EMPOWERING GIRLS AS CHANGE MAKERS IN MAKER CULTURE: STORIES FROM A SUMMER CAMP FOR GIRLS IN DESIGN, MEDIA & TECHNOLOGY

by

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ABSTRACT

This dissertation investigates how girls develop new affinities towards and capabilities in media and technology. Thirty co-researchers, girls aged 10 to 13, were recruited into *101 Technology Fun*, a series of summer camps with learning labs in animation, game design, movie production, robotics programming, and web development. The design studio setting, created by the How We Learn (Media & Technology Across the Lifespan) collective, offered girls their own makerspace to explore new roles as media and technology producers. Highlighting the importance for youth voices to be recognized and given influence in the academic research concerning their lives and learning circumstances, the findings focus on the catalytic or generative artifacts and "little stories" (e.g., Lyotard's *petits récits*) revealing the co-researchers' experiences and expressions of *girlhood-in-interaction-with-technology* (the key unit of analysis).

Artifacts are addressed as they relate to stories made or analyzed by the girls, including their concerns, needs, talents, inspiration, literacy, and volition. The artifacts, such as music videos, robotic amusement park, and the *momME* alternate reality game, are catalytic for storymaking and, symmetrically, the stories are catalytic to artifact production and sharing. Four distinct yet interrelated elements characterize the co-researchers' fieldwork and designworks: (1) *agency* (girls having influence and power); (2) *ingenuity* (girls being clever and inventive); (3) *self-interpretation* (girls making sense and significance); and (4) *self-efficacy* (girls believing in or judging their technological capabilities).

Findings underscore the matter concerning how, why, and where do girls learn to become innovators, leaders, and producers of media and technology (thereby overturning traditional gender and generational stereotypes)? Indeed, *how* a group of female youth story

changes in their sense of technological self-efficacy, self-interpretation, ingenuity, and agency is one of the most important contributions of this study. Another contribution involves the formation of the Tween Empowerment & Advocacy Methodology (TEAM), a design-based and participatory research approach that emphasizes relational ethics through artifact production, storymaking, mind scripting, invention, and imagination. Questions, both guiding and emergent, are articulated in artifact and text to motivate further scholarly inquiry, action, and advocacy, thus generating more opportunities for girls to participate in, design, make, and transform technology culture.

PREFACE

This dissertation is original, unpublished, and independent research by the lead author, Paula MacDowell (formerly Paula Rusnak). As the lead investigator, I designed, conducted, and reported this study with the assistance of Dr. Stephen Petrina, Dr. Franc Feng, Dr. Sandra Scott, and the graduate team of researchers assembled in the How We Learn (Media & Technology Across the Lifespan) lab. Ethics approval for this research was provided by the University of British Columbia Behavioural Research Ethics Board: certificate #H06-80670. All of the artifacts and stories were produced in close collaboration with the *101 Technology Fun* co-researchers (thirty girls ages 10 to 13). I remain solely responsible for the content of this dissertation, including any errors or omissions.

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Adolescent Self-Perception Inventory (ASPI)

Advancing Excellence in Technological Literacy (AETL)

Alternate Reality Game (ARG)

Design-Based Research (DBR)

How We Learn (HWL)

International Technology Education Association (ITEA)

Public Service Announcement (PSA)

Qualitative Data Analysis (QDA)

Questions Concerning Girls (QCG)

Questions Concerning Technology (QCT)

Science, Technology, Engineering, Mathematics (STEM)

Standards for Technology Literacy (STL)

Tween Empowerment & Advocacy Methodology (TEAM)

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I draw these Acknowledgements to a close with two inspiring quotations. The first

from one of my design heroes and guiding lights, Buckminster Fuller, who made a

remarkable practice of questioning things: "Unconscious decisions have consequences. Our

assumptions drive our priorities, and in many cases we don't even acknowledge they are

there…. Innovation arises from questioning the old assumptions" (quoted in Sieden,

1969/2011, p. 95). A second from Miriam Brody's introduction to a modern reprint of

Wollstonecraft's (1792) *A Vindication of the Rights of Woman,* one of the earliest works of feminist philosophy:

> It is useless, then, to seek to reform women alone, without speaking about a general reformation of all society. For the same economic and social system which oppresses women, and limits their rational development, contains, and restricts with the exercise of arbitrary power vast numbers of men as well (1975, p. 47).

To all of my co-researchers: you are the heart and soul of this project, and I cherish our time together at *101 Technology Fun*. I thank each of you for enriching my dissertation with your compelling arguments, ingenuity, inquisitiveness, and vitality. Never forget to do your own research and question taken-for-granted assumptions. Never lose sight of your dreams to make a difference. Know that you are the change makers and designers of our technology futures. May you continue to expand horizons and apply your diverse talents towards designing a brighter world for girls.

On behalf of my team, we sincerely thank our readers for your engagement with our stories and hope that you learn more about girls by reading them. Our technology futures are bound together, hence we need to work collectively such that learners of all ages and abilities can have the status, rights, and freedoms to realize their dreams and greatest capacity-to-be in ways that are simultaneously being-for-the-world. We will know we have done enough work when: "expectations will not be set by gender but by personal passion, talents, and interests" (Sandberg, 2013, p. 169). Although we have a long journey ahead to bring forth the ingenuity, intelligence, and greatness of girls, the *101 Technology Fun* vision is a powerful one that is deeply respectful of young people, and it serves as a caring foundation for the kind of world that I want my children to live in and help to create.

101 Technology Fun @ UBC

DEDICATION

To my creative daughter Jasmine who is a continuous
source of light, love, and inspiration in this study.

introduction

Artifact 1. 101 Technology Fun Website
[www.101technologyfun.com]

CHAPTER 1: INTRODUCTION

1.1   RESEARCH PURPOSE

This dissertation directs attention to girls' participation in, artifacts from, and stories about technology. For at least the past 30 years, females as a group are significantly under-achieving and under-represented in technology-related academic fields and professions.[1] Although today's girls are the most avid, if not the most creative, technology users of any generation, they continue to be marginalized in its development and innovation (Farmer, 2008; Kearney, 2006; Sandberg, 2013; Sandberg & Grant, 2015). This has serious consequences for girlhood, womanhood, and the future of technology in terms of innovation capacities and diversity of perspectives: "If technology is designed mostly by the half of our population that's male, we're missing out on the innovations, solutions, and creations that 50% of the population could bring" (Ashcraft, Eger & Friend, 2012b, p. 4).

In education, considerable under-enrollment or low rates of participation in technology-intensive courses in the British Columbia K–12 system (Braundy, 2012; Braundy, O'Riley, Petrina, Dalley & Paxton, 2000; Bryson, Petrina, Braundy & de Castell, 2003) and high schools throughout Canada and the United States (Hill, 2009; Legwie & DiPrete, 2014) hints at why this is the case in workplaces. How might we increase girls' influence and participation in technology culture? What are the consequences of not hearing

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[1] e.g., AAUW, 2000; Ashcraft & Blithe, 2010; Brunner & Bennett, 2002; Camp, 2001; Bryson, Petrina, Braundy, & de Castell, 2004; Cassell & Cramer, 2008; Denner et al., 2005; Doyle, 2013; DuBow, 2011; Edwards, 2002; ESA, 2014; Farmer, 2008; Freeman, 2004; Gee & Hayes, 2009; Girls Action Foundation, 2011; Goetz, 2010; Hafkin, 2006; Hill, 2009; Hill, Corbett & St. Rose, 2010; Honey et al, 1991; Kearney, 2006; Kelleher, 2006; Kramarae, 1998; Legwie & DiPrete, 2014; Leonard, 2003; Lewis, 1987; Lipkin, 2009; Rusnak, 2010a, 2014a, 2014b; Sandberg, 2013; Schwartz-Cowan, 1995; Steeves, 2014; Turkle, 1988; Wajcman, 1998, 2004; Weber, 2007; Weinberg, 1987.

or silencing their voices? Rather than helping females adapt to the predominantly male world of technology, how can we ensure that their experiences, ideas, needs, and values are represented in ways that result in the creation of more equitable, meaningful, and sustainable technology futures?

My position is that girls need affirmation and support for maintaining their sense of identity within a historically masculine culture of technology that continues to dominate such that girls distance themselves from its fields, careers, symbolism, and ideologies (AAUW, 2000; Farmer, 2008; Sandberg, 2013; Sandberg & Grant, 2015). As a result of their evident ambivalence toward and disidentification from technology, girls are not establishing the confidence, interests, literacies, mindsets, and tools that are necessary for them to fully benefit from or to participate in advancing our increasingly media-driven and technologically dependent society (Camp, 2001; DuBow, 2011; Kearney, 2006). Hence, the design-based research (DBR) setting of my study, a *101 Technology Fun* summer camp, was created by the How We Learn (Media & Technology Across the Lifespan) (HWL) team to support tween-aged girls in developing new affinities towards and capabilities in media and technology through hands-on design, invention, and imagination.

A core of 30 girls (ages 10 to 13) participated in the makerspace design community (a form of maker movement culture, UBC campus) with learning labs in game design, image editing, movie making, robotic programming, animation, and web design (Artifact 1). The girls were placed in empowering roles as technology co-researchers and designers (e.g., game designer, graphic artist, media producer, and robotics engineer) and challenged to:

1. Take sensible risks in pursuing their media and technology-related interests, talents, and concerns (Cassell & Cramer, 2008; Goldman-Segall, 1998; Hill & Smith, 2005; Kafai, 1995, 2006; Kelleher, 2006; Weber, 2007; Wilson, 2013).

2. Define and solve design problems of their own volition (Bottrill, 1995; Cross, 2006; Druin, 1999; Edwards, 2002; Hill, 2010; Petrina, Feng & Kim, 2008).

3. Identify, negotiate, and question the gender stereotypes in their currently held beliefs or unconscious biases, and within hegemonic techno-cultural discourses (Allhutter, 2012; Bach, 1998; Farmer, 2008; Kearney, 2006).

4. Discover the amazing things that girls are capable of achieving when supported with equitable education in technology (Denner et al., 2005; Sandberg, 2013).

Highlighting the importance for girls to be recognized and given influence in the educational research concerning their own lives, the purpose of my study is to give voice, visibility, and vitality to how a team of girls "story" themselves within a media and technology-rich learning environment. The girls' stories refer to how they articulate and reflect upon their transformative learning experiences of identity construction, meaning making, and knowledge production at *101 Technology Fun*. Using innovative research techniques such as artifact production, storymaking, and mind scripting, I provoked my team to generate their own insights about how girls are held back and how they hold themselves back within technology cultures (Allhutter, 2012; Sandberg, 2013). My commitment is to get the co-researchers to identify and examine the taken-for-granted and unquestioned ways in which they position themselves into (and are positioned by) technological discourses. This involves careful attention to supporting the development of tech-savvy female youth who resist and reconfigure (rather than simply receive and reproduce) their doubly insubordinate status in technology; both gender and generational dynamics have historically marginalized girls' involvement (DuBow, 2011; Honey et al., 1991; Wajcman, 2004; Weinberg, 1987).

Building upon feminist technology and girl empowerment approaches, my research begins by engaging girls with the hands-on, heads-on, hearts-on, and feet-on experiences as designers and researchers of technology (Petrina, Feng & Kim, 2008). My commitment is to

develop new ways of inquiring into the complexity of girl/media/technology relationships such that the co-researchers and relevant others will be challenged to question and transform the outdated and oppressive techno-cultural scripts written about girls that serve to justify, produce, and perpetuate gender inequity— and thereby restrict girls' opportunities to benefit from and contribute to media and technology culture (Rusnak, 2010a, 2014b).

1.2 RESEARCH PROBLEM

The research problem focuses on how a group of tween-aged girls story themselves through their design, media, and technology practices— in their own ways, on their own terms, and for their own purposes— not merely as consumers, child users, or "surrogate boys or men" (within the locale and maker culture of *101 Technology Fun*) (Kearney, 2006; Wajcman, 1998, 2004). I am particularly interested in understanding: (1) how or why the co-researchers articulate and reflect upon the ways they are thinking and the meanings of their storied selves as they make and share artifacts; (2) interdependencies between their artifacts and stories; and (3) changes inspired by generating and hearing different stories such that my team and I can come to understand each other and technology from diverse perspectives (e.g., beyond hegemonic techno-cultural perspectives about who girls are, what they *should* be, and how they *should* act) (Allhutter, 2012; Bach, 1998; Mallan, 2003).

The key unit of analysis is *girls-in-interaction-with-technology-and-stories,* wherein artifacts and stories are made, shared, and reproduced (Petrina, Feng & Kim, 2008). I address individual girls to the degree that they are *in-interaction-with-technologies* or each other in artifact production and storymaking. Similarly, I am interested in artifacts inasmuch as they relate to stories made or analyzed by my team (e.g., how the co-researchers negotiate the

implicit and explicit ways in which they position themselves into well-established and popular techno-cultural discourses) (Allhutter, 2012; Kearney, 2008). The artifacts were and are catalytic for storymaking and, symmetrically, the stories were and are catalytic to artifact production and sharing (Goldman-Segall, 1998; Lewis, 2011; Mallan, 2003). The specific dataset selected for my study focuses on the catalytic or generative "little stories" (e.g., Lyotard's *petits récits*) and agentive artifacts that reveal how a girl-led design team develop new affinities towards and capabilities in media and technology (Denner et al., 2005; Lyotard, 1984). This is a question of the catalytic validity of our artifact and storymaking practices within our DBR community (Kovach, 2009; Lather, 1986).

1.3 RESEARCH QUESTIONS

Grounded in the realities of the co-researchers' artifacts and stories, which are significant carriers of meaning and knowledge, I examine two primary questions:

- How do girls, through their artifact making and *designerly* practices, story themselves and express their understandings of technology (e.g., how do girls articulate their experiences of *girlhood-in-interaction-with-technology*)?

- What are the implication of adopting *designerly* roles (e.g., game designer, graphic artist, media producer, and robotics engineer) in terms of developing girls' capabilities in media and technology?

Two secondary questions, relevant to the research purpose and problem, are addressed:

- How do we educate tween-aged girls to identify, interrupt, and transform the oppressive stereotypes in media and technology cultures about who girls are, what they *should* be and how they *should* act (e.g., how do we get girls to understand the taken-for-granted beliefs, norms, and value systems within well-established and hegemonic techno-cultural discourses)?

- How do we empower today's girls to grow up as a new generation of tech-savvy leaders of change who possess the tools, capabilities, and initiative to take sensible risks in designing more equitable and sustainable technology futures?

1.4   RESEARCH BACKGROUND & RATIONALE

This research has been ongoing and evolving for the past five years and is part of a larger project and lab mobilized around the HWL project (http://blogs.ubc.ca/howwelearn), within the Department of Curriculum and Pedagogy at the University of British Columbia. The HWL lab, funded through various agencies including the Social Sciences and Research Council of Canada (SSHRC), sponsors and supports a range of undergraduate, MA, MEd, and PhD research theses. My study design and *101 Technology Fun* camps were developed and conducted in close collaboration with Dr. Stephen Petrina (my Supervisor), Dr. Franc Feng, and the graduate team of researchers assembled in the HWL lab (Petrina, Feng & Kim, 2008; Petrina et al., 2010; Petrina et al., 2014). My doctoral work, funded through my Supervisor's SSHRC SRGs, including the most recent in collaboration with Dr. Feng, and my own SSHRC Doctoral Fellowship, has developed in accordance with the objectives articulated in the HWL lab and is covered by my Supervisor's Research Ethics Board applications and certificates (Appendices A–F).

Previous studies identify the age 10 to 14 demographic as the optimal time for working with girls to support their technology related interests and encourage a positive disposition towards technology careers (e.g., AAUW, 2000; Denner et al., 2005; Farmer, 2008; Kearney, 2006; Kelleher, 2006; Weber, 2007). Hence, I worked closely with the HWL team to develop and supervise *101 Technology Fun*, a series of intensive research and design camps held in various media and technology-rich labs on the UBC campus (five one-week sessions were held during the summers of 2008, 2009, and 2011). Eleven energetic co-researchers (girls ages 10 to 13) participated in *101 Technology Fun* 2009 (July 27–31), positioned in roles of game designers with real-world design challenges, heuristics, and

enabling constraints. Research successfully continued in the summer of 2011 (July 18–22 and July 25–29) as another lively team of 21 girls (ages 11 to 13) participated in a makerspace community with learning labs in animation, graphic design, movie making, robotics programming, and website development. Table 1 provides an overview of our data collection events and focuses. Registration was complimentary, and lunch, snacks, and prizes were included, but space was limited. Hence, girls were required to apply by submitting a short summary describing why they wanted to participate. Fortunately, I was able to accept all applicants, which included girls from diverse racial and socio-economic backgrounds. As indicated on both their camp applications (see Table 3 in Chapter 2) and technology skills surveys, none of my 30 co-researchers had any previous experience designing their own computer games or programming robotics; they were nervous yet excited to learn how.

Table 1. Data Collection Procedural Timeline

VENUE	DATE	PARTICIPANTS	FOCUS
101 Technology Fun Camp Pilot	July 2008	14 girls and 15 boys; Ages 7–14	Gaming, Robotics, Technology Research
101 Technology Fun Camp 1	July 2009	11 girls (5 from Pilot Study); Ages 10–13	*momME* Game Design, Technology Research
101 Technology Fun Camp 2	July 2011	10 girls (1 from Pilot and Camp 1); Ages 11–13	Designworks, Robotics, Technology Research
101 Technology Fun Camp 3	July 2011	11 girls (1 from Pilot and Camps 1 & 2); Ages 11–13	Designworks, Robotics, Technology Research
Total for dissertation dataset: 30 unique girls (from the 101 Technology Fun Camps 1, 2, 3)			

Drawing upon DBR practices that are inclusive of and sensitive towards girls, my study also seeks to provoke scholarly reflection about what it means to do research with youth, asking: what are children's rights and roles concerning the knowledge made

about, for, from, and with/against them (Bach, 1998; Goldman-Segall, 1998; Scott, 2007)? Despite the fact that my study findings are based on a small team of co-researchers and are not intended to be representative of all girls, they reveal some of the ways that diverse cultural constructions of media and technology are appropriated, negotiated, rejected, and remade by girls through their design activities and storymaking processes. My participatory and learner-centered approach, in all its creativity, emotionality, and originality, offers new dimensions to current understandings of how technology shapes our notions of girlhood and girl culture, and the ways that girls see themselves within well-established and hegemonic techno-cultural discourses (Farmer, 2008; Rusnak, 2014a, 2014b; Turkle, 1988).

