Burke & Kafai, 2010) focused on storytelling within *Scratch*.

Table 2.1

Scratch Emphasis in Articles Reviewed

Scratch Emphasis	Author(s)
Storytelling	Burke & Kafai (2010)
Computer Science Concepts; Programming/Coding	Denner, Werner, & Ortiz (2012) Graner (2009) Harvey & Monig (2010) Kordaki (2012) Fincher & Utting (2010) Lewis (2010) Malan & Leitner (2007) Peppler, Kafai, Resnick, & Rusk (2008) Meerbaum-Salant, Armoni, & Ben-Ari (2010) Utting, Cooper, Kolling, Maloney, & Resnick (2010) Traylor (2008) Resnick et al. (2009) Maloney, Resnick, Rusk, Silverman, & Eastmond (2010) Fessakis & Mavroudi (2013)
Participatory Culture	Peppler & Kafai (2007) Monroy-Hernandez & Resnick (2008) Brennan, Monroy-Hernandez, & Resnick (2010)
Creativity/Problem Solving	Adams (2010) Lee (2011) Navarrete (2013)
Multimodality	Birchfield et al., (2008)
Media Literacy/Content	Blau, Zuckerman, & Monroy-Hernandez (2009) Moore (2013) Peppler & Kafai (2011)
Writing	Burke (2012)

Literacy practices connected to reading. Although my review of literature did not reveal research with an explicit focus on specific reading practices supported within *Scratch*, I observed an implicit connection to the inclusion of reading. Burke (2012) described a seventh grader's "One-Man Hamlet-Scam" project. The lead character, a

robot, recited Shakespeare as he is shuttled off the stage prematurely. Creation of this program would require the designer to first read and become familiar with Hamlet prior to development of the program. Additionally, the designer would read and input the appropriate text from Hamlet into the coding application. Embedded reading can also be found in an example provided by Lee (2011). A digital storybook created by a nine-year-old contained written text for community members to read. It is important to note none of the studies reviewed explicitly discussed communication between community members, which includes reading of text.

My review of projects shared on the *Scratch* site revealed numerous examples of reading based experiences. A Harry Potter sorting quiz required members to read and answer questions in order to receive their placement at Hogwarts (see Figure 2.5 below). Many users engaged in the Harry Potter program as evidenced by the 26,881 members who viewed the project and 5,427 comments created in response. Interestingly, the Harry Potter project was remixed by 96 *Scratch* members.
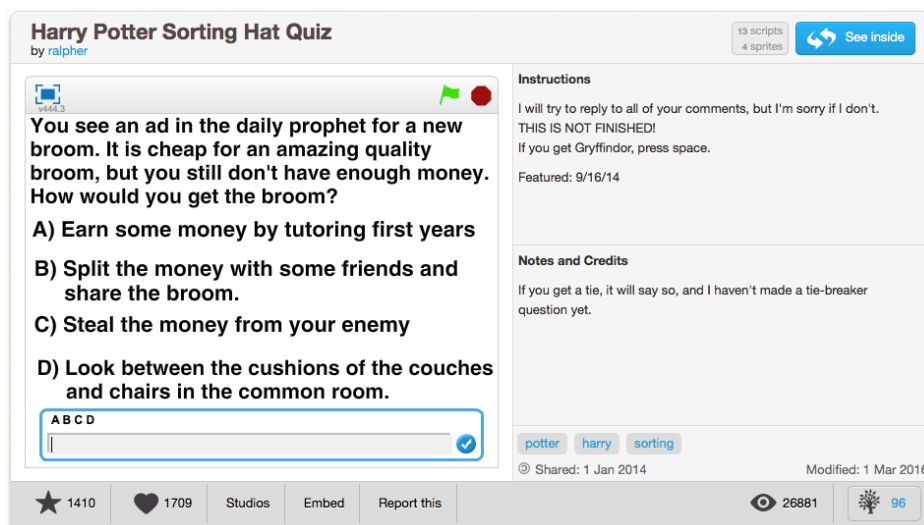
Figure 2.5. Harry Potter quiz (retrieved 3/28/16)

Another project featured a story titled *Rabbit Feathers* for members to read (see Figure 2.6 below). The story was created by a *Scratch* member and found within a reading and writing *Scratch* studio. Members create and curate studios in Scratch. Each studio is focused on specific types of projects. Although not explicitly researched, *Scratch* contains programs, which embed a variety of reading experiences.
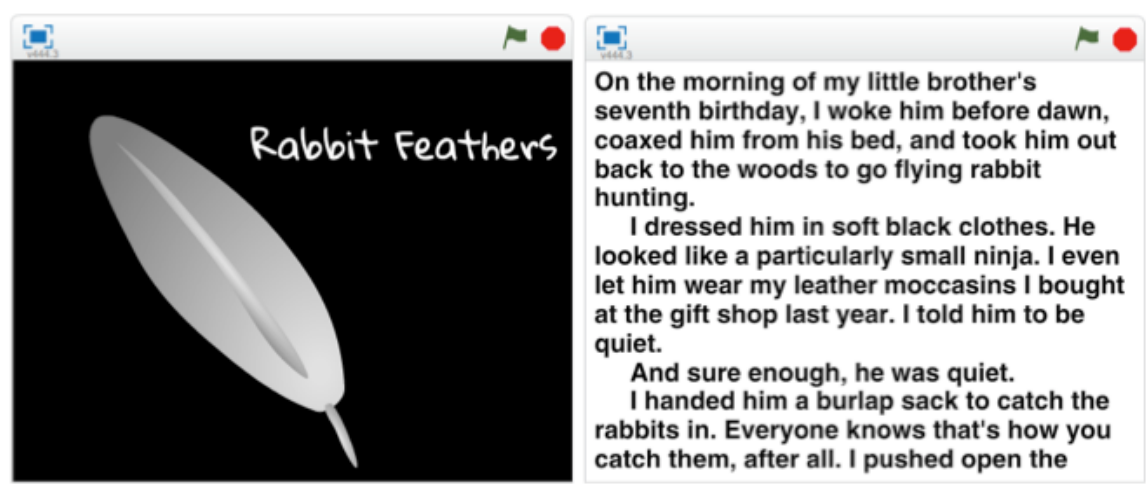
Figure 2.6. Rabbit Feathers (retrieved 3/28/16)

Writing and storytelling in *Scratch*. Although elements of writing (e.g., organization; ideas; presentation) are inherent in digital storytelling and game creation (Gee, 2003), only one study (Burke 2012) had a direct focus on the use of programming as writing. Burke studied the use of *Scratch* to promote writing skills with middle school students in an elective language arts class. His objective was to consider programming in terms of writing within the traditional core subject of English language arts. The qualitative data suggested the workshop setting, inclusive of *Scratch*, alongside the school's existing language arts standards was an effective framework for facilitating digital composition skills of participants. The digital composition evidenced in the

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Scratch products, "underscored the wider connection between coding and writing as interrelated processes of composition" (p. 131).

An additional study connected to writing (Burke & Kafai, 2010), examined how the narrative structure of stories created in *Scratch* offered users the opportunity to better understand the process of expanding an idea into the arc of a story. The six-week qualitative study focused on the use of *Scratch* during an after-school club called, "Storytelling with Scratch Club". The purpose of the study was to examine how writing computer programs can help children develop their storytelling and creative writing abilities. Initially, the students encountered coding issues connected with desired outcome verses actual outcome. For example, a Sprite would not meet with another Sprite at the intended moment within the story. Although students initially became frustrated, the instructor redirected them to the initial storyboard to maintain a focus on the finished product. Interestingly, programming in *Scratch* offered a more immediate revisionary process. Students were able to immediately check the effectiveness of coding scripts, which resulted in a seamless process of creating and revision more efficient than traditional writing tasks.

Multimodal composition in *Scratch*. The ability to compose with tools in a multimodal fashion creates an empowering experience on *Scratch* (Birchfield et al., 2008). Birchfield and colleagues define multimodality as, "interactions and knowledge representations that encompass students' full sensory and expressive capabilities" (p. 3). In a literature review focused on convergent themes across human computer interaction and education for mixed-reality learning environment, Birchfield et al. (2008) indicated

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Scratch as proven to effectively foster and orient innate creativity within an online learning environment.

An inherent strength within the *Scratch* community is the ability of members to easily design and redesign multimodal products. Essentially, all *Scratch* products are considered multimodal as programs created contain multiple modes to communicate meaning. The design and redesign of programs engage users in multimodal literacy experiences. *Scratch* embodies the agentive property, whereby multimodal composition serves as a powerful tool in literacy development (Burke et al., 2016; Rowsell, 2013).

Summary

As children learn to navigate in a technology-saturated world, the nature of literacy experiences continues to evolve. While linguistic modes of communication have been historically valued, the advent of online communication and communities are changing what it means to be literate in society. Children need to move beyond traditional reading and writing, toward proficiency in contemporary conditions for meaning-making.

Scratch is an online community designed to engage and support children in the acquisition of coding and programming skills. The participatory culture embedded within *Scratch* provides an environment where members with no experience in coding concepts can begin to design and remix programs, and collaborate with community members. The intuitive interface and tools make it easy for novice users to create and remix designs. The immersive experiences in a wide variety of programs supports the acquisition of skills required to comprehend and produce multimodal texts.

My review of the existing literature related to *Scratch* revealed an emphasis in research focused on the use of *Scratch* to teach computer science concepts. There is a dearth of research focused on literacy practices embedded within *Scratch* experiences. Research focused on the literacy practices embedded in a medium typically reserved for research on computer science concepts will elucidate literacy practices hitherto unexplored within the context of programming.

CHAPTER THREE

RESEARCH DESIGN

In this study, I used a descriptive case study approach to explore participant engagement in literacy practices within an online programming community. A descriptive case study "illustrates the complexities of the situation, and presents information from a wide variety of sources and viewpoints in a variety of ways" (Brown, 2008, p. 3). As the researcher conducting this study, my aim was to describe how the literacy experiences of participants were embedded in an online programming community called *Scratch*. Further, I sought to describe ways in which decisions were made during the design and remix of products.

In this chapter I describe the choices I made regarding methodological design in relation to the research questions: 1) What are the literacy practices and processes embedded in the design and collaboration of products created in an online programming community? 2) In what ways do participants make decisions regarding the creation of their projects created in *Scratch*? In addition to discussing my choice of case study as a research framework, I provide details regarding participant selection, data collection, data analysis, trustworthiness of findings, and research ethics.

Research Methodology

An essential element of case study research is the study of a bounded system (e.g., a particular individual; situation; program; institution; time period; set of events) (Krathwohl, 1998; Stake, 2000; Yin, 2009). In this case, the bounded system is group of participants who form a collaborative unit within an online programming community. Taking a sociocultural view of literacy (Lankshear & Knobel, 2007), I framed the participants' literacy practices holistically and I was also sensitive to the context. A holistic perspective underpins the study because engagement in multiliteracies is a complex process that is more than the sum of its parts; engagement is focused on, "complex interdependencies and system dynamics that cannot meaningfully be reduced to a few discrete variable and linear, cause-effect relationships" (Patton, 2002, p. 41). Further, I aligned this study with Merriam's (1988) four characteristics of a case study research: 1) *particularistic*, this study is centered on participant engagement in an online programming community; 2) *descriptive*: I provide rich descriptions of participants' literacy practices; 3) *heuristic*, the study will enrich a reader's understanding of the literacy practices embedded within an online programming community; and 4) *inductive*, as determined by the domains I identified during analysis of data.

The purpose of this case study is considered *instrumental*, which delineates a study used to examine or provide insight into an issue or to redraw a generalization (Stake, 2000). According to Stake (2008), "the case is of secondary interest, it plays a supportive role, and it facilitates our understanding of something else" (p. 123). I chose to employ a case study design in order to advance understanding of the literacy practices experienced by the participants within an online programming community. Further, I

explored the ways participants made decisions regarding the creation of their projects and I describe how literacy practices are embedded within an online programming community.

Participants

My selection of participants began with my eleven-year-old daughter. Inquisitive at an early age, her school identified her as "gifted" and placed her in the gifted education program at her elementary school in first grade. My daughter is a self-motivated reader and writer who prefers to read texts in the fantasy genre; especially animal fantasy. Her favorite book series include *Harry Potter* by J.K. Rowling, *Guardians of Ga'Hoole* by Kathryn Lasky, and *Warrior Cats* by Erin Hunter.

Initially, my daughter began to engage in multimodal online communities, including *Animal Jam* and *Club Penguin*, at the age of eight. Two years ago she was introduced to *Scratch* via her gifted education teacher. Soon after, my daughter requested use of the home computer to design multimodal products influenced by characters from the *Warrior Cats* series. She created a *Warrior Cat* influenced avatar to represent herself in the online community.

My daughter's active engagement in an online programming community intrigued me. As I watched her engage, I recognized the unique literacy practices this programming community required of participants. After reviewing the limited literature on children's programming, I felt these literacy practices warranted further study. Additionally, my unrestricted access to her experiences and products on *Scratch* provided me with an opportunity to create a holistic and nuanced account of her embedded literacy practices.

As *Scratch* has gained in popularity, several of my daughter's friends are now active participants in the online programming community. I consulted with my daughter to determine which of her friends were active members in *Scratch*. Using snowball sampling (Noy, 2008), I recruited additional participants who were connected with my daughter via *Scratch*, between the ages of 10-14, active *Scratch* members, and who lived within a 30-mile radius of my daughter's middle school. This sampling technique provided a means to recruit members of *Scratch* who reside in the local area. Additionally, I experienced increased opportunities to interview participants and communicate with the parents of participants. I frequently interact with the parents of her friends during my daughter's extracurricular activities. After my daughter identified friends who are members of *Scratch*, I talked with the respective parents about their interest in having their child participate in the study. I sent an introductory letter to interested parents explaining the purpose of the study, my interaction with their child during the study, and anticipated time requirements, along with the informed consent form to review. A meeting was arranged with the custodial parents and participants to discuss the study, answers questions, and sign the consent form.

Including my daughter, five participants were recruited for this study. The bounded system within this study is the community of friends in *Scratch* who are connected by my daughter. Initially, all of the participants were introduced to and mentored in *Scratch* by my daughter. She helped the participants with their initial projects in *Scratch* and she continues to help when assistance is requested by her friends in *Scratch*. Within *Scratch,* the participants follow each other and communicate via comments posted in the comment section of published projects.

Role of the Researcher

The focal participant is my daughter and I am aware my experience as her mother influenced my understanding of the phenomenon and interpretations of data. In addition, I have a strong affinity for the participants being studied as I had prior experiences with them because they are friends of my daughter (Chenail, 2011). Consequently, I sought research methods to cultivate awareness of my preexisting beliefs to bring about a "critical self-awareness of [my] own subjectivity, vested interests, predilections, and assumption and to be conscious of how these might impact on the research process and findings" (Finlay, 2008 p. 17).

In the past, research resulting from shared intimate relationships has met with concern regarding researcher/researched relationships (Alley, 2013; Cole, 1995); however, fieldwork is interpretive. In specific types of research contexts, "intimate relationships have been shown to be useful and appropriate" (Alley, p. 95). Further, Maguire (1987) posited, "without close, empathic, interpersonal interchange and relationships, researchers will find it impossible to gain meaningful insights into human interaction or to understand the meaning people give to their own behavior" (p. 20). Although my intimate relationship with my daughter and previous experiences with participants influenced perception of data collected, my interpersonal interchange provided elucidation into participant interaction within an online programming community and subsequent literacy practices.

Additionally, my perspective of coding as a form of literacy was influential in my methodological approach. I viewed the use of coding by participants to create digital

media as engagement in literacy practices and processes. Coding combined with the design of multimodal products coalesce into literacy experiences for both the designer and audience. Further, I view coding as a language. An ability to understand coding is required to communicate meaning via the use of programming to create digital media. My belief in coding as language and literacy shaped my perspective of the data collected and influenced my methodological approach. I chose to look beyond the application of coding concepts in order to delve into the literacy practices that emerged from participants as they engaged in coding to create digital media.

Data Collection

In this study I explored embedded literacy practices within an online programming community and the ways participants made decisions regarding the creation of their projects in *Scratch*. Yin (1994) posited an important aspect of a quality case study is the use of multiple sources of evidence. The use of multiple data sources facilitates the discovery of a "converging line of inquiry" (Yin 1994, p. 92). To provide insight into the participants' processes, I collected and created data within the context of the online environment via interviews with and observations of participants. I analyzed digital media artifacts designed and redesigned within the online environment and transcribed interviews with participants.

Literacy artifacts. For the purpose of this study I defined literacy artifacts as digital media texts created by participants within *Scratch*. Examples of texts created in *Scratch* include digital stories, games, simulations and music videos. I analyzed literacy artifacts to determine observable literacy practices embedded within the design and

redesign of products. To complete the content analysis the artifacts were required to be published in *Scratch* in order to have access to the project. I selected up to five artifacts from each participant to be analyzed. With the exception of one participant, I analyzed all published projects. For the remaining participant I selected artifacts representative of a variety of digital texts.

I used screen capture to collect participants' online digital media products to save for later analysis. Each frame of the artifact was captured via screen capture. As the project changed frames or a shift in modal interaction occurred (e.g., new text is introduced in the story; a character moves; a color is changed or added to the stage) a screen shot was completed to capture the new frame. The completion of transcription frames provided a methodological approach for both a linear/temporal and a layered/spatial analysis of multimodal data.

Community artifacts. I collected artifacts reflecting communication between the participants and community members as they pertained to the multimodal artifacts analyzed. For the purpose of this study, artifacts included screenshots of communication between participants and community members within *Scratch* and transcript sections related to member communication collected during participant interviews.

Community interaction in *Scratch* takes place within the comments section of each project. *Scratch* members are encouraged to leave feedback or ask questions within the comments section of published projects. I collected community artifacts via screen capture of member comments within the comments section of participants' published projects. I chronologically ordered and stored the images collected within the respective

literacy artifact digital folders I created for each participant. The collection of community artifacts, via screen capture, provided a systematic approach in the organization of community artifacts for inductive analysis.

Community artifacts represent an important aspect of online interaction within a virtual space. As community members interact, they leave tracks of their social interaction via communication in the comments section of published projects. Collection and analysis of community artifacts provided data regarding the response received by the Scratch community regarding published projects. Additionally, the community artifacts provided data regarding how participants interacted with *Scratch* members and how this interaction affected the design of digital media projects created by the participants.

Interviews. I interviewed the participants to ascertain their experiences designing and redesigning digital media texts and collaborating with community members. Jenkins and Kelley (2013) posited young people engage in literacies (e.g., close reading activities directed toward popular music or books; reflections on what they read via social networks) embedded within engagement in participatory culture. Some of these literacies were hidden within participant engagement in the online community. While I could identify how members interacted with participants via comments left within their published projects, it was challenging to determine all of the participant interactions with *Scratch* projects, studios, and community members. Under the profile of each member *Scratch* will list the four most recent activities initiated by the member (e.g., a studio selected to follow; a project identified as being loved; a comment left on a published project). *Scratch* will only allow the four most recent activities to be viewed for each

member. Any additional activity is hidden from view. Participant interviews provided a way to delve deeper into interaction within the *Scratch* community.

The nature of the interviews focused on uncovering hidden literacy practices and processes not evidenced through analysis of literacy artifacts. Further, I asked the participants questions about their design choices. Questions focused on how participants used modal resources to construct and communicate meaning, enhanced understanding of how early adolescents use design to create and remix digital media products.

The location of the interviews varied among the participants. I interviewed three participants within their home environments. I also interviewed one participant at the local library and another participant was interviewed at my home. The location of the interviews was based upon parental preference. I offered to interview participants in their home environment, at the local library, or at my university office. I interviewed a participant at my home due to convenience and parental preference. Since he was scheduled for a play date with my daughter and son, I interviewed him in my home prior to the play date.

I began each interview with asking participants to explain why they joined *Scratch* and to describe the type of activities they like to engage in on *Scratch*. I created an interview guide for each participant, which contained a set of interview questions. The interview questions focused on the design and redesign of their published projects. In tandem with the interview questions I selected images that aligned with the questions to assist with the stimulated recall of their design choices. I organized these images within a PowerPoint and displayed them on my laptop during the interview. The customization of

participant interview guides provided a method to delve into the specific design and redesign practices initially identified in the content analysis. Each participant's interview guide was based upon the content analysis of projects created and customized for each participant. An example of a participant interview guide is located in Appendix C. I audio recorded all interviews via a memo app on my iPhone and transcribed the interviews using Express Scribe.

Study Design and Data Analysis

Phase I. The research design was comprised of two phases. The first phase of the study began with a content analysis (Krippendorff, 2013) of participant literacy artifacts. I analyzed artifacts to determine observable literacy practices embedded within the design and redesign of products and how the modes interact. I included literacy artifacts representing a variety of texts in order to provide a comprehensive view of literacy practices and processes. Using a Microsoft Excel program, I employed a multimodal analytic approach (Domingo 2012; 2014), to create transcription frames for analysis of how participants used different modes across each segment of the products created (see Figure 3.1 below). The elements I analyzed included landscape, gestures, images, written language, spoken language, visual effects, sound effect, and color (see Table 3.1 below for how I defined modes and examples).

Table 3.1

Mode Definitions and Examples

Mode	Definition	Example
Landscape	All visible features of the *Scratch* stage	Interior walls or cabinets; exterior woods or sky
Gestures	Movement or expression made by a sprite	A sprite waves hello; a sprite exits the stage
Images	A picture or drawing added to the stage or sprite	Stars and moons added to a sprite's clothing; illustrated labels placed on containers
Written Language	The use of print-based text to communicate	Written sprite dialogue; project instructions
Spoken Language	The use of speech to communicate	Spoken sprite dialogue; lyrics heard within music
Visual Effect	Imagery created, altered, or enhanced within a project	Bouncing text; a stage that disappears into another stage
Sound Effect	The use of sound or music to influence the project experience	Music to cultivate the atmosphere of a project; a sound used to represent a horse galloping
Color	The use of color within a project	Pastel walls throughout a house; earth tone color used on a teepee

A colleague, who is an expert in literacy and technology, was consulted during the creation of the transcription frames for the multimodal analysis. My purpose in consulting with an expert was to acquire assistance in the design of transcription frames that would allow for a linear/temporal and a layered/spatial analysis of data. I also wanted to confirm that my methodology, based upon a study completed by Domingo (2011), for the content analysis aligned with the data analyzed. After explaining the linear/temporal and layered/special analysis of data I planned to complete, the expert confirmed the methodology used by Domingo (2011) would align with the content analysis for this

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study. We began with an image of a transcription frame used by Domingo (2011) for a similar type of data analysis. Domingo's transcription frame provided a method for analysis of the modal interaction observed in the digital media created by participants.