While big or grand narratives may be articulated, my study findings focus on the more modest and localized "little stories" that my team contribute within the domain of the *101 Technology Fun* maker-culture camp (Goldman-Segall, 1998; Lyotard, 1984). Girls' stories enable access to the emotional, physical, social, spiritual, and virtual worlds in which they make meaning, construct identity, and come to know what they know about technology and girlhood (e.g., girls believe, dream, doubt, hope, fear, love, learn, remember, feel, see, think, and wonder in story) (Hardy, 1994; Langellier & Peterson, 2004; Lipkin, 2009). Girls' stories can simultaneously express underlying emotions and intellect, thereby making visible the complex and multi-dimensional understandings that they have about their lives, selves, and worlds *in-interaction-with* media and technology (Allhutter, 2012; Bottrill, 1995; Lewis, 2011; Mallan, 2003; Petrina, Feng & Kim, 2008).

Although they are value laden, dynamic, and subjective meanings are present, I maintain that my team's storied understandings are as epistemologically valuable as quantitative and scientific findings. My study of girls and maker culture, like other design-

based inquiry, is a particular form of constructed knowledge designed by particular research processes to serve purposes for which the researcher is held accountable (Denner et al., 2005; Freeman & Mathison, 2009; Kovach, 2009; Lather, 1986; Law, 2004; Seidel, 1998). As Goldman-Segall (1998) advises, I believe that a key value of educational research is:

> to invite others to explore how we see the world… We do not end our search by understanding our own perspectives; that is where we begin our journey. We build out from the center to fringes that may, in turn, become new centers. And we continue learning by looking for new perspectives that deepen and broaden our ways of looking at the world around us (p. 273).

1.5   DEFINITIONS OF KEY TERMS

Artifact: Artifact or "anything made by human art" derived in the 1820's from a combination of two Latin words: *arte* "by skill" and *factum* "thing made" (*Online Etymology Dictionary*, 2014). The philosopher Wartofsky (1979) defines artifacts (tools and languages) as: "the objectification of human needs and intentions; i.e., as *already* invested with cognitive and affective content" (p. 204). He refines a tradition of distinguishing between several types of artifacts: external (non-linguistic or material), internal (linguistic or cognitive), and those that are transitional from cognitive to material and vice versa. He also defines an analogous three-level hierarchy of primary, secondary, and tertiary artifacts, corresponding with perceptual, conceptual, and imaginative activity. In my study, artifact refers to Wartofsky's primary artifacts that are used directly in production for a particular purpose or function, including physical objects or entities, tools and technologies, modes of social organization, and signs and texts (digital or analog). According to Wartofsky's framework, a storybook is a

primary artifact that mediates perceptual activity, while a story is a tertiary artifact (e.g., the outcome of imaginative activity). Nonetheless, for my research study with girls, distinctions are made between artifacts and stories (see story definition below).

Catalytic or Generative (artifact and story): Lather (1986) characterizes catalytic validity as "the degree to which the research process re-orients, focuses, and energizes participants… this is by far the most unorthodox [of validities] as it flies directly in the face of the essential positivist tenet of researcher neutrality" (p. 67). Hence, catalytic or generative artifacts and stories within my study are those that empower, focus, and re-orient my team. Artifacts and stories become catalytic or generative when they are changed into new actions, attitudes, or behaviours that evidence activism, growth, insight, learning, and/or liberation in the co-researchers (Rusnak, 2010a; 2014a, 2014b). This grounds my qualitative research approaches and techniques, emphasizing the "generative story question" (Kovach, 2009). By researching with (not on) girls, I use the inquiry process itself as a means towards the empowered transformation of my team (Bach, 1998; Goldman-Segall, 1998). My goal is to increase the co-researcher's understandings of gender/media/technology inequalities, hegemonies, hierarchies, and marginalization issues such that they can individually and collectively effect and stimulate change (Kearney, 2006; Sandberg, 2013; Sandberg & Grant, 2015). Hence, catalytic or generative artifacts and stories are those that reveal distinct changes in the co-researchers' sense of technological self-efficacy, self-determination, and/or self-interpretation. My study focus is to "pursue rigor as well as relevance" in the production of personal and cultural knowledge that is useful in developing technology futures that are wide open with possibility and opportunity for girls (Lather, 1986, p. 67).

Design / Designerly: Simon's (1969/1981) definition of design remains universal and comprehensive: "devis[ing] courses of action aimed at changing existing situations into preferred ones" (p. 129). In the HWL project, we define design as assembling existing situations or states of affairs (e.g., events, objects, spaces, systems, etc.) into desired states of affairs. Hence, when we refer to "designerly ways," we mean a manner or mode that involves assembling a given into a desired state. Recognizing that design has its own "things to know, ways of knowing them, and ways of finding out about them," Cross (2006, p. 17) theorizes "designerly ways of knowing" as a third intellectual culture (distinct from the established traditions of the arts/humanities and sciences) in which knowledge is constructed and adapted to a purpose with a context, rather than something 'out there' waiting to be discovered. This emergent view of knowledge offers new and transformative opportunities for the learners in my study to make their own meanings and knowledge through diverse media forms (e.g., beyond words or symbols), whilst creating rich artifacts of and for learning (Wilson, 2013). Like Denner et al. (2005), I utilize design as a vital bridge or meaning-making activity to connect my team to the innovation and production aspects of technology.

Story: Etymologically, story was first used as an English word in the early 13th century, deriving from the ancient Latin *historia* and the Old French *estoire*, an "account of some happening" (*Online Etymology Dictionary,* 2014; *Oxford English Dictionary*, 2014). Within its origins is an epistemological sense of a truthful narrative or an account with some fidelity to the truth. At the present time, a story is commonly defined as a specific text type: "an event: a state of affairs, and a second state of affairs which differs from the first, accomplished through some agency" (Storkerson, 1996, p. 4). This supports Mallan's (2003, p. 9) interpretation of story as a "discursive representation or sequence of randomly

connected events" including imaginary and real accounts. In my study, a story is a shared event sequence grounded in artifact design and production that creates disequilibrium and equilibrium and is eventually rendered into a shared account (Herman, 2008, p. 456). Epistemologically, story is a cognitive process and product through which the co-researchers give shape to meaning and come to understand, remember, and embody knowledge about themselves and the media and technology in their lives and worlds (Goldman-Segall, 1998; Mallan, 2003). Ontologically, story is central in constituting and constructing my team's identities, realities, relationships, and ways of being with/against technology: one might say that "without a story, there is no identity, no self, no other" (Lewis, 2011, p. 505). Within the context of my inquiry, stories have indeterminate beginnings and endings, and live on after we make and share them (Bruner, 2003, p. 22). The co-researchers' stories are dynamic, diverse, subjective, and come into existence in and out of their experiences at *101 Technology Fun* (e.g., girls' stories are made, not found in this DBR setting).

Storymaking: Harvey and Martin (1995) prefer to use the term storymaking to "represent the more comprehensive class of activities including story-comprehending, –remembering, –constructing, and –telling" (p. 87). A story is made through these practices. With this in mind, storymaking is distinguished from storytelling for the purposes of my research, in order to focus on the creation (but not opposed to the gathering, listening, performing, and sharing) of stories. These distinctions are often explicit in marketing and gaming industries where the practice of storyboarding for storyworlds is essential. The differentiation is somewhat as Monasco (2006) puts it: "We don't need great storytellers who force us to quietly listen to *their* story. We need storymakers who can collaborate with us to create *our* story." What comes to matter most then, for my study, is supporting the co-researchers to

make their own stories (interdependent with their artifact design and media production activities). Girls' storymaking practices can act as a catalyst to ignite and inspire change within themselves and hegemonic techno-cultural discourses (e.g., to generate more equitable and empowering stories about who girls are and how they should be). Building upon Goldman-Segall's (1998) storymaking approach, I use storymaking methodologically for inquiring into, capturing, and communicating to others the complexity of my team's transformative learning and thinking *about, from, through, and with/against* technology.

1.6   DEFINITIONS OF THEMES IN DATA ANALYSIS

Four elements or themes characterize the co-researchers' artifacts from and stories about media and technology: agency, ingenuity, self-efficacy, and self-interpretation. These themes generally helped frame the research and were refined as they emerged during the data analysis phase as a framework to synthesize the *101 Technology Fun* team's fieldwork and designworks (see section 4.4 and Chapter 5).

Agency: Sewell's (1992) definition of agency is elegant in its simplicity: an "actor's capacity to reinterpret and mobilize an array of resources" (p. 19). For this research and given the unit of analysis (*girls-in-interaction-with-technology-and-stories*), Sewell's sense of agency is extended to the collective or team of girls. For example, some of the design problems and activities were open-ended in providing resources, learning environments, and stories with no pre-defined use or interpretation. This left the girls' agency in design, media, and technology an open question. The interplay of the co-researchers' collective creativity and technological skills were taken as a demonstration of agency (Emirbayer & Mische, 1998), summarized in

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this study as girls having influence and power (Rusnak, 2014b). Bleeker's (2006) definition is also insightful in its intelligibility: "Agency is about having an ability to foment action, to be decisive and articulate, to foment action" (p. 8).

Ingenuity: Homer-Dixon (2000) defines ingenuity as "ideas… for solving technical or social problems" (p. 1). In my analysis, the focus is on the co-researchers' ideas directed at resolving design problems and the resultant artifacts and stories that emerged, as demonstrative of technological ingenuity. Similar to agency, ingenuity here refers less to its individual sense than to its social or collective sense. Petrina (2010, p. 146) includes ingenuity in a taxonomy of technological literacy, which in this case refers generally to creative cognition and invention (novice and expert). For this research, ingenuity is summarized as girls being clever, original, and inventive (Rusnak, 2014b).

Self-efficacy: Specific to this research, self-efficacy is important in relation to how girls develop new affinities towards and capabilities in design, media, and technology. For example, a common definition is McDonald & Siegall's (1992): "the belief in one's ability to successfully perform a technologically sophisticated new task" (p. 467). A criticism about measures of self-efficacy is that they are dependent upon an individual's perceptions rather than demonstrated capabilities. This definition derives from a longstanding tradition in education and psychology that focuses on the questions of conviction and perception as important in relation to evidence of competency (Bandura, 1997). Measures of self-efficacy and competence were not germane to the *101 Technology Fun* research design. However, the attention the co-researchers gave to their convictions and perceptions of their demonstrated

competencies in design, media, and technology were extremely important thematically in this study. Self-efficacy is summarized as girls believing in or judging their technological capabilities (Rusnak, 2014b).

Self-interpretation: In general terms, as the co-researchers in this study create, interact with, and interpret artifacts or designworks, they construct, deconstruct, and interpret themselves. This more closely aligns with the data, as the important process of self-definition for tweens is dependent upon the ways in which they interpret what they can do or achieve in relation to each other *and* media and technologies used, produced, or storied. As Callero (2003) states, "the self at its most basic level is a reflexive process that regulates the acting, agentic organism" (p. 120). The "reflexive process" here refers to self-interpretation, summarized as girls making sense and significance of self in-interaction-with technology (Rusnak, 2014b).

1.7   RESEARCH DESIGN

In order to generate more knowledge about girls' affinities towards and capabilities in media and technology, as well as to empower them as change makers in maker culture, I chose a designerly and participatory methodological approach. The 101 Technology Fun maker labs were design-based and girl-centered such that the co-researchers could have relevant opportunities to engage with the technological tools and creative practices to experience, learn, and develop their interests in media and technology (both during and beyond the domain of the summer camp program). For example, the girls made and shared artifacts and stories that expressed their concerns, desires, purposes, talents, and volition (Rusnak, 2010a, 2014b).

My team's participation was scaffolded (e.g., design challenges matched design skills and progressed from simple to complex) but not constrained by the guiding research structures and goals (Denner et al., 2005; Petrina, Feng & Kim, 2008). We individually and collaboratively generated a diverse and dynamic dataset using innovative DBR methods including: story and artifact making, design thinking challenges (e.g., gaming and robotics), logging *iLife Diaries* (Appendix G), mind scripting interview sessions, producing *ME Documentaries* and PSAs (Public Service Announcements), pre and post questionnaires, and writing technology affirmations (in which girls identify particular strengths in the work of their peers). As my study was designed to spark girls' interests in media and technology and to develop their confidence and capabilities, drawing from a range of research methods using a wide-angle lens of analysis allows for authentic and alternative representations of my team's experiences with and expressions of technology (e.g., beyond the dominant or already-interpreted ones) (Goldman-Segall, 1998; Hill & Smith, 2005; Kearney, 2006).

To make sense of the co-researchers' fieldwork and designworks, I carefully interpreted our dataset in a way that embraces the ambiguities, complexities, imaginaries, and subjectivities of the *girls-in-interaction-with-technology-and-stories*, which is the key unit of analysis (Bach, 1998; Petrina, Feng & Kim, 2008). Informed by Freeman and Mathison's (2009) guiding principles for interpreting visual, verbal, and textual materials, my first task was to sort our data into sense-making themes or patterns. As indicated in the previous section, I identified four themes that characterize my team's artifacts from and stories about technology: agency, ingenuity, self-interpretation, and self-efficacy. As the interpretation of each individual piece of data also emerges in connection with the entire collection, I was challenged with how to form a whole yet polyphonic research text (without dilution,

conformity, or privileging one perspective as absolute). Each section of my analysis offers a piece of a wider picture: when taken together they create a coherent story and working theory of how girls cultivate new affinities towards and capabilities in media and technology. The co-researchers resonate throughout this portrait as powerful voices that adopt, adapt, blend, reject, remake, and rethink diverse techno-cultural understandings.

The format and approach of my study is innovative and somewhat unconventional. Findings are introduced through girls' artifacts and stories, inviting personalized and complex subtexts that are typically not discerned from large-scale studies or quantitative surveys (e.g., Allhutter, 2012; Bach, 1998; Baldwin, 2005; Freeman & Mathison, 2009; Goldman-Segall, 1998; Hardy, 1994; Haynes, 2008; Kafai, 1995, 2006; Mallan, 2003). I employ Bach's (1998) two-column montage approach to analyze and synthesize our research results in a way that emphasizes the co-researchers' findings and situates them as leaders of change or change makers in the cultural shaping of media and technology discourses.

One dimension of analysis (the left-hand column) honours and details my team's original data collected and created during *101 Technology Fun* (e.g., codes, critiques, diaries, drawings, interviews, photographs, storyboards, questions, and quotations). This serves two major purposes: (1) to represent the co-researchers' fieldwork and design work with minimal interpretation, thereby increasing confidence in the trustworthiness of our study data; and (2) to respect and honour my team's intensity and diversity to the greatest extent possible, rather than suggesting that they share one homogeneous identity (Bach, 1998; Goldman-Segall, 1998). Data selection is guided by the catalytic or generative artifacts and stories that empower, focus, and re-orient the co-researchers and I (e.g., the artifacts and stories that evidence activism, growth, insight, learning, or liberation in my team) (Kovach, 2009;

Lather, 1986). Importantly, each element that I select is chosen not only to tell the co-researchers' stories, but also to show *why* I tell their stories. For example, I want to counter stereotypes that girls are culturally unproductive and that technology research is the privileged domain of adult male scholars.

A second dimension of analysis (the right-hand column) represents how I, as an actively engaged co-researcher, co-designer, and co-learner, connect and make sense of my team's data from the first dimension. This includes key information about the interpersonal, personal, and situational contexts, as well as discussion, field notes, questions, statistics, and theory integrating the *girls-in-interaction-with-technology-and-stories*. My approach to data analysis is guided by Seidel's (1998) inductive approach to qualitative data analysis (QDA): "a process of noticing, collecting, and thinking about interesting things" (p. 1) whilst repeatedly engaging and re-engaging with the dataset.

My commitment is to foster girls' understanding of the gender hegemonies, inequalities, and injustices in popular media and techno-cultural discourses such that they can effect transformation in pro-social, pro-feminist, and empowering ways (Allhutter, 2012; Rusnak, 2014a, 2014b). Hence, the co-researchers and readers are also active storymakers (e.g., not merely passive recipients of authorial analysis) in uniquely interpreting and questioning my study findings: "the answers we look for are not in the codes, but in ourselves and our data" (Seidel, 1998, p. 14). Smith and Sparkes (2008) offer a productive distinction between story analysis and storytelling, wherein I add storymaking: "Rather than adopting the standpoint of a story analyst, a different preference one might adopt toward conducting narrative analysis is that of a storyteller [or storymaker]. Unlike story analysts that conduct an analysis of stories, for storytellers [or makers] analysis is the story" (p. 21).

1.8 RESEARCH OVERVIEW

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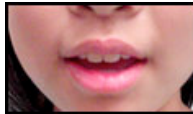
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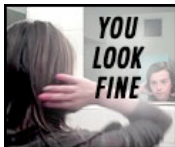
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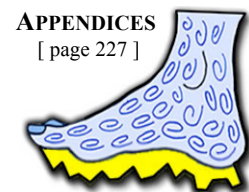
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Table 2. Research Overview

My dissertation is divided into six chapters. Chapter 1 overviews the purpose, problem, questions, key terms, research design, and theoretical framework. Chapter 2 introduces the *101 Technology Fun* team; connects my contemporary girl designers to the lengthy herstory of technology; analyzes girls@play with games, technology, and social media; and argues why we need more females (of all ages) as the designers, leaders, and innovators of technology. In Chapter 3, I develop a foundation to ground my approach for studying with (not on) child participants as co-researchers, including my rationale for utilizing a story epistemology to understand how girls come to know what they know about themselves and the technology in their lives and worlds. I also work through various ethical, etymological, epistemological, and methodological dimensions of story and storymaking, focusing on educational literature related to young adolescents.

Linking my designerly and participatory methodology to the theoretical framework that I build upon, Chapter 4 reports: (1) the learning environment of the *101 Technology Fun* maker lab for maker girls; (2) DBR and participatory techniques for data collection and creation; (3) data selection processes, study parameters and limitations, and issues of accountability and validity; and (4) procedures for presenting research findings utilizing an innovative montage approach. Chapter 5 analyzes and synthesizes key findings concerning *girls-in-interaction-with-technology-and-stories*. My preference was to write four themed sections (rather than one large conglomerate), reporting on my team's *agency* (section 5.1), girls having influence and power; *ingenuity* (section 5.2), girls being clever, original, and inventive; *self-interpretation* (section 5.3), girls making sense and significance of self in-interaction-with technology; and *self-efficacy* (section 5.4), girls believing in or judging their technological capabilities. Chapter 6 summarizes the research, presents study contributions,

offers recommendations for future inquiry, and concludes with: What remains for girls? What endures? What hopes?

The following research origami, (Artifact 2) summarizes my study of maker girls and maker culture in a concise and designerly way. This is significant because decoration and style are important elements in both the work and lives of the co-researchers. The origami metaphor highlights an important subtext within the context of my work, representing the folding and unfolding of my team's dataset into a multi-faceted and multi-perspective scholarly format that invites an unlimited play of interpretations (of interpretations of interpretations). The origami illustrates that there are no ultimate or unquestioned ways or magic formulas for understanding the complexity and diversity of girls' experiences, expressions, and positions within technology (Farmer, 2008; Freeman & Mathison, 2009; Kearney, 2006; Lipkin, 2009).

Like the art of origami, my research is a dynamic and creative process of construction and deconstruction (subject to negotiation, interpretation, and enabling constraints), as well as a designed end product that has permanence or longevity. As a one-dimensional sheet of paper can be transformed into a variety of stimulating and multi-dimensional origami forms, my study also has transformative potential: by listening to girls and to each other, including our shifting subjectivities, we can come to know from many viewpoints and remain open to knowledge that is partial, dynamic, and constructed in particular social contexts (Allhutter, 2012; Bach, 1998; Goldman-Segall, 1998).

STORY EPISTEMOLOGY

INTERPRETIVE PARADIGM

- My research contributes towards understanding girls' participation in, artifacts from, and stories about technology.

- Form influences interpretation of content, hence the development of an alternative scholarly format can significantly open up new possibilities for inquiry with (not on) girls.

- My co-researchers and readers are all active participants in uniquely interpreting the findings: "the answers we look for are not in the codes, but in ourselves and our data" (Seidel, 1998, p. 14).

- Girls' stories evidence how they make meaning and construct new knowledge about the technology in their lives and worlds (Petrina, Feng & Kim, 2008).

- Girls' stories can express their underlying emotions and cognition simultaneously, thereby making visible the complex understandings that children have about themselves in-interaction-with technology (Denner et al., 2005; Freeman & Mathison, 2009).

- Girls' stories do not mirror or reveal objective truths, rather reality is multiple and comes into existence in and out of girls' experiences that are constructed in particular techno-cultural contexts (Rusnak, 2010a).

THEORETICAL FRAMES

Building upon the scholarly work of:

- Allhutters' (2012) deconstructive feminist theory of "mind-scripting" as a tool to get girls to identify and question how they are positioned (by themselves and others) within existing techno-cultural discourses.

- Bach's (1998) participatory and girl-centered research principles for honoring and representing the complex, dynamic, and subjective realities of girls' lives.

- Denner et al.'s (2005) "girls creating games" strategies for empowering girls with technology and fostering the creative contributions of youth in educational research.

- Freeman & Mathison's (2009) social constructivist approaches for engaging children as "true partners" in researching their learning, growth, and development.

- Goldman-Segall's (1998) "points of viewing" theory for capturing children's unique expressions and experiences of technology within technology-rich immersive spaces.

- Petrina, Feng & Kim's (2008) well-grounded theories and techniques for researching technology, cognition, and learning across the lifespan.

Artifact 2. Research Origami (1 of 2)

METHODOLOGY

- The Tween Empowerment & Advocacy Methodology (T.E.A.M.) is grounded in the realities of girls' artifacts and stories, offering more nuanced and personalized accounts than larger scale surveys.

- Participatory and designerly ways of gaining more knowledge about girls as the researchers and innovators of technology on their own terms, not as consumers, child-users, or "surrogate boys" (Denner et al. 2005; Petrina, Feng & Kim, 2008).

- Layering multiple strategies of inquiry creates many opportunities for girls to make their own meanings and to cultivate new affinities towards media and technology (e.g., to express their concerns, interests, pleasures, and talents) (Goldman- Segall, 1998).

- Key unit of analysis: "girls-in-interaction-with-technology-and-stories" wherein artifacts and stories are made, shared, and reproduced.

RESEARCH VALUES

- My study strives to respect, honour, care for, and be sensitive towards girls (Bach, 1998; Rusnak, 2010a).

- My research practices provoke scholarly reflection about girls' rights and roles concerning the knowledge made about, for, from, and with/against them (Allhutter, 2012; Goldman-Segall, 1998).

- Situating girls as "leaders of change" in the cultural shaping of technology discourse, DBR is valued as essential in my study's transformative potential (e.g., engaging girls with hands-on, heads-on, hearts-on, and feet-on experiences as the designers and researchers of technology).

STRATEGIES OF INQUIRY

- Girls create data using multiple and unique research methods in order to generate new understandings beyond the already-interpreted and normative perspectives (Bach, 1998; Goldman- Segall, 1998).

- My data selection processes focus on the artifacts and stories that are generative or catalytic within our community of designerly inquiry (Allhutter, 2012; Lather, 1986).

- Freeman & Mathison's (2009) guiding principles are utilized to analyze my team's dynamic and varied forms of data (i.e., verbal, visual, and textual materials).

- I build upon Bach's (1998) two-column montage to synthesize findings, highlighting the need for girls' voices to be recognized and given influence in the educational research concerning their own lives.

Artifact 2. Research Origami (2 of 2)

co-researchers

PJ RUSNAK

Game Designer
101 TECHNOLOGY FUN

HOW WE LEARN LAB · UNIVERSITY OF BRITISH COLUMBIA

Artifact 3. 101 Technology Fun Team Name Badge

CHAPTER 2: 101 TECHNOLOGY FUN CO-RESEARCHERS

This chapter begins by introducing the *101 Technology Fun* team of co-researchers. The balance of the first section includes a review of research literature that connects my contemporary girl designers to the lengthy herstory of technology, including *Feminism Confronts Technology* (Wajcman, 1998), *TechnoFeminism* (Wajcman, 2004), *The Ironies of Household Technology from the Open Hearth to the Microwave* (Schwartz-Cowan, 1995), and *Women, Technology, and the Myth of Progress* (Leonard, 2003). In the second section, I analyze girls@play with games, technology, and social media, including current statistics and trends regarding female gamers and intergenerational groups of game players. Next, I examine the meaning and importance of design, design thinking, and designerly ways of knowing for empowering my team with the production and development aspects of technology. I conclude by arguing why we need more females (of all ages) as the designers, leaders, and innovators of technology.

I have been thinking a great deal about a comment made by the late education researcher Myra Sadker: "If the cure for cancer was in the mind of a girl, we might never discover it" (www.sadker.org/about.bio.htm). Girls need educational spaces (physical, virtual, and conceptual) where they are supported to explore new identities as makers (e.g., designers, engineers, and robotics programmers), such that they can experiment with their ideas for innovation (Artifact 3). It is not that females lack technological ingenuity or a creative spirit, they lack opportunity to contribute to technology culture, as Hillary Clinton is frequently quoted as saying: "women are the world's most underused resource." This research story begins with a group of young women applying to attend *101 Technology Fun* summer camp (Table 3). The girls, ages 10 to 13, are from a wide range of class, ethnicity,

religious affiliation, and racial composition, including Caucasian, Chinese, East Indian, Greek, Japanese, Jewish, Romanian, Spanish, Thai, and Turkish. All of the girls attended culturally diverse elementary schools located in a densely populated and transient area of the west side of Vancouver, British Columbia. Their compelling words on the applications serve as important introduction to the co-researchers in my study[2] (Table 3).

Table 3. 101 Technology Fun Co-researchers' Applications

GIRL	CO-RESEARCHER APPLICATION	CAMP
Cassidy	I love not only electronics, but I fairly enjoy technology of any kinds too. I am very enthusiastic about gaming and learning, my favourite summer activity is all sorts of camps, and being both a person who loves working with electronics and also going to camp, this summer camp would be perfect for me! Last year, I was involved in this camp experience, and I never forgot how much fun I had then. I would absolutely love coming to this technology camp again, and it would be fun learning for me.	Pilot Study Camp 1 Camp 2 Camp 3
Lark	I want to participate in the gaming camp because I like playing games. I am also curious about how gaming works. Learning about gaming would be really great because I could make my own games and have fun with it. I have always wanted to see what is inside gaming and this would be a great chance for me to find out.	Pilot Study Camp 1
Jodi	I love technology and I have wanted to invent a kind of computer game ever since I was small. I also really like playing the *Sims 3* game. *101 Technology Fun* camp is super cool.	Pilot Study Camp 1
Pei-Ling	I attended this camp last year and I learned a lot of really amazing things and I made new friends. Mostly I want to come back and learn more about how to design my own computer game. *101 Technology Fun* is tons and tons of fun.	Pilot Study Camp 1
Adrienne	I want to participate in this program to learn more about robots and science. I recently saw a robot vacuum cleaner and robot lawn mower and was amazed at the technology. I took Mad Science in school and found that science can be interesting. Last year, I became really interested in science when UBC students came to our school to teach us how to make gadgets. I hope to understand more about technology from this program.	Camp 1

[2] 25 usable applications from the *101 Technology Fun* camps are reported in Table 3.

GIRL	CO-RESEARCHER APPLICATION	CAMP
Tami	I like to go to camps. I want to learn more things. Playing games is my hobby. Stay out of my boring house and meet some new friends are the best things.	Camp 1
Kara	I want to go to your design research camp to learn how to use technology to my advantage, because being a girl in this world you need to put yourself out there to prove that women are just as strong as men. Also to build a robot... How cool is that? I have always been interested in robots and computer software and would love to learn how to use them and have fun at the same time. I take pictures for fun so learning how to make a movie would be amazing.	Camp 2
Crystal	To learn more about computers and media and how to keep up with it. I would like to learn more about science and technology and their future. I also would like to be involved with my friend who is applying for this camp.	Camp 2
Anne	I really want to come to this camp. I just love to learn new things and meet new people. I think technology is really fun and it would be so cool to design my own computer game. I think that I work really well with others. Thank you and I hope I will get to be part of the *101 Technology Fun*.	Camp 2
Taslim	I would like to learn how to make my own website to teach others what I know. I just can't wait to make robots. It looks like so much fun! Computer games sound cool and interesting. I would like to know lots more about animation, so that I can make creative movies.	Camp 2
Claudia	I want to come to learn more about robots and how to make a robotic pet. I play lots of games on my computer and have ideas of my own that I want to make a game about. *101 Technology Fun* camp will teach me how.	Camp 2
Daniela	Technology has always been something that I am very interested in. For the longest time, animated cartoons and video games have been some of the things that I enjoy. Ever since I got interested in this portion of technology, I have gotten very fascinated about how things are created. One of my goals for the future is to create a fun yet productive and educational video game for kids to enjoy and enrich the mind. Leaning to animate and create some of my favourite activities is something I enjoy and wish to do this summer.	Camp 2
Lily	I attended a computer workshop for girls in the spring and loved it! I liked taking apart the mother computer, and making my own website with Firefox. I also liked designing plans for *Willy Wonka and the Chocolate Factory* (oompaloompas). I hope I get to go to this camp.	Camp 2

GIRL	CO-RESEARCHER APPLICATION	CAMP
Marie	I want to enter this program because every time I see an animated movie I think, "How did they do that?" I also want to make a poetry website where kids can post poetry and comment on others' poetry. I want to learn how to make a robot because one day I want to make one that will clean my room and care for the elderly and the sick. I want to learn how to design games and virtual worlds that would let me interact online with other people and the characters they create.	Camp 2
Robyn	Because I think creating a gaming system would be interesting. I want to get better at science and this is a new subject for me. And it would probably be a lot of fun.	Camp 2
Salina	I would like to attend *101 Technology Fun* because I think it would be a fun and educational experience. I think it would be exciting to build a robot or design a computer game and find out how these things work. I am very interested in technology and feel very comfortable studying this subject with other girls my age. It sounds like this camp would be a great opportunity to be creative and express myself by using technology.	Camp 3
Kim	I think this camp will help me to learn useful things for high school next year. I hope you will choose me although I don't have much experience with computers and technology except for playing games. I have never made my own robotic pet but it sounds like something really educational to do this summer. Thank you, Kim.	Camp 3
Jayden	This program really interests me because I love technology and I love learning. I think this summer camp will help me to prepare for high school. I have my own laptop and I want to learn how to use it make my own computer games and to edit with iMovie. I will be very excited if I am chosen for this camp.	Camp 3
Jordan	I want to attend *101 Technology Fun* because I think it will be good for me to learn how to create computer games. I play a lot of fun computer games but I'd like to know how they are made. I'd also like to know about robots because sometime in the future robots will help us with our daily needs.	Camp 3
Aslin	Because, if I am a game designer or a website designer that will be very cool! I want to create a website for my mom to help her business, and I can make a game for people to play.	Camp 3
Chani	I am very interested in how to make a robot pet that can really move! And it will be so cool that I can design a computer game and everyone will play my game. Plus if I don't go to this summer camp, I will be so bored and have nothing to do. I want to learn something this summer.	Camp 3

GIRL	CO-RESEARCHER APPLICATION	CAMP
Halina	Hi, I am Halina and I am interested in joining this camp because it is so fascinating how people design the games. I play Wii and DS but I have never imagined how hard it would be to create these games. So I thought this is a perfect opportunity to learn and discover new things. Robotic pets triggered my attention right away and I am eager to learn how to assemble the right pieces and connect cords to make robots functioning. Thank you.	Camp 3
Raywin	I think it must be fun. I have never participated in this kind of summer camp. I'm interested in making robots. I believe I can learn knowledge for this camp and I hope to meet new friends here.	Camp 3
Meledy	I enjoy working with others and meeting girls who like the same things as me. I am interested in building a robot and to see how it works. I want to learn more about computers and computer programs. I really like to learn about websites and hope to build my own. I hope I can be accepted into this program.	Camp 3
Jill	I want to participate in this camp because I think it will be a lot of fun and I will learn a lot of new things about technology. I am very interested in these types of things. I love making movies and building websites. I am eager to try something like making a robot. Last year I started a blog and it is all about the odd and fun things I like. I am really hopeful that I am accepted because it will be lots of fun and a great experience before I head into high school. Please pick me :)	Camp 3

And then there's me:

Paula (PJ)	**Daughter:** "Mom, how'd you know that?"
	Mother: "I'm a mother. Mothers know everything."
	Daughter: "No, seriously, how'd you know that?"
	Mother: "I'm a researcher."
	Daughter: "Mom! Being a researcher is just another politically correct term for being a stalker. That's like saying a porn star is an exotic dancer or a drug dealer is a street pharmacist."
	The above conversation with my daughter shares some of the fun that my team and I had together whilst role-playing with new identities and titles during our maker-culture camp. Amongst various roles played in my life, I am most remarkably a designer, media and technology teacher, educational researcher, and mother. These roles have come together to inform or offer a critique of what I call designerly ways of teaching and learning.

2.1 CONNECTING CONTEMPORARY GIRL DESIGNERS TO THE LENGTHY HERSTORY OF TECHNOLOGY

Deriving from the Greek *technê*, meaning "art, craft, method, system," the meaning of technology has evolved over the centuries to "discourse or treatise on an art or the arts" (1610) to "science of the mechanical and industrial arts" (1859) to the latest and most advanced "high technology" (Petrina & Rusnak, 2010). If today's girls are not the most avid technology users of any generation, they are certainly the most linguistically innovative with the new technologies (Tagliamonte & D'Arcy, 2005; Tagliamonte & Denis, 2008). Girls are significantly under-represented in development and innovation, and their current ways of interacting with technology are an increasing concern from the point of view of education, economics, and culture (DuBow, 2011; Girls Action Foundation, 2011; Sandberg, 2013; Sandberg & Grant, 2015). It is well documented that even though girls are initially excited to learn about technology (e.g., Table 3), by the age of 15 to 16 many girls' interests in technology are limited to their own personal communication and social use, such as chatting, gaming, pinning, and surfing in diverse networked publics and game environments (Denner et al., 2005; Farmer, 2008; Kearney, 2006; Kelleher, 2006). What happens between pre and post adolescence? Why do few girls enroll in computer science and technology-based courses at either the high school or post-secondary level? By the time these girls graduate and enter the job market, their lack of education and experience in these areas translates into a shortage of qualified women in technology-related professions and industries.

My study on girls, media, and technology is timely and important for a number of reasons. Due to widespread access to the most ubiquitous communication and productivity tools in human history, girls are defining new patterns of behaviour, values, and ways of being more rapidly than educational researchers can study them (Rideout, Foehr & Roberts,

2010). Teenage girls are now using computers and the Internet at rates similar to teenage boys, but we are only at the beginning of understanding how the lives of youth are changing (e.g., how they are simultaneously inhabited by, dependent upon, immersed in, and yet indifferent to the technology in their daily lives) (Rusnak, Petrina, Feng & Wang, 2010). Despite all the liberating possibilities, many girls are distancing themselves from technology-related careers and studies. Consider the following statistics: the National Center for Women & Information Technology reports that female SAT takers intending to major in computer and information sciences decreased from 20% in 2001 to 12% in 2006. Hence, teenage girls are eight times less likely than boys to consider enrolling in post-secondary technology classes (DuBow, 2011). In the United States, the number of computer science undergraduate degrees earned by women steadily decreased from a peak of 37.1% (1984) to 29.9% (1989–90) to 26.7% (1997–98), despite the fact women graduated with 56.1% of university degrees in 2004–05 (an increase from 39% during 1984–85) (Camp, 2001). More recent findings from the Computing Research Association's Taulbee Survey indicate that only 12% of bachelor's degrees, and 19% of doctoral degrees in computer science programs were awarded to women in 2010–11 (Zweben, 2012; see also Legewie & DiPrete, 2014).