In addition to coding each participant's mode across the segmented product, I added narrative descriptions to each frame, which included reflexive notes to link each segment of the analysis to the overall textual product. I also included summaries of my observations regarding member communication related to the product analyzed. I met with a colleague, with research experience in multimodal texts, to review the narrative content of the transcription frames. My purpose was to confirm the quality of the multimodal analysis of the data completed and identify potential gaps across transcriptions frames in the narrative created. My literacy colleague identified the need to include additional information in the narrative section of specified frames to better elucidate how the design of products affects the meaning made as *Scratch* members experience the digital media created. For example, regarding frame 4 of *Grace's House* (see Figure 3.1 below) my colleague stated, "You need to explain the potential significance of Grace's disappearance in this analysis. I imagine this plays a significant role now in the 'fun' and 'exploration' Mira seeks to achieve." Confirming my analysis of the data and receiving feedback from an expert in multimodal literacy strengthened the quality of the content analysis.

TIME:	Frame 3	Frame 4	Frames 3 and 4 provide a glimpse inside Grace's house. The interior colors match exterior colors used. Brigther colors are introduced on the doorknob and welcome mat. Grace speaks directly to each visitor to provide a welcome. Modal Interaction: The text (welcome to my house), color, music, and images all work together to provide a welcoming space. Potential Questions: 1) Why did you decide to have Grace say "Hiya" (instead of "Hi" or "Hello")? 2) What were you thinking as you created the inside of Grace's house? 3) How did you decide upon the shape of Grace's eyes? 4) Tell me about the items on her dress. Mira's responses: When asked why Grace says "Hiya!", Mira asked for a pencil and proceeded to draw a cat face with symbols (see Hiya artifact). This Hiyaa cat face is a signature greeting and she chose to have Grace say "Hiya!". Graces facial features mimic Mira's Scratch avatar. In Frame 4 the speaker is intentionally androngionous. Grace stated, "It could be a boy it could be a girl. Anybody can play it."
LANDSCAPE:	Interior of house is featured; viewer is shown behind the front door, window, and cat shown in the front view of	Interior of front room is the same as frame 3. Now a welcome mat can be seen in front of the door because orginal text is removed.	
GESTURES	figures are still; closed thin lines for Grace's eyes; nose and mouth are missing; only back of cat is visable; Grace's arms are open and held down at her side		
IMAGES	3 moons are on Grace's skirt; main window is rectangular while door window is rounded on the top	an outline of a head and shoulders with a "?" appears beside the text to represent the visiter who is speaking	
WRITTEN LANGUAGE:	A greeting from Grace welcomes visitors. Text features a casual tone like "Hiya" for hello. "Next" and an arrow indicates where to click for the next frame. Exclamation points used instead of	The dialogue represents a response from the person entering Grace's house. "You" indicares the speaker and is representative of a script. "Welcome" appears on mat in front of door.	
SPOKEN LANGUAGE:			
VISUAL EFFECTS	The front of the house dematerializes when you click on the front door. The front room materializes, which is the other side of the first frame.		
SOUND EFFECT	music continues to play		
COLOR	The colors used for the house interior mirror colors used for the exterior. Grace's clothes incorporate the house colors. Pastel yellow moons are on her skirt. Her headband and skirt match the house walls. Black is used for the text.	Brown is used for the mat and "welcome" is in orange. The orange is more bright and aligns with the yellow used in the doorknob. Mat is a soft shade of brown and outlined using a darker brown.	

Figure 3.1. Sample transcription frame.

Upon completion of the content analysis, Phase I continued with participant interviews focused on stimulated recall (Bruce, 2008; Gruba, 2006). I showed the participants specific images from their multimodal products. During the content analysis I notated in the narrative section of each frame questions generated as I completed the linear/temporal and layered/spatial multimodal analysis. These questions related to the modal choices made as participants designed and redesigned their projects. The images I selected to include in the interview were connected to the questions I planned to ask participants.

Each participant's interview guide was based upon the multimodal analysis of projects created and customized for each participant. I placed the images in a PowerPoint and presented each image on my laptop as the respective question was asked (see Figure 3.2 below). Questions focused on the design choices made by participants. I identified specific images from transcription frames for inclusion in the stimulated recall protocol for each participant. My criteria for selection of transcription frames included frames representative of multifaceted literacy processes and/or frames representing complex modal interaction. I defined multifaceted literacy processes as the use of digital tools to construct new knowledge or create media expressions. I defined complex modal interaction as the use of multiple modes to extend the meaning of digital text. Dependent upon the length of each product analyzed, I selected for analysis no fewer than ten frames and no more than 25 frames. Ten frames were representative of modal interaction for artifacts of limited length while up to 25 frames provided flexibility to use the appropriate number of frames to represent modal interaction.
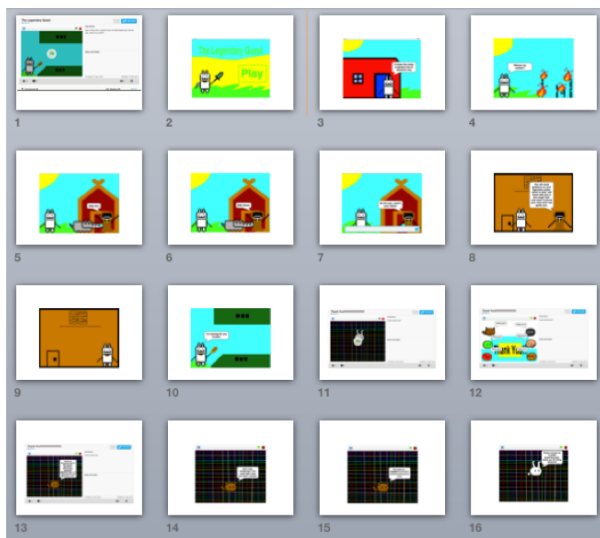
Figure 3.2. Sample set of stimulated recall images.

I used a semi-structured approach for the stimulated recall (Koh & Frick, 2009). I developed specific questions during the content analysis in addition to open-ended questions designed to examine the language and terminology used to describe the products created and the content of items discussed. I also asked questions, based upon participant responses, to further explore ideas related to design, and literacy practices and processes expressed by participants. I added participant responses to the narrative description of the applicable transcription frames and completed an inductive analysis upon the transcripts. A sample interview guide is provided in Appendix C.

Phase II. The second phase was comprised of participant observations combined with verbal probing. I completed three observations in the home environment of participants, one observation occurred in my home, and I completed another observation with a participant at the local library. I asked participants to work on a project within *Scratch* that was in process or to begin a new project, which was audio and video recorded.

I employed the use of verbal probing (Willis, 1999; Willis, DeMaio, & Harris-Kojetin, 1999) to evaluate the thought processes and decision-making as participants created or remixed a multimodal product. I used general probes to explore participant thinking and specific probes to delve deeper into their thinking (see Table 3.2 below for verbal probing examples). I chose the use of verbal probing as a method to guide participants to discuss the design process and choices made as they created a product. I included general probes when I noticed a shift in the design process of participants. My purpose was to foster articulation of the design process for each participant in order to learn about how the process shifted as participants created projects. I choose to employ

specific probes when there appeared to be an opportunity to delve deeper into the decision making process.

Table 3.2

Example of Verbal Probes Used During a Participant Observation

Probe type		
general	Researcher	What are you doing now?
	Participant	I'm adding a game over background.
specific	Researcher	Why did you choose a black background?
	Participant	I don't know. It just seems fitting.
specific	Researcher	Why would black seem fitting?
	Participant	When it's game over you know it's over. My common sense for this would be there are no more colors and you've just failed the game so you get a black screen.

The observation duration was between 30 to 45 minutes, dependent upon participant interest in continuing to work on their project in *Scratch*. After an inductive analysis was completed, based upon the transcribed responses and selected transcription frames, I triangulated the analysis results from Phase 1 and Phase 2. The use of triangulation provided a more detailed and balanced representation of early adolescent literacy practices and processes in *Scratch* . A comprehensive treatment of the methods used in Phase I and II can be found in Appendix D.

Inductive analysis

After the data were collected, I used inductive analysis, as described by Hatch (2002), to analyze the stimulated recall and participant observation data. I began the analysis by proceeding from specific to general thinking, whereby understanding was generated by finding connections among specific elements (Hatch, 2002). Data analysis occurred in the stages outlined in Table 3.3. The primary purpose of an inductive approach is to, "allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies" (Thomas, 2006, p. 238). It is important to note data analysis was ongoing and recursive throughout data collection and analysis.

Table 3.3

Steps in Inductive Analysis (Hatch, 2002, p. 162)

Steps in Inductive Analysis

1. Read the data and identify frames of analysis
2. Create domains based on semantic relationships discovered within frames of analysis
3. Identify salient domains, assign them a code, and put others aside
4. Reread data, refining salient domains and keeping a record of where relationships are found in the data
5. Decide if your domains are supported by the data and search data for examples that do not fit with or run counter to the relationships in your domains
6. Complete an analysis within domains
7. Search for themes across domains
8. Create a master outline expressing relationships within and among domains
9. Select data excerpts to support the elements of your outline

An important aspect to consider within inductive analysis is identification of frames for analysis (Hatch, 2002). Essentially, frames of analysis are the levels of specificity in which the data will be examined. The frames of analysis selected have major implications on analysis of data and conclusions determined. The purpose of selecting frames of analysis is to set rough parameters on how to begin close examination of the data. Smagorinsky (2008) cautioned that failure to complete an exhaustive, systematic analysis results in research reflective of a researcher's preconceived thesis rather than data exhaustively mined to determine what they suggest or reveal. The caution expressed by Smagorinsky (2008) is particularly important for the current study. Since I am interested in exploring the literacy practices of early adolescents engaged in an online programming community, my agenda could influence data analysis. Based upon the initial review of data, I chose to create frames of analysis focused on how participants designed and redesigned projects in *Scratch*. A focus on the design of digital media provided insight into the literacy practices and processes of my participants. I focused the frames of analysis for the interview data on comments related to the design and redesign of *Scratch* products. I focused the frames of analysis for the observation data on participant comments and events connected with the design and redesign of *Scratch* products. I also reviewed my researcher journal entries for observations made regarding practices and processes connected to the design and redesign of participant projects.

I engaged in a recursive process to identify salient domains within the frames of analysis. As mentioned above, I chose to focus the frames of analysis on the design process of participants. I engaged in repeated readings of the data. As I read the data, I highlighted text focused on the design process and annotated the data via notes written

within the margins of each page of data. For example, when Zoe discussed why she made the comment, "Don't get me wrong, I like these two characters" in the introduction to her project, *Kinkajou is So Annoying*, I wrote in the margin of the transcribed interview, "Zoe was concerned *Scratch* members would think she didn't like Kinkajou and Glory." The process of annotating the data assisted with my observation of patterns within the data analyzed. This initial analysis helped me to identify that participants would discuss specific types of decisions they made when talking about their design process.

Next, I reread the data to examine the types of decisions made by participants. Upon repeated readings of the data, I focused on the identification of the types of choices made by participants during the design process. I created terms to represent the types of decisions made by participants as they created digital media in *Scratch*. These terms (e.g., personal preference for design; audience driven decisions; text-to-text decisions; latent decisions; decisions to develop skills; work around limited skills; improve functionality of projects; decisions to elaborate an existing story; decisions connected to personal meaning; decisions to embed meaning) became a set of codes used to further examine the types of decisions made by participants during the design and redesign process (see Figure 3.3 below).

Design	Personal	Audience	Text-Influenced		Latent
Function	Develop Skills	Work Around Limited Skills	Improve Functionality		
Meaning	Elaborate an Existing Story	Personal	Embedded		

Figure 3.3. Codes created to identify the types of decisions made by participants during the design process.

After I created codes to represent participants' design decisions, I coded transcripts using an assigned color for each code. Figure 3.4 (below) is an example of a section of coded transcript completed after analysis of interview transcripts. Each color represents a specific code.

Figure 3.4. Example of coded transcript.

Additionally, I reviewed the color-coded transcripts to determine the type and frequency of decisions made by participants. Table 3.4 (below) provides the type and frequency of decisions made by participants based upon my analysis of the coded transcripts.

Table 3.4

Type and Frequency of Design Decisions Made by Participants

Code	Mira	Steven	Andrew	Zoe	Alexis
Personal Design Preference	42	12	23	4	1
Latent Decisions	4	0	2	3	0
Audience-Driven Decisions	31	2	22	4	2
Text-Influenced Decisions	5	2	12	8	0
Decisions to Develop Skills	6	4	9	4	0
Decisions to Improve Functionality	22	12	13	8	7
Decisions to Work Around Limited Skills	2	4	8	12	2
Decisions to Elaborate an Existing Story	12	1	27	24	6
Decisions Connected to Personal Meaning	8	3	6	2	0
Decisions to Embed Meaning	25	0	11	8	7

During the recursive analysis process described above, I created domains based upon my analysis of data. At first the domains were general as I started the recursive analysis process. I began with the creation of a domain focused on the types of design decisions made by participants. Then, I added domains as I analyzed the data. Based upon the iterative coding of the data, I created domains to reflect the themes observed. I identified terms to represent the domains and a cover term indicative of each domain. The domains I identified include decisions connected to the design of projects created, decisions focused on the function of projects created, decisions connected with meaning, and the participants' adoption of expert stances. Figure 3.5 (below) represents the domains created to reflect the themes observed in the data.

Domain 1 – Design: Decisions connected to the design of projects created.

- Decisions connected to a personal preference for the aesthetics of design
- Audience-influenced decisions
  - Decisions made to increase audience interest
  - Creation of projects to engage *Scratch* members
  - Consideration of audience feedback
- Text-to-Text influenced decisions
- Latent decisions

Domain 2 – Form: Decisions focused on the function of projects created.

- Decisions made to develop skills
- Decisions made to work around limited skills
- Decisions made to improve functionality of projects created

Domain 3 – Meaning: Decisions connected with meaning.

- Decisions to elaborate an existing story
- Decisions connected to personal meaning
- Decisions made to embed meaning into projects created

Domain 4 – Expert Stance: Early adolescents adopted an expert stance regarding the design of digital media.

- Order of operations
- Level of complexity
- Consideration of audience
- Quality control

Figure 3.5. Domains identified during the inductive analysis of data.

Trustworthiness of Research

Trust and confidence in interpretive research is dependent upon the research choices and protocol enacted by the researcher. The application of traditional criteria of validity (e.g., generalizability; objectivity; reliability) for qualitative research is problematic due to the complexity of the research (Guba & Lincoln, 2005). Tracy (2010) posited a model for quality in qualitative research that is expansive, yet flexible. Trustworthiness of the data is enhanced by attention to the following criteria:

Worthy topic. A research topic is considered worthy when it is relevant, timely, significant, and interesting (Tracy, 2010). An increase in the use of coding to create digital media is reflective of a recent shift in the literacy practices of youth. Considered to be the new literacy of the 21st century, coding represents a fundamental and powerful way to establish a presence in the digital world (Burke et al., 2016). With an emphasis in exploring the literacy practices and processes of early adolescents engaged in an online programming community, this research provides insight about a relevant, timely, and significant topic.

Rich rigor. Elements adding richness and rigor to research include a variety of theoretical constructs, data sources, contexts, along with careful attention to data collection and analysis procedures (Tracy, 2010). In this study I provided appropriate time, effort, care, and thoroughness reflective of quality in qualitative research. A rich theoretical framework informed my decisions regarding appropriate data sources, collection, and analysis. The multiple forms of data collected (e.g., multimodal artifacts; interviews; observations) and the types of analysis completed (e.g., content analysis;

inductive analysis) provided the rigor required to substantiate meaningful and significant claims.

Sincerity. Tracy (2010) defined sincerity as research marked by honesty and transparency regarding the researcher's biases, goals, and challenges. Further, an awareness is expressed regarding how these elements influence the choices made during the research process. An integral component of sincerity is self-reflexivity about subjective values, biases, and inclinations of the researcher (Morrow, 2005).

A focal participant in this study is my daughter. She was the catalyst for this study and has become an expert other (Alley, 2013) by providing her unique insight I would not have obtained otherwise. My daughter helped to develop my understanding of *Scratch* by sharing her experiences in the online programming community. Our conversations related to *Scratch* influenced my understanding of the phenomenon studied. Her influence on my subjectivity provided a deeper pathway into understanding the literacy practices and processes within the *Scratch* community (Peshkin, 2000). My access to an expert other led to a deeper understanding of the phenomenon studied. My enhanced perspective is both informative and a necessary part of the research. Throughout the research process I worked to maintain an open and critical stance toward my subjectivity and how it might impact the research process and findings.

It is through the process of reflexivity that researchers become aware of "one's self, one's research, and one's audience" (Tracy, 2010, p. 842). Self-reflexivity helps to cultivate awareness of subjectivity in order to provide an honest and authentic description of the research process and interpretation of the findings. I used a researcher reflexive

journal with analytic memo writing to bring about self-awareness of my subjectivity and

how the research process and findings were influenced by my perspective and

relationship with participants (Finlay, 2008). Journal entries included a critical self-

reflexive commentary about subjective feelings and perceived impact of previously held

perceptions. Table 3.5 (below) provides examples from my researcher reflexive journal.

Table 3.5

Researcher Reflexive Journal Examples

Date	Question	Reflection
10/5/15	How does my relationship with Mira affect subjectivity?	While having an intimate relationship with a participant provides an insider perspective I am cognizant of the need to consider subjectivity. As I collect data and begin analysis I am amazed by the complex literacy practices demonstrated by my daughter. Then, I question whether parental bias influences my perspective.
	Am I overcompensating for parental bias?	I find myself underemphasizing the advanced literacy skills demonstrated in my daughter's projects in an effort to compensate for parental bias. However, data supports the conclusion that Mira demonstrates sophisticated literacy practices in her created projects. Her simulation has been viewed by almost 30,000 *Scratch* members and selected as a featured project on the main page of *Scratch*. The quality of her projects has established her as mentor in *Scratch* and curator of studios. I need to be sure not to minimize my daughter's work in *Scratch* because I am her parent.

Table 3.5 (Continued)

Date	Question	Reflection

10/8/15

"I really like *Scratch* since me and _____ and _____ can do collabs, which is like doing stuff together on Scratch. We get to work on stuff together and it really brings us together. Now we're at _____ Middle School and we have six teachers and separate teachers and we don't have any of them together. *Scratch* really brings us together."

Could *Scratch* be used to collaborate outside of the classroom?

I find Steven's comment fascinating because an online programming community is providing a space for him and his friends to connect, even though they all attend the same school. In school they are divided by different schedules, which essentially places them in a different space. Yet, they created a shared space in an online programming community in which to collaborate. An important element to consider here is the agency demonstrated by these students. When a space was not available to connect during school they created a space within an online programming community.

The shared spaced created by Steven and his friends to collaborate caused me to consider educational applications. In what ways could *Scratch* be used to extend in-school collaboration outside of school? Immediately I began to envision students working together to create a digital story in Scratch to extend upon a literacy experience from class. The online platform would afford the ability to create a shared project outside the classroom, thus extending opportunities to collaborate.

Credibility. According to Patton (2002), credibility is indicative of congruency of findings and dependent upon rigorous methods, credibility of the researcher, and the philosophical belief in the value of qualitative inquiry. Ensuring credibility is one of the most important factors in establishing trustworthiness (Lincoln & Guba, 1985). To bolster research credibility, I followed a comprehensive approach to inductive analysis of data, detailed in the methods section. Collection of multiple types of data (e.g., literacy artifacts, community artifacts; interviews) provided triangulation to capture and represent the multiple perspectives encompassed within the study (Morrow, 2005). Thick description of the phenomenon under study increased credibility. Shenton (2004) posited, "detailed description in this area can be an important provision for promoting credibility as it helps to convey the actual situations that have been investigated and, to an extent, the contexts that surround them" (p. 69). Further, credibility was reinforced via meetings with Dr. King and Dr. Schneider to crosscheck analysis of data.

Resonance. Engagement in practices to promote empathy, identification, and reverberation of research by readers promotes resonance in qualitative research (Tracy, 2010). Resonance can be achieved through transferability of findings. Transferability pertains to how findings are applicable in other contexts. Although the scope of this case study was bounded within a specific context, a rigorous approach to methodology provided rich and significant insights into the literacy practices embedded within the participatory culture of online communities and they ways participants made decisions regarding the creation of their projects in *Scratch*. This research has the potential to, "contribute uniquely to our knowledge of individual, organizational, social, and political

phenomena" (Yin, 1984, p. 14). My thick description accompanying the reporting of data will aid in potential transferability of the data from this research.

Significant contribution. Research can provide a significant contribution in a variety of ways. This research contributes toward theoretical understanding of literacy within the context of coding in an online programming community. Coding is typically studied within the context of computer science. The findings in this research provide insight into the literacy practices and processes of early adolescents as they created digital media via coding. A new and unique understanding of coding emerged from the analysis of data. The research provides theoretical significance by presenting new conceptual understandings about literacy within the context of coding, which can be used by future researchers.

Ethical considerations. This study is unique due to researching my daughter. Since she is a minor, I provided parental consent for her to participate in a study. Additionally, I also studied my daughter's acquaintances. I explained to participants that I planned to collect information to learn more about their online experiences regarding *Scratch*. Approval from the USF Institutional Review Board (IRB) was obtained for this study. A pseudonym was used for all study participants.

Participation in the study was voluntary and participants were able to withdraw from the study at any time. I established checkpoints during the collection of data to discuss continued participation in the study with participants and their parents. No participants demonstrated any sign of distress or annoyance and all participants completed the study.

Due to the participatory culture embedded in the *Scratch* community, data collected included contributions made by additional members of the online community. I removed all identifying information from all data contained in the dissertation and will remove identifying information from future research submitted for review in order to protect the identities of people in the online community. I converted all data collected to an electronic format and stored at https://www.**dropbox**.com, a password protected online storage site. I will destroy all data upon the determination it is no longer required

Meaningful coherence. Meaningful coherent studies accomplish the intended purpose and align the research elements in a meaningful way (Tracy, 2010). This study achieved the stated purpose, included methods and procedures that fit the stated goals, and the literature reviewed interconnected with the research focus, methods, and findings. I connected the findings to the research questions. During the discussion of findings I connected reviewed literature to situate the findings. Additionally, the conclusions and implications interconnect with the literature and data presented.

Summary

In this study I explored the literacy practices embedded within an online programming community and decisions made by participants during their creation of digital media. The study is focused on the literacy practices and processes of early adolescents engaged in *Scratch*. I collected multiple data types to enhance confidence and reliability of the research. My choice of a descriptive case study within qualitative research provided a framework to explore the phenomenon in both a rigorous and holistic

manner. An inductive analysis of data provided an iterative and recursive method to extrapolate themes demonstrative of the phenomenon studied.

CHAPTER FOUR:

RESULTS

In this chapter I present my interpretation of early adolescents' literacy practices as they designed and redesigned multimodal products in an online programming community called *Scratch*. Through my analysis of data sources including the participants' projects, transcripts of participant interviews, observations of their process, and researcher reflexive journal entries, I address two specific research questions :

1 What are the literacy practices and processes embedded in the design and collaboration of products created within an online programming community?

2 In what ways do participants make decisions in the design of their projects created in *Scratch*?

Below, I present profiles of the study participants to elucidate the experiences of my focus group of early adolescent members who were engaged in *Scratch*. I also provide my interpretation of the data sources, which function as supporting documentation of the ways participants made decisions during the creation of projects in *Scratch*.