Although the technology workforce is one of the fastest growing and highest paying, with demand far greater than current supply, not enough females are pursuing these jobs and the opportunities they afford. For example, in the book *Gender codes: Why women are leaving computing,* Misa (2010) reveals that women working in the United States computing and information technology sector has decreased from a peak of 38% (1985) to 33.1% (1993) to 29.6% (1999) to 27% (2010). After they make it into the field, women often leave due to the undesirable working conditions, undermining, and incivility that many females

experience within a male-dominated sector (Misa, 2010; Sandberg, 2013). According to a study commissioned by the Center for the Study of Women in Television & Film, females comprised a minority 26% of key roles (e.g., cinematographers, directors, editors, producers, executive producers, and writers) in broadcast television programs during the 2013–14 prime-time season, only a 1% increase since 1998 (Lauzen, 2014). The Consumer Electronics Association reports that today's working women have a more sophisticated understanding of and increased interest in electronics, a market where they previously had little or no presence: women are now spending more on technology than men, purchasing $55 billion of the $96 billion spent on electronics in 2005. Although 47% of computer and video gamers are women, a dominating 88.5% of games developers are male (IGDA, 2005). Similarly, an employment census by Sector Skills Council for the Creative Industries (2002) reports a gendered-biased and male-dominated interactive entertainment industry in which women represent a minority 16% of all workers. Who holds the power when few females feature amongst the designers, developers, and producers of new technologies?

The under-achievement of females in the technology sphere has serious consequences for girlhood, womanhood, and the future of technological innovation, for if girls do not reach their full potential, then society does not benefit from their full potential either (Ashcraft, Eger & Friend, 2012a, 2012b). Girls' lives have undergone massive transformation over the last century, and their relationships *about, for, from, and with/against* technology are currently being subjected to profound and urgent questioning. My review of relevant academic and industry research literature from the past 30 years examines why many females are continuing to disidentify with or are not attracted to technology careers, symbolism, ideologies, and its social context (e.g., AAUW, 2000; Cassell & Cramer, 2008; Denner et al.,

2005; DuBow, 2011; Girls Action Foundation, 2011; Hafkin, 2006; Hill, Corbett & St. Rose,

2010; Honey et al, 1991; Kelleher, 2006; Kramarae, 1998; Sandberg, 2013; Turkle, 1988;

Weinberg, 1987). Diverse reasons for girls' technological disenchantment include:

1. Stereotyped as less competent than boys in technology culture, girls have lower confidence in their capabilities (even when actual achievement levels are similar).

2. The absence of few prominent female role models to mentor girls reinforces gender stereotypes about the sexual division of labour (e.g., the technology field is only for boys and men).

3. Technology curriculum with a masculine worldview is perceived as irrelevant to the social and emotional realities of girls' lives.

4. The pedagogy of technology education and computer science classes favors male students (e.g., teachers prompt boys to answer more questions than girls).

5. Parents, teachers, and other influencing adults are not supporting or encouraging girls to pursue technology-related studies and careers.

6. Cultural expectations about female roles pressures girls to conform to traditional gender stereotypes so they lack opportunities to take risks, make mistakes, and realize their potential in the technology sphere.

7. Girls have little desire to conform to the well-established world of patriarchal behaviours, norms, and values within technology work and study environments.

8. Girls do not believe that the technology sector is suitable to family life (e.g., long hours and lack of work/life balance).

9. Girls are not attracted to technology-related careers, which they perceive as solitary, sedentary, and boring computer jobs with little social relevance.

10. Girls fail to see how technological and computer training can provide them with an opportunity to meet key career goals (e.g., jobs that improve the lives of others and help to make our world a better place).

As a result of their disenchantment, and taken-for-granted association of technology

with masculinity, today's girls are not developing the confidence, literacies, and tools for the

jobs that are key to the design and innovation of our future society. The chronic under-

representation of females in technology-related areas of study and work is a challenging issue

involving a multitude of attitudinal, cultural, curricular, economical, familial, institutional, pedagogical, psychological, and social factors. This complex problem is both progressive as the farther along the 'pipeline' the fewer women you find, and persistent as progress is halting despite special initiatives, educational programs, and government policies geared toward the advancement of women and minorities in technology (Misa, 2010; Sandberg & Grant, 2015; Zweben, 2012). The statistics cited above show that worldwide efforts over the past 30 years to attract more women to the technology field have not achieved their intended results. Why not? What can and should be done to bring about equitable change? As Wajcman (1994) warns: "Every aspect of our lives is touched by socio-technical systems, and unless women are in the engine-rooms of technological production, we cannot get our hands on the lever of power" (p. 111).

Historically speaking, technology has often acted against the best interests of women and children such that feminist scholars have complex and conflicting perspectives "torn between utopian and dystopian visions" regarding our techno-cultural futures (Wajcman, 2004, p. 3). Despite all the media hype and rhetoric that associates technology with opportunity and prosperity, an extensive and diverse academic literature challenges these naive and universalizing claims and argues that men's historical dominance of technology continues such that its impact on the lives of females (of all ages) is both liberating and limiting (e.g., Brunner & Bennett, 2002; Farmer, 2008; Hafkin, 2006; Hill, Corbett & St. Rose, 2010; Honey et al., 1991; Kearney, 2006; Kramarae, 1988; Turkle, 1988; Wajcman, 1998, 2004; Weber, 2007; Weinberg, 1987). Wajcman (1994) reiterates that even when new technological advancements are determined to be in the best interests of women, "it would be

unwise to presume that the direction of technological change has simply changed sides to benefit women where once it benefitted men" (p. 76).

With considerable injustice, the well-established meaning of technology has a patriarchal bias that is defined in terms of the activities, artifacts, desires, knowledge, processes, and skills that interest men, subsequently diminishing the significance and lengthy herstory of feminine technologies like horticulture, cooking, childcare, and textiles (Kramarae, 1998; Schwartz-Cowan, 1995). The popularized history of technology is predominantly a masculine version, resulting in the taken-for-granted association of technology with overwhelming maleness. Changing the historical focus to a feminist perspective, however, suggests that indigenous women are likely the first designers of technology: "women were the main gatherers, processors and storers of plant food from earliest human times onward. It is therefore logical that they should be the ones to have invented the tools and methods involved in this work, such as the digging stick, the carrying sling, the reaping knife, and the sickle, pestles and pounders" (Wajcman, 2004, p. 15).

Recent technological developments have remarkably improved the lives of diverse groups of females by legitimizing their legal status, increasing education and employment opportunities, advancing healthcare options, enabling control over reproduction and family planning, offering more ways to communicate and socialize, and presenting new forms of recreation and entertainment (Hafkin, 2006; Kramarae, 1998). The progressive view of technology as a positive agent of change for all females, however, only tells part of the story. For example, whilst household technologies (e.g., washing machines, vacuums, processed goods, and affordable clothing) have alleviated middle-class women from the burdens of labor-intensive housework, it has neither freed them from being primarily responsible for nor

decreased the time spent doing domestic duties. Schwartz-Cowan's (1995) lively and provocative research on *The Ironies of Household Technology from the Open Hearth to the Microwave* evidences how the industrialization of the home during the early 20th century ironically resulted in more work for mother as today's busy moms spend as much time as their colonial grandmothers did on near-daily chores, in addition to working full or part-time outside the home (p. 178). Modern labour saving technologies were first marketed to offer women increased quality of life, leisure, and comfort, however, these devices, goods, and services largely replaced tasks that were previously the responsibility of men, children, and servants. Moreover, standards of cleanliness intensified along with the ever-increasing ability to clean that technology enables, which resulted in an exhausted group of middle-class women who struggle to keep up with household work that is never done. Schwartz-Cowan theorizes that large-scale housing co-operatives, multi-generational homes, communal laundries, and community kitchens might have truly reduced the strain of household chores for females, but most of these more public and centralized amenities were unpopular due to the preference for decentralized single-family residences.

Building upon Schwartz-Cowan's (1995) work, the salient purpose of Leonard's (2003) research on *Women, Technology, and the Myth of Progress* is to investigate the inequitable use of technology and labour within the home. Leonard (2003) traces how women employed outside the home do 72% of the unpaid household labor, not including care of children, the sick, and the elderly (p. 148). She finds that despite all of the significant advances of technology, persistent inequity still exists between males and females (and amongst females) in terms of education, income, lifestyle, occupation, power, and social position: "Although women's status varies enormously from one country to another, women

remain far from equal politically, economically, or socially, and nowhere in the world are women equal to men" (p. 52). Furthermore, as Leonard's research evidences, most of the benefits and opportunities that technology makes available are limited to the privileged females who can afford them: "The poverty of many woman in the Third World, as well as in industrialized societies is particularly noteworthy. Worldwide, a stunning 70% of women live in poverty" (p. 52).

This necessitates a pause to bring forth vital questions regarding the underlying purposes of technological design and development: What shapes and who controls the ideation and production of household technologies (Leonard, 2003)? Whose viewpoints are privileged? Whose voices are silenced or unheard? Who benefits from technological innovation and on what or whose terms do we judge it as valuable or progressive for females (Ashcraft, Eger & Friend, 2012a, 2012b)? How do we get from Schwartz-Cowan's (1995) "more work for mother" to a technology culture with "more mothers with paid work" or "more fun for mother"? How do we define and collect statistical data to measure the impact of technological change on women and men around the world, for "without data there is no visibility, without visibility there is no priority" (Hafkin, 2006, p. 50)?

Drawing upon diverse perspectives in postmodernism, feminist theory, and science and technology studies, Wajcman's research in *Feminism Confronts Technology* (1998) examines how technology is designed, developed, and used in particular ways that embody gendered meanings, hierarchies, and discrimination. She argues that technological innovation serves to liberate females and encourage equity, but also to maintain gendered power relations within a masculine technology structure: "the male orientation of most technological research has long obscured the significance of 'women's sphere' inventions,

and this in turn has served to reinforce the cultural stereotype of technology as an activity appropriate for men" (Wajcman, p. 15). New technological developments, Wajcman warns, are powerful sites of political struggle with unanticipated results and consequences, and as history tells, desired outcomes for females can never be guaranteed. In *TechnoFeminism,* Wajcman (2004, p. 6) is particularly critical of how some women (of their own volition) appropriate and reinforce patriarchal notions of technology that serve to justify, produce, and perpetuate stereotypes, and thereby restrict their opportunity to benefit from and contribute to technology culture. She analyzes how technology is constructed historically, politically, and socio-culturally, providing detailed examples of how women's everyday lives are strongly influenced by the expanding technological society that we are in and part of.

Wajcman argues that the chronic under-representation of females is a key feature of a male dominated technology culture as few women are achieving in precisely the jobs that are key to creation and innovation of the world we inhabit: for many women, "the everyday experience of technological change tends to be one of constraint, surveillance, confusion, and lack of control" (1994, p. 101). Hence, as we enter into yet another era of technological innovation with unprecedented advancements in communication, education, and health, Wajcman warns that we must continue to be critical of technology, which has never been an autonomous agent of equitable change. She also theorizes how, "the correspondence between men and machines is thus neither essential nor immutable, and therefore the potential exists for its transformation" (1998, p. 159). To put it another way, because technology is in part socio-culturally constructed and not inherently male dominated, realistic potential exists for a post-patriarchal future— not only to avoid further marginalization of women— but also to generate and realize new possibilities for improving their lives (across age, class, ethnicity,

nation, race, and sexuality). The involvement of more females in technological innovation, education, research, and policy may bring forth significant advances in redesigning technology culture and renegotiating gendered power relations; however, "an emancipatory politics of technology requires more than hardware and software; it needs wetware— bodies, fluids, human agency" (Wajcman, 1994, p. 77)

Achieving gender equity in technology culture is a complex and immense challenge. Leonard (2003, p. 13) provokes pause: "Why hasn't technology met expectations of profound social change? What prevents dramatic technological advances from resulting in equally astonishing social advances? And can it be otherwise?" As Honey, et al. (1991) protest, "women's desire for communication, collaboration, and integration is not central to the masculine technological world view, which is increasingly accepted as the only legitimate model for discussing, developing, and evaluating technology." What if we change the cultural conversation from what women can't do to what they can? What if more females are empowered to believe in themselves and their technological capabilities (Rusnak, 2014a)? What if more girls are educated to understand the consequences of new technologies being designed and developed in particular ways that embody gendered power relations (Turkle, 1988)? How would gender gaps in technological development and opportunity be impacted (Leonard, 2003)? What would it mean for the creation of more meaningful, equitable, and sustainable technology futures (Hill & Smith, 2005; Wajcman, 1998, 2004)?

2.2   GIRLS @ PLAY WITH GAMES, TECHNOLOGY & SOCIAL MEDIA

The AAUW's (2000) commissioned report *Tech-Savvy: Educating Girls in the New Computer Age* finds that girls are not computer phobic rather they are computer reticent,

which is to say that girls are not afraid of technology, but they are critical of being associated with it, expressing an "I can, but I don't want to" attitude. Girls' contradictory and mixed feelings about technology are not surprising considering that its culture, language, and symbolism are pre-dominantly defined by and associated with men. As AAUW co-chair Sherry Turkle (2000) argues, "the computer culture has become linked to a characteristically masculine worldview, such that women too often feel they need to choose between the cultural associations of femininity and those of computers" (p. 7). Hence, females tend to disconnect and turn away from technology, as they cannot reconcile it with their ways of being feminine. Turkle noted in 1988 that, "women look at computers and see more than machines. They see the culture that has grown up around them and they ask themselves if they belong" (p. 42).

Although today's girls are now playing video and computer games in sizeable numbers, gender disparities remain strong in the as-yet male dominated game development teams, which are highly challenged to integrate feminine perspectives and avoid gender stereotyping (e.g., new games invariably bear the sexist imprints of their designers). Gee and Hayes (2009) identify the early disconnect between women and digital games, explaining it is not that women do not enjoy playing games, it is that the games have not appealed to women. To achieve greater gender equity in one of the world's fastest growing and most creative industries, I believe that more females, of all ages and cultures, need to be involved in the research and development of new gaming hardware and software. Instead of females fitting into a masculine gamer culture, the gamer culture must become more inviting with subject matter of interest to girls and styles of interaction they prefer (Denner et al., 2005; Kafai, 2006; Kelleher, 2006).

The striking minority of women working as professional game developers is a well-known cause for concern. For example, in order to advance or succeed, many female developers experience gender-based discrimination, harassment, unequal treatment, hostile working conditions, and a persistent frat boy culture or boy's club mentality (McDonald, 2014; Misa, 2010; Sandberg, 2013; Sandberg & Grant, 2015). Historically created by men (with men in mind), the 21st century entertainment industry is a highly gendered source of pleasure and power from which females have been marginalized (Gee & Hayes, 2009). Although mastery over media and technology has been closely identified with masculinity, gender-technology relationships have been changing in response to recent innovation in social media and the rise of pervasive networked publics (IBIS World, 2008; Pew Internet, 2010, 2010; Rideout et al., 2010). Despite the fact that fewer games have been designed specifically to target females, this demographic has increased significantly during the past decade to a sizeable 48% of the total game-playing population (ESA, 2014). Technology is becoming a key source of pleasure and relaxation for many adult women over 18 years of age, who now represent 36% of all gamers, a remarkably greater presence than that of the stereotypical geeky teenage boy age 18 years or younger (17%) (ESA, 2014). In Canada, the average gamer age is 35.8 years, and 34.9% of Canadian gamers are female, of whom 27% play every day, and 45% play a few times per week (ESAC, 2009). Adult female gamers ages 25 to 34 strikingly outnumber male gamers (65% of women in this demographic play video games compared to only 35% of men), and this age category has the largest concentration of female gamers overall (29%) (CEA, 2006).

Working women and busy mothers are surpassing boys as the fastest growing gaming cohort, for various pleasures and technical pursuits, most notably achievement, attention,

friendship, fun, identity play, recognition, social interaction, and to manage and sustain

relationships (Gee & Hayes, 2009; Goetz, 2010; IBISWorld, 2008). During the past five

years, the computer game industry has been attracting a brand new market of enthusiastic

players by offering social and casual games that are free to play (often sponsored by

advertisers) on readily available platforms such as smart phones, iPads, and Facebook. The

games most popular with females typically contain massively multi-player and non-violent

content, including real life simulations like *Farmville* and *FrontierVille*; virtual worlds like

Millionaire City and *Pet Society*; role playing and strategy games like *Mafia Wars*; puzzle

games like *MindJolt*; poker card and casino games like *Texas HoldEm*; and quiz games like

Bejewelled, eight popular Facebook games that range from 11,707,821 to 55,502,307 unique

and active players per month (Facebook Game Center, 2011).

Social networking sites currently play a significant role in enticing girls of all ages to

gaming, and they are largely responsible for creating industry wide changes in not only the

way computer games are designed and delivered, but also for whom. The majority of both

adult women and teenage girls use networked publics: 73% of American teens (ages 12 to

17) and 57% of adult Internet users have at least one profile on an online social networking

site, of which the most popular platform is Facebook (Pew Internet, 2010). As most games on

social networks are played with family and friends, they are quickly drawing in women who

previously did not consider themselves as gamers, but are now compelled to play because

they have a new way for keeping in touch with those they care about, as well as making new

acquaintances, with the kind of regularity and intimacy that would otherwise be impossible

due to insufficient time and physical location constraints (Cassell & Cramer, 2008; Gee &

Hayes, 2009). According to Misiek Piskorski, a Harvard Business School Professor who is

well-known for his research on social networking: "What you find is a lot of women who are both working and raising children just have no time for relationships… But it's not like they wouldn't want to spend more time having these relationships. It's just really, really hard. And this allows them to basically sustain these relationships" (Goetz, 2010).

Studies conducted by the Pew Internet & American Life Project (2005–2010) provide evidence that young women's gaming and social media usage has grown steadily for more than a decade. Following social networking sites is the most popular computer activity amongst 8 to 18 year-old girls, 40% of whom will spend an average of one hour per day engaging in social networking. The second most popular activity is playing games. Girls typically play a variety of games and frequently change their favourite online game sites (Pew Internet, 2005, 2010). Although girls have always been culturally productive, using mixed media for valuable communication and creative expression, more girls are now engaged in cultural production than at any other point in history, largely as a result of the increased availability of inexpensive, pervasive, and user-friendly social media technologies and networked publication channels like Blogger, Facebook, Flickr, Pinterest, Tumblr, Twitter, Vimeo, and YouTube (Gee & Hayes, 2009; Kearney, 2006). As previously discussed, an important aspect of this cultural production is linguistic innovation (Tagliamonte & D'Arcy, 2005; Tagliamonte & Denis, 2009).

According to a landmark survey by the Kaiser Family Foundation, however, there is a cause for concern with girls' incessant multitasking, such as simultaneously using multiple devices to engage with diverse media. On an average day, 11 to 14 year-olds in the U.S. spend 8.40 hours using media, and when multitasking is taken into consideration, youth spend 11.53 hours of media engagement each and every day, and this does not

include time spent using computers for school work, or extra time spent texting and talking with friends (Rideout et al., 2010). Mobile technologies like iPads, iPods, smart phones, and tablets are bringing media and Internet access into the precious pockets, packs, purses, and bedsides of today's youth. Always on and always connected, the last thing that many girls touch before falling asleep at night, and the first thing that they lay their eyes upon when they wake, is their internet-enabled digital device (Kearney, 2006).

A mixed demographic of inter-generational gaming families is a new industry trend. According to the Entertainment Software Association (2014) in the United States, 42% of parents play computer and video games with their children weekly, 58% of parents play with their children at least once a month, and 32% of gamers play with other family members. 88% of parents think that game play is fun for the whole family; 75% believe playing games offers a good opportunity to socialize with their child; and 55% believe interactive gaming helps the family spend time together (ESA, 2014). In Canada, 80% of parent gamers play computer and video games with their children and 52% of parent gamers report family game play of once per week or more (ESA, 2012). The top four reasons that Canadian parents play video games with their children include: (1) it is fun for the entire family, 87%; (2) because they are asked to, 83%; (3) it is a meaningful opportunity to socialize and bond together, 75%; and (4) it is a useful way for monitoring household game content, 60% (ESCA, 2009) (Artifact 4).

Video games and virtual worlds are becoming a dominant form of art, expression, and socialization in today's technology culture (Kafai, 2006; Kelleher, 2006). During the last five years, an explosion of social media games has attracted non-traditional and non-hardcore gamers to join in on the fun, however, few of these games are designed specifically for

families to play together (Goetz, 2010; Kearney, 2006). Hence, there is a need for the innovation and development of new high-quality games that do no unintentionally engage family members, but purposefully unite them in the multiple pleasures of intergenerational gaming, with play patterns that foster richer social and collaborative experiences (Szulborski, 2005). Accordingly, parents can become meaningful participants in the gaming lives of their children, and digital games can claim a rightful place within family traditions and everyday familial leisure activities (ESA, 2014; ESAC, 2009, 2012; Gee & Hayes, 2009).
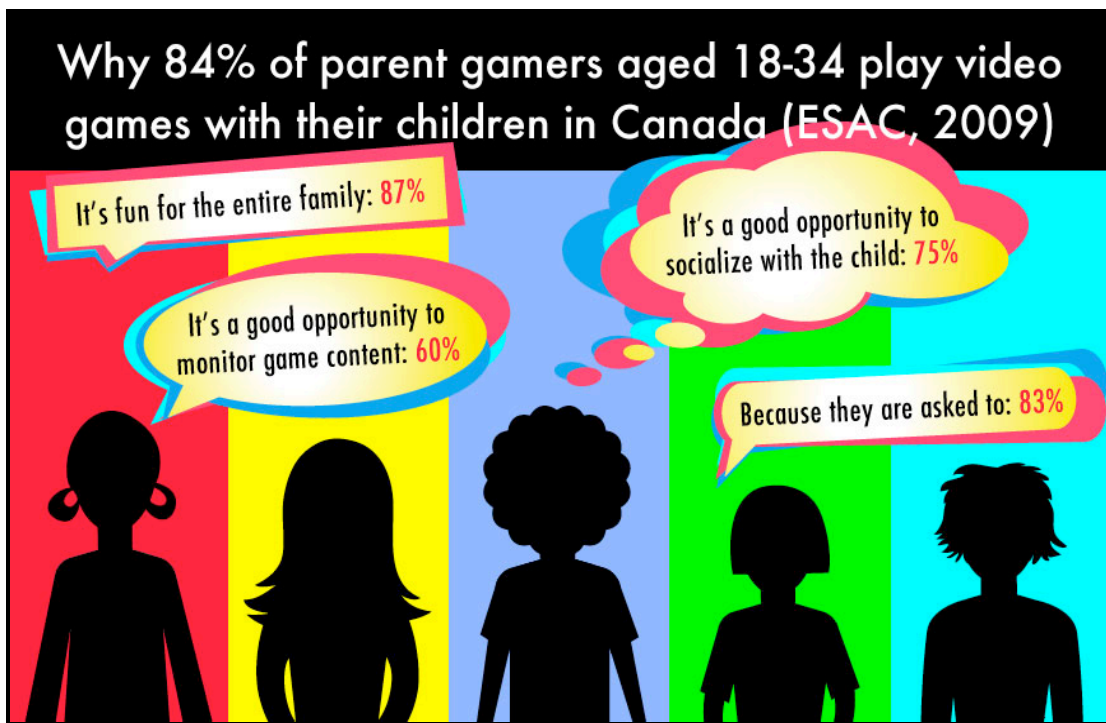
Artifact 4. Why Parents Play Video Games With Their Children

Focusing attention to feminist perspectives on and participation in game development (a genre too often marginalized as tangential), the *101 Technology Fun* team designed a new kind of social media play: an alternate reality game (ARG) for females to play together in commemoration of Mother's Day (Rusnak, 2010b, 2014a, 2014b; Szulborski, 2005). The *momME* game weaves together a boldly adventurous plot, positive social energy, feminine

power, and fun. Teams of mothers and daughters (and even grandmothers) must unite together to save Mother's Day from its 'looming demise' by undertaking collaborative game missions that help them to unravel *The Infinite Evil's* wicked plot. Whereas most traditional games are developed to help people escape from reality, the *101 Technology Fun* co-researchers designed *momME* to make reality more engaging. For example, players are challenged to complete real-life game missions that involve creating personalized media works of song, dance, photography, art, and story.

momME's key objective is for mother/daughter teams worldwide to generate thousands of meaningful artifacts, stories, and community-building experiences that will be archived on the *momME* website as a living cultural legacy of collaborative, non-violent, and inter-generational game play (Rusnak, 2014a, 2014b). With intelligence and passion, *momME* is significant for empowering females to be game designers, innovators, and producers not just users of technology. *momME* is characterized by powerful feminine energy that stands up to a games industry as-yet dominated by a masculine culture of play, in part due to the fact that the storyline and game content are designed, rated, and contributed by girl gamers of all ages and cultures. Rather than making a gender-neutral game, *momME* is specially designed for females who are gaming together for their own social, creative, intellectual, and recreational pleasures (Gee & Hayes, 2009; Rusnak, 2014a, 2014b).

The design, development, and distribution of new kinds of digitally-interactive games is contingent upon no shortage of complex and ongoing tensions amongst market demands, industry stakeholders, production infrastructure, distributor relations, advertising campaigns, political and social agendas, educational philosophies, popular culture, previous successes, new technological developments, and much more (Petrina, Rusnak, Eklund, & Kocher, 2010;

Pew Internet, 2010, Rideout et al., 2010). With certainty, the problem of creating pro-social,

pro-feminist, and intergenerational gaming worlds serves as the catalyst for a remarkable

design challenge. It remains an open question as to whether or not new gaming cultures will

benefit the vast majority (including all gender, race, and class), and whether they will serve

the consumerist marketing machine or humanity's social concerns (Cassell & Cramer, 2008;

Rusnak, 2014a, 2014b)? Although many feminists are intrigued by the possibilities that new

gaming technologies and social media platforms offer today's generation of girls, stressing

their capacity for agency and empowerment, Wajcman (2004) shares a cautionary view:

> The contemporary use of the Web by transnational corporations, financial markets,
>
> global criminal networks, military strategists and international racists is a means to
>
> evade social regulation, entrench political control, and concentrate economic power.
>
> Men still heavily dominate these institutions and groups, and there are dramatic
>
> gender differentials in access to, and control over, electronic networks. Furthermore,
>
> rather than celebrating cyberspace for providing the opportunity for free expression of
>
> people's desires, we should lament the massive growth of pornographic web sites,
>
> amongst the most frequently visited and most profitable sites on the Internet. Sexual
>
> harassment, the international sex trade, pedophile networks, and anxiety about
>
> children's vulnerability, are the focus of this perspective (p. 7).

What might become thinkable and 'doable' if we heed Wajcman's (2004) counsel and act

upon Leonard's (2003, p. 188) advice: "For if we decide what a technological society ought

to be and set out to make it that way, then we have reason to expect that we have a chance to

succeed in putting technology to work to serve the values we believe in." As critically

discussed in the research of Brunner and Bennett (2002), Kramarae (1998), Schwartz-Cowan

(1995) and Wajcman (1998, 2004), women's ways, voices, and values can shape the design and use of new technologies (including the computer and video games of today and tomorrow) in ways that are currently nonexistent and undiscovered.

I believe that the advancement of a more equitable, inclusive, and fun games industry is possible, and *momME* is one example of how this innovation may proceed, with the objective of not to figure the one 'right' game for all girls (who are as diverse in their interests, abilities, and preferences as any other category of people), but to bring forth new gaming experiences that include diverse feminist perspectives and play preferences (Cassell & Cramer, 2008; Gee & Hayes, 2009; Kafai, 2006; Kearney, 2006). I am not so naïve to view *momME* as an autonomous agent of pro-feminist and pro-social change, and I realize that this game may have unanticipated negative and unjust outcomes. However, it does represent a creative and meaningful attempt by a team of tween-aged girls to design and innovate a new kind of social media ARG for mothers and daughters to play together (Rusnak, 2010a, 2014b). Fathers and sons are also welcome to play, without penalty!

As with all forms of technology, today's computer and video games are cultural artifacts with remarkable potential to generate new ways of gender bending and human flourishing (Kafai, 2006; Kearney, 2006). Of critical relevance for a society in which games are ubiquitous and a more significant contributor to culture than ever before, we need to understand how making and playing games can influence players' lives, impact familial relationships, and transform the worlds in and around us (both real and virtual) (Denner et al., 2005; Gee & Hayes, 2009). At stake is how the divergent gaming worlds we inhabit are designed: by whom, for whom, and for what purposes (Wajcman, 1998, 2004)?

What kind of initiatives will attract more girls to become game developers such that they can create their own games, on their own terms, and in feminine ways (Kelleher, 2006)? What changes are needed within the masculinist culture of the interactive entertainment industry to improve its image, reduce its discrimination, and make it more appealing to females (AAUW, 2000)? What new types of social media and gaming experiences need to be invented to foster positive familial experiences for intergenerational groups of gamers (Rusnak, 2014a, 2014b)? If, as Turkle (1998) suggests, humans and technology are co-constitutive and co-evolving, how might virtual world builders create gaming experiences that offer players more meaningful materials, narratives, cultures, and identities with which to construct themselves?

2.3 WHY DO WE NEED MORE GIRLS AS THE DESIGNERS, INNOVATORS & LEADERS OF TECHNOLOGY?

Originally a verb derived in the 1540's from the Latin *designare* "to mark out, devise, choose, designate, appoint," from *de* "out" + *signare* "to mark," the meanings, methods, and practices of design have changed significantly over the years (*Online Etymology Dictionary*, 2014). Design is most commonly associated with aesthetics, fashion, photography, and the covetable objects found in the pages of avant-garde publications, but this is a narrow view of what design is and why it matters (Brown, 2006; Perkins, 1986; Petrina, 1998, 2000). The discipline encompasses everything from architecture and urban planning, to computer and visual arts, to information and management systems, yet seldom do we give much thought to how we live in the most ubiquitously (and perhaps overly) designed time in human history. Design can be found in every brand, bridge, building, city, code, computer, concert, curriculum, landscape, process, product, school, service, system, textbook, etc. Design offers

a way of seeing not just what is but what might be, and therein has the potential to change the way we think, act, teach, learn, and story the realities of everyday life (Berger, 2009). As Berman (2009) explains, design is increasing the diversity of the worlds we live in, influencing consumption habits, and expanding the space of the possible for our choices, freedoms, and opportunities to be.

Simon's (1969/1981) definition of design remains universal and comprehensive: "devis[ing] courses of action aimed at changing existing situations into preferred ones" (p. 129). Design is "making sense of things" or a "sense creating activity" (Krippendorff, 1989, p. 9) and "a structure adapted to a purpose" (Perkins, 1986, p. 2) that is also a significant contributor to culture and identity as Heskett (2002) explains: "Design, stripped to its essence, can be defined as the human nature to shape and make our environment in ways without precedent in nature, to serve our needs and to give meaning to our lives" (p. 7). Or as Fry (2009, p. 25) puts it, design is amongst "the main operative agents of the social, cultural and economic functioning and dysfunctioning of humanity's made world." Design is the "conception and realization of new things. It encompasses the appreciation of 'material culture' and the application of 'the arts of planning, inventing, making, and doing' "(Cross, 2006, p. 17). In the HWL project, we define design as assembling existing situations or states of affairs (e.g., events, objects, spaces, systems, etc.) into desired states of affairs. Hence, when we refer to designerly ways, we mean a manner or mode that involves assembling a given into a desired state.

Recognizing that design has its own "things to know, ways of knowing them, and ways of finding out about them," Cross (2006, p. 17) theorizes "designerly ways of knowing" as a third intellectual culture distinct from the well-established educational traditions of the

sciences and humanities (Table 4). Cross's research builds a network of academic arguments and industry evidence for designerly ways of knowing in which knowledge is constructed and adapted to a purpose with a context, rather than something 'out there' waiting to be discovered. Explaining what it means to be designerly (rather than scientific or artistic) Cross (p. 18) theorizes how designers must define and resolve design problems; create non-verbal models or prototypes; employ methods of modeling, pattern formation, and synthesis; value practicality, ingenuity, empathy, and appropriateness; and use abductive or appositional thinking. Design problems are commonly recognized as ill-defined, ill-structured, and 'wicked' because all of the necessary information is not usually available to the problem solver who must therefore explore diverse aspects of an issue from a variety of perspectives, whilst simultaneously considering possible solutions from different vantage points (p. 25).

Table 4. A Three Cultures View of Human Knowledge and Ability (Cross, 2006, p. 18).

THREE CULTURES	PHENOMENON OF STUDY	VALUES & PRACTICES	APPROPRIATE METHODS
Design	human-made or artificial world	practicality, ingenuity, empathy, and a concern for appropriateness	modeling, synthesis, pattern forming, technacy, machineries
Humanities	human experience	subjectivity, imagination, commitment, and a concern for justice	criticism, metaphor, analogy, evaluation, literacies
Sciences	natural world	objectivity, rationality, neutrality, and a concern for truth	controlled experiment, classification, analysis, numeracy

Design involves an interactive relationship between design problems and design solutions. It is not a matter of first defining a problem and then searching for the best solution by exhaustive investigation, but rather a co-evolution of developing and refining both the formulation of a problem and its potential solutions. Development of the problem/solution

pair necessarily involves an iterative cycle of analysis, synthesis, and evaluation, as Cross

(2001) explains: "design is not so much a 'creative leap' from problem to solution as the

building of a 'bridge' between the problem space and the solution space by the identification

of a key concept" (p. 435). Hence, in my design work with girls, there is not a single correct

or finite solution that exists somewhere waiting to be discovered, rather the design process

constantly generates new ideas, criteria, and enabling constraints that may subsequently

change their design problem(s) and/or solution(s) (Hill, 2010). To put it another way, what

my team of co-researchers need to know about their design problems will only become

apparent as they are engaged in the process of solving them (Rusnak, 2014a, 2014b).

Designerly ways of knowing depends upon "our ability to be intuitive, to recognize

patterns, to construct ideas that have emotional meaning as well as functionality, to express

ourselves in media other than words or symbols" (Brown, 2009, p. 4), which is to say that

through the act of making things, girls can develop a wide range of abilities in nonverbal

thought and communication. Focused on action-oriented behaviour rather than discussion-

based work, design is biased towards doing, making, planning, building, inventing, modeling,

taking risks, and engaging with various materials and tools (both physical and virtual) in an

experiential learning environment. Designers are actively engaged, individually and

collectively, in a design cycle of questioning, empathizing, prototyping, evaluating, and

refining. This is an iterative feedback loop from which new design solutions grow out of,

resolve, and create new design problems (Brown, 2009; Hill, 2010; Wilson, 2013). The key

principles for designers are to be: (1) mindful of their design processes (e.g., not narrowly

focused on specific or pre-determined outcomes); and (2) cognizant of what they are doing

and where they need to go next (thereby developing meta-cognitive awareness). As Cross

(2006) cautions, "method may be vital to the practice of science (where it validates the results) but not to the practice of design (where results do not have to be repeatable, and in many cases must *not* be repeated or copied)" (p. 121).

Brown's (2009) work expands the notion of design to *design thinking,* a term that he uses to describe a set of design principles that can be applied by humans to affect positive change and bring innovation into our world. Design thinking is a catalyst for generating new ideas and creative solutions to a wide range of issues in diverse domains such as banking policy, crime prevention, education, global warming, health care, national security, and quality of life. Coinciding with the latest trends towards the sustainable redesign of our future world (where waste is a design flaw), design thinking is "at the core of the world's largest challenges… and solutions" (Berman, 2009) with massive power to "transform your life, your business, and maybe even the world" (Berger, 2009) by responsibly "designing tomorrow today" (Brown, 2009). Design's greatest contribution is not to make better things, but to make the world a better and more sustainable place by improving the relationships between our communities, cultures, economic systems, education institutions, environments, governments, technologies, and each other (Petrina, 2000a). Likewise, Bottrill (1995, p. 5) emphasizes that "design activity in school can enable students to appreciate the human-made world in which they live and work; and through taking action with technology, students can begin to shape their future environment." Henceforth, design prepares learners to become empowered "world builders" or "systems thinkers reinventing the world" who possess the tools, confidence, and initiative to co-create the worlds in and around them (Brown, 2009).

Although women have a long history of design achievements, evidenced by the artifacts and traditional craftwork of previous civilizations and cultures from around the

world, the practice of design became professionalized in the 20th century and subsequently restricted to the specialized domain of experts working in exclusive studios (Berger, 2009; Brown, 2009). Simultaneous with the maturation of industrial society, design's cultural richness was narrowly reduced to that of a mere tool for consumerist priorities and interests (Berman, 2009). In the last few decades, however, the role of design has been shifting away from the "blind consumption" and "invisible production" of objects (Petrina, 2000a), and moving towards mutual participation in the creation of things and experiences that are meaningful, productive, and profitable. Or as Brown puts it, "balancing desirability, what humans need, with technical feasibility and economic viability" (2009). Facilitated by the rise of networked publics, massive collectivity and connectivity, and globalization, design is now being democratized with a do it yourself (DIY) and do it together (DIT) ethic that invites all citizens to be designers, including those who may have never thought of themselves as such. While upholding rigorous standards is undeniably problematic and some people appear to be better designers than others, Brown (2009) believes that "design may have its greatest impact when it's taken out of the hands of designers and put into the hands of everyone" (p. 8). Hence, design is evolving into a participatory practice in which it is up to us all to consider how everything we create and consume effects the culture and condition of the human and more-than-human worlds that we are in and part of (Petrina, 2000a, 2010).