Participant Profiles

In the following profiles, I provide demographic information about the study participants, the features of their engagement in *Scratch,* and information they shared

regarding the creation of their *Scratch* projects. This information is derived from interviews and observations completed in person with each participant. The participant profiles are presented in order based upon the length of membership in *Scratch*, beginning with the most experienced participant, as shown in Table 4.1 (below).

Table 4.1

Participant Profile Characteristics

Participants	Gender	Age	Length of *Scratch* Membership	Number of Projects Published	Number of Followers	Number of Studios Curated
Mira	Female	11	1 year, 11 months	2	385	88
Steven	Male	12	11 months, 1 week	2	5	3
Andrew	Male	12	10 months, 2 weeks	2	1	0
Zoe	Female	11	10 months, 1 week	12	6	0
Alexis	Female	11	7 months, 2 weeks	1	1	0

Mira / Scratcher. Mira is an 11-year-old Caucasian female in 6th grade currently enrolled in the Academically Gifted Program (AGP) at her local public middle school. She lives with her parents, twin brother, and younger brother. At the time of the study, Mira was one month shy of her two-year anniversary as a member in *Scratch*. Within the *Scratch* community, Mira is recognized as an experienced member by the designation of

"Scratcher" underneath her member name. This designation communicates that Mira is an active and helpful member within the *Scratch* community. The title is bestowed by the *Scratch* Team, which is comprised of employees from the Lifelong Kindergarten Group at the MIT Media Lab. A Scratcher is also afforded increased functionality by the ability to use cloud data, post links to non-*Scratch* forums, post images, and respond faster between posts.

Mira's experience in *Scratch* began with her AGP teacher. Her teacher introduced Mira to *Scratch* as a tool to reinforce interdisciplinary concepts taught in her program. After working with *Scratch* in the AGP, Mira chose to continue engagement in *Scratch* outside of school. At the time of the study Mira had created 26 projects in *Scratch*. Interestingly, Mira chose to only have two projects published. This means *Scratch* members could only experience the two projects Mira chose to share. The use of the term experience is intended to convey an interaction with digital media that extends upon the imaginary and sensory domains encompassed within the composition of the projects. One published project by Mira is an interactive simulation of a house owned by a young girl, while the other project is a math review created for Mira's AGP class. When asked why she only published two items Mira explained communication is an important element of *Scratch* for her. In order to remain current in her communication with members regarding her projects, Mira chose to constrain the amount of projects visible. By limiting her projects, she can be more responsive to member comments or questions regarding her published projects.

My review of Mira's communication with *Scratch* members revealed she has established herself as a mentor within the *Scratch* community. Members contact Mira to

request assistance or feedback regarding their projects (see Figure 4.1 below). Mira appears to value her role as a mentor based upon her intentionality in limiting the amount of projects published in order to focus on member communication and mentorship, along with the responses provided by Mira to *Scratch* members.
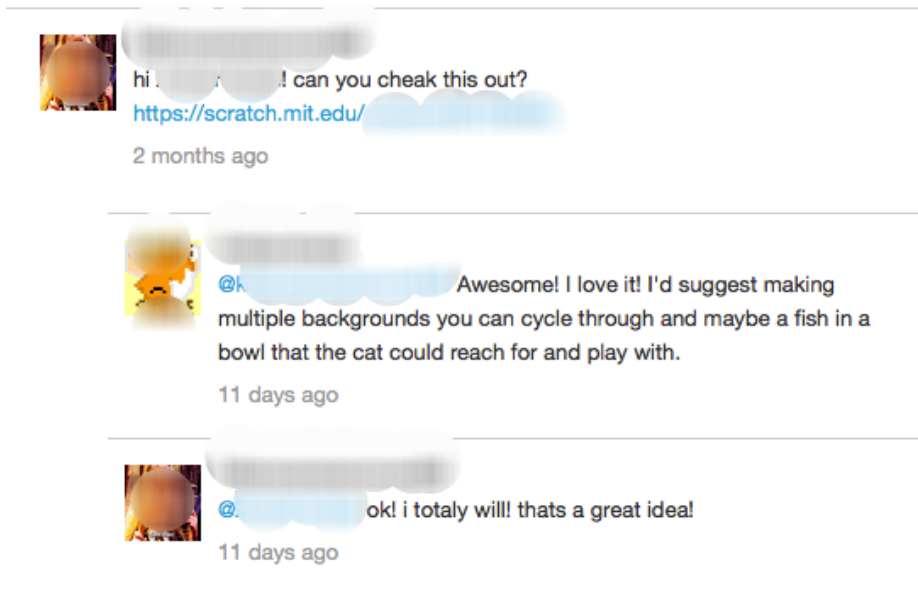
Figure 4.1. Example of mentorship provided by Mira (retrieved 1/2/16).

Shortly after this study began, Mira had a project featured on the *Scratch* home page. From over 13,000,000 projects published, up to 20 projects are featured on the main page for approximately two weeks. It is considered a high honor to have a creation selected as a featured project and a mark of excellence within the *Scratch* community. Over 28,000 members experienced Mira's featured simulation and 2,900 comments have been created in response to her project. Currently, her featured project has been remixed 75 times. Meaning, 75 members have taken Mira's project, changed the original content,

and published the remixed project within *Scratch*. When asked about why her project was featured, Mira was unsure.

Upon examination of her communication in *Scratch* I was able to determine why her project was featured. It appears Mira's agency and emphasis on member communication contributed toward selection of a featured project. After completing her project, which had a pastel theme, Mira sought to find a studio to feature her simulation. Studios are created in *Scratch* and curated by members to provide a collection of projects grouped around a theme. Mira discovered a studio focused on projects with a pastel theme and contacted the curator to request the addition of her project to the studio. After previewing and accepting Mira's project, the curator contacted the Scratch Administration Team to recommend her simulation as a featured project due to the quality of her project (see Figure 4.2 below).
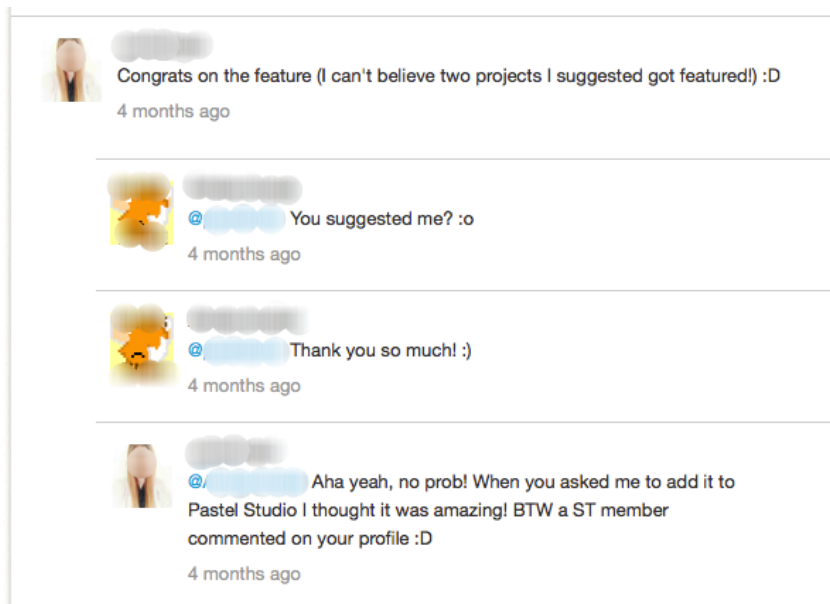
Figure 4.2. Example of Mira's agency (retrieved 10/4/15).

Once the Scratch Team received the request, a member of the Scratch Team reviewed Mira's project and communication. Based upon feedback received from a Scratch Team member (see Figure 4.3 below), Mira's emphasis on communication and interest in constructive feedback impressed the Scratch Team. Mira's demonstrated agency and initiative in finding a studio for her project, along with her emphasis on member communication, led to the selection of her simulation as a featured project in *Scratch*.
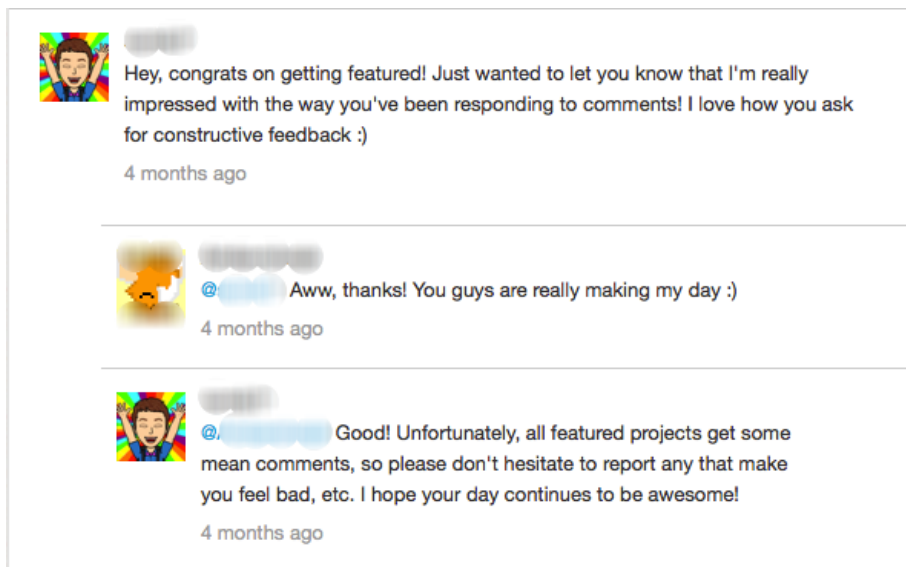
Figure 4.3. Feedback provided from a Scratch Team member (retrieved 10/4/15).

Mira currently curates 88 studios and has acquired 385 followers. The success of her featured project established her reputation as an experienced Scratcher, which resulted in invitations to curate studios and increased mentorship opportunities as members contacted her for constructive feedback. In addition to mentorship on *Scratch*, Mira has also assisted her personal friends with learning about *Scratch*. Mira initially mentored all the participants recruited for this study as they learned about *Scratch*.

Steven / New Scratcher. Steven is a 12-year-old Caucasian male in 6th grade and currently enrolled in the Academically Gifted Program (AGP) at his local public middle school. He resides with both parents. Steven lived in New Jersey until his parents moved two years ago to a large town in a southern state. During his initial interview Steven shared he enjoys playing platforms games like Super Mario Bros.

Steven is designated as a New Scratcher on his profile page. The New Scratcher status communicates to the community that Steven is a newer member of *Scratch*. Additionally, Steven is unable to post images, include clickable links, and use cloud data. These restrictions are in place to prevent spam attacks. To gain the Scratcher status members must be active around most parts of the site (e.g., studios; comment sections; love and favorite projects) and publish multiple projects. The status of a member can only be changed by the Scratch Team, which is comprised of employees from the Lifelong Kindergarten Group at the MIT Media Lab.

First introduced to *Scratch* by his AGP teacher, Steven continued to learn about *Scratch* via collaboration with Mira. Steven joined *Scratch* 11 months prior to the start of the study and he has two published projects. His first project was the initial frame of a video game and his most recent project is a platform game focused on the movement of a ball. According to Steven, this platform game is a "premodel" of the platform game he eventually wants to create. The purpose of his draft platform game is to focus on the programming concepts required for the game to function. He plans to focus on the aesthetic elements of his platform game in the final version.

Currently, Steven curates three studios and has earned seven followers within the

Scratch community. Steven primarily communicates with Mira as evidenced within his

profile page. Twelve of the 16 comments found are from Mira. Interestingly, Steven

branched outside of *Scratch* to improve his programming skills. During our initial

interview Steven shared a *YouTube* video he found, which focused on a specific

programming skill. During the creation of his platform game Steven was unable to make

his ball bounce. He searched *YouTube* and discovered a video explaining how to

complete the coding required to make his ball bounce in *Scratch* (see Figure 4.4 below).

Steven was then able to transfer what he learned in the video over to *Scratch* and

successfully programmed his ball to bounce by adding code focused on event handling,

looping, and Boolean logic.
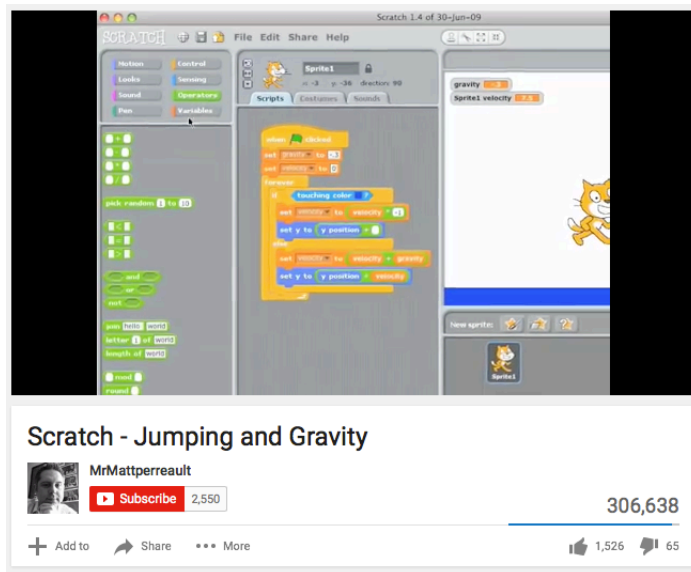
Figure 4.4*. YouTube* coding video used by Steven (retrieved 10/23/15).

Steven finds that *Scratch* brings him and his personal friends together. Since

transitioning to middle school, Steven is unable to see his friends during school due to

different class schedules. While talking about *Scratch* he stated, "we get to do stuff together and it really brings us together". He and Mira currently collaborate with an additional friend on a role-playing game (RPG) within *Scratch* focused on Pokémon. They plan to turn their RPG into a video game via *Scratch* when the RPG is completed.

Andrew / New Scratcher. Enrolled in AGP at his local public middle school, Andrew is a 12-year-old Caucasian male in 6th grade. He lives with both parents and a younger brother. At the time of this study Andrew had been a member of *Scratch* for 10 months with two projects published. Initially, I was unable to view Andrew's projects within *Scratch*. He was unable to access the email requiring parental permission to publish projects in *Scratch*. Shortly before our initial interview Andrew was able to publish his two completed projects. Mira is Andrew's only follower and he does not curate any studios.

Andrew's first project was created as a thank you to the makers of a game he experienced in *Scratch*. In response to his enjoyment of the game, Andrew was inspired to create a thank you project. He also wanted to request that a character he created be added to the game (see Figure 4.5 below). The music selected for his project was a song he heard in a video created by Mira on *Scratch*.

Figure 4.5. Andrew's request to add his character (retrieved 11/15/15).

A programming camp he attended during his summer break also influenced Andrew's ability in *Scratch*. Over the course of five days he attended a camp focused on learning how to program. The camp used *Scratch* as a vehicle to teach basic programming skills. The goal for each student was to create a full project to share with everyone on the final day of the camp. Due to his difficulty publishing projects on *Scratch*, Andrew was unable to share his project on the final day. The project completed by Andrew was a digital story focused on the quest of a rabbit to save his younger brother via the help of a wise rabbit. With the assistance of a camp counselor Andrew was able to create original coding to embed a question/response sequence. He exuded a sense of accomplishment when discussing elements of the project completed during his camp experience.

Zoe / New Scratcher. Zoe is an 11-year-old Caucasian female in 6th grade. She lives with both parents and attends a local charter school for students in kindergarten to eighth grade. Zoe was introduced to *Scratch* via Mira. They immediately collaborated to create Zoe's first published project focused on cats. Zoe joined *Scratch* 10 months prior

to the start of this study and currently has 12 projects published. She does not curate any studios and has acquired six followers.

The projects published by Zoe represent a wide range of interests and styles. Although most of the projects are original creations, Zoe's published items include three remixed projects. Her projects represent content connected to the *Harry Potter* series by, J.K. Rowling, the *Wings of Fire* series by Tui T. Sutherland, *Five Nights at Freddy's*, and *Minecraft*. The types of projects created include a simulation, maze, digital story, and music video.

Zoe considers *Scratch* to be a "stepping stone" for those new to programming. Before *Scratch*, Zoe thought programming was "just typing in numbers and letters." She realized, "there could be such a thing as just clicking a box and actually watching, making things come alive in programming." Once Mira showed her examples of projects in *Scratch*, Zoe was eager to create her own projects. The types of projects completed by Zoe appear to follow a recurrent cycle. Initially, she began with original creations before deciding to remix projects. Zoe reverted back to producing original projects and now plans to switch to remixing projects again.

Alexis / New Scratcher. Alexis, an 11-year-old Caucasian girl in 6th grade, is enrolled in the AGP at her local public middle school. She lives with both parents and an older brother. Alexis became interested in *Scratch* after watching Mira work during an AGP session. She thought *Scratch* looked "pretty cool" and wanted to try it. Mira's assistance was required to help Alexis publish her completed project on *Scratch*. Alexis

has been a member of *Scratch* for seven months prior to the study, with one published project, and Mira as her only follower.

Initially, Alexis was hesitant to participate in the study. She expressed that she had not completed many projects in *Scratch* and she did not think she would be able to contribute important information for the study. I assured Alexis she would be able to provide important information regarding the questions I wanted to explore.

When discussing future projects she plans to create, Alexis was unsure of her next project. Her only published project was an extra credit assignment focused on math, which was created for her AGP class. Since completing the extra credit assignment Alexis had minimally worked in *Scratch*. She had a project focused on science within her *Scratch* folder, however, Alexis stated, "it's really nothing yet." Now that she understood how to publish her projects in *Scratch*, Alexis planned to complete additional items to share.

Subtext of Decisions

Through my analysis of the data, I created four distinct domains to explain how the participants engaged in literacy practices and processes (Research Question 1) and how they made decisions during the coding and design of digital media products (Research Question 2). The domains include decisions connected to the design of digital media, decisions focused on the function of digital media, decisions connected with meaning, and participants' adoption of expert stances. Combined, the domains represent a subtext of decisions enacted as early adolescents design and redesign digital media. The

subtext of decisions represents the underlying process as participants' designed digital media in an online programming community.

Domain 1: Decisions Connected to the Design of Projects Created

As participants designed and redesigned projects in *Scratch* a variety of decisions were made, which in turn influenced the multimodal form of the projects created. The decisions enacted by participants influenced the type of projects created and modes related to visual effects, sound, color, images, gestures, written language, and spatial placement of elements. The types of decisions made by participants that affected the design of projects included decisions made based upon personal preference for the aesthetics of design, decisions influenced by the *Scratch* audience, text-to-text decisions, and latent decisions.

Personal preference for the aesthetics of design. The notion of design refers to how creators manipulate available modes to create meaning (Jewitt, 2008; Kress, 2003). The modes work together to create a transformation of available designs, whereby meaning is created anew with each act of reading (Serafini, 2012b). For example, in describing the process of reading contemporary picture books, Serafini (2012a) stated, "the meanings of multimodal texts are constantly shifting and responding to the dynamic social environments in which these texts are made and remade" (p. 4). The meanings created reflect the needs and interests of the producers and consumers of texts.

Similarly, when discussing decisions made during the creation of projects all of the focal participants mentioned their personal preferences as influencing the design of projects. However, the extent to which they emphasized personal preference for the

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aesthetics of design varied. Mira and Andrew made frequent references to personal preference (42 and 23, respectively), while Zoe and Alexis made fewer references (4 and 1, respectively). In the following data excerpts, two participants state how their design aesthetic influenced their coding decisions.

While discussing what he liked about *Scratch*, Steven stated, "they have a ton of things and it's really cool because you can change what you want it to look like." By "things" Steven is referring to the design tools available for *Scratch* members to design and redesign digital images. For example, Steven mentioned he used the design tools to change a blue and black unicorn into rainbow hues because, "blue and black are not really my thing." Steven feels that blue and black are depressing colors and he prefers to use "colorful" and "cheerful" colors when designing digital media.

When discussing his first project titled *Video Game* (see Figure 4.6 below), Steven stated he selected a puppy as a character because, "I just love dogs and especially cute dogs." Steven mentioned that he would often have a dream of himself as a puppy in New York. Included in the design of Steven's first project in *Scratch* is the colorful unicorn he redesigned to be more colorful and a puppy placed in front of a background intended to represent New York. His ability to apply personal preference to his design of digital media influenced Steven's decisions.

Figure 4.6. Steven's first project created in *Scratch*.

During our stimulated recall conversation, Andrew identified his preference for specific colors. After viewing several slides of his project he stated, "I just like the colors red and blue." During the observation I noted that Andrew continued to use red and blue in his developing project. In fact, both homes and settings looked similar (see Figure 4.7 below). Not only was his personal preference for these colors evident, he also demonstrated a clear personal preference in the design of structures and settings used in his creations.
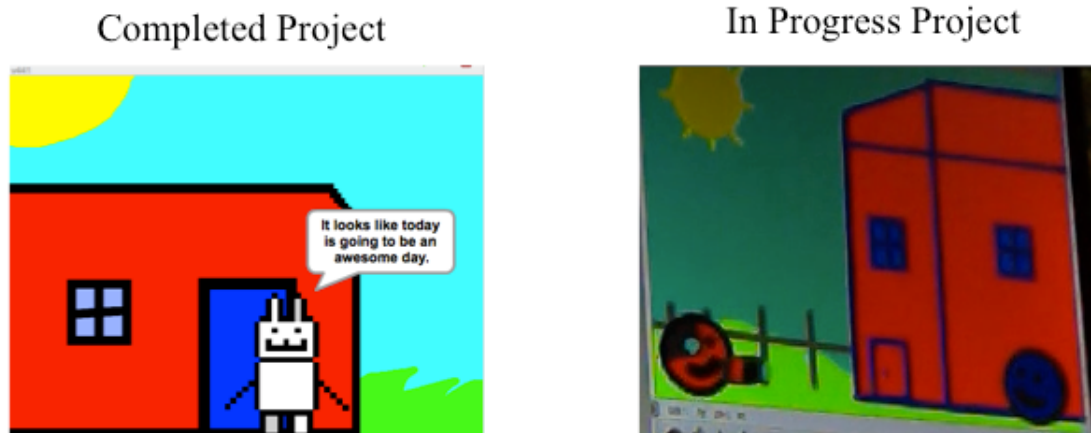
Figure 4.7. Example of Andrew's personal preference in color, structure, and setting.

The personal preference in design demonstrated by participants touched upon the power of personal expression (Bull & Kajder, 2004). In a study focused on students in a low achieving rural high school, Chisholm and Trent (2013) incorporated digital storytelling in a composition course. The researchers discovered multimodal authorship afforded opportunities for participants to better understand thinking, feeling, and the power of personal expression. The multimodal nature of *Scratch* afforded participants the opportunity to express themselves in ways that provided opportunities to incorporate personal preference for the aesthetics of design.

When exploring Andrew's projects, a personal style is evidenced. His use of color, shape, and spatial arrangement across projects are ways in which Andrew represented himself as an author. In a study focused on children's website design, Welsh (2014) concluded many of the webpages children spend time in contain highly culturally-contextualized and richly multi-modal text. Children choose to spend time in these spaces as they consume and produce digital media. The use of color and aesthetic design choices

made by participants in this study is a manifestation of children borrowing those same design practices they engage with as they interact with children's websites.

Audience-influenced decisions. While analyzing the data for the types of choices made during the design and redesign process I observed that all participants enacted decisions influenced by their perceived audience. In the context of this study, I defined audience as members within the *Scratch* community. A core design principle of *Scratch* is an emphasis in making the community more social. Members are encouraged to create and share digital media within the community. Members who have published projects are able to track how many people view their project, how many members indicate their project as a favorite, and how many times their project is remixed within *Scratch*. Additionally, the audience can provide feedback via comments provided within a comment section for each project published. The emphasis placed on making *Scratch* more social increases the presence of audience within the creation and publication of projects.

When designing digital media products, participants considered the *Scratch* audience when making design decisions. The extent in which audience was considered during the design process varied across the participants. In the data analyzed, Mira and Andrew made frequent references to audience-driven decisions (31 and 22, respectively), while Steven and Alexis each evidenced audience-influenced decisions twice. Interestingly, Mira demonstrated the most audience-driven decisions and also received the most audience feedback. Across her two projects shared, Mira received 2,953 comments. Steven received no comments for his two projects shared and Alexis received no comments for her one project shared. In sum, the participant demonstrating the most

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emphasis placed on audience-driven design practices received the most audience feedback, while the participants with the least emphasis on audience-driven design practices received the least audience feedback. In a study focused on youth online authorship, Stern (2008) identified that active commenters were often included in the imagined audiences of bloggers. The response received from Mira's audience influenced her design practices as she considered her audience during the creation of projects in *Scratch*.

In the context of this study participants demonstrated an implicit awareness of audience. Meaning, participants did not actively engage in discussion regarding their perceived audience. Rather, the decisions discussed and observed demonstrated an implicit awareness of audience. For example, Mira included arrows to help guide members through a house she created for members to explore (see Figure 4.8 below). In the design of the house Mira embedded arrows to help visitors navigate between the rooms. Mira's use of arrows implies an awareness of audience and demonstrates an effort to consider the audience in the design of her house.

Figure 4.8. Mira includes arrows to help guide members through *Grace's House*.

Andrew created a digital story titled *The Legendary Quest*. The main character, Royal, embarks on a quest to save his brother from a dungeon. Royal seeks the council of Wise Rabbit before he begins his recue mission. Royal arrives at the home of Wise Rabbit to discover he is about to be attacked by an evil wolf. Wise Rabbit gives Royal a dagger to kill the wolf. During the creation of this potentially graphic scene in his digital story Andrew considered his audience in his design choices. Andrew stated, "I'm not doing any violent things like flipping the wolf and having blood spilling all over." He didn't want kids, "to be frightened for the rest of their life." Instead, he chose to have the wolf disappear after Royal stabbed him with the dagger by coding a sequence into his program to define when the wolf would disappear from the stage. Andrew felt "responsible" for his audience reaction. His assumed responsibility for audience reaction influenced Andrew's approach toward killing the wolf.

Decisions made to increase audience interest. An aspect of audience-driven decisions I observed in the data was an intentionality of participants to capture the interest of their audience. While explaining why she chose to have the title of her project bounce on the initial frame Mira stated, "It looked a little catchy when the words are moving up and down. Your eyes go straight to them to read them." She used looping to add the bounce effect in order to increase audience interest in the title of her project. Andrew discussed his intentionality in using bright colors. During character dialogue bright colors were used to maintain audience interest. Andrew stated, "I wanted it to be interesting and people actually be interested and not be like 'oh I have to listen to this guy talk over and over'. I wanted it to have some sort of niceness to it." He believed bright colors would help maintain interest during embedded character conversations. Steven

discussed his plans to change the scenery after every other level to make the background in his game interesting.

The examples provided illustrate intentionality in cultivating the visual interest of the perceived audience. Bezemer & Kress (2008) posited design is the result of the interaction between producer and audience interests as they are shaped by social, cultural, economic, political, and technological environments in which signs are made. A transition from composition to design occurs when the focus of the author shifts toward coherence of the designer's interests and the characteristics of the audience. Andrew's use of bright colors to maintain the interest of his audience and Mira's use of special effects to attract attention to her text represent intentionality in the design of digital media for an audience. Consideration of ways to increase audience interest is representative of the use of available semiotic resources to create complex signs designed for a specific audience. This type of rhetorical literacy is important for preparing early adolescents to become global citizens (Adsanatham et al., 2013; Kalantzis and Cope, 2012). The next theme also taps into rhetorical literacy, whereby participants focused on increasing audience engagement.

Creation of projects to engage Scratch members. In contrast to an emphasis on the visual interests of the audience, participants also demonstrated decisions made to create a physical interest among their audience. Participants demonstrated the inclusion of interactive components into their projects to physically engage their audience. While discussing his ball adventure, Steven touched upon why he integrated multiple levels in his game. Steven stated, "I like adding levels because the player will have a variety of things to do instead of just playing through one plain old game." Steven's comment

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illustrates the interactivity common in the digital literacy experiences of early adolescents. To integrate multiple levels in his game Steven employed sequence, variables, and Boolean logic to the programming created.

While working on a new project, Alexis discussed the addition of more interactive items for members to experience. Alexis was creating science laboratory and in the process of determining the items she wanted to include. After adding a bat to make her laboratory "spooky", I asked Alexis what she planned to do next with her project. Alexis replied, "Add more things people can click." When asked what interactive features she would like to include, Alexis was unable to provide any features. Curious, I asked her how she decides the type of items to include for people to click. Alexis replied, "just think about it I guess." Alexis' understanding of audience is that they will want interactive features, however, she is unable to articulate specific interactive features she would like to include. Alexis demonstrated and emergent awareness of audience and developing ability to design for an audience. Although she was unsure of the specific elements she planned to include, Alexis was beginning to demonstrate an awareness of audience and intentionality in programming to increase the physical engagement of her audience. Her intention to add interactive elements into her project represents a shift from a focus on aesthetic design elements toward embodied engagement with digital media.

Mira demonstrated an advanced awareness of audience in her design decisions when compared with Alexis. Mira's project, *Grace's House*, was developed as an interactive experience for *Scratch* members. Upon arrival in Grace's house visitors are greeted by Grace and encouraged to explore and interact with the features in her house (see Figure 4.9 below).
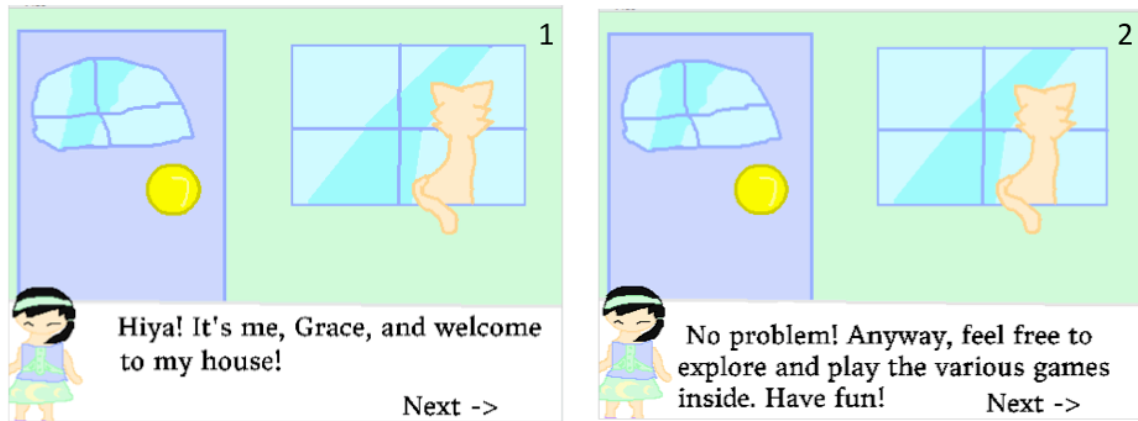
Figure 4.9. 1) Visitors are welcomed by Grace when they enter her house. 2) Grace invites everyone to explore and interact with the experiences embedded in her house.

The interactive features created to engage the audience are interacting with the cat in each room, feeding the fish in the aquarium, selecting an outfit for Grace to wear, turning on/off the light in her bedroom, feeding a cat in the kitchen, changing the television channel, selecting music to play on the "beat box", and interacting with a parrot in the living room. Mira integrated the programming concepts of sequence, variables, event handling, and dynamic interaction to integrate interactive experiences into her program. When discussing these interactive features Mira stated, "It adds to the experience. Imagine if you click around and you can't interact with anything. You're the only person in the house so you may as well interact with the fish and the cats." Jenson (1998) defined interactivity as, "a measure of a media's potential ability to let the user exert an influence on the content and/or form of the mediated communication" (p. 201). Mira's incorporation of radio stations and television channels to select and characters to interact with are features embedded to provide interactivity for her audience. For Mira, interactivity equals audience interaction.

Interestingly, Mira created an androgynous character to represent the audience during conversation with Grace (see Figure 4.10 below). She described this character as "fluent". Mira stated, "I didn't want to make it a girl if a boy played it and I didn't want to make it a boy. I figured a lot of girls would be playing too." Mira's response demonstrated audience awareness and the need to create a character everyone could connect with as they engaged in a conversation with Grace.

Figure 4.10. Androgynous character created to represent the audience.

Andrew embedded a feature in his quest story requiring his audience to demonstrate engagement in order to continue the quest (see Figure 4.11 below). The member must enter the hero's name or the quest will end and the program must be restarted. Andrew added the programming concepts of coordination and synchronization, along with keyboard input, in order to include this interactive feature in his program. When asked why he embedded a feature requiring the hero's name Andrew responded he wanted there to be a consequence if the member entered, "some weird name or offending name." He wanted members to go through the programming again if they weren't going to seriously engage in Royal's quest. It could be argued Andrew mandated a specific level of audience engagement in order for the audience to proceed with his program.
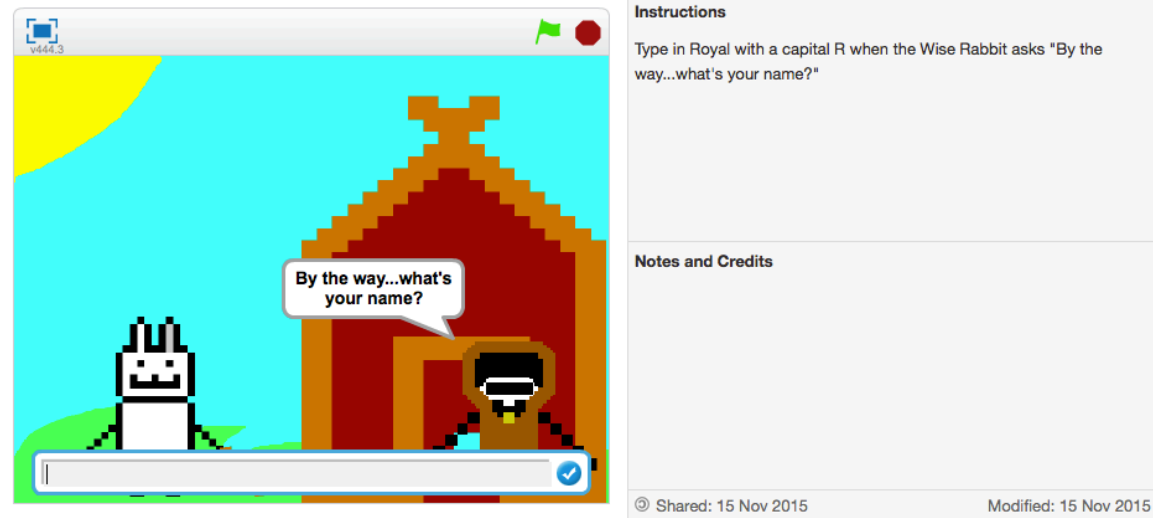
Figure 4.11. The correct hero name must be entered to continue the quest.

In compositional studies, audience reception theories emphasize the reader's reception of text or media. Specifically, audience studies recognize the relations of power at each end of the communication process (Wood, 2007). Recent research has begun to explore the concept of audience in the context of interpersonal communication within digital platforms (Brake, 2012). Litt (2012) argued the role of the audience is becoming more active as the ability to provide presence cues increase due to an online site's technical structures and audience-feedback mechanisms. These presence cues embedded within the audience-feedback mechanisms of *Scratch* (e.g., member comments; member likes; member favorites; number of times a project has been remixed; credit given to original designers of remixed texts) potentially influence the design choice of members coding and publishing project in *Scratch*.

Additionally, the literacy practices of children have shifted from consuming texts towards producing texts. Many early adolescents are 'prosumers' of products (e.g., fan fiction; *YouTube*; *Flickr*) in which texts are concurrently consumed and produced

(Kalantzis & Cope, 2012, p. 86; Ito et al., 2010). The interactive nature of features embedded in the projects created by the participants is instantiations of the types of texts they experience in their literate lives (Dezuanni, 2015; McLean & Rowsell, 2013). Audience engagement is emphasized in the design of projects via the addition of interactive experiences.

       Consideration of audience feedback. Steven and Mira demonstrated consideration of audience feedback as they designed projects. A feature found on each *Scratch* project page is a section for members to leave comments regarding the respective project. Steven mentioned he preferred to have the comments feature turned on for his projects. Steven mentioned he wanted to acquire member comments because, "other people can tell me how I can fix something or maybe their ideas I could add into the ball adventure." His response indicated an interest in collecting feedback from his audience. McLean & Rowsell (2013) posited the process of design is social; it takes into account, "the presence and active role of an audience" (p. 18). Steven's desire to actively collect feedback from his audience is evidence of the active role of audience in his design of a platform game.

       Mira also demonstrated consideration of audience feedback in the design of her simulation. In fact, the interactive parrot mentioned above was created in response to feedback received from a member in the comment section of her project. This example of audience feedback consideration illustrates the social interaction inherent in design. (Kress & van Leeuwen 2001) argued, "designs are means to realize discourses in the context of a given communication situation…they realize the communication situation which changes socially constructed knowledge into social (inter-) action" (p. 5). Mira's

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response is evidence of the social (inter-) action referenced by Kress & van Leeuwen (2001).

Although Steven demonstrated an interest in the use of audience feedback to inform the design of his platform game, he received no member comments regarding his published projects. Andrew received one comment from a *Scratch* member regarding *The Legendary Quest* and Zoe received at total of five comments across 13 projects published. Andrew did not respond to his member comment, however, Zoe thanked everyone who responded to her projects. Alexis had only recently published her project at the time data was collected and therefore received no member comments.

Compared with the other participants, Mira's focus on audience feedback was remarkable for the steps taken to sustain and organize audience feedback. Mira's effort to sustain a response to audience feedback was evidenced in her control of the amount of projects published. Although Mira had created 26 projects, she chose to publish two projects at a time. When asked why she only had two items published Mira stated, "when people comment I want to answer and interact with them." Mira limits her published projects to ensure she will be able to interact with her audience. Mira also created a system to organize feedback received. An unpublished project was created to archive recommendations received until she was ready to implement the feedback (see Figure 4.12 below). She would also access the information to attribute recognition for the suggestion in her published project once the suggestion was implemented.
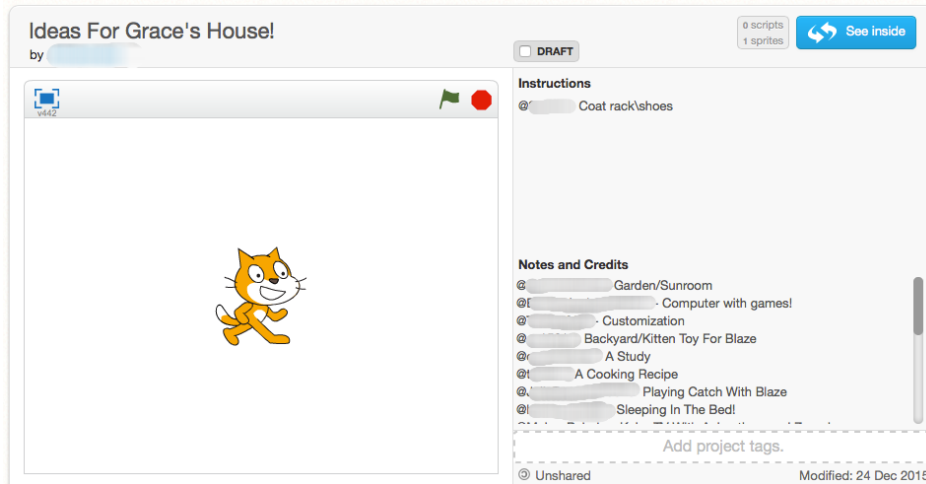
Figure 4.12. Unpublished project to archive member feedback.

In response to feedback received, Mira added a bathroom to *Grace's House*. She accompanied the addition with an announcement acknowledging the feedback from numerous *Scratch* members (see Figure 4.13 below). Mira's response to audience feedback and attempts to organize and credit feedback demonstrate an emphasis in audience driven programming. Further, consideration of audience and context directly shaped the design process of the original text (*Grace's House*) and the text created to organize audience feedback. For Mira, the influence of audience is interactive and dynamic in her design process as evidenced in the creation of additional text to support her ability to integrate audience feedback into her design.

Figure 4.13. 1) Bathroom created based upon audience feedback. 2) Announcement posted regarding the bathroom addition to *Grace's House*.

The consideration of audience feedback by participants is representative of collaborating within participatory culture. The ability to easily share projects and receive feedback from community members enabled participants to design for their audience. Participants were able to situate themselves within the community and acquire feedback to consider in the design of their projects. Experiences in audience-driven programming positioned participants to engage in functional and rhetorical literacies via multiple modalities and use of technology. Further, this type of engagement in participatory culture helps early adolescents develop their voices and identities as media creators via continuous interaction with their audience (Ito et al., 2010; Jenkins, 2006). Chisholm and Trent (2012) posited author identities are fostered when students are able to draft, revise, and reproduce genres for authentic audiences.

Text-to-text influenced decisions. Evidence of text-to-text influenced decisions was also observed in the data. For the purpose of this study, text was defined as a print-based or digital form of communication by which modal systems are used to convey meaning. The extent to which participants made text-to-text influenced decisions varied.

Andrew made the most references regarding text-to-text influenced decisions (12), while

Zoe, Mira, and Steven made fewer text-to-text influenced decisions (8, 5, and 2

respectively). Alexis did not mention any text-to-text influenced decisions. Interestingly,

participants naturally mentioned textual influences as they discussed features of their

published and in development projects. For example, Andrew mentioned *Terraria*, an

action-adventure video game, when discussing the design of his dungeon in *The

Legendary Quest* (see Figure 4.14 below). Andrew stated, "he is trying to save his brother

from an evil dungeon which is this (pointing to a screenshot of his dungeon entrance),

like the entrance in *Terraria*."
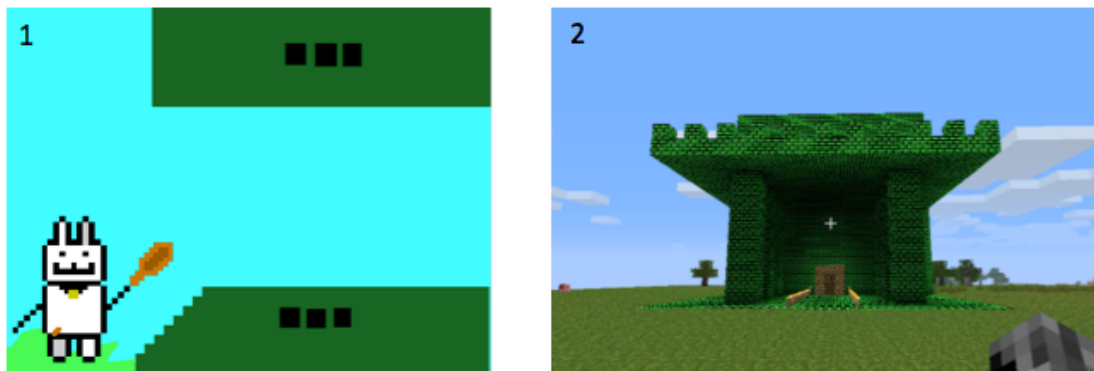
Figure 4.14. Example of Andrew's Text-to-Text influenced decision 1) Dungeon

entrance designed by Andrew. 2) *Terraria* dungeon entrance.

Andrew commented upon a text-influenced decision when discussing the wolf

attack in *The Legendary Quest* and the style he used to make the conquered wolf

disappear. After the wolf is attacked, "it just disappears like in *Terraria*." Andrew also

explained how he redesigned an image of flames to represent pixelated games (see Figure

4.15 below). He stated, "pixels kind of remind me of those video games from the 1980s."
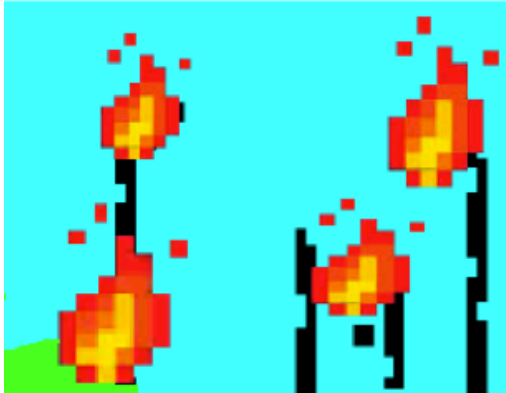
Figure 4.15. Pixelated fire influenced by 1980s video games.

When discussing the use of armor for his main character Andrew shared, "This is where *Minecraft* comes in. Basically the *Minecraft* game is going to have the armor influence on him." Andrew planned to have his character upgrade his armor in a manner patterned after *Minecraft*. While working on a project Andrew stated, "Pam was inspired by *Plant vs. Zombies* because Crazy Dave Boy has a pan on his head." Andrew used a character from a video game as an influence in the design of his character for a project in development.

Zoe also demonstrated decisions influenced by text. The first project that I analyzed from Zoe was focused on the character, Voldemort, from the *Harry Potter Series*. Interestingly, Zoe preferred to create a comical interpretation of popular genres. Her Voldemort project focused on 10 ways to annoy him. She suggested "Voldy" be taken to anger management class as a way to annoy him. Zoe also created a comedy based upon *Five Nights at Freddy's*, a survival horror video game, because she was, "absolutely terrified of that game." In an attempt to make fun of *Five Nights at Freddy's*, Zoe's project featured two of the characters arguing (see Figure 4.16 below).

Figure 4.16. Characters from *Five Nights at Freddy's* arguing.

The influence of the *Wings of Fire* series by Tui T. Sutherland was evidenced in decisions made by Zoe. Two of her projects were based upon characters from the series. Zoe attempted to recreate the visual aspects of each character in her projects. While talking about a character named Kinkajou, Zoe stated, "RainWings can change colors so Kinkajou was turning invisible at that point." While analyzing Zoe's projects I noticed a variance in colors used to represent her characters, Glory and Clay, in a project titled, *Clay Wake Up*. Zoe designed Glory with bright colors, while Clay was brown (see Figure 4.17. below). When asked why Glory was colorful, Zoe explained, "She's a RainWing, so like Kinkajou she changes color. RainWings show emotions through their scales. For example, if they're happy or kind of embarrassed they turn rose pink." When asked why Clay was brown, Zoe replied, "He is a MudWing. Mudwings are well camouflaged against, well mud." Zoe's intention to recreate the characters from the *Wings of Fire* series influenced her design of the characters featured in two of her published projects.