Like Denner et al. (2005), I utilize design as a vital bridge or meaning-making activity to connect the *101 Technology Fun* team members to the production and development aspects of media and technology. Design is an alternative way of teaching and learning that is not found in any other subject in standard school curriculum (e.g., students construct their own knowledge through their interactions with ideas, problems, peers,

teachers, tools, and materials), and its "technacy" is recognized as having intrinsic value in the development of intellect and basic educational proficiency, just like literacy and numeracy (Cross, 2006). Design offers new and transformative opportunities for the *101 Technology Fun* co-researchers to make their own meanings and understandings through diverse media forms (e.g., beyond words or symbols), whilst creating rich artifacts of and for learning (Rusnak, 2014a, 2014b; Wilson, 2013).

While the girls in my study might not become professional designers, they will develop a deep awareness of what design is and how to use it as a powerful tool for generating multiple solutions to complex problems (Cross, 2006; Denner et al., 2005). Additionally, they will have an opportunity to develop valuable design skills, including creative confidence; self-expression; teamwork and team building; empathy for others (e.g., those who will be using their design solutions); the capacity to appreciate and evaluate the human and more-than-human worlds; and the ethical know-how to understand and use technology purposefully and sustainably (Petrina, 2000a, 2010; Scott, 2007; Wilson, 2013; Wilson & Schwier, 2009). These design mindsets, sensitivities, and abilities are essential to give girls the agency and motivation to create positive change in themselves and in our technologically dependent society which has "challenges and opportunities beyond what we can predict, with new possibilities and problems that will demand creativity, ingenuity, responsibility, and compassion" (OWP/P Architects et al., 2010).

How do we empower today's girls to grow up as a new generation of tech-savvy agents of change who possess the tools, capabilities, and initiative to take sensible risks in designing more equitable and sustainable technology futures (Rusnak, 2014a, 2014b)? "Girls' lack of participation in this growing and important sector of society has serious

consequences not only for girls and women but also for the future of technical innovation" (Ashcraft, Eger & Friend, 2012b, p. 2). Increasing female participation in designing and innovating technology is essential to ensure that their experiences, needs, and desires are represented in ways that result in meaningful and positive outcomes for both the lives of girls and future society (AAUW, 2000; Edwards, 2002; Hill, Corbett & St. Rose, 2010). Design offers a vehicle for females to explore media and technology and express their concerns, interests, pleasures, and talents, thereby intensifying femininity and mitigating masculinity (Kafai, 2006; Kearney, 2006; Kelleher, 2006). Girls need to know that their perspectives matter and are significant in media and technology culture, and we need to encourage them to become designers, innovators, and leaders of change as Doyle (2013) criticizes: "Another year has now passed with the collective intelligence of the other half of the human race— female brainpower, perspective and life experience— barely tapped."

TO MAKE A LONG STORY SHORT

Building a case for the importance and necessity of this study, chapter two traced the research literature relating to how girls learn to design media and technology (e.g., games, movies, robots, and websites). I argued why it is essential for today's girls to participate in creating media and technology futures with increased gender parity, responsibility, and sustainability (Leonard, 2003; Schwartz-Cowan, 1995; Wajcman, 1998, 2004). Next, I reviewed how a range of academic and industry initiatives are supporting girls to acquire the confidence, literacies, motivation, and tools to become empowered leaders of technological innovation and change (AAUW, 2000; Denner et al., 2005; Sandberg, 2013; Sandberg & Grant, 2015). Finally, I explored the literature for designerly ways of educating girls to

understand and overcome the taken-for-granted beliefs, norms, and value systems within well-established and hegemonic techno-cultural discourses (Allhutter, 2012; Farmer, 2008; Hill & Anning, 2001; Kearney, 2006). I quote Ashcraft, Eger & Friend (2012b, p. 2) to draw this chapter to a close: "Technology increasingly permeates every aspect of society and provides the foundation for most modern innovation" and yet "girls represent a valuable, mostly untapped talent pool."

girls-in-interaction-with-technology-and-stories

3

CHAPTER 3:
GIRLS-IN-INTERACTION-WITH-TECHNOLOGY-AND-STORIES

Artifact 6: "Oh, let me tell you a story about my doctoral research!"

> Alice was beginning to get very tired of sitting by her sister on the bank and
> of having nothing to do: once or twice she had peeped into the book her
> sister was reading, but it has not pictures or conversations in it, "And what
> is the use of a book," thought Alice, "without pictures or conversations?"
>
> **Alice, *Alice's Adventures in Wonderland,***
> **Chapter 1, *Down the Rabbit Hole***

In this chapter, I develop a foundation to ground my doctoral research. I begin by

providing a rationale for utilizing a story epistemology to understand how girls make

meaning and construct knowledge *about, for, from, and with/against* technology (e.g., how

they view themselves in media and technology cultures). This is followed by an examination

of the issues and implications associated with engaging tween-aged participants as co-

researchers in an educational study concerning their lives and learning circumstances (e.g.,

Artifacts 5, 6). Next, I work through various ethical, etymological, epistemological, and

methodological dimensions of story and storymaking, focusing on literature related to young

adolescents. As a significant contribution of my research involves a team of girls as Alternate

Reality Game designers, this chapter will get some help from Alice, fiction's most famous

Alternate Reality Girl. I juxtapose evocative excerpts from Lewis Carroll's (1865) *Alice's*

Adventures in Wonderland and *Alice Through the Lookinglass* (1871) with the theoretical

framework that I build upon. These are places to pause and question the already-interpreted

understandings made about story within the 'wonderland' of academia (as well as to have

some fun along the way). The *Alice* stories serve in this chapter as insightful allegories of

how girls come to know about themselves and the technology in their lives and worlds[3].

3.1 STORY EPISTEMOLOGY: UNDERSTANDING HOW GIRLS CONSTRUCT KNOWLEDGE IN-INTERACTION-WITH TECHNOLOGY

Few would doubt that narrative is a research methodology, where "narrative" is

shorthand for narrative analysis. Whether story is a research methodology is somewhat more

complicated, although not at all contested within indigenous or postcolonial methodologies.

For example, in *Story as Indigenous Methodology,* Kovach (2009) advocates for methods

that honour story in congruency with Indigenous epistemology. The issue of "story as

research methodology" cannot be reduced to mere semantics, however, as scholars often use

narrative and story interchangeably (e.g., Clandinin & Connelly, 2000; Freeman & Mathison,

2009; Fulford, 1999; Hardy, 1994; King, 2003; Langellier & Peterson, 2004; Leggo, 2004,

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[3] Charles Lutwidge Dodgson (1832–1898), aka Lewis Carroll, has been the subject of a variety of biographies, some of which allege pedophilia and illegal drug use. For some, the pedophilia evidence rests on Dodgson's photographs, which range from little girls and boys to grown women and men. I believe that these unproven charges are dispelled and evidence to the contrary is provided in standard biographies, including Karoline Leach's (1999) *In the Shadow of the Dreamchild,* Christopher Hollingsworth's (2009) *Alice beyond Wonderland: Essays for the Twenty-First Century,* and Jan Susina's (2010) *The Place of Lewis Carroll in Children's Literature.*

2009; Mallan, 2003). Additionally, story-based methodology and story-based research, seemingly in some ways different from narrative analysis, have become popular referents across a variety of disciplines in the humanities and social sciences, including law, marketing, management studies, and nursing (Bruner, 2003; Monasco, 2006; Stevenson, 2009). Although story may be defined as "an oral or written performance involving two or more people interpreting past or anticipated experience" (Boje, 1995, p. 1000), I am primarily interested in the storymaking aspects of stories, which are part and parcel of girls' everyday sense-making and meaning-making practices (Bach, 1998; Goldman-Segall, 1998).

My study begins with the premise that engaging girls with hands-on experiences as designers and researchers of technology, rather than simply as consumers, can be personally and culturally transformative in pro-social, pro-feminist, and empowering ways, rather than simply reproducing existing gender roles. My research broadly investigates how girls learn and construct identity *about*, *through*, *from, and with/against* technology in a culture where technology (most notably games) is immersive and pervasive (Petrina, Feng & Kim, 2008). One way of addressing my research problem is by attending to the stories that girls make and tell about how they learn, who they are, and who they want to become (Artifact 5). Hence, my study concentrates on the story artifacts and vignettes that a team of girls individually and collectively created during their learning experiences in-interaction-with the *101 Technology Fun* makerspace community (e.g., animating characters, building websites, designing games, making movies, and programming robots). As my team are learning, playing, and thinking at *101 Technology Fun*, their participation is scaffolded but not constrained by guiding research structures and goals, such that the girls are encouraged to cultivate new affinities, identities, and relationships with media and technology, both during and beyond the domain of the

summer camp program (Denner et al, 2005; Goldman-Segall, 1998; Kafai, 1995, 2006).

While there may be big or grand narratives articulated, I am primarily interested in the more

modest and localized "little stories" (e.g., Lyotard's *petits récits*) (Lyotard, 1984).

As articulated in the first chapter, my research emphasis is on girls' storymaking. The

key theoretical assumptions grounding the use of story and storymaking include:

- Storymaking serves as a motivating framework for getting girls involved in the research and design processes as research partners (not research objects), thereby minimizing the misrepresentation of the co-researchers through adult research lenses or hegemonic media and technology stereotypes (Bach, 1998; Denner et al, 2005; Mallan, 2003).

- Girls' stories are a rich source of research to examine because they express underlying emotions and intellect simultaneously, thereby allowing for complex understandings of how the co-researchers are positioned (by themselves and others) within existing techno-cultural discourses (Goldman-Segall, 1998; Freeman & Mathison, 2009).

- Storymaking contributes a complex and dynamic dataset that captures and gives voice to girls' learning experiences in diverse media forms (e.g., avatar, game, image, text, and video), thereby honouring and representing the multi-dimensional perspectives that the co-researchers have about *girlhood in-interaction-with technology* (Kearney, 2006; Kelleher, 2006; Petrina, Feng & Kim, 2008).

- Girls' stories are as epistemologically valuable as more objective and quantitative findings because they are consistent with how children come to know what they know about themselves and the technology in their lives and worlds (e.g., story embraces wonder, imagination, curiosity, ambiguity, and play) (Haynes, 2008; Lipkin, 2009; Mallan, 2003).

- Storymaking generates a personal, subjective, and transgressive research product, thereby opening up space and supporting the co-researchers to contribute their stories to technology culture, as meaningful alternatives to the dominant ones (Allhutter, 2012; Bach, 1998; Sandberg, 2013).

This research continues to develop and refine empowering and ethical research

practices that are respectful towards and inclusive of girls. Hence, definitions of story and

storymaking must necessarily emerge in consonance with an age cohort of 10 to 13 year old youth. My commitment is to encourage scholarly reflection about what it means to do research with these young girls. As such, my study moves away from rigidly categorized thought and "statistically valid, generalizable, and conclusive" fact, and leans into a creative, evocative, multifaceted, and transgressive scholarship that finds its force in the rich complexities and subjectivities of girls' stories. My intent is not to straitjacket the study of *girls-in-interaction-with-technology* but to open the door of possibility, and then go in and search (Bach, 1998). Henceforth, I heed Stevenson's (2009, p. 1) caution that "eliciting stories from research participants is not always methodologically simplistic or ethically straightforward." I am mindful of Vickers' scholarly warning that story researchers are "writing on the edge— and without a safety net" (2002, p. 619) in view of the fact that stories are enfolding and entangling everywhere within (and beyond) this dissertation:

- Story as data, story as method, story as analysis.
- Story as knowing, story as learning, story as being.
- Story as political, story as personal, story as poetic, story as pedagogical.

Furthermore, there is the *momME* game story, the *101 Technology Fun* story, and my doctoral studies story (Artifact 6). Such is the proliferation of story in my research: refusing to be still, wanting to be valued, and urging to be understood as, "the truth about stories is that's all we are" (King, 2003, p. 2). Such is the necessity to understand that which we have never ceased to be, which we simply become once more— human stories (Bruner, 2003). But how do we account for the thinking that story produces (Mallan, 2003)? How do we account for the being that story is (King, 2003)? What makes a story a story (McKee, 1997)? Is story of epistemology or is story epistemology (Kovach, 2009)? How and why do girls' colorful

and imaginative stories matter in educational research (Bach, 1998)? How might analyzing girls' stories enable us to understand their experiences and expressions of technology in a more-than-human world that often defies logic (Carroll, 2000)? How can a researcher be a storyteller (Vickers, 2001)? And whose story is it anyways (Goldman-Segall, 1998)?

3.2 RESEARCH(ERS) IN WONDERLAND: WONDER IN RESEARCHLAND

> "Who are you?" said the Caterpillar.
> This was not an encouraging opening for a conversation. Alice replied, rather shyly, "I— I hardly know, Sir, just at present— at least I know who I was when I got up this morning, but I think I must have been changes several times since then."
> "What do you mean by that?" said the Caterpillar, sternly. "Explain yourself!"
> "I *ca'n't* explain myself, I'm afraid," said Alice, "because I'm not myself, you see."
>
> **Alice and the Caterpillar,** *Alice's Adventures in Wonderland,*
> **Chapter 5,** *Advice from a Caterpillar*

What does story mean for educational research, especially in an era of increasing accountability and rising academic standards with quantifiable assessments? Traditional research methods look for clarity and precision, and it is implied that messy findings are a product of poor research (Denzin, 1997, 2002; Law, 2004). Standard research practices tend to have clear rules and everything seems to have a well-defined and proper place. Well, not exactly everything… Wonder is easily misplaced or lost altogether. For example, the graduate thesis in education or the social sciences conventionally ends with the student stating, "I found or I conclude [it was found or concluded]…" or "I recommend [it can be recommended]…" Rarely will the thesis end with the student stating, "You know, I really wonder…" We forget about the vastness of our world and that how we learn in it can never be reduced to polite logic and institutional norms. Wouldn't we rather know and be right than live in a state of wonder and uncertainty? Or would we?

After Alice falls down the rabbit hole, nothing she knew from above ground makes sense anymore. None of the rules are the same and things behave differently from how they appear. Alice arrives in Wonderland not as her childlike-self, but as the most sensible, reasonable, and grown-up being. She wanders around frustrated by her size until she figures out how to eat the right amount of mushroom to grow bigger and smaller. Then she meets all kinds of colorful characters who do not seem to be following any rules at all, which brings Alice much confusion and adventure: the smoking blue caterpillar, the Mad Hatter who is forever stuck at 6:00 having tea, and the White Queen who lives backwards and remembers forward. They do not do anything that Alice thinks is proper or right! The Wonderland inhabitants, events, and environments do not comply with Alice's lived experiences or her understanding of beings-in-the-world.

And so I wonder: what is story's capacity for unmaking many of our normative ideas about how research should be proper and right? What is story's capacity for contradicting gender norms in media and technology culture? Suppose we, as educational researchers, opened our minds to wonderment (like Alice) and were able to peel away the preconceptions, constructed realities, and habitual patterns that we take for granted and bring to our work. Would we expand the space of the possible for thinking differently in order to "see anew the wonder in the quotidian," and create the conditions for the emergence of the "as-yet unimagined" (Lewis, 2011, p. 510)? Would we see through our illusions, our literalisms, and our conditioning (Bruner, 2003; Law, 2004; Pelias, 2004)? Would we hear alternative truths and make them targets of inquiry in the "already interpreted" worlds in and around us (Bach, 1998)? Just wondering…

As the framing of research determines its importance and is never a neutral act, it behooves me, as an educational scholar, to carefully consider my methodological decisions and practices, which are far greater than a specific set of procedures that, if followed correctly, lead to a new or better understanding of knowledge. Methodological forms also serve to produce and perform realities, as Law (2004) demonstrates in *After Method: Mess in Social Science Research.* This raises political questions about what or whom do my research methods benefit, serve, and privilege (Freeman & Mathison, 2009)? How do certain methods become normalized as part of the canon, whilst other approaches are discounted as unintelligible or inarticulate (Bruner, 2003)? What are the relationships between forms of representation and forms of understanding (Langellier & Peterson, 2004)? What gets revealed and what gets concealed as we "word the world" (Leggo, 2004)?

If our interpretive practices have a material effect upon the world and there are ethical and material consequences of our research findings (Denzin, 2002), then what is the productive potential of story research that "finds its force in the imaginative" (Pelias, 2004, p. 12)? How might girls' stories productively contribute to the education research agenda as a valid form of knowledge creation and analysis (Bach, 1998; Kearney, 2006; Schwartz-Cowan, 1995)? Why is it particularly important to employ methodological approaches that empower the voices of marginalized groups to be heard by others, and in ways that do not further marginalize them (Goldman-Segall, 1998; Sandberg, 2013; Sandberg & Grant, 2015; Vadeboncoeur, 2005)? Furthermore, if my story-based research methods contribute to structuring meaning and serve in producing and performing realities (Kovach, 2009; Law, 2004), then what kinds of realities do I (as a co-researcher, co-learner, and co-designer) want to make possible for the girls in my study (Rusnak, 2010a, 2014b)?