Zoe's creation of projects based upon literature is essentially fanfiction with coding. She is using a coding platform to create texts based upon literature she has read.

Figure 4.17. Zoe's portrayal of Glory and Clay from the *Wings of Fire* series.

Other participants evidenced additional examples of text-to-text connections. In her project, *Grace's House*, Mira chose to have a themed outfit in Grace's closet (see Figure 4.18 below). The 4th of July holiday was near and she enjoyed themed events from her experiences in *Club Penguin* and *Animal Jam*, which are online virtual worlds created for children. In *Grace's House*, Mira also used chat boxes to converse with Grace because, "it's sort of something you would see in real video games."

Figure 4.18. 4th of July themed outfit based upon *Club Penguin*.

Steven chose to create a platform game focused on the adventure of a ball because, "I'm a huge fan of platform games." Steven explained a platform game as, "games where you make an icon or character and you make a layout or background and then your icon or player can walk. You make your icon or player try to get all through the obstacles." A well-known example of a platform game is *Donkey Kong*. The premise of *Donkey Kong* is that Mario must navigate a series of platforms to recuse a damsel in distress from Donkey Kong. In Steven's platform game the *Scratch* member navigates a ball through a series of platforms across multiple frames (see Figure 4.19 below). Steven's design choices focused on replicating his version of a platform game.
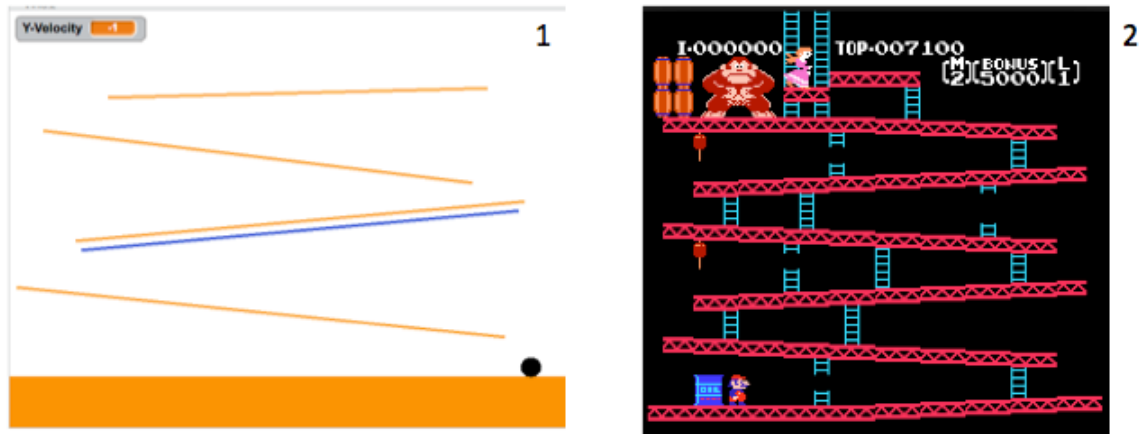
Figure 4.19. Example of text-to-text influenced design 1) *The Ball Adventure* created by Steven. 2) A platform game called *Donkey Kong*.

The participants' text-based decisions are representative of intertextuality between texts. These examples observed in the data are reminiscent of the types of intertextuality that Rojas-Drummond, Albarran, and Littleton (2008) described in their analysis of fourth grade children engaged in collaborative production of multimedia texts. The students appropriated intertextuality in the process of producing their multimedia stories (Rojas-Drummond et al., 2008). The intertexuality incorporated by participants influence the reader and add layers of depth to the texts. The text-to-text connections made by participants during the design process are extensions of their engagement with text. Andrew's experience in *Terraria* influenced the design of his dungeon. Zoe's experience in the *Wing of Fire* series influenced her decisions, ranging from the type of digital product to create down to the color of scales to incorporate on Glory's wings.

Many of the texts that influenced the decisions of participants were examples of digital media. The understanding of digital media demonstrated by participants is

evidence of a shift from engaging as consumers to producers of digital. Zoe's transformation of *Five Nights at Freddy's* from a terrifying video game to a comedic digital story is an example of a recontextualisation (Marsh, 2008). Essentially, Zoe translated cultural material into a new type of knowledge. She engaged in transformative practice in which a new kind of knowledge was produced based upon *Five Nights at Freddy's*. This shift toward becoming a producer of digital media is representative of the early adolescent literacy practices. Early adolescents have moved beyond operating as receivers-of-knowledge toward operating as producers-of-knowledge (Kafai & Burke, 2014; Lee, 2011).

Latent decisions. I also observed latent decisions made by Mira, Zoe, and Andrew. Mira made four latent decisions, while Zoe and Andrew together made only five. latent decisions are defined as choices made without participants being cognizant of the decisions. For example, when discussing why a cat's features were different than the other cats in her project Mira replied, "I guess it was unintentional. Maybe he's a ghost cat." The same cat was also brighter than the objects when the light was turned off (see Figure 4.20 below). When asked if this effect was intentional Mira responded, "it just kind of happened that way." When Andrew realized his homes across two projects were similar he replied, "I didn't actually intend that."

Figure 4.20. Cat is unintentionally brighter than other objects.

Although latent decisions lack overt reasoning in the decision making process, these decisions can influence the design of projects. Further, latent decisions provide insight into design preferences. A preference is ingrained to a degree where the designer is unaware how this influence affects the design of the project. Andrew's latent similarity across projects demonstrated clear preferences in design. It could be argued that the latent decisions observed are in fact intentional. Meaning, it is possible the participants had a reason for the design choices made, however, they are unable to recall the reasoning or the choice was not significant enough to recall.

Domain 2: Decisions Focused on the Function of Projects

The next set of decisions types I observed focus on the function of projects. If a program was intended to perform a specific function, the designer needed to make decisions to support the intended function. The types of decisions that affected the

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function of projects include choices made to develop skills, work around limited skills, and improve functionality of projects.

Decisions made to develop skills. During the analysis of data I discovered four participants made decisions to develop design and programming skills. Andrew made the most decisions to develop skills (9), while Zoe, Mira, and Steven made fewer decisions (8, 5, and 2, respectively). Alexis did not demonstrate any decisions made to develop design or programming skills. As mentioned in Steven's description, decisions were made to develop his programming skills. Steven searched and found a *YouTube* video to learn how to program his ball to bounce in his ball adventure game (see Figure 4.4 above). He then applied event handling, looping, and Boolean logic to code his game.

Andrew chose to attend a week long camp to learn more about programming. When provided choices of camps to attend during the summer, Andrew selected a camp focused on teaching children how to code. With this professional development experience behind him, he then transferred concepts and applied strategies into his digital story created in *Scratch*. An example of a concept transferred can be found in the use of a custom command incorporated in *The Legendary Quest* (see Figure 4.21 below). Andrew wanted to include a sequence of code requiring everyone to provide the name of the hero to Wise Rabbit in order to continue the quest. A wrong answer automatically ended the quest. Andrew explained, "I had a little help from the teacher because this was one of the most important things. This was the first time I actually used an ask or an answer equals blank then something." Andrew described the programming concepts of coordination and synchronization and keyboard input, which are used to embed a question into the digital project and require the user to provide a specific answer. In the case of Andrew's project,

the user would be diverted to a "Game Over" frame if the incorrect answer is provided. A correct answer allows the user to continue with the program. He went on to explain he plans to use the custom command code in his next project, *The Friend*.

Figure 4.21. Andrew's custom command code block created during coding camp.

In contrast to Steven, who used *YouTube* and workshops to advance his programming skills, Mira relied on her intuitive sense and she explored *Scratch's* programming tools in order to advance her strategies. Mira stumbled across a community within *Scratch* called *Starland*. The community focused on members creating a space representative of a small town. Members created projects that helped develop the town into a community. For example, *Starland Bank* was created by a *Scratch* member in order for everyone to set up a bank account. Another member created a project focused on

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acquiring a job in *Starland.* Mira saw an opportunity in *Starland* to contribute to the

community as she developed her design and coding skills. After exploring *Starland*, Mira

chose to create a house within the community. Mira stated, "I've been wanting to make

this for awhile and *Starland* popped up so I figured I would make this house a part of

Starland." Mira chose to create a simulation, titled *Grace's House*, in an effort to

cultivate her programming skills and contribute to the community. Specifically, when

Mira discussed her experience learning how to create an interactive fish tank she stated,

"I had a little trouble with it at first but eventually, through playing with the scripts, I

figured out how to do it" (see Figure 4.22 below). Mira's description of how she created

the interactive fish tank is representative of using logical reasoning and debugging

problems to determine the code required to execute her program. She used sequence,

looping, coordination and synchronization, event handling, dynamic interaction, and

Boolean logic to program the interactive fish tank.

Figure 4.22. Mira's interactive aquarium.

While the examples above focus on decisions that have already been made, Andrew touched upon an aspect of his next project he expected to be a challenge. He planned to complete a second part to his legendary quest digital story. Andrew mentioned the main character will need to upgrade his costume and he was unsure how to include this in the programming. For now Andrew is, "waiting to figure out how I'm going to do this." Andrew's decision to wait until he figured out the costume upgrade represented situated 'just-in-time' learning' (Melhuish & Falloon, 2010). A well known cognitive issue of instruction is people learn best when information is provided at the point of need (Gee, 2003). The increased accessibility and use of information and communications technology (ICT) affords individuals flexibility to determine when to learn a technology-based skill or strategy. In a study by Warschauer (2007), increased access to ICT facilitated more just-in-time learning of students across 10 schools ranging from Grade 2 to Grade 12. For example, language arts students went online to find images or clarify confusing terms or concepts they came across in medieval literature.

Mira and Steven's approach toward developing coding skills vary from Andrew's approach. Although Andrew has identified the need to learn a new coding skill, he is waiting to figure it out. In contrast, Mira and Steven actively sought information and ways to transfer new learning to their in-progress projects. An important aspect of information technology fluency is the ability to independently learn and use new technology (Lee, 2011). Mira and Steven demonstrated an ability to actively seek information to develop their coding skills. Further, the coding context created opportunities for metacomposing development, along with concrete skill improvement.

Decisions made to work around limited skills. I discovered another type of decision connected to the function of projects was a choice by participants to work around limited skills. Rather than developing skills, I identified examples of participants learning to work around limited skills. I defined decisions connected with working around limited skills as choices made to improve the functionality of projects that incorporated alternatives to learning new coding skills. The extent to which participants made decisions to work around limited skills varied. Zoe and Andrew made frequent decisions to work around limited skills (12 and 8, respectively), while Steven, Mira, and Alexis made fewer decisions (4, 2, and 2, respectively).

Steven and Andrew chose to use available tools within *Scratch* to work around the coding skills required for the desired design and functionality of projects. For example, when discussing his first project Steven stated, "I didn't really know how to code anything yet so I made a unicorn because I thought maybe that would be like a final boss or something." Steven selected the unicorn from the image library provided within *Scratch* instead of attempting to create his own Sprite. Additionally, Andrew shared that he was unable to figure out how to make his wolf flip upside down after an attack. Instead he chose to make the conquered wolf disappear because, "it's harder to make him flip upside down, then do that, and switch costumes too." Andrew and Steven used available resources in *Scratch* to worked around their limited skills in order to design their digital projects.

Zoe was the only participant to remix projects from user generated text within *Scratch*. When asked about why she chose to remix two projects, Zoe explained remixing allows her to work around what she is unable to create. Zoe stated, "sometimes it won't

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work for you unless you do remix." She went on to explain, "remixing helps you to be able to include things you find challenging to include on your own. It lets you add extra things." Next, Zoe plans to remix a project called *Where's the Bunny* in an effort to make more funny things about *Five Nights at Freddy's*. Rather than having the bunny pop around the door, Zoe planned to use funny variations of the characters from *Five Nights at Freddy's*. She was unable to align the sound with the action and identified *Where's the Bunny* as a remix that will allow her to create the desired action.

Zoe's use of remixing to work around limited skills represents an interesting notion regarding the remixing of digital media. Remixing is portrayed as a new, intentional type of intertextuality and unique form of composition. Zoe, however, has appropriated the use of remix to work around her limited skills. She has learned how to extract the desired elements found within projects, via the use of remix within *Scratch,* as a way to work around her limited coding skills. In other words, for Zoe remixing is an in-between state between plagiarism and novel composing.

Whereas "work arounds" are often considered a person's technological skill, participants also chose to use Mira as a way to work around their programming constraints. In other words, they referred to an expert. Mira assisted Zoe and Steven with their initial projects on *Scratch*. Zoe was introduced to *Scratch* by Mira during a sleepover at Zoe's house. Mira began teaching Zoe about *Scratch* by explaining how to use the animation tools. She showed Zoe how to use the mosaic feature in *Scratch* to duplicate images and change colors (see 4.23 below). Steven was introduced to *Scratch* by his AGP teacher. During class he received help from Mira on how to select graphics and create a stage.

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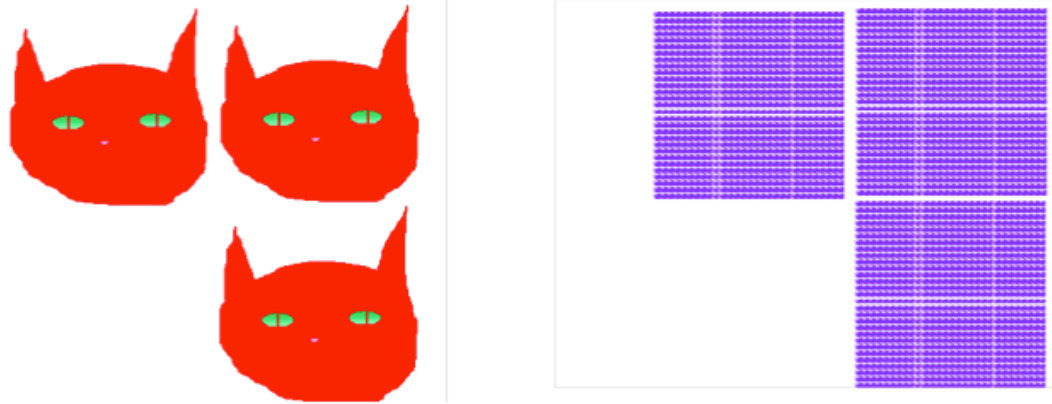
Figure 4.23. Mosaic effect: Initial cats multiply to an infinite number as their colors change.

During Andrew's observation he experienced difficulty programming the intended actions for his Sprites. Andrew's response to his difficulty with the Sprite was, "this is where I need Mira to help me." He and Mira collaborated face-to-face regarding the challenging features in his digital story after his observation with me was completed. When discussing mentorship received from Mira he stated, "I really learned a lot from Mira."

Decisions made to improve functionality of projects. Participants also demonstrated evidence of making decisions to improve functionality of their programs. Mira demonstrated the most decisions made to improve functionality (22), while Alexis demonstrated the fewest decisions (7). While completing the multimodal analysis of participant projects, I noticed Mira waited until after a conversation with the main character of her simulation to include an aquarium into the scene. The main character disappears and the aquarium appears within the same background. When asked why she waited to have her aquarium appear in her simulation Mira responded, "It's a lot of

Sprites to put in while you are adding a conversation. It was easier to introduce the aquarium on this screen when there wasn't a conversation going on." During her observation, Mira also described the creation of a coding block to assist with programming a special effect. Mira explained she was creating a code set to facilitate an effect she wanted to employ in her game. She stated,

> Over the course of the game you use a whole lot of fade-ins and fade-outs. I'm making it a little easier because you have to drag out all the scripts throughout the games, put them in, when you can just do it with one script.

The creation of a code set reduced the work required to replicate the effect Mira planned to repeatedly program into her game. When describing her programming process Mira explained, "a lot of times when I'm making projects I sort of have to make a little tweak and then start the project over again to make sure it works." Mira's decisions represent an emphasis in improving the functionality of her programs.

In his digital story, *The Legendary Quest*, the main character must kill an evil wolf with a dagger. Andrew described how he improved the functionality of the dagger attack to kill the wolf. He stated, "the hard part was making the pixels for it. I had to delete the dagger again and again and I had to position his arms again and again. The attack is basically him switching through his costumes." To increase the functionality of the attack Andrew used the programming concept of sequence to change the character's costumes in order to provide the motion of his character attacking the wolf in the digital story (see Figure 4.24 below). The dagger moves closer to the wolf with each costume change.
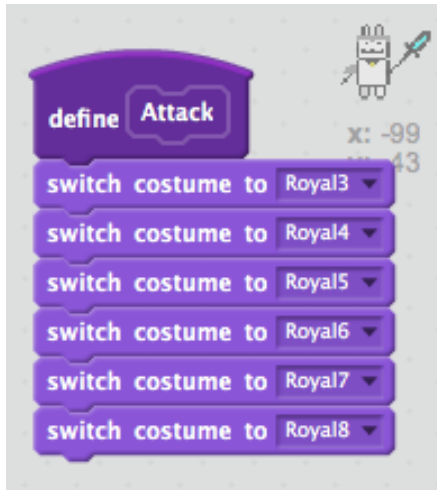
Figure 4.24. Code created to simulate Royal's wolf attack.

Zoe's first project, *Kitten Apocalypse*, features multiplying kittens. The animation begins with three kittens, which then multiply into hundreds of kittens. During the multimodal analysis of *Kitten Apocalypse* I noticed one quadrant in Zoe's project was empty for the duration of the animation (see Figure 4.23 above). When asked why the quadrant was empty Zoe explained, "it was going to overlap and not really function properly." Zoe's decision to leave the quadrant empty preserved the functionality of her project.

When discussing the color choice in his platform game, *The Ball Adventure*, Steven explained he chose bright colors because, "if I'm ever programming at night it will always pop up for me." His ball adventure game was created as a pre-model in order for him to focus on the functionality of his game. His pre-model was essentially a rough draft of the game he planned to publish on *Scratch*. Steven planned to create a more realistic version of his game once he completed the coding for his pre-model. Steven's choice to focus on the functionality of his platform game is in contrast to what most kids

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do with digital tools. For example, when kids use power point or iMovie they are all about the bells and whistles, rather than the content. In this case, Steven is focused on the functionality of his project before focusing on the aesthetic design. This is a big shift in the composition practices of early adolescents.

Domain 3: Decisions Connected with Meaning

In addition to decisions focused on the design and function of projects, participants also demonstrated decisions connected with meaning. These decisions include decisions to elaborate an existing story, personal preference for meaning, and decisions made to embed meaning within projects.

Decisions to elaborate an existing story. I defined decisions to elaborate an existing story as choices made to contribute toward elaboration of a story embedded in a *Scratch* project. When discussing decisions, all participants mentioned decisions made to elaborate an existing story, however, the extent to which they emphasized these decisions varied. Collectively, Andrew and Zoe made 51 references, while Mira, Steven, and Alexis together made 19.

I found examples of decisions made to elaborate an existing story in Zoe's project, *Wake Up Clay*. Zoe chose to recreate a scene from the *Wings of Fire* series in which Clay, a dragon, would not wake up. She made intentional decisions to recreate the story she read about in the series. Clay, who is a MudWing dragon, was made brown because, "Mudwings are well camouflaged against, well mud." Glory is a RainWing dragon, who is known to change colors. Zoe explained Glory was, "a very colorful dragon. She does camouflage a lot, but only for stealth." Zoe's representation of the

characters aligns with her perception of the story contained within the *Wing of Fire* series. Her use of color matches the characterization of Clay and Glory (see Figure 4.25 below). She used bright colors to represent the characteristics of Glory and dark brown to resemble the appropriate shade for Clay.

Figure 4.25. Zoe's scene from *Clay Wake Up.*

Additionally, Zoe also included her memory of the text in her story. She explained, "I remember Clay was inching forward in his sleep and when he wakes up he's like 'Where did the cows go?' that was the weird part." Zoe incorporated Clay's dialogue into her Scratch project (see Figure 4.25 above). These decisions made to elaborate an existing story work together to create Zoe's interpretation of a specific event from *Wings of Fire* and provide a narrative for her project.

I also found decisions made to elaborate a story in *The Legendary Quest*. Andrew created a digital story focused on the quest of a rabbit to save his brother from a dungeon. Each frame continues the story created by Andrew (see Figure 4.26 below). The use of landscape, color, dialogue, gestures, and music contribute towards the story. For example, Andrew described his use of color to make the wolf look evil. He used, "red eyes, vicious teeth, and grey colors because grey sometimes mean evil. Grey and red, like when you think of grey you think of not happy." Dialogue is layered throughout the digital story to continue the narrative. Royal begins the story by stating he is going to visit his brother. A series of frames follow, which contain dialogue to tell the story. At the moment Royal officially begins his quest music begins to play. Andrew described his selection of music as "legendaryish." Even Royal, the rabbit's name, resonates the quest theme. Andrew explained, "I was like honor and stuff so I just named him Royal." The narrative of Royal's quest is extended via the decisions made by Andrew as he created his digital story.

Figure 4.26. Story sequence from *The Legendary Quest.* 1) Royal begins an ordinary day. 2) He discovers his brother's house is on fire and he is missing. 3) Royal saves Wise Rabbit, who agrees to help him on his quest. 4) Royal enters the dungeon to rescue his brother.

Decisions connected to personal preference for meaning. Another type of decision made by participants included a personal preference for meaning. Specifically, these decisions were associated with a personal connection to meaning rather than developing a story. Mira referenced the most decisions connected to personal preference for meaning (8), while Andrew and Steven made fewer references (6 and 3, respectively).

Zoe and Alexis made no references to decisions connected to a personal preference for meaning.

I observed an example of personal preference in the choice of music selected by Mira for *Grace's House*. Although Mira searched for music to match the personality of her character, Grace, she also focused on finding music from Korea. Her father recently worked in Korea and she was inspired to find music reflective of the culture. Mira settled on a Korean Vocaloid called *Blue Fairy Forest* to provide music for *Grace's House*.

Zoe also evidenced decisions focused on personal meaning. While working on a new project, Zoe chose to create a cat girl. Zoe stated, "she's a cat crossed with a girl. She will have a tail and I'm going to make the tail." Her decision to create a cat girl was based upon personal preference. Zoe planned to enable movement of her character by the *Scratch* members who experience her project.

Additionally, an example of personal preference for meaning can be found in the *Legendary Quest*. Andrew chose to name the brother of the main character the same name as his own brother. In the *Legendary Quest*, Royal is searching for his brother. Andrew made a decision to name Royal's brother after his brother based upon personal meaning, rather than the based upon the narrative of the story.

It is interesting to note during the creation of projects, participants sought to include personal connections as they worked to create meaning. This focus on personal preference for creation of meaning is indicative of a situated perspective of literacy. Malinowski (2014) posited, "where language learners are, and where they understand themselves to be, may have everything to do with the meanings they are able to make" (p.

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64). Language, thinking, and creating meaning are tied to individuals' experiences of situated action in the material and social world (Gee, 2009). As participants created meaning within *Scratch* they made connections to personal preference and experiences in the design of projects.

Decisions made to embed meaning. The multimodal nature inherent in the projects programmed in *Scratch* affords a variety of ways to embed meaning into the digital media texts created. Although each person's product contained layered elements, the participants embedded meaning to achieve four primary purposes: to guide visitors through exhibits, to story, to engage in conversation, and to game. To achieve each goal, the participants embedded unique semantic cues within specific *Scratch* structures. Mira made frequent references regarding decisions to embed meaning (25), while Andrew, Zoe, and Alexis made fewer references (11, 8, and 7, respectively). Steven made no references regarding decisions made to embed meaning.

In order to guide visitors through programming exhibits and to direct visitors' interactions, the participants used spatial positioning, text support and labels, and foreshadowing through imagery. In order to tell a story, the participants used narrative text and dialogue along with music, color, design, and metaphorical imagery. To engage users in a conversation, the participants used chat boxes, color, music, positioning, and recurring characters. To create a product for the purpose of gaming, the participants used various *Scratch* features that allowed for interaction with Sprites (e.g., Grace; Wise Rabbit) and objects (e.g., cat food box; television; radio). The programming concepts supported in *Scratch,* which provide interaction, include event handling, coordination and synchronization, keyboard input, dynamic interaction, and user interface design. In

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addition, those participants who created products for gaming purposes, also included

elements to build and maintain a fan base. These elements included recurring characters,

catch phrases, product placement, commercialization, and promotion. In this section, I

share detailed examples to illustrate the purposes and connected structures.

Guiding visitors through interactive experiences: Feeding Miko. As mentioned

previously, Mira incorporated numerous interactive experiences in *Grace's House*. One

of these interactive experiences focused on feeding Miko, a cat belonging to Grace. Upon

entering the kitchen Miko is positioned near a kitchen cabinet (see Figure 4.27 below).
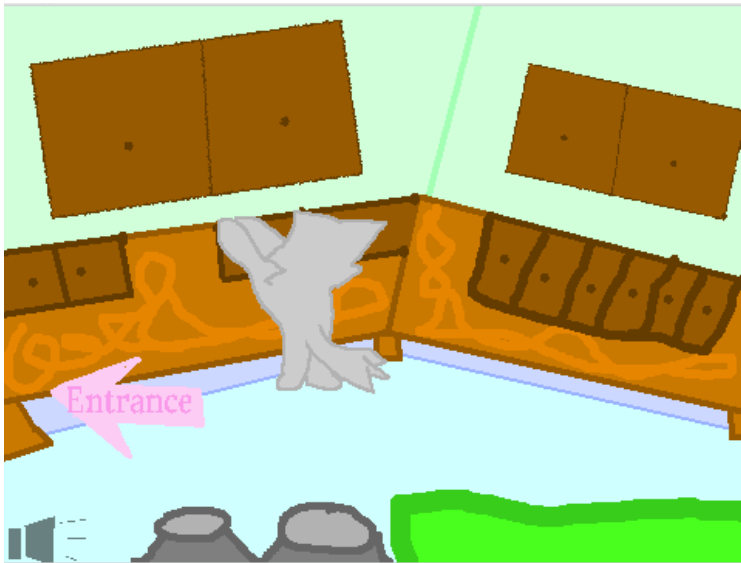
Figure 4.27. View upon entering Grace's kitchen.

Mira used multiple semantic cues to direct visitors toward the interactive

experience of feeding Miko. The types of semantic cues used included spatial positioning

of Miko and the cat food, textual support via Miko's annoyed hiss, and the positioning of

empty food bowels in the foreground of the kitchen view (see Figure 4.28 below). These

semantic cues coalesce to position the interactive experience within the narrative of

Grace's House. Visitors are able to combine the semantic cues to mediate the interactive experience, however, they may be able to mediate the interactive experience using only one semantic cue.

Figure 4.28. Semantic cues for feeding Miko: 1) Miko is positioned in front of the cabinet with paws extended upward. 2) Miko communicates an annoyed hiss when clicked upon. 3) Empty food bowels are located on the floor. 4) Cat food is located above Miko's extended paws when the cabinet is opened.

The use of symbols to embed meaning. An example of embedded meaning can be found in the character development of Grace, the young girl featured in *Grace's House*. As Mira explained, Grace was a character created by Mira for a community called *Starland*. During the multimodal analysis of *Grace's House*, I noticed symbols on Grace's skirt and shirt. When I asked Mira what these symbols represent she responded,

"the moons are meant to represent that Grace is a night person and she is also a part of

Starland." To connect Grace with *Starland* a lunar theme was expressed in her clothing.

Mira drew a space shuttle on her shirt and moons were placed around her skirt (see

Figure 2.9). The embedded meaning adds an additional layer to the character

development of Grace.

Figure 4.29. Lunar symbols incorporated on Grace's clothing.

Mira continues her emphasis on the use of symbols to embed meaning when

discussing her current project called *My Little Alchemist*. While creating a character, Mira

discussed how she determines a character's name. She stated, "my people are usually

unrealistic. There is one strange feature of them that is worthy of a name." Mira was

contemplating whether to name her current character Icy or Star because of her blue hair.

She selected Star as the name of her character and proceeded to add star decorations to

her shirt (see Figure 4.30 below).

Figure 4.30. Mira's character named Star.

> ***Telling a story: Royal begins his quest.*** The next example of embedded meaning encapsulates a pivotal moment in Andrew's *The Legendary Quest*. In Andrew's digital story, Royal's brother is missing and he must journey to a dungeon to rescue him. Before he begins his quest, Royal seeks out Wise Rabbit to gather information. He finds Wise Rabbit and rescues him from an evil wolf. At this moment in the story Royal's quest begins.

> A complex array of resources of various modes are used to embed meaning during this pivotal moment (see Figure 4.31 below). Dialogue is incorporated to provide a narrative for the quest. Up until this point in the program no music is provided in the digital story. The moment Wise Rabbit hands Royal a dagger to kill the wolf, music with a heroic or quest type of theme begins to play. Andrew's use of music signals the start of Royal's adventure. The music is synched to begin the moment Royal is given the dagger from Wise Rabbit. Subtle meaning is also layered into the text. Andrew chose to use "Native American" colors and design in the home and clothing of Wise Rabbit to convey his wisdom. Royal's ear and leg are mismatched to resemble the patterning of a rabbit.

Figure 4.31. Embedded meaning in a pivotal scene from *The Legendary Quest.*

Conversing with guests: Welcome to Grace's House. Grace's House is Mira's simulation designed to provide interactive features as guests explore the house of Grace, a young girl who loves cats. A pivotal moment in the simulation is when Grace concludes her conversation with the guest and provides an invitation to explore her house. At this point the guest is informed of the interactivity of the house and released from the conversation to explore.

The deconstructed scene provided (see Figure 4.32 below) illustrates the ways meaning was embedded by Mira. Chat boxes are used to create a conversation with Grace and convey simulation information. The use of pastel colors for Grace's house and

clothing connotes the perceived aesthetic preferences of a young girl. The music accompanying the experience in Grace's house is light and airy, which is intended to be reflective of Grace's personality. The celestial theme displayed on Grace's clothing (e.g., moons surrounding the skirt; space shuttle on the shirt) is a nod to *Starland*, the community in which Grace is a resident. Mira also made sure to feature Blaze in the front window. According to Mira, Blaze is a "fan favorite" of her audience and she wanted him to be featured prominently in Grace's house. Mira has even embedded personal meaning via her use of a Korean Vocaloid to represent the time her father recently spent in Korea.
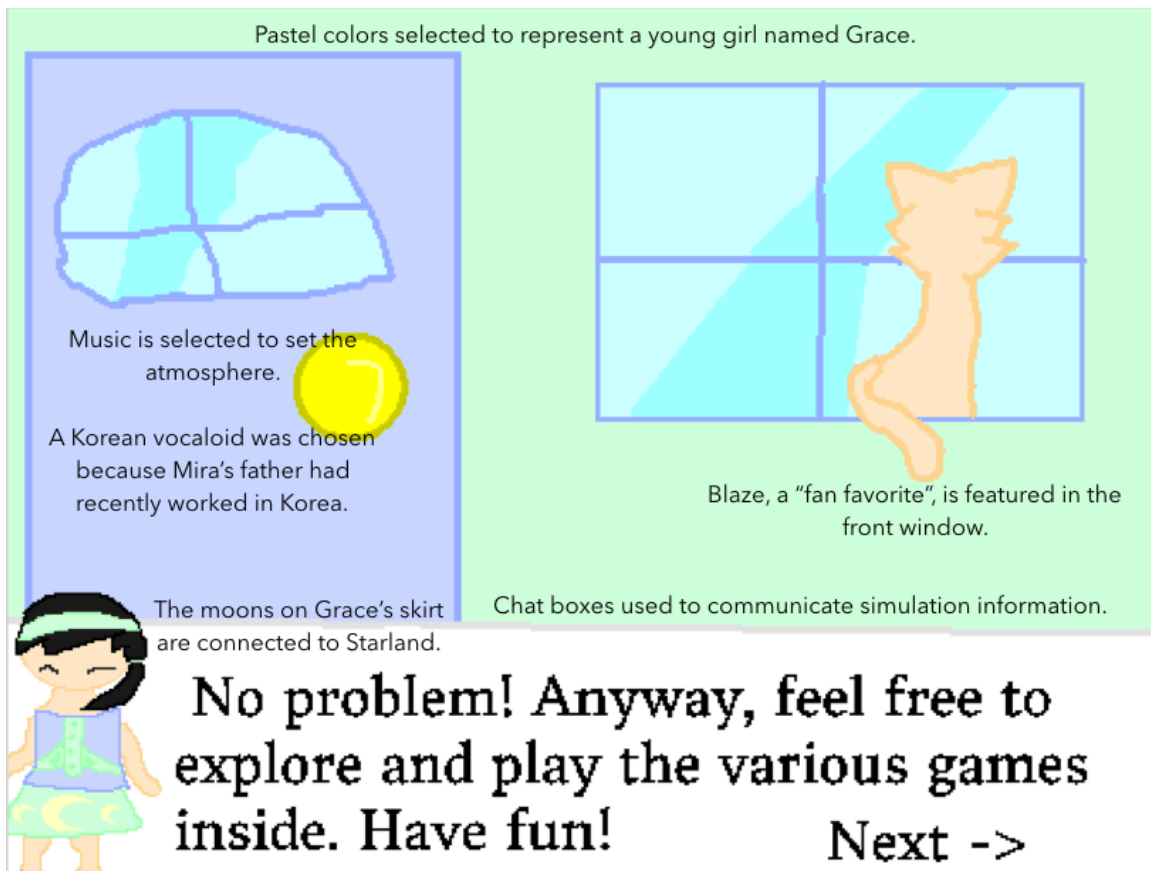
Figure 4.32. Examples of embedded meaning in Grace's House.

Gaming and marketing: Grace's Easter egg. Another example of embedded meaning is the use of an "Easter egg" in *Grace's House* (see Figure 4.33 below). According to Mira, an Easter egg is, "a little thing hidden in the game with a reference to something in the game or out of the game." Mira chose to embed an Easter egg focused on Blaze because he is a popular character featured in her *Scratch* projects. Blaze, a cat resting in the front window of Grace's House, is also featured on the boxes of Blaze Food located in the kitchen. The same cat food is featured in a commercial on the television located in Grace's living room.
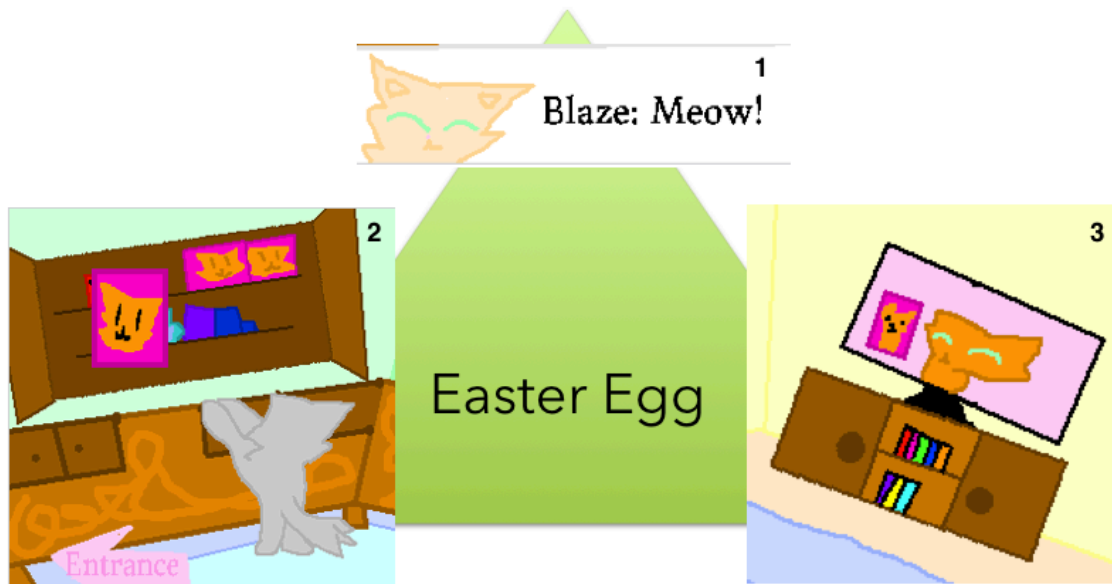
Figure 4.33. An embedded Easter egg: 1) Blaze is featured in the front window of Grace's house. 2) Blaze's picture is featured on the box of Blaze Food 3) One of the channel selections for the television is a commercial for Blaze Food.

Symbols and color: Clash of the dinosaur. Alexis, the least experienced member of *Scratch*, also demonstrated evidence of embedded meaning. Her published project was a math extra credit assignment created for AGP. Her characters in the project were competing to see who loves math the most. Alexis sought to layer in meaning via her use of color. She stated, "it's suppose to look like the dinosaur is really angry and all these dark colors are coming." Alexis used red and purple to portend a clash between the characters. The pointed tips on the mountains are meant to convey, "those are the mountains where he (the dinosaur) lives and he doesn't want people coming by." Finally, mathematical symbols were etched into the skin of the dinosaur to connote his love of math (see Figure 4.34 below). Even though Alexis was new to *Scratch*, her published project demonstrated examples of embedded meaning.

Figure 4.34. Example of color and symbols to embed meaning.

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Connections. The use of semantic cues signaled an interactive experience while the use of multiple modes provided and extended upon the texts created. The ability to juxtapose available modes to create meaning is reflective of sophisticated and complex ways to enact literacy practices. Further, these examples highlight the creativity and skill in which early adolescent participants created new texts as they engaged in multimodal literacy practices.

Mira's use of an Easter egg is a sophisticated use of intertextuality. The construction of meaning required cross-textual integration spread throughout Grace's house. Traditionally, intertexuality is studied with print-based texts (Van Meter & Firetto, 2008). Mira's use of intertextuality is situated within the use of digital media to create meaning. Creative use of additional modes provided an opportunity to embed the use of intertextuality in her simulation.

Mira's Easter egg is also considered genre play. Edwards (2016) proposed a typology to map remix practices. He defined genre play as, "the ways in which rhetors playfully re-conceptualize reified norms, working both within and against those socially constituted ways of doing and knowing" (Edwards, 2016, p. 50). Mira playfully altered her simulation by including an additional way of knowing via the embedded Easter egg.

The programming environment provided in *Scratch* provided a space for participants to create unique, intertextual, multimodal meanings. The ability to use the design tools and coding options afforded within *Scratch* provided a space to create digital assemblages. The orchestration of modal systems to embed meaning required proficiency to combine and remix varied textual and linguistic practices (Burnett & Merchant, 2015).

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Andrew's use of music, dialogue, color, and Native American design represented skilled ways to embed meaning into digital media. Leander and Boldt (2012) argued youth are understood as powerful when they are able to use texts to design their own practices, activities and texts.

The examples of embedded meaning demonstrate how multimodal, "literacies call us to generate and communicate meanings and to invite others to make meaning from our text in turn" (Lankshear & Knobel, 2007, p. 4). Resnick et al. (2009) argued for the need to broaden the notion of "digital literacy" (p. 10). The embedded meaning evidenced by participants expands the notion of digital literacy to include designing.

Typography of Decisions
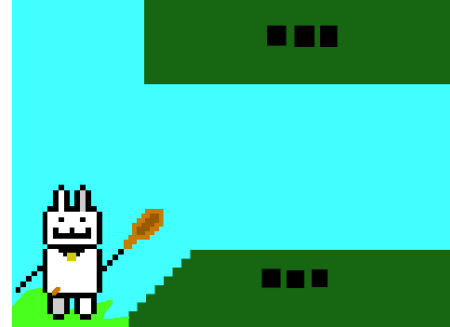
I created at typography of the participants' decision making processes, as shown in Table 4.2 (below). The typography represents of the types of choices made as participants created projects in *Scratch*. Together, the decision types inform understanding of the ways early adolescents create programs within an online programming community. Rushkoff (2010) argued,

> The digital realm is biased toward choice, because everything must be expressed in the terms of a discrete, yes-or-no, symbolic language. This, in turn, often forces choices on humans operating within the digital sphere. (p. 55)

The design, functional, and meaning-based decisions demonstrated by participants illustrates the type of choices made during authorship of digital products.

Table 4.2

Typography of Decisions
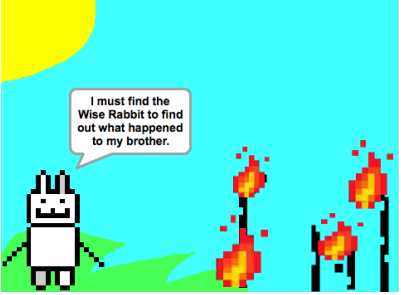
Typology	Characteristics	Example	Image
Design Decisions	Personal Preference for Design	Steven prefers to use a cute puppy in his project.	
	Audience-Influenced	Guests can interact with Grace's parrot. Suggestion was provided by a *Scratch* member.	
	Text-Influenced	Dungeon entrance design is based upon *Terraria*.	

Table 4.2 (Continued)

Typology	Characteristics	Example	Image
Design Decisions (Continued)	Latent	Grace's cat unintentionally glows in the dark.	
Decisions to Improve Function	Develop Skills	A custom command code Andrew learned in summer camp and applied to a *Scratch* project.	
	Work Around Limited Skills	Zoe remixed to work around limited skills.	

Table 4.2 (Continued)

Typology	Characteristics	Example	Image
Decisions to Improve Function (Continued)	Improve Functionality	Andrew created a code block to simulate an attack. The code block improved functionality of the attack.	
Meaning Based Decisions	Elaborate an Existing Story	A recreated scene from the *Wings of Fire* series.	
	Personal Meaning	The hero's brother is named after Andrew's brother.	
	Embedded Meaning	Semantic cues to indicate an interactive experience.	

Domain 4: Expert Stance

Among the participants in this study, only one person was considered an experienced Scratcher (Mira) and only one participant had more than two projects published (Zoe). However, all the participants expressed a sense of accomplishment and expertise in *Scratch* product development. Throughout my observations and interviews, participants frequently adopted an expert stance when explaining how they selected content. For example, while discussing why he chose to place a character inside an amulet, Andrew explained, "I've seen on TV characters that get stuck inside of stuff. I thought what if I put it in reverse and instead of a bad thing it's a good thing?" Andrew approached this discussion as an author explaining his plot development. He articulated clear reasoning in an authoritative manner. Andrew demonstrated an authorial style and content borrowing. Zoe provided a lesson when discussing duality of colors. She stated, "you have a light shade of blue and a darker shade of blue for your two colors." Zoe then gave a tutorial on how to use the paint button to create dual colors. During our interview she assumed the position of an expert in *Scratch*.

In this section I discuss the order of operations, level of complexity, consideration of audience, and quality control demonstrated by participants as they positioned themselves as experts in the design of digital media. Additionally, I develop the expert stance adopted by participants to explore how youth learn language within an online programming community.

Order of operations. Digital writing tools reshape notions of authorship by providing flexibility to allow for recursive and ongoing modifications to text (Martin &

Lambert, 2015). During the design of digital media, multiple steps are enacted to construct new knowledge, create media expressions, and communicate in virtual spaces. An aspect of the design process is to determine the order in which operations are completed to create digital texts.

While explaining her order of content creation, Zoe demonstrated an awareness of her design process for the creation of digital media. She shared, "I first work on the background, then I go to music and sometimes if I want to I will add pictures." Zoe's response indicated a process she adopted to develop the content of her programs. She presented her process for content selection as if she was an expert.

Steven referred to his project as a pre-model. He stated, "this is a pre-model and when I make another it's going to have better looking characters." Andrew's use of "pre-model" was from the perspective of a designer. He was intentional in his terminology and articulation of his description. Further, Steven determined the order of operations for his design process. First, he would create a draft focused on the functionality of his project before focusing on the aesthetic elements of his project.

Mira also demonstrated in expert stance when discussing her work in *Scratch*. While explaining the design of a room in *Grace's House* Mira stated, "at first I added space here. I knew I would intentionally add other stuff over time so I made the rooms a little spacey." She demonstrated intentionality in her design and expressed it in an authoritative tone. Mira's response is reflective of an experienced designer familiar with her order of operations for the creation of digital media.

Level of complexity. The intuitive coding system contained within *Scratch*

provides members with the ability to create projects of significant complexity. Creative

media production requires learning how to create digital texts and an understanding of the

complexity of the design process (Peppler & Kafai, 2007). Experienced designers are

able to identify the complexity of a task to determine whether they are able to create the

proposed task. While preparing for her stimulated recall, I noticed Mira appeared to value

member feedback and attempted to integrate suggestions into her published programs. I

was curious to know how she determined which suggestions to implement. When asked

about how she selected suggestions Mira described an internal complexity scale (see

Figure 4.35 below). Her response described a scale she created to evaluate the complexity

of tasks. Mira determined that tasks with a complexity factor less than 9 would merit

consideration for inclusion in her programs. Mira positioned herself as an expert in the

design of digital media when describing her process for content selection. Her response

indicated a self-awareness regarding her ability to create specific types of texts.

Researcher	I noticed you have a long list of suggestions from *Scratch* members. How do you decide what you are going to add?
Mira	There are a lot of things I add and some things I don't add. Some things are way too hard for me and I say I can't do that period.
Researcher	So it is too complex?
Mira	On a scale of 1 to 10 it is an 11. Anything below 8, that's fair game.

Figure 4.35. Mira describes her complexity scale.

Consideration of audience. Expert designers consider their audience during the

creation of digital media (Litt, 2012). Characteristics of the audience are brought into

coherence with the rhetorical purpose and interests of the designer (Bezemer & Kress,

2008). Steven demonstrated an expert stance when he commented, "I found that if I

want to make games for kids I don't want to make it depressing like blue and black."

Steven's response positioned him as an authority on how to design games for children.