3.3 RESEARCHED PARTICIPANTS: PARTICIPATORY CO-RESEARCHERS

> "When *I* use a word," Humpty Dumpty said, in rather a scornful tone,
> "it means just what I choose it to mean— neither more nor less."
> "The question is," said Alice, "whether you can make words mean
> so many different things."
> "The question is," said Humpty Dumpty, "which is to be master— that's all…
> They've a temper, some of them— particularly verbs: they're the proudest –
> adjectives you can do anything with, but not verbs— however, *I* can mange the whole
> lot of them? Impenetrability! That's what *I* say!"
> "Would you tell me, please, what that means?"
> "Now you talk like a reasonable child," said Humpty Dumpty, looking very pleased.
> "I meant by 'impenetrability' that we've had enough of that subject…"
>
> "That's a great deal to make one word mean," Alice said in a thoughtful tone.
> "When I make a word do a lot of work like that," said Humpty Dumpty,
> "I always pay it extra."
>
> **Humpty Dumpty and Alice, *Through the Looking-Glass,***
> **Chapter 6, *Humpty Dumpty***

This conversation between Humpty Dumpty and Alice is worth quoting at length, as I

turn our attention towards the paradox of researcher/participant partnerships that seek to be

collaborative, despite the fact that multiple inequalities always already exist. Discourses of

power, re/presentation, and voice are inherently problematic in participatory research

practices, and as Humpty's rhetorical question provokes, I must attend to the ultimatum of

"which is to be master" (e.g., researcher or participant) in our co-inquiry endeavors? Who

writes? Who speaks? Who designs? Who participates in analyzing and synthesizing the

research stories (Allhutter, 2012)? When multiple points of viewing are presented, whose

voices are heard the loudest (Goldman-Segall, 1998; Mallan, 2003)? From what or whose

standpoint are the co-researchers speaking? Whose interpretations are trusted the most? Who

has the authority to approve or reject the final research text? Who receives publication credit?

In *my* dissertation writing, use of the first person connotes individual authorship,

however, I wonder about the implications of using *we* or *our* to refer to the individual or collective thinking, writing, and designing contributed by myself or my multiple teams of co-researchers. For example, Deleuze and Guattari (1987) describe the *we* of their writing partnership to refer to the multiplicity of perspectives taken up by either or both authors. Humpty Dumpty's bold and commanding use of language, to the point of imponderable impenetrability, is particularly worthy of consideration for researchers like myself who are engaged in the generative and creative processes of storymaking. Lewis Carroll's (2000) capricious language play is perhaps made more sensible by German philosopher Heidegger (1971) who, despite his own impenetrability, theorizes that we have a "house of being" which exists first in language (preceding anything else) in order to engage with the world: "Man [sic] acts as though *he* were the shaper and master of language, while in fact *language* remains the master of man" (p. 146). What are the roles of language, discourse, and story in the re/production of identity, knowledge, reality, and research?

I am well aware of the considerable honour and responsibility that I have as an educational researcher; hence, I endeavor to be mindful of how my epistemological beliefs, methodological commitments, language choices, professional experiences, theoretical positions, and value commitments affect my young co-researchers and our study findings (Haynes, 2008; Scott, 2007). With care and concern, I question the knowledge claims made *about, for, from, and with/against* girls, and ask: "who in today's culture speaks for our children and youth?" Academics, activists, artists, educators, fiction writers, filmmakers, game designers, journalists, parents, peers, psychologists, sociologists, songwriters, and relevant others are constantly projecting a barrage of conflicting yet influencing messages about how girls *should* learn and who they *should* be (Bach, 1998; Kearney, 2006; Turkle,

1988). As a self-reflexive scholar, I am compelled to ask myself "who am I in constructing a re/presentation of how girls learn in-interaction-with technology?" To what extent does my dissertation study act as yet another methodological or societal template for filling in, shaping, and creating girls (Bach, 1998; Farmer, 2008; Law, 2004)? How are the co-researchers influenced by my subjectivity, as Denzin (1997, p. 5) challenges: "Who is the subject? Does the subject have direct access to his or her lived experiences? Is there a layer of lived experience that is authentic and real? Is any representation of an experience as good as any other? Are the subject's formulations always the most accurate?"

In response to Denzin's (1997) provocative questions, I have additional questions: How do I celebrate or give the co-researchers voice and authentic representation that allows for multiple, dynamic, and contradictory perspectives, rather than privileging my views as 'master of all' (Haynes, 2008; Schweir & Wilson, 2010)? To what extent or capacity can girls identify, analyze, and communicate their experiences and expressions of media and technology (Petrina, Feng & Kim, 2008)? What does it mean to challenge the passive acceptance of fixed knowledge with storied and designerly ways of knowing (Cross, 2006; Hill & Anning, 2001)? How do I get my team to think creatively and freely, without conceptual barriers to imagination and innovation (Pelias, 2004)? Who will listen to girls' colorful stories and imaginative descriptions of how they are learning, playing, and making meaning at *101 Technology Fun*? How will our research be valued and interpreted? Will it generate more equitable and progressive possibilities for girls to contribute and to be (e.g., beyond mere conformists or consumers)? Will the co-researchers learn how to examine their media and technology relationships with a critical eye towards empowered transformation and counter-masculinist technology culture (Sandberg, 2013; Turkle, 1988; Wajcman, 2004)?

3.4 RESEARCH AS STORY: STORY AS RESEARCH

"There's no use trying," she said: "one *ca'n't* believe impossible things."
"I daresay you haven't had much practice," said the Queen.
"When I was your age, I always did it for half-an-hour a day.
Why, sometimes I've believed as many as six impossible things before
breakfast."
Alice and the White Queen, *Through the Looking-Glass,*
Chapter 5, *Wool and Water*

I believe that stories are a powerful way to communicate research findings and one of

the most persuasive ways to put ideas into the world today. Consider Plato's declaration that:

"Those who tell stories rule society" (Geivett & Spiegel, 2007; McKee, 1997). In 388 BCE

Plato implored the city fathers of Athens to exile all storytellers and poets as they threatened

to rule society with their passionate and emotional ideas. Storytellers are dangerous people,

Plato insisted in his skepticism of rhetoric, as they hide their thoughts and feelings in

seductive artistic forms unlike the principled, open, and rational approach of philosophers.

But then again, Plato thought that many types were dangerous, including the technicians of

his day. Telling the power of story, McKee (1997, pp. 129–130) warns, "Every effective

story sends a charged idea out to us, in effect compelling the idea into us, so that we must

believe. In fact, the persuasive power of a story is so great that we may believe in its meaning

even if we find it morally repellent."

Similarly, Jensen (1996, p. 9) reports that: "the highest-paid person in the first half of

the next century will be the storyteller," as the value of products will depend upon the stories

they tell. Apple, Nike and many other global companies are powerful storytellers, and

through their well-established stories, they are thereby lifestyle designers or shapers.

Corporate strategy sessions are increasingly about storytelling and storymaking, not merely

manufacturing and supply chains (McKee, 1997, 2003; Monasco, 2006). This is not to say that what Fisher (1989) calls the "narrative paradigm" (p. 64), a power or persuasion distinguished from rhetoric, exhausts the purpose of story. For example, in this research, the girls' stories are more geared toward expression than persuasion. The girls make artifacts and stories that they can identify with or to which they can relate. This has its own end in identification, as there is less persuading here through story than inter-relating.

Gathering, making, and telling of stories for research purposes has a long lifespan, particularly in cultural anthropology, cultural studies, ethnography, historical research, indigenous studies, law and legal studies, linguistics and literacy studies, nursing, and in educational research, albeit somewhat limited until the 1980s (Boje, 1995; Bruner, 2003; Stevenson, 2009). Interest in story has grown steadily during the past three decades to the extent that story methods are increasingly viewed as legitimate scholarship in social science research. On this "narrative turn" Bruner (2003, p. 111) asks if it was in reaction to the "depersonalized sociological and Marxist renderings of the past... Or was it disenchantment with cut-and-dried, impersonal history, sociology, and anthropology that produced it? Or was it a response to the enormous personal suffering and dislocation of the most destructive century in human history?" Stevenson (2009) observes that story-based research is now becoming popular with diverse researchers because:

eliciting stories can provide a rich seam of data, which helps us to understand how those we are researching make sense of and compose meaning in their lives. Stories help to explain the human experience, they bring research to life and they help inform policy and practice in ways that quantitative data may fail to do (p. 7).

Story is a powerful form to shape our conceptions of reality and amongst the most persuasive of ways to put ideas into the world, however, its productive potential has yet to be fully realized and recognized in research and its alliance with prevailing methodologies remains controversial (Bach, 1998; Emihovich, 1999; Leggo, 2009). As Lewis (2011, p. 506) questions: "If story is central to human existence and understanding why, in the research world, is there not more storytelling, particularly in the social sciences?" What types of stories lead to knowledge (Bruner, 2003; Clandinin & Connelly, 2000)? What kinds of research lead to knowledge (Kovach, 2009; Lather, 1986)? What are "valid" ways of knowing and who decides legitimacy (Denzin, 1997, 2002; Scott, 2007)? What is the value of the research that is told in story form (Leggo, 2009; Mallan, 2003)? What traits of texts do people tend to ascribe to the categorization of story and research (Langellier & Peterson, 2004)? Is research fact and story fiction (Fulford, 1999; McKee, 1997)? Who or what governs storytellers, story researchers, and their powerful tales (Boje, 1995; Stevenson, 2009)? What can be known and for whose purposes? Let me address these important questions by considering an engaging example that evidences the permeability of the boundaries between fact/fiction, researcher/participant, and research/story.

In April 2003, Doubleday Books released *A Million Little Pieces*, James Frey's "unflinchingly honest" and "courageously confessional autobiography" of his hellish recovery from alcohol and drug addiction. Oprah lauded Frey's work as "a gut-wrenching memoir that's so raw and so real" and after she selected it as the first non-fiction book for her book club, Frey's book sold millions of copies and topped the *New York Times* best-seller list for fifteen straight weeks (October 26, 2005 Oprah episode entitled, *The Man Who Kept Oprah Awake At Night*). Rather scandalously, however, many details in Frey's alleged

memoir were exposed as exaggerations and fabrications when The Smoking Gun (2006) published *A Million Little Lies*. Oprah made Frey apologize on another episode of her show where she criticized him (along with his publisher, Nan Talese) for betraying millions of readers. Relevant others argued that Frey's inspirational message and story are of greater importance than the factual truth, thereby evoking passionate debate about the categorization of fiction and nonfiction, as well as the publishing industry's increasing reliance on nonfiction memoirs as the fast track for creating bestsellers. Although Frey initially shopped his book around as fiction, he was unsuccessful, so he said that he changed his strategy and called his work a memoir, resulting in a lucrative publishing contract.

Educational researchers are also writers who use language to communicate with an audience and, like James Frey, are highly motivated to publish their work for various reasons such as career advancement, income, reputation, power, and prestige. In his confessional *Note To The Reader* (which is posted online and included in all reprints), Frey (2006) expresses his motivation to write a story "that would change lives, would help people who were struggling, would inspire them in some way." While explaining why he made himself seem "tougher and more daring and more aggressive than in reality," Frey claims literary reasons for his exaggerations: "I wanted the stories in the book to ebb and flow, to have dramatic arcs, to have the tension that all great stories require."

Like Frey (who strongly defends the right of writers to draw upon their memories, impressions, and feelings), educational researchers (who are guided by rigorous ethics that carefully practiced and valued) may be wont to exaggerate or take liberties with data, stories, and findings. To what extent, however, are scholars likely to be outed for embellishing ideas they feel compelled to prove? For prematurely reporting (under pressure) preliminary results

that are unreliable? For motivations or desires to be right rather than to acknowledge uncertainty? For personal ambitions to publish in top-tier journals? For covering over or caving into selection biases, leading questions, and a superficial tendency to find the answers they are looking for? For massaging data to create a breakthrough or present more compelling research findings? Not likely… but nor are they likely to be rewarded with Frey's level of publishing contracts.

Many researchers do not want to be regarded as *mere storytellers* and deliberately write their research as "unstorylike as possible, even anti-storylike: factual, logically self-evident, hostile to the fanciful, respectful to the ordinary, seemingly 'untailored'" (Bruner, 2003, p. 48). Definitions of research typically include exemplary words such as *systematic investigation*, *facts, principles, logic, rigor, rationality, and neutrality,* whereas story, with its associated connotations of *fiction, feelings, imagination, make-believe, speculation, uncertainty, lack of rigor*, and yes, *wonder*, is easily relegated to the margins of educational research (Clandinin & Connelly, 2000; Langellier & Peterson, 2004; Mallan, 2003). Yet, upon closer examination, the popular distinctions between story and research do not, in fact, stand up. Story plays a key role in all educational research, which is always-already a subjective product of the researcher's storymaking and storytelling efforts. Even the most systematic approach to reporting on human behaviour and experience cannot avoid story because story is fundamental to human behaviour and experience, as Lewis (2011) theorized: "story is central to human meaning— it makes life livable, because without a story, there is no identity, no self, no other" (p. 505).

The "human being is storied" according to Lewis (2007) and "so pervasive and powerful is this relationship that if we change our story, we may even change our lives" (p.

506). Again to make the point, Richard Wagamese, one of Canada's foremost authors and legendary storytellers, explains on his personal website (www.richardwagamese.com):

> All that we are is story. From the moment we are born to the time we continue on our spirit journey, we are involved in the creation of the story of our time here. It is what we arrive with. It is all we leave behind. We are not the things we accumulate. We are not the things we deem important. We are story. All of us. What comes to matter then is the creation of the best possible story we can while we're here; you, me, us, together. When we can do that and we take the time to share those stories with each other, we get bigger inside, we see each other, we recognize our kinship— we change the world, one story at a time.

Research and story are both interactive forces at play in terms of understanding the complex and diverse datasets associated with educational inquiry, and it is probable that they cannot operate independently of each other (Allhutter, 2012; Bruner, 2003; Clandinin & Connelly, 2000). Indeed, if we agree with Vadeboncoeur (2005) that, "humans socially construct meaning with cultural tools, along with interpretations of social positions, the behaviour of others, and the roles we perform" (p. 4) then it may be that "to understand ourselves as fictions, is to understand ourselves as fully as we can" (Leggo, 2004, p. 99). Or to put it another way, "if we are always making up stories and being made up in stories," then the "so-called facts of our individual worlds are highly colored and arbitrary, facts that fit whatever fiction we have chosen to believe in" (Leggo, 2004, p. 99). As such, how might restrictive distinctions between the categorization of what is commonly used to distinguish and label research from story be problematic and a form of *intentional fallacy* in which "the design or intention of the author is neither available nor desirable as a standard for judging

the success of a work" (Wimsatt & Beardsley, 1954, p. 3)? Of course, like biography

distinguished from memoir, reports of research were developed as genres distinctive from

fiction. In the case of "The James Frey Controversy," only when it is suspected that we have

the *wrong* story do we then start to seriously question how stories can structure (or distort)

our representations of reality.

Traditionally the genre of scholarly writing has an objective stance, is not overly

general, correctly utilizes formal academic rhetoric, specifies precise logical criteria, and is

reported with sufficient detail such that other scholars can try to reproduce the results. These

are standardized conventions that researchers should follow in order to establish a claim to

legitimate knowledge. In this rationalistic approach to epistemology, knowledge then

becomes that which can be proven "true" and only "knowable when rigorous scientific

methods are employed" (Vadeboncoeur, 2005, p. 3), a perspective which Emihovich (1995,

p. 44) further questions: "in the world of meaning and perception where there are no tangible

physical referents to guide us, can the truth ever be established?" Scholars from diverse

disciplines are increasingly challenging the academy to recognize alternative methodologies,

like story, that can not only contribute more meaningful forms of research and practice but

also stand on their own as valid ways of knowing with aesthetic, emotive, imaginative, and

subjective elements (e.g., Allhutter, 2012; Bach, 1998; Bruner, 2003; Clandinin & Connelly,

2000; Freeman & Mathison, 2009; Goldman-Segall, 1998; Kearney, 2006; Kelleher, 2006;

Kovach, 2009; Kramarae, 1998; Leggo, 2009; Lewis, 2011; Mallan, 2003; Stevenson, 2009).

Although a rational or scientific research model remains dominant, the

epistemologies of scientific scholarship hardly exhausts research in the field of education,

and the well-documented and debated "crises of legitimation and representation" have

challenged the standardization of scholarly publication formats (Denzin, 2002). The privileging of objective and logical style of discourse as the exclusive measure of valid, generalizable, and transferable knowledge has been interrupted by the need for new kinds of self-reflexive, non-reductionist, and interconnected scholarship that question our ways of knowing and meaning-making practices (e.g., autoethnography, biography, complexity theory, ecological theory, feminist theory, memoir, narrative inquiry, postcolonialism, postpositivism, and poststructuralism (Lather, 1986; Scott, 2007; Wajcman, 1998, 2004).

Bruner (1986, 2003) proposes two ways in which we can know about the world: the logical style of discourse in the scientific tradition and storied knowing or narrative cognition; neither are inferior to the other. He argues, "there are two modes of cognitive functioning, two modes of thought, each providing distinctive ways of ordering experience, of constructing reality…Yet what they convince of is fundamentally different: arguments convince one of their truth, stories of their life-likeness" (1986, p. 11). Evincing the dialectical relationship between story and knowledge: (1) Lewis (2011) explains that storied knowledge is not only emotive expression, but also a legitimate form of reasoned knowing; and (2) Vadeboncoeur theorizes that it is possible to view scientific knowledge as stories that contain "a combination of fact and fiction, more or less "truth," and as being motivated by the perspectives that positivism was attempting to control: political, economic, cultural, and religious beliefs and their concomitant value system" (2005, p. 5). Likewise, when Kovach (2009, p. 102) asks, "Is story of epistemology or is story epistemology?" she answers: "It does not likely matter for the question implies segregating the two. From a tribal perspective, they are inseparable."

If we accept that the creation of research is necessarily a personal and performative act "revealing researcher/participants as both masked and unmasked, costumed and bared, liars and truth tellers, actors and audience, off stage and onstage" (Prendergast et al., 2009, p. xxiii), then we can focus energies on more important issues, such as what constitutes ethical and viable research practice? How does story color, shape, and transform our knowledge-generating research texts (Clandinin & Connelly, 2000)? Why is story a "primary act of the mind" (Hardy, 1994)? How do stories stimulate the brain and influence how children learn and come to know what they know (Freeman & Mathison, 2009)? How can stories help scholars to understand girlhood and girl cultures (Bach, 1998)?

Although research processes that claim objectivity use many strategies for generating accurate and legitimate knowledge, such as critical self-reflexivity, diverse recording devices (audio, video, photograph, and print), multiple critics and observers, participant checks, peer debriefing, reliability reviews and triangulation, validation cannot be ensured simply by adhering to a checklist of the right things to do as there are no guarantees for objectivity in educational inquiry (Allhutter, 2012; Denzin, 1997, 2002). Researcher biases and colorful or selective readings of data are part and parcel of all "non-fiction" studies. For example, results may be biased in research approaches that rely on participants to report their thoughts and experiences as participants often seek to please by giving answers they think researchers might be looking for, or they divert us from truths they do not wish to reveal (Freeman & Mathison, 2009; Law, 2004). Additionally, access to participants informs whose stories we are privileged to hear and analyze, and those that will never be known or reported.