Andrew's discussion regarding design was also notable for how he positioned himself as an expert. When explaining why he chose bright colors Andrew stated, "when you give color to things people get more interested to bright colors than dark colors." To explain his used of contrasting color Andrew stated, "I contrast the dark color with a bright color. I made the doorknob a bright color so it still brings the person's attention. That's something you have to do." Andrew's positioning as an expert in design made him sound as if he was teaching about the use of color. He established himself as an expert in the use of color for his audience.

Quality control. In virtual groups built around technology expertise, media fandom, or electronic gaming the ability to produce interesting and high-quality productions are highly valued practices (Ito et al., 2010). Mira communicated a work ethic when discussing her creation of projects by stating, "sometimes you have to work to make the good stuff happen." Her response seemed to demonstrate a mature and arguably expert approach toward the amount of work required to create quality projects.

Mira's responses were also notable for how she phrased her work. For example, when talking about her process of design she stated, "My games involve a lot of drawing. Every single thing needs to be drawn." Her use of "my games" delineates ownership of a specific style of games. Essentially, she views her games as a specific type of game, which incorporates a large amount of digital drawing. Interestingly, I was corrected by Mira regarding my use of "like" when asked if her project was like a video game (see

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Figure 4.36 below). She informed me her project IS a video game. Her response to my question indicated strong positioning of herself as an expert at creating video games.

Researcher	What made you have dialogue between Grace and the guest?
Mira	It's sort of something you would see in real video games.
Researcher	**Did you want this to be like a video game?**
Mira	**It is a video game!**
Researcher	Oh! What do you mean it's a video game?
Mira	I view it as a simulator. They go through the house and interact with the objects. So it's *Grace's House* simulator.

Figure 4.36. Mira's simulator description.

Expert learners. The expert stance expressed by participants is indicative of early adolescents who are developing their voices and identities as media creators (Chisholm & Trent, 2013; Pyo, 2016). During discussion of their work, participants assumed an agentive role in the creation of multimodal text, similar to conversations experienced by Roswsell (2013) as she interviewed professional creators of multimodal texts. Participants discussed elements of their programming and design as though they were professional creators of multimodal products.

The experiences acquired in *Scratch* provided opportunities for participants to engage in participatory culture in ways that promoted agency and the fostering of author identities. Ito et al. (2010) posited, "as young people begin to develop their expertise in creative production, they often also work to develop a unique voice and specialty" (p. 289). The self-positioning of participants as experts within the discourse of authorship of multimodal texts is remarkable when considered within the context of the accumulated

experience of most participants within *Scratch*. Although only one participant was labeled an Expert Scratcher by *Scratch*, most participants assumed an expert stance when discussing the creation of digital media in *Scratch*.

Participants engaged in the design of texts on *Scratch* as "lexperts". While most participants were new to the context of *Scratch* and learning how to code, they still assumed an expert stance when discussing elements of design. The combination of "learning" with "expert" provides the term lexpert, which encapsulates the stance adopted by participants as they discussed composition of texts in *Scratch* while still learning to code. Once participants acquired the process skill, they also acquired the language, and therefore identified with having expertise in the design of digital media in *Scratch*. Additionally, the "lex" in lexpert also denotes the expanding programing lexicon developed as youth acquire the ability to understand and apply coding to create digital media.

Language acquisition by doing. As mentioned previously, *Scratch* is experiencing an unprecedented jump in membership as youth learn to code. The coding revival is situated within a larger maker movement (Kafai & Burke, 2014). While the maker movement is a recent trend focused on the creation of products assembled from raw materials, the coder movement is focused on the creation of digital material via the use of coding.

In *Scratch*, youth learn literacy processes and a new language through doing. Their language grows alongside their design and redesign of projects. It is the making of things that gave participants expertise while learning to code, thus positioning themselves

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as lexperts. They are making real video games that other people can experience and manipulate. Here, the making goes beyond simply generating the content. Burke et al. (2016) argued, "having something to share, something to bring to the party, gives youths newfound entry points to these open networks" (p. 373). Through "doing" comes great pride and a sense of accomplishment.

Participant experiences in *Scratch* represent the use of a new language within a new space. The literacy processes demonstrated by participants as they learned to code are connected to order of operations, level of complexity, consideration of audience, and quality control. As participants engaged in coding they were able to acquire the language, as they identified with having expertise.

It is also important to note a missing voice in this discussion focused on adoption of an expert stance and language learning. Alexis, the most recent member of *Scratch*, situated herself as a novice programmer. As mentioned earlier, she was at first hesitant to join the study due to her limited experience in *Scratch*. When asked about her plan for future creations Alexis responded, "I haven't really thought of anything yet." Comments regarding her work in *Scratch* focused on her perceived limited skills. When asked about a character, Alexis stated, "I don't know how to make a face like that." Interestingly, Alexis required the most verbal probing during her observation and her responses were limited in length when compared to other participants. For example, when asked what else Alexis would like to do with her project she responded, "add more things people can click." When asked what type of interactive items she planned to include, Alexis was unable to provide a specific example. Alexis requires an understanding of the language in order to articulate her literacy process. Additionally, Alexis did not appear to view herself

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as an author and her responses indicated she had yet to find her voice and agency as a creator of digital media in *Scratch*.

How Alexis positioned herself as a creator and programmer is important to consider when compared with the other participants. Alexis required Mira's assistance to publish her project on *Scratch*. At the time of her interview and observation Alexis did not have an opportunity to engage in the participatory culture of *Scratch*. Alexis demonstrated a beginner perspective of engagement and authorship in Scratch, which provided a valuable juxtaposition of experiences. Whereas the other participants were able acquire the language to engage in coding and articulate their design process, Alexis struggled with acquiring fluency in coding and design. With the exception of decisions made to elaborate an existing story, Alexis demonstrated the least frequency in every design decision analyzed. Alexis doesn't know how to do, therefore she doesn't know how to speak the language, therefore she doesn't know. Alexis is unable to position herself as a lexpert because she has yet to engage in the making of things within the *Scratch* community.

Summary of Data Interpretation

Virtual spaces like *Scratch* afford early adolescents opportunities to explore, play, and experiment with different types of texts and multimodal design. Decisions were enacted which influenced the design, functionality, and created meaning of their projects. I observed sophisticated ways to embed meaning into digital texts. Participants engaged in rhetorical and functional literacies in multiple modalities within a new space and using a new tool. Most participants also positioned themselves as lexperts regarding the

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creation of digital media. The self-positioning of participants as lexperts demonstrated an expert stance toward design as they learned about the coding language.

Participants learned about programming as they created multimodal texts in *Scratch*. The programming concepts of sequence, looping, variables, and Boolean logic were represented in programs created by participants. Further, most participants included programming concepts to embed interactivity into programs (e.g., event handling; coordination and synchronization; keyboard input; dynamic interaction). In the process of creating digital media in *Scratch*, participants applied computational concepts via the use of coding blocks. These participant experiences are representative of the use of a new language within a new space. As participants engaged in programming they were able to use more specific language to articulate the creation of their projects via the use of coding.

My interpretations of the data collected outline a subtext of the decision-making process as participants designed and redesigned projects in *Scratch*. The typography representing the type of decisions made by participants illustrates decisions they enacted during the design and redesign process. The lexpert stance adopted by most participants informs how they positioned themselves during the creation of digital media in the programming community. The literacy practices observed are the types of experiences required for youth to achieve full participation and negotiation of a technologically saturated society (Burke et al., 2016; Edwards, 2016).

CHAPTER FIVE:

DISCUSSION AND IMPLICATIONS

Coding represents a fundamental and powerful way to learn programming and establish a presence in an increasingly digital world (Burke et al., 2016). *Scratch* provides an online community designed for youth to play, interact, and create as they design digital media via coding. Historically, coding has been situated within the field of computer science. Recently, researchers began to explore coding within the context of literacy.

The purpose of this study was to examine the literacy practices and processes of early adolescents as they designed and redesigned digital media in *Scratch*. Based upon the findings, I created a subtext to the decisions made as participants designed and redesigned digital media. I identified specific types of decisions and organized them into a typography. I categorized design decisions into choices focused on design, functionality, and meaning. Additionally, I discussed the lexpert stance adopted by participants as they created digital media via the use of coding. I provide insight into the literacy practices and processes of early adolescents as they create digital media in an online programming community via the data presented in this dissertation.

Lessons Learned

Before I delve into a discussion focused on the findings, I would like to explore lessons learned as I completed this research. As I became immersed in *Scratch* I gained insight into the programming community and also my daughter. The lessons I learned connect to the literacy practices and processes enacted within *Scratch* and also to the broader concepts of participatory culture, genre, and language acquisition.

Mentorship provided by my daughter. Delving into the community of *Scratch* afforded a view of my daughter I was unable to see during our daily interaction. I was surprised to discover the level of support provided to members and the value placed upon mentorship demonstrated by my daughter. After Mira's project was selected as a featured project, members sought her out for support. Mira frequently provided guidance to *Scratch* members who asked for her feedback. Her approach was constructive yet encouraging. When a member asked Mira to preview a program her response was, "I love it! I can't wait to see the living room! I'd really recommend adding pets as well." Her response expressed approval, provided the next step, and offered a suggestion. This pattern was demonstrated in numerous comments provided by my daughter as she mentored *Scratch* members.

The mentorship provided by Mira is representative of the increasingly participatory culture experienced within online communities. Underwood, Parker, and Stone (2013) argued 21st century literacies involve collaborating with others. Further, Sheridan and Rowsell (2010) described architectures of participation as the types of communities that provide legitimate spaces for learning where people can contribute,

receive constructive feedback, and shape the community. I was able view how my daughter contributed to the community of *Scratch* via the mentorship she provided to community members.

Genre in a Literacy 2.0 World. When I began this study I viewed genre within a traditional construct of genre as a being bound by rule-governed texts. After researching early adolescent literacy practices within an online programming community, I observed Miller's (2014) expanded construct of genre: Where genre is now the social action while in a digital environment.

The internet enables new communication parameters that reconfigure the conditions by which pragmatic features of language respond (Giltrow & Stein, 2009). Miller (2014) posited genre theory is undergoing a shift in response to the more complex multidimensional social phenomenon found in online environments. Further, genre is now the social action while in a digital environment: The texts ARE the social interaction online. Within the regions of the multimodal genre space, genre can be observed in the traces left by artifacts resulting from social action of online community members. It's not the text that results, it is the process of social action that results in the text. The tracks left in the online space lead to the social action produced within the genre.

Genre was observed within the interaction between participants and *Scratch* members providing feedback on their projects. Genre can be seen in the comments provided by members. The projects fueled social action, which resulted in an exchange of texts connected to projects. The comments are tracks left by the social action within *Scratch*. I argue that the 75 members who remixed *Grace's House* are evidence of genre.

Mira's simulation spurred numerous members to reshape her original text into their own texts. The 75 remixed projects are the artifacts of genre found within *Scratch*. Conversely, Zoe's remixed projects are evidence of how she was spurred to redesign projects created by *Scratch* members.

Miller's (2014) response to genre in online spaces is important to consider within the context of *Scratch*. Genre can be used to characterize the community of *Scratch*, whereby members engage in joint action and uptake, which results in recurrent patterns of social action. Genre provides a way of theorizing the multidimensional social phenomenon and structurational nexus between action and structure, and between agent and community. The application of Miller's (2014) updated Genre Theory to the study of literacy practices in *Scratch* would elucidate the ways genre is manifested as members engage within the *Scratch* community as they design and redesign digital media.

Coding lexperts. While completing this study, I discovered participants engaged in *Scratch* as lexperts. As participants learned to code during the creation of programs in *Scratch*, they adopted an expert stance regarding the design of their projects. This positioning is situated within the context of a programming community. Most of the participants were new to coding, however, they were able to position themselves as lexperts regarding the creation of their programs. This lexpert stance is important to note because it provides insight into how early adolescents position themselves as creators and producers of digital media in *Scratch*.

The positioning of participants as lexperts also informs understanding of how youth learn language within a programming community. In *Scratch*, language is

developed via a concurrent process enacted during the making of products. As youth learn literacy by doing, their acquisition of language grows in tandem with their expertise. Members are not required to know coding before they engage in programming. It is through the making of products in *Scratch* that youth learn a new language, which develops a sense of accomplishment.

Framed within a multiliteracies perspective of design, children are understood as powerful when they are able to move beyond the reading of multimodal texts to use the texts to design and redesign their own practices, activities, and texts (Leander & Boldt, 2012). Youth are able to express themselves and their understandings in authentic ways. Yang and Chang (2013) posited the design of digital games is an ideal tool for enhancing empowerment. The ability to engage in coding and digital media design, combined with opportunities to design and produce authentic digital media for an audience, enhanced empowerment of participants. This empowerment helped to position early adolescents as experts in the design of their digital media in *Scratch* as they negotiated learning a new language to produce texts.

Lapp, Moss, and Rowsell (2012) posited full participation in the 21st century requires the skills strategies, and dispositions necessary to adapt to changing technologies influencing all aspects of life. I argue it is participation and making of 21st century literacy that develops the skills, strategies, and dispositions. Any participation in a programming community is full participation in 21st century literacy. Rather than skills and dispositions, youth need opportunities for full participation. Within a virtual environment like *Scratch*, participation is the primary requirement. The skills and dispositions will develop concurrently via the creation of products within the *Scratch*

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community. Burke et al. (2016) assert the idea of computational participation. The process and product of coding within a programming community provides youth with opportunities to create content as they develop literacy practices required to participate in 21st century literacy. My data demonstrate that computational participation is the key to full participation in 21st century literacy. Participants positioned themselves as lexperts via the making of digital media within the *Scratch* community. I posit that skills, strategies, and dispositions will develop as a result of the creation of digital media within a programming community and are therefore not a requirement for participation.

Discussion: Shifting Literacy Practices of Early Adolescents

Burnett and Merchant (2015) asserted new literacies are continually evolving as new communicative practices flow into life and social interaction and technology co-shape each other. As technology continues to evolve and influence the ways people communicate, there is a need to master a wide range of technological and social competencies (Eshet-Alkalai & Soffner, 2012; Burnett & Merchant, 2015). Digital media technologies and digital materials become part of the socio-material networks youth engage in on a daily basis (Ito et al., 2010). In response, early adolescents are socialized into a wide range of new digital media, which has resulted in a shift in literacy practices. Further, children participate in complex media ecologies that allow a wide range of socio-material interactions (Dezuanni, 2015). Youth are seeking new spaces for communication and composition while accessing a wide range of information sources (Vasudevan, 2010). Early adolescents engage in literacy practices as they interact in these virtual spaces.

Increase in coding. A recent shift in the literacy practices of early adolescents is an increase in the use of coding to create digital media. During the 18 month timeframe of this study the amount of users registered in *Scratch* increased from 3,980,270 to 11,020,750 members. The increase in users represents a 277% growth in the amount of *Scratch* members. This significant increase in the amount of *Scratch* users is indicative of youth exploring new ways to communicate and compose.

The participant experiences in *Scratch* are representative of a shift in the literacy practices of early adolescents. In this study, early adolescents worked in *Scratch* to create and publish digital media via the use of coding. Considered to be the new literacy of the 21st century, coding represents a fundamental and powerful way to establish a presence in the digital world (Burke et al., 2016; Rushkoff, 2010). In this study, early adolescents used coding to engage in meaningful and productive authorship within an online community. Participants engaged in functional, critical, and rhetorical literacies as they designed texts via the use of digital tools and coding. Mills (2011) argued crossing from print to digital modes adds an important layer of complexity to text and knowledge creation. Participants employed available modal resources to shift meaning across modes in order to communicate their message with community members. Further, early adolescents interacted and negotiated with the hardware and software required to effectively create and present their texts. Participants demonstrated the ability to refigure semiotic material across modes, contexts and audience with a new set of tools.

Social interaction and influence on design. Dyson (2006) called for a new way to think about literacy, which is informed by children's lived experiences, their diverse cultural and linguistic resources, and the expanded opportunities for symbolic

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conventions. Wohlend (2010) extended Dyson's call for a new set of literacy basics to include online interaction emphasizing global participation, multiuser collaboration, and distributed resources and knowledge. 21st century literacies involve doing things not only with technologies, but also with others (Underwood et al., 2013). The influence of social media and online interaction shapes and shifts the literacy practices of youth coming of age in a digital and globalized world (Vasudevan, 2010). In this study I determined that early adolescents situated themselves within the programming community and used their understanding of the audience to influence the design of digital media. Via social interaction, *Scratch* members were able to contribute to the design of projects through their interaction with the designers. The role of the audience in the design of participant projects aligns with McLean and Rowsell's (2013) assertion that the process of design is social; it takes into account the presence and active role of the audience. This discourse between designer and audience is representative of a shift toward participatory culture in which youth have an expanded ability to communicate and circulate their ideas and where online communities can help shape their collective agendas.

Meaning-making in *Scratch*. When discussing the shifting literacy practices of early adolescents it is important to consider how meaning is created via the new digital spaces and tools afforded by innovations in technology. New media provides new types of modal ensembles, offering possibilities for representation that rarely or never existed before (Bezemer & Kress, 2009). Such is the case for youth producing digital media within the online community of *Scratch*. The creators of *Scratch* added programmability to media-manipulation activities popular in youth culture while encouraging members to learn coding through exploration and peer sharing. This juxtaposition of coding with the

ability to create digital media provides a new space for creative meaning-making with a new tool.

The types of meaning-making demonstrated by early adolescents in this study ranged from the use of color to communicate emotion and foreshadowing of events to the use of semantic cues for guiding interactive experiences. Mira's use of an Easter egg in her simulation demonstrated genre play, while Zoe's attempt to recast Five Nights at Freddy's into a comedy was an example of recontextualization. While learning how to code, early adolescents were able to concurrently focus on meaning-making as they designed digital media. Further, participants engaged in creative ways of meaning-making via the use of coding and digital media tools. The types of meaning-making demonstrated are similar to the meaning-making practices observed in a study focused on the interaction of early adolescents in *Minecraft* (Burnett & Bailey, 2014). Participants recontextualized a *YouTube* machinima (i.e., use of real-time computer graphics to create a cinematic production), focused on a spoof of *Minecraft*, into an animation in *Scratch*. The findings illustrated how improvisations in different modes create new possibilities as texts and interaction spark each other in different ways to construct new meaning (Burnett & Bailey, 2014).

The meaning-making demonstrated by participants is important to note because it elucidates the potential for *Scratch* to be used with early adolescents in the development of literacy practices. The intuitive block design does not require extensive training in a programming language, which allows digital media designers to focus on plot design, character development, and the content of projects (Yank & Chang, 2013). *Scratch* reduces the barriers to computer programming, enabling early adolescents to easily

develop sophisticated computer programs, whereby members have the potential to create meaning in complex ways.

Additionally, the three core design principles (e.g., more tinkerable; more meaningful; more social) contribute to the potential for early adolescents to engage in sophisticated ways of meaning-making. The single-window user interface and immediate feedback for script execution increased the ability of participants to code as they designed. Participants were able to quickly test whether a code worked and if revision was needed to execute the desired function. The ability to quickly code affords increased attention to meaning-making. Also, emphasis in providing a platform where members can create personally meaningful projects promotes meaning-making. The diversity in the type of projects members are able to create supports varied interests. The ability to easily personalize projects affords personalization in the design process. Further, the social context of *Scratch* allows members to share their projects, receive feedback and encouragement, and learn from the projects of others. These elements of *Scratch* help to promote meaning-making by the designers of digital media in the online programming environment. The varied ways participants created meaning in *Scratch* warrants further research into multimodal semiosis within the context of *Scratch*.

Although I observed creative ways for meaning-making, I also found examples of constrained meaning-making. Another element to consider in the meaning-making of early adolescents designing in *Scratch* are how the tools available constrain meaning-making; especially when coding is required to implement each creation. Zoe and Alexis indicated constrained ability to visually represent their characters. Zoe found it challenging to draw a dragon while Alexis selected an image from the *Scratch* library

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because she was unable to draw a face. It could be argued the image Alexis selected from the library represented her character, however, her modal options were constrained due to the challenge of drawing her character with the tools provided within *Scratch*. Andrew stated he chose to have a wolf disappear after an attack in his digital story because he was unable to create the required code to make him flip on his back after the attack. Rather than having the defeated wolf present during the remainder of the scene, Andrew programmed the wolf to disappear. The coding limitation experienced by Andrew changed the spatial arrangement of his character for the remainder of the scene, thereby potentially reshaping the meaning within the text. McVee, Bailey, and Shanahan (2008) articulated the importance of understanding that affordances and constraints of modes provide choices in how meaning is communicated and represented. As literacy practices are explored in *Scratch* it is important to consider the constraints experienced within the tools provided to create meaning.

Discussion: Subtext of Decisions

The subtext of decisions evidenced by participants provides insight into the literacy practices of early adolescents as they engaged in the creation of digital media to share with an audience in an online programming community. Additionally, the findings help to elucidate how early adolescents positioned themselves as designers of digital media via coding. In addition to composing digital text, participants also employed the use of coding to implement their digital creations. Due to the recent development of and increased access to coding for youth, this is the first study to explore the subtext of decisions as early adolescents created projects in *Scratch*.

Scratch provides a virtual space for new meaning-making practices. The tools used to convey meaning shape the kinds of meanings made (Haas, 1996). The types of decisions made by participants and how they engaged in meaning-making provides insight into how early adolescents used the available tools within Scratch. For example, I observed in the data an emphasis in audience-driven programming by participants as they designed projects. In a study focused on differentiating digital writing instruction for adolescent learners, Martin and Lambert (2015) discovered digital writing tools foster connections between readers and writers and reshape notions of authorship. The emphasis placed on audience by participants in this study during the design and redesign process aligns with the findings of Martin and Lambert (2015). The digital writing tools available in Scratch combined with the social elements of the programming environment resulted in participants engaged in audience-driven programming. The influence of audience in the design and redesign of projects provides insight into the literacy practices of early adolescents and how those practices shift based upon the active role of audience in Scratch.

The meaning-making practices afforded by Scratch are representative of literacies that are hard to gauge in fixed measurable outcomes. Burnett, Davies, Merchant, & Rowsell (2014) argued, "we can no longer easily know where one text ends and another begins or even who wrote what; texts are constantly reworked and remixed, writing shades into design" (p. 155). The culture of remix embedded in the design of Scratch promotes the blending of texts and literacy practices that are challenging to isolate as observable instantiations of practice. Rather, texts and practices blend together as texts are designed, redesigned, and shaped by genre. Instead of attempting to determine fixed

measurable outcomes I sought to explore the nature of literacy practices as early

adolescents created digital media in a programming community. The domains I created

during analysis of data focused on the decisions participants made during the design

process and the positioning of participants as lexperts. I identified specific types of

decisions, including the ways in which participants embedded meaning into digital

media. The domains I created help to elucidate the underlying practices and process of

early adolescents as they create projects within *Scratch*. The subtext of decisions

provides insight into literacy practices and processes that are fluid, multimodal, and

meshed with other social practices.

Limitations

This descriptive case study, although not generalizable, does begin to illustrate the

literacy practices and processes enacted as early adolescents create and remix digital

media in an online programming community. Additional investigations need to occur in

order to look across multiple cases studies to gain enhanced understanding of digital

media literacies within a new social space and with the new tool of programming.

An additional limitation of this case study was the homogeneity of the participant

sample. Four of the five participants were enrolled in an academically gifted program. A

greater number of participants functioning at differentiated ability levels would provide a

more comprehensive composite of the literacy practices and processes of early

adolescents within *Scratch*.

Implications and Future Research

The results of this study provide insight into the literacy practices and process of

early adolescents engaged in the creation of digital media in an online programming

community. In the following sections I discuss the implications for this study as it relates to the literacy practices and process of early adolescents. Next, I consider the gap between in-school and out-of –literacy practices as it connects to the topic of this study. Additionally, I suggest future directions for research.

Literacy practices and processes of early adolescents. Youth are seeking new spaces for communication and composing, accessing a wide range of information sources, searching for new audiences, engaging in new communities, and creating new relationships (Vasudevan, 2010). Exponential growth in technology provides increased meaning-making opportunities with new tools in new spaces as youth come of age in a digital and globalized world. The findings from this study raise important implications regarding the literacy practices and processes of early adolescents engaged in an online programming community and provide directions for future research.

The participant experiences in *Scratch* are representative of a shift in the literacy practices of youth. No longer merely recipients of knowledge, children create and publish an array of texts as they interact within virtual social spaces. As youth explore new ways to communicate and engage in an increasingly globalized world, the ways they engage in meaning-making expand. In response, researchers need to examine the ways youth use new tools within new spaces to create meaning. How does multimodal semiosis occur and shift as digital media is created, shared, and remixed?

Historically, coding has been studied within the context of computer science. This research represents the first study focused on the literacy practices and processes of early adolescents engaged in *Scratch*. Specifically, the findings provide insight into the subtext

of decisions enacted as digital media is designed and redesigned in *Scratch*. The findings in this study provide an introductory step toward enhanced understanding of the ways youth enact literacy practices and processes via the use of coding to create digital media within a participatory culture. The use of coding needs to be explored as it relates to literacy practices and process. How does the use of coding affect the design and redesign of digital media in *Scratch*? What are the affordances and constraints experienced by youth designing and redesigning digital media in *Scratch*? How do these affordances and constraints compare to digital media created in other spaces with other tools? Further research is needed regarding the intertextuality, hybridity, and recontextualization of digital media in *Scratch*. In what ways does *Scratch* afford or constrain intertextuality, hybridity, and recontextualization of digital media? How does the intertextuality, hybridity, and recontextualization of projects in *Scratch* compare to digital media created in other online communities using other tools?

Coding is considered to be the new literacy of the 21st century (Hutchison et al., 2016). As individuals learn to program they also learn the language of coding. Burke et al. (2016) argued the demarcation line between the literate and illiterate is now the capacity to code. I discovered in the data that language is learned in *Scratch* via a concurrent process enacted during the creation of products. Literacy is learned by doing, while language develops in tandem with expertise. Although my findings provide a first step in determining how a language is learned within an online programming community, future research is required. In what ways does development of a process skill influence language acquisition and perceived expertise?

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The construct of genre is undergoing a transformation as technology continues to provide new ways to communicate and reconfigures the conditions to which pragmatic features of language respond (Giltrow, 2009; Miller, 2014). Youth are engaging in virtual spaces, whereby genre is evidenced in the tracks left by their social actions. For example, the feedback provided by a member propels the recipient to reconstruct a text. Or, a member is inspired by a project experienced and the project is then remixed by the member into a new text. Miller's (2014) reconceptualization of genre provides a theoretical framework for researchers to explore the social action enacted within the *Scratch* community.

A trend in literacy research is the notion of embodied literacy (Burnett et al., 2014). The role of feelings, objects and bodies in interactions around and through texts are explored. The design principles (e.g., more tinkerable; more meaningful; more social) of *Scratch* lend themselves toward fostering embodied literacy experiences. Mira's inclusion of interactive experiences in *Grace's House* and the intention of Alexis to embed interactive features into her next project are reflective of young designers embedding embodied literacy experiences into the design of digital media. A next step in research would be to explore how literacy experiences are embodied as youth design and redesign digital media.

Finally, most of the participants in this study were identified as academically gifted and enrolled in a gifted program. The homogeneity of participants and sample size limits the ability to generalize the findings. This study should be replicated using a heterogeneous sample with a larger sample size to confirm if the findings are supported across multiple case studies.

Connections to literacy instruction. Literacy is clearly changing in the world, however, schools continue to privilege traditional texts, beliefs, and print-based forms of reading and writing (Lapp et al., 2012). An emphasis on high-stakes testing constrains literacy skills emphasized by educators and restricts the types of texts valued in classrooms (Burnett et al., 2014; Dennis, 2014). Given the demands of new types of literacies, scholars argue that schools are obligated to prepare students to develop competencies in digital media literacies (Chisholm & Trent, 2013; Kalantzis & Cope, 2012). Although this study is not connected to in-school literacy practices, it is important to consider the implications of *Scratch* within the context of literacy instruction.

The composition skills and strategies employed by youth as they create digital media projects outside of school are the types of skills and strategies educators beg students to enact in the classroom with print-based texts. The process of organizing modes and materializing discourses based on context, rhetorical purpose, knowledge, and skills for the purpose of presenting meaning are included the design of digital media. *Scratch* provides a space for educators to use design as a means to teach functional, critical, and rhetorical literacies in multiple modalities via the use of coding.

Recently, coding has shifted from the context of computer sciences toward literacy. Burke et al. (2016) posited the understanding of coding as an extension of literacy instruction. This positioning of coding within literacy instruction has important implications for connecting in-school and out-of-school literacy practices. The use of a writing workshop model of instruction combined with *Scratch* can be implemented to introduce students to programming as a new type of composition and integrate out-of-school literacy practices. The principles of composition are taught via the creation of

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digital stories in *Scratch*. Students would also be able to engage in the participatory culture within *Scratch* to receive feedback and mentorship regarding their digital stories. Future research is needed to explore the use of *Scratch* as an extension of literacy instruction.

Closing Thoughts

The focus of this study was of interest for professional and personal reasons. As a literacy researcher and teacher educator specializing in literacy studies, I am interested in learning about digital media literacy practices and processes. On a personal level, my daughter introduced me to the world of *Scratch* and digital media created via coding. My daughter enhanced this study by providing an insider perspective, which contributed valuable insight into the community of *Scratch*.

My objective in completing this research was to inform understanding of how literacy practices and processes are enacted as early adolescents create digital media in *Scratch*. It is my hope this study will inform future research to further explore literacy practices and processes within the context of coding and the creation of digital media. Additionally, I want this research to challenge educators to consider how to integrate coding and the creation of digital media into curriculum in meaningful ways to support the development of 21st century literacies. It is time to think more progressively about what literacy means in the context of a digital and globalized society and how to prepare youth to become proficient in functional, critical, and rhetorical literacies in multiple modalities and technologies.

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APPENDICES

Appendix A: Programming Concepts and Skills Supported in *Scratch*

PROGRAMMING CONCEPTS AND SKILLS SUPPORTED IN SCRATCH

In the process of creating interactive stories, games, and animations with Scratch, young people can learn important computational skills and concepts.
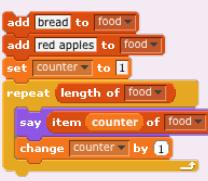
PROBLEM-SOLVING AND PROJECT-DESIGN SKILLS
• logical reasoning
• debugging problems
• developing ideas from initial conception to completed project
• sustained focus and perseverance

FUNDAMENTAL IDEAS ABOUT COMPUTERS AND PROGRAMMING
• Computer programs tell the computer precisely what to do, step-by-step
• Writing computer programs doesn't require special expertise, just clear and careful thinking
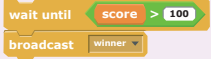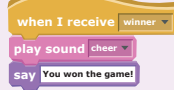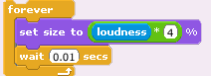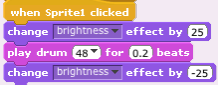
SPECIFIC PROGRAMMING CONCEPTS

Concept	Explanation	Example
sequence	To create a program in Scratch, you need to think systematically about the order of steps.	
iteration (looping)	**forever** and **repeat** can be used for iteration (repeating a series of instructions)	
conditional statements	**if** and **if-else** check for a condition.	
variables	The **variable** blocks allow you to create variables and use them in a program. The variables can store numbers or strings. Scratch supports both global and object-specific variables.	
lists (arrays)	The **list** blocks allow for storing and accessing a list of numbers and strings. This kind of data structure can be considered a "dynamic array."	

http://scratch.mit.edu   SCRATCH

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Appendix A (Continued)

Concept	Explanation	Example
event handling	**when key pressed** and **when sprite clicked** are examples of event handling – responding to events triggered by the user or another part of the program.	when [left arrow] key pressed / point in direction -90 / move 10 steps
threads (parallel execution)	Launching two stacks at the same time creates two independent threads that execute in parallel.	when [flag] clicked / glide 3 secs to x: -75 y: 80 / glide 5 secs to x: 175 y: -130 / when [flag] clicked / forever / next costume / wait 1 secs
coordination and synchronization	**broadcast** and **when I receive** can coordinate the actions of multiple sprites. Using **broadcast and wait** allows synchronization.	For example, Sprite1 sends the message *winner* when this condition is met: / wait until score > 100 / broadcast winner / This script in Sprite2 is triggered when the message is received: / when I receive winner / play sound cheer / say You won the game!
keyboard input	**ask and wait** prompts users to type. **answer** stores the keyboard input.	ask What's your name? and wait / say join Hello, answer
random numbers	**pick random** selects random integers within a given range.	set x to pick random -100 to 100
boolean logic	**and, or, not** are examples of boolean logic.	when space key pressed / if touching color ? and x position > 200 / change score by 1 / play sound music until done
dynamic interaction	**mouse_x, mouse_y,** and **loudness** can be used as dynamic input for real-time interaction	forever / set size to loudness * 4 % / wait 0.01 secs
user interface design	You can design interactive user interfaces in Scratch – for example, using clickable sprites to create buttons.	when Sprite1 clicked / change brightness effect by 25 / play drum 48 for 0.2 beats / change brightness effect by -25

PROGRAMMING CONCEPTS NOT CURRENTLY INTRODUCED IN SCRATCH:
- procedures and functions
- parameter passing and return values
- recursion
- defining classes of objects
- inheritance
- exception handling
- file input/output

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Scratch is developed by the Lifelong Kindergarten Group at the MIT Media Lab.

See http://scratch.mt.edu.

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Appendix B: *Scratch* **Copyright Information**

5. Scratch Content and Licensing

5.1 Except for any user-generated content, the Scratch Team owns and retains all rights in and to the Scratch code, the design, functionality, and architecture of Scratch, and any software or content provided through Scratch (collectively "the Scratch IP"). If you want to use Scratch in a way that is not allowed by these Terms of Use, you must first contact the Scratch Team. Except for any rights explicitly granted under these Terms of Use, you are not granted any rights in and to any Scratch IP.

5.2 Scratch provides support materials, including images, sounds, video, and sample code, to help users build projects. Support materials are licensed under the **Creative Commons Attribution-ShareAlike 2.0** license. You may also use screenshots of Scratch under the same license. Please note that this does not apply to materials that are also trademarked by the Scratch Team or other parties as described in parts 5.4 and 5.5, below.

The **Creative Commons Attribution-ShareAlike 2.0** license requires you to attribute any material you use to the original author. When you use Scratch support materials, or screenshots of the Scratch website, please use the following attribution: "Scratch is developed by the Lifelong Kindergarten Group at the MIT Media Lab. See http://scratch.mit.edu."

5.3 The source code for Scratch 1.4 is available for download and subject to the copyright notice as indicated on the **Scratch FAQ** page.

5.4 The Scratch name, Scratch logo, Scratch Day logo, Scratch Cat, and Gobo are Trademarks owned by the Scratch Team. The MIT name and logo are Trademarks owned by the Massachusetts Institute of Technology. Unless you are licensed by Scratch under a specific licensing program or agreement, you many not use these logos to label, promote, or endorse any product or service. You may use the Scratch Logo to refer to the Scratch website and programming language.

5.5 The Scratch support materials library may contain images and sounds that are trademarked by third parties. The fact that materials are included in the Scratch support materials library does not in any way limit or reduce intellectual property rights, including trademark rights, otherwise available to the materials' owners. Nothing in these Terms of Use or the Creative Commons 2.0 license will be construed to limit or reduce any party's rights in that party's valid trademarks. You may not use these materials to label, promote, or endorse any product or service. You are solely responsible for any violation of a third party's intellectual property rights caused by your misuse of these materials.

Appendix C: Sample Interview Guide

1) Why did you decide to join *Scratch*?
2) What are some things you like to do in *Scratch*?
3) How do you communicate with *Scratch* members?
4) Q: Why did you create Grace's House? What was your objective?
5) Q: Tell me about Grace and her connection to Studio Starland.
6) Q: How did you decide upon Blue Fairy Forest as the beginning music?
7) **SLIDE 1**: How did you decide upon the colors to use? Why did you decide to have the letters bounce?
8) **SLIDE 2**: 1) Why did you decide to have Grace say "Hiya" (instead of "Hi" or "Hello")? 2) What were you thinking as you created the inside of Grace's house? 3) How did you decide upon the shape of Grace's eyes? 4) Tell me about the items on her dress.
9) **SLIDE 3:** What did you want Grace to communicate?
10) **SLIDE 4:** Why did you choose to add the aquarium and flower after the conversation with Grace? Why did you decide to include interactive features? How did decide upon the features to include?
11) **SLIDE 5:** At what point during the design of Grace's house did you decide to make Blaze interactive?
12) **SLIDE 6:** Why are Sparks' eyes different in the discussion box?
13) **SLIDE 7:** How did you create the effect of turning off the light in Grace's bedroom? Why did you keep the arrow and cat bright?
14) **SLIDE 8:** What made you decide to include a wardrobe activity? How did you determine the wardrobe choices? Describe how you implemented the coding for the wardrobe activity. What were you thinking as you created the items for Grace's wardrobe? What prompted you to create a 4th of July outfit for Grace?
15) **SLIDE 9:** Why did you choose to show Grace with her hair down?
16) **SLIDE 10:** What made you think to program the radio? How did you select each song to by played on the radio? What does the grey arrow on the TV represent?
17) **SLIDE 11:** Why did you decide to include tv channels? Tell me about this tv channel. Why did you decide to include *Scratch*? How did you determine what to include in the image?
18) **SLIDE 12**: Why did you use the orange on the counters? Ask additional questions regarding the design.
19) **SLIDE 13:** It is interesting to note the face on the cat food box contains eyes, nose, and mouth while Grace's cats found throughout the house only contain eyes. Can you tell me more about that?
20) Q: What changes or additions did you make based upon comments received from *Scratch* members?
21) Tell me about the Math Bulletin board. What was your purpose in creating it?
22) In the notes and credits section you stated, "I found this somewhere in my unshared projects just sitting there". What made you decide to publish Math Bulletin Board?
23) **SLIDE 14**: How did you decide upon the colors to use? Why did you select those shapes? Why did you have the shapes move? How did you select the music? Why did you choose this song?
24) **SLIDE 15**: How did you decide upon the content to include within each shape?
25) **SLIDE 16**: Why did you decide to include a quiz? How did you decide upon the questions to ask in the quiz? Describe how you were able to make the quiz interactive. How did you implement the coding for this?

Appendix D: Methods Chart

	Method Description	Steps	Method Purpose	Location
Phase 1				
Content Analysis	I analyzed artifacts to determine observable literacy practices embedded within the design and collaboration of products and how the modes interact. I used a multimodal analytic approach (Domingo, 2011; 2014). Transcription frames were used to analyze products created and remixed. No fewer than ten frames and no more than 25 frames were selected for analysis. Each frame included a segment bar with the artifact title and artifact theme. Then, a body frame was completed, which accounted for each mode used in the segment. Finally, I completed a narrative description. I included reflexive notes in the narrative description to link each segment of the analysis to the overall textual product. Reflexive notes included observations made regarding member communication related to the product. **Length of Data Creation**: all published projects **Scope/Amount**: 10 – 25 frames per artifact	1) selected artifacts to analyze; researcher selected a variety of artifacts (e.g., digital story, game, music video); no more than five artifacts for each participant were analyzed 2) viewed artifacts and member communication connected with artifacts analyzed to determine observed literacy practices 3) completed analysis of multimodal transcription frames to identify how modes interact; color codes were used to represent sound effects and visual effects	* identify literacy practices *understand the relations among modes; how they interact	N/A
Rationale	The completion of transcription frames as outlined by Domingo (2012) provided a methodological approach for both a linear/temporal and a layered/spatial analysis of multimodal data. Ten frames were representative of modal interaction for artifacts of limited length while up to 25 frames provided flexibility to use the appropriate number of frames to represent modal interaction.	Selecting a variety of artifacts provided a comprehensive view of literacy practices and processes found within the online community studied.		

Appendix D (Continued)

	Method Description	Steps	Method Purpose	Location
Stimulated Recall	Upon completion of the content analysis, I created semi-structured interview questions to explore the literacy processes used to create and remix products. Questions focused on the design choices made by participants. I included open-ended questions to examine the language/terminology used to describe products created and the content discussed. For example, does the participant discuss elements of coding or audience reaction? I selected specific frames to include as part of the stimulated recall. Criteria for selection of frames for the interview focused on frames representative of multifaceted literacy practices and/or frames representing complex modal interaction, I added participant responses to the narrative description of the applicable transcription frames. Additionally, screenshots of member communication related to creation of products were included in the interview when applicable. **Length of Data Creation**: The duration of interviews ranged from 35 minutes to 55 minutes, dependent upon participant responses. **Scope/Amount**: The scope of the each interview was dependent upon each participant. My objective was to uncover as much as possible regarding participant literacy processes and practices. Each interview concluded when participants appeared to be disengaged or responses no longer lead to new information.	1) selected transcription frames to include in the stimulated recall interview; at least two transcription frames from each product analyzed were selected; frames were included in a PowerPoint to view during the stimulated recall 2) created specific questions focused on each transcription frame; questions related to the literacy practices employed, features of the projects and design choices made; participants were asked to articulate how they composed the product 3) at least three open-ended questions related to literacy practices were created 4) interviewed the participant 5) transcribed responses were added to the applicable transcription frames 6) completed inductive analysis	* expand upon observations made during the content analysis * further explore the literacy practices observed during the content analysis * elucidate the design choices made by participants * explore terminology and content used during open-ended question responses	Home of participants, if available; a local place (e.g., library)

Appendix D (Continued)

	Method Description	Steps	Method Purpose	Location
Rationale	The use of a semi-structured interview approach provided flexibility to modify or add questions based upon participant responses. Open-ended questions helped to gauge the language and terminology used to describe products created and literacy experiences within the context studied. Numbering the transcription frames and referencing the number during the interview helped to connect participant responses to specific frames. The selection of frames representing sophisticated literacy practices and modal interaction provided an opportunity to delve deeper into the research questions explored. Screenshots of member communication helped to explore literacy practices outside the transcription frames. I wanted to be cautious about setting an arbitrary time limit on the semi-structured interviews. Participants indicated when they were finished (verbal or non-verbal) or I ended when responses no longer revealed new information.	Two transcription frames for each product analyzed helped to delve into the literacy practices used to create the frame and design choices made, without overwhelming the participants. Embedding the frames used during the recall in a PowerPoint helped participants to have visual access to the images referenced in the questions.		

Appendix D (Continued)

	Method Description	Steps	Method Purpose	Location
Phase 2				
Participant Observation	I completed analysis of the Phase 1 data prior to participant observations. Participants were asked to work on a product that was in process or to begin a new product. If the product was in process, I asked the participant to provide background information regarding how the product began and what was created to date. I used verbal probing (Willis, 1999; Willis, DeMaio, & Harris-Kojetin, 1999) to evaluate the thought-processes and decision making while participants created or remixed a multimodal product. I used general and specific probes to explore the choices made during the design process. I videotaped the participant observation using the Photobooth app on iPad and recorded via the Voice Memo app on the iPhone. Duration of participant observations ranged between 30 to 45 minutes. **Length of Data Creation**: 30 – 45 minutes **Scope/Amount**: Focus was on the design process rather than product size. The objective was to acquire an understanding of the design process participants used during the creation of each artifact, rather than completion of the artifact. As a result, products varied in size. Rather, the focus was on delving deeper into the design process within the given conditions.	1) scheduled observation after completed analysis of Phase 1 data 2) participants identified the product they wanted to create or remix; if an in-process product was selected the participant was asked to provide background knowledge regarding how the product began, what has been completed, and what will be accomplished during the observation; if a new product was selected the participant was asked to describe what they hoped to accomplish 3) participants were asked general and specific probes during the observation 4) the observation was concluded when the participant completed the product or expressed a desire to end the observation 5) transcribed audio recording and selected transcription frames to analyze 6) completed inductive analysis and data triangulation	*to explore the design process of participants	Home of participants, if available; or a local place (e.g., library)

Appendix D (Continued)

	Method Description	Steps	Method Purpose
Rationale	The observation was more naturalistic if participants were given a choice in the type of product to create. Use of verbal probing provided a direct verbalization of cognitive processes. Verbal probing helped to focus discussion on specific elements of the design process. A video recording provided screenshots of the design process to analyze. An audio recording provided a means to transcribe responses to verbal probing.	Phase 1 data was analyzed first in order to acquire a broad sense regarding the level of literacy for each participant, in addition to gaining understanding of the terminology and thinking related to literacy practices and processes.	

Appendix E: IRB Certificate

Certificate of Completion

Julia Hagge

Completed the Social / Behavioral Investigators and Key Personnel
Refresher Course

on Sunday, November 23, 2014

USF
UNIVERSITY OF
SOUTH FLORIDA

CITI Certificate ID#: 14477

Appendix F: IRB Study Approval

April 30, 2015

Julia Hagge
Teaching and Learning
Tampa, FL   33647

RE: **Expedited Approval for Initial Review**
IRB#: Pro00021711
Title: Programming for Literacy: Embedded Literacy Practices within an Online Programming
         Community

Study Approval Period: 4/30/2015 to 4/30/2016

Dear Dr. Hagge:

On 4/30/2015, the Institutional Review Board (IRB) reviewed and **APPROVED** the above
application and all documents outlined below.

Approved Item(s):
Protocol Document(s):
Programming for Literacy Protocol

Study involves children and falls under 45 CFR 46.404: Research not involving more than
minimal risk.

Consent/Assent Document(s)*:
Parental Informed Consent Form.pdf
Participant Assent Form.docx.pdf

*Please use only the official IRB stamped informed consent/assent document(s) found under the
"Attachments" tab. Please note, these consent/assent document(s) are only valid during the
approval period indicated at the top of the form(s).

It was the determination of the IRB that your study qualified for expedited review which
includes activities that (1) present no more than minimal risk to human subjects, and (2) involve
only procedures listed in one or more of the categories outlined below. The IRB may review

research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review category:

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John A. Schinka, Ph.D.

John Schinka, Ph.D., Chairperson
USF Institutional Review Board