From Kovach's (2009) indigenous perspective, the main purpose of both research and story is to come to a sense of shared understanding as to what is known: "reliable

representation engenders relevancy and is a necessary aspect of giving back to the community" (p. 100). Likewise, as Langellier and Peterson (2004) contend, striving for research legitimacy in story lies in collaboration or building consensus around shared meanings and revealing openings to other stories in all their variety and degrees of articulateness. This is an iterative and participatory process that "is not a linear conveying of experience to an audience, but a reversible and reflexive experience" (p. 3). Hence, credibility is not driven by hard truths or isolated facts but by *fidelity*, which is to say that story in research is believable when: (1) it can be credited with authentically conveying the perspectives of the participants; (2) there is a convincing resonance between the story told and its social, cultural, political, physical, and temporal contexts; and 3) readers are invited to tell the research stories to others and to reciprocate with their own accounts to ensure that diverse views are heard (Emihovich, 1995; Kovach, 2009; Langellier & Peterson, 2004).

According to well-respected narrative scholars like Clandinin and Connelly (2000), Freeman and Mathison (2009), and Langellier and Peterson (2004), the value of story research is that it captures the complexity, interconnectedness, and rich nuances of meaning from the participants' perspectives. Therefore, they are the only ones who can legitimately judge the credibility of the study findings. But, how do researchers give diverse participants voice to represent their unique points of viewing (Goldman-Segall, 1998)? If story research is a collaborative document without fixed rules, a dialogue mutually constructed out of the experiences of the researcher and participants, then the meaning of story is always in flux, ambiguous, and open to new interpretations. Hence, research using story methods can be perilous, as Stevenson (2009) warns, because for every story that is told there are multiple versions that are not.

Researchers who choose to tell stories must be committed to a careful, complicated, persistently self-critical, and sensitive scholarship that shows the multiple (im)possibilities of their research. Not only is writing a story always already a matter of personal choice with selective bias, it is only one story of many stories, a version that is told by the person with the power to make her/his story known (Mallan, 2003). As Leggo (2004) shares:

> I am the interpreter who stands between the chaos of the experience and the production of a tidy narrative that *re*-presents the experience. In the end the *story of sorts* becomes one of multiple possible stories, and the story that I, as researcher, am writing now is one more *story of sorts,* one more effort of meaning-making (p. 106).

Although most of the academic literature focuses attention on the potential for story-based research to personally or emotionally harm *vulnerable* participants, Stevenson (2002) argues that it is also important to consider the unintended damage that educational researchers using story methods may experience. As Vickers (2002) warns, "they truly are writing on the edge— and there is no safety net. However, the reward and excitement come from connecting with others and sharing with those who want to know" (p. 619).

3.5   TROUBLING CLARITY: STORY, STORYMAKING & NARRATIVE

> 'Be what you would seem to be'— or; if you'd like it put more simply—
> 'Never imagine yourself not to be otherwise than what it might appear
> to others than what you were or might have been was not otherwise
> than what you had been would have appeared to them to be otherwise.'"
> "I think I should understand that better," Alice said very politely,
> "if I had it written down: but I *ca'n't* quite follow it as you say it."
>
> **The Duchess and Alice, *Alice's Adventures in Wonderland,***
> **Chapter 9, *The Mock Turtle's Story***

A Jewish proverb asks: "What's truer than truth?" The answer: "The story." This Hasidic adage implies that the stories we make and tell about ourselves, our lives, and our worlds often reveal as much as (or more than) hard-evidenced facts (Baldwin, 2005). Of course here, "the story" will always be contingent on a *truth*, interdependent with "nothing but the truth" or "the whole truth," choose a perspective. Etymologically, story first appeared during the 13th century from ancient *estoire*, "account of some happening" or "narrative of important events or celebrated persons of the past" (*Online Etymology Dictionary*, 2014). Correspondingly, the term most commonly interchanged with story is narrative, derived from the Latin *narros*, "to make known" (Emihovich, 1995, p. 38). It is interesting to consider that story was not differentiated from history (Latin *historia*) until the 15th century, and since then story has occupied many meanings, depending upon the user and circumstance, and further evolving with time. Like the enigmatic conversation between the Duchess and Alice (in the Mock Turtle's story above), I caution readers not to expect a simple, clear definition of what story is and how it works, as story is conveyed in a variety of ways by different disciplines, but I will outline what I think are the essential features.

The *Oxford English Dictionary* (2014) primarily defines story as: "an account of imaginary or past events; a narrative, tale, or anecdote." Scholars commonly interpret story as a specific text type, "an event: a state of affairs, and a second state of affairs which differs from the first, accomplished through some agency" (Storkerson, 1996, p. 4). Stories are as old as humankind and recognized as "the foundation of being human" embodying "what it means to be human and giving humanity its voice" (Baldwin, 2005, p. xii). Lewis denotes story as a "cognitive process and product of cognition" that is "art and quotidian, centripetal and centrifugal, running deep and wide through the human psyche" (2011, p. 505). Indeed,

we continually create ourselves and give meaning to our lives by the endless series of stories that we (individually and collectively) make, tell, and believe: "our stories are the masks through which we can be seen, and with every telling, we stop the flood and swirl of thought so someone can get a glimpse of us, and maybe catch us if they can" (Grumet, 1987, p. 322).

While stories embody our individual identities, they also make up the grander meta-narratives or "meta-stories" that express our cultural knowledge, family relations, political values, shared realities, and social practices, as well as the ecstasies and terrors of our worlds (Leggo, 2009). According to Fulford (1999, p. 6) there is no such thing as a value-free story: "Stories inevitably demand ethical understanding… A story is always charged with meaning, otherwise it is not a story, merely a sequence of events." Fulford's view of "ethical understanding" proposes that stories always have meanings and messages (revealed or concealed) that are interpreted according to our values and ideologies. Langellier and Peterson (2004, p. 3) theorize both the transgressivity and normativity of a story's "productive potential for creativity and resistance" as well as its "reproductive capacity to reinscribe conventional meanings and relations." They argue that story is a "site for understanding and intervening in the ways culture produces, maintains, and transforms relations of identity and difference" because story has the potential to both disrupt and reinforce pre-existing cultural, political, and social stereotypes, thereby giving rise to new stories for new times (Langellier & Peterson, 2004, p. 3). As Bruner (2003, p. 15) puts it, "Story is enormously sensitive to whatever challenges our conception of the canonical. It is an instrument not so much for solving problems as for finding them. The plight depicted marks a story's type as much as the resolution."

Story is everywhere, but not everything is story. Story is present in advertisements, archival documents, autobiographies, comedies, comics, conversations, diaries, dramas, fairy tales, health records, memoirs, myths, novels, paintings, photographs, political campaigns, stained glass windows, works of art, and much more. The earliest forms of story can be found in the images scratched onto the walls of caves and carved into wood or stone. The first stories were also communicated orally, combined with gesture and expression, and passed on from generation to generation by memory (Clandinin & Connelly, 2000). Debate is sustained around whether myths, inscribed as drama or channeled via oral traditions, actually embody the everyday stories of humans living and walking the earth (Mallan, 2003). With the invention of writing and eventually the printing press, new kinds of stories (e.g., the Bible, confessions, novels, tragedies, etc.) were recorded, transcribed, and shared worldwide.

Along with technological development, modern day stories can now be told in new ways through free digital platforms (e.g., blogs, social networking sites, and video sharing services), thereby accelerating their speed of distribution and enabling a new kind of cross-media engagement that is hyperlinked, interactive, and massively collective (Lewis, 2011; Weber, 2007). Translating research into story is engaging new audiences in diverse fields of study. For example, Boje (1995) uses post-modern story analysis to do a marketing critique of Disneyland by positioning excluded stories and hidden voices (as told in context by employees going about their everyday business) in comparison to the dominant culture narratives that portray the Disney storytelling organization as happy and profitable. Whether we are researching, remembering, comprehending, speaking, or writing stories, "we constantly weave life events into story and interpret everything that happens through the veil of story" (Baldwin, 2005, p. 77).

It is not the intention of my dissertation to determine a clear point of termination

between story and narrative. Although narrative is sometimes positioned as academically

superior with more credibility than story, I find that the two terms are frequently used

interchangeably in recent education literature such that many researchers employ narrative in

the same way that others might use story (especially in child and youth studies) (e.g., Bach,

1998; Freeman & Mathison, 2009; Goldman-Segall, 1998; Hardy, 1994; Haynes, 2008;

Kearney, 2006; Lipkin, 2009; Mallan, 2003; Tagliamonte & D'Arcy, 2005; Tagliamonte &

Denis, 2009; Weber, 2007). Rather than proposing a separation or trying to discern unique

differences between story and narrative, the salient point in my work is that both terms are

directed towards representing experience and making meaning. In this view, I follow

Mallan's (2003) lead as she declares in her dissertation:

> The fine-grained distinctions over story, narrative, and discourse, which have
>
> occupied literary theorists and narratologists, are not relevant to the purpose here.
>
> This study is not concerned with story grammar or literary devices. Rather the focus
>
> is on the discursive production of narrative and in particular the discursive practice of
>
> storytelling (p. 9).

Correspondingly, I add here that the focus is on storymaking and heed Bruner's (2003)

warning that "we are becoming too detached, concentrating on the abstract definition of a

story" (p. 17) instead of carefully examining real ones. Further, I take Emihovich's (1995)

advice to heart, notably that:

> Academe adheres to the tenet that if meaning becomes too accessible, profundity
>
> disappears. In high-stakes academic politics, people judge academic competence in
>
> inverse relation to their ability to understand what is said. Graduate school is the

means by which students are socialized into using the right jargon" such that with "blind adherence to grammatical rules… literacy is severed from imagination (p. 42). In my research, a story is a shared event sequence (including imaginary or real accounts) grounded in the realities of girls' experiences with artifact design and production that leads more or less from a state of equilibrium to disequilibrium to a state of restored (yet empowered) equilibrium (Herman, 2008, p. 456; Mallan, 2003, p. 9). While I privilege the term story (and storymaking) over narrative, this is because the co-researchers use the term story more frequently than narrative. Pragmatically, story is the language of my tween-aged team, not narrative. These girls understand storymaking and pause over narrativemaking.

Building upon Goldman-Segall's (1998) storymaking approach, I use storymaking methodologically for inquiring into, capturing, and communicating to others how a team of girls articulate their experiences and expressions of *girls-in-interaction-with-technology (*Petrina, Feng & Kim, 2008). Like Harvey and Martin (1995, p. 87), I prefer to use the term storymaking to represent "the more comprehensive class of activities including story– comprehending, –remembering, –constructing, and –telling." A story is made through these practices. In my storymaking work with girls, I question if we have become too comfortable with the passive consumption of stories as we have spent the past century indoctrinated by a consumerist ideology that teaches us to consume too much media, too many products and services, and too much of most everything else (Brown, 2009, 2014). Youth are particularly vulnerable as they are an "important demographic only to the extent that they participate in our economy as consumers" and are presented with such high expectations for consumption they are "not valued for what they could contribute in terms of participating in the mode of production" (Vadeboncoeur, 2005, p. 15).

Within the context of my study, storymaking emphasizes the production and performance aspects of story. Girls as storymakers who use their knowledge and experience to reinterpret, reject, and remix existing stories in order to make new ones, and then in turn, invite others to respond and reciprocate with story remakes for yet another audience, and so on (Goldman-Segall, 1998; Langellier & Peterson, 2004). Storymaking is not a finite linear process, rather it is a reflexive experience of individually and collectively constructing understanding and crafting meaningful expression through a variety of story structures, images, sounds, and text, and by employing the valuable resources of creativity, emotion, imagination, intellect, memory, wisdom, and wonder (Baldwin, 2005; Leggo, 2004, 2009; Scott, 2007). Storymaking is an experiential practice that is cultural, discursive, embodied, familial, material, political, relational, and social, thereby enabling my team of storymakers to participate in important cultural conversations about which stories, what meanings, and whose interpretations matter (Bach, 1998; Vickers, 2002). Epistemologically, storymaking is a powerful cognitive process and product through which girls give shape to meaning and come to understand, remember, and embody knowledge about themselves and the media and technology in their worlds (Mallan, 2003).

The co-researchers' stories are dynamic, diverse, and come into existence in and out of their experiences at *101 Technology Fun*. In my storymaking research with girl cultures, I am not looking for the one master story of all (the so-called dominant or universal truth), rather I am primarily interested in the connections and contradictions between diverse perspectives and multiple story artifacts. My focus or interest is on a specific group of girl storymakers who "let many stories bloom" (Bruner, 2003, p. 103) across ranges of artifacts and media. At *101 Technology Fun,* what matters most is supporting girls with equitable

opportunities and tools to generate their own stories, in their own ways, and for their own

purposes. Girls' storymaking practices (interdependent with their artifact design and

production activities) can act as a catalyst to ignite and inspire change in media and

technology culture (e.g., to develop girls' affinities towards and capabilities in technology).

3.6 IMAGINING OTHERWISE

"Reeling and Writhing, of course, to begin with," the Mock Turtle replied,
"and then the different branches of Arithmetic –
Ambition, Distraction, Uglification, and Derision."
"What else had you to learn?"
"Well, there was Mystery." The Mock Turtle replied,
counting off the subjects on his flappers.

The Mock Turtle and Alice, *Alice's Adventures in Wonderland,*
Chapter 9, *The Mock Turtle's Story*

This is one of many passages from *Alice's Adventures in Wonderland* that reveal

Carroll's imaginative satire of the British education system. The basic courses that the Mock

Turtle takes at school are "reeling and writhing" (rather than reading and writing) and the

four branches of arithmetic are "ambition, distraction, uglification, and derision" (rather than

addition, subtraction, multiplication, and division). Other subjects studied by the Mock Turtle

include "mystery" (as opposed to history) and "laughing and grief" (as opposed to Latin and

Greek). The Gryphon (another Wonderland character who has the head, talons, and wings of

an eagle, but the body of a lion) laughs at Alice because she is unable to figure out what the

study of "uglification" means and naively claims absolutely no knowledge of it whatsoever.

By displaying Alice's lack of understanding for the Mock Turtle's "real world" school

subjects, Carroll's characteristic "meaningful nonsense" is playfully questioning that which

is normalized and abnormalized within the education system. He is challenging how the

traditional school curriculum is valorized with the veneer of valid knowledge, whilst many 'real-world' subjects of study remain under-valued and poorly understood.

Although storytellers like Lewis Carroll are free to write with emotional intensity, many researchers are taught to discipline their passion. When "taught to believe that the mind, not the heart, is the site of learning," many of us believe that to write research with any subjectivity or imagination risks that our work will be perceived as irrational, insubstantial, or invalid (hooks, 2000, p. xxvii). Emihovich (1995), however, is convinced that emotion and reason can be linked together through story and she quotes Mary Catherine Bateson (1991) to back her up: "There's no need to drain intelligence out of situations where emotions are important" (p. 40). Likewise, in *Pedagogy of the Heart*, Freire (1998, p. 30) proclaims: "I know with my entire body, with feelings, with passion, and also with reason." I concur with these scholars and I also believe that we are transformed by the wonders of our imaginations just as we are changed by our intellectual ideals, political urgings, and ethical convictions. As such, how might emotional intensity and vitality be expressed within story to engender new insights, practices, and relationships for how girls learn media and technology (Kelleher, 2006; Rusnak, 2014a, 2014b)? How might girls' stories enable access to the cognitive, emotional, material, social, spiritual, and virtual worlds in which children assemble meaning, identity, and knowledge (Bach, 1998; Goldman-Segall, 1998; Mallan, 2003)? What is story's productive potential for communicating research findings that motivate, unite, and provoke on a more personal level, thereby engaging new audiences and challenging orthodoxies in standard academic texts (Leggo, 2004, 2009; Pelias, 2004; Prendergast et al., 2009)? In contemplating connections between story and educational research, Vickers' (2002) argues:

Texts produced in the traditional manner sustain the illusion of disinterest and

neutrality. It is worse for our readers. Keeping the personal voice out frequently

means that our work is under read, dry, inaccessible— and boring. We do a good job

of protecting our secrets, although many of us are increasingly troubled by the loss of

excitement and liveliness that follows… We need to find the strength of our voice—

our story (pp. 613–614).

TO MAKE A LONG STORY SHORT

Educational researchers who choose to enrich scholarly inquiry with their research

stories and personal selves need to be mindful that: "we change the world by changing the

way we make it visible" as our methodological practices and academic conversations "have a

material effect upon the world; there is a materiality to [our] text" (Denzin, 2002, p. 483).

Henceforth, the purpose of this chapter was to develop a foundation to ground my doctoral

study. Divided into six detailed sections, I investigated various epistemological, ethical, and

etymological issues concerning *girls-in-interaction-with-technology-and-stories* at *101

Technology Fun*. I justified the utilization of story epistemology for the purposes of my

investigation and juxtaposed scholarly definitions of story, storymaking, and narrative.

"No, no!" said the Queen. "Sentence first— verdict afterwards."
**The Queen of Hearts, Alice's Adventures in Wonderland,
Chapter 12, Alice's Evidence**

hands-on

hearts-on

used for thinking

feet-on

heads-on

use for decoration, design and camouflage
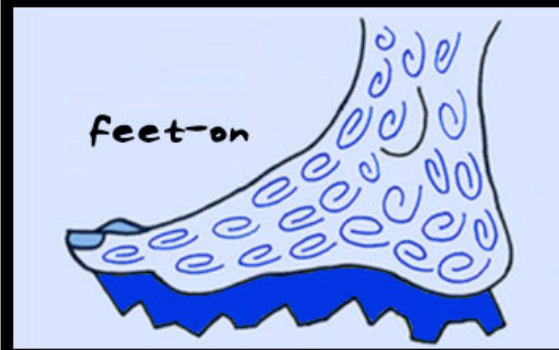
designerly ways of researching with girls

4

CHAPTER 4: DESIGNERLY WAYS OF RESEARCHING WITH (NOT ON) GIRLS

Chapter Four articulates the design-based and participatory ways of researching with (not on) girls at *101 Technology Fun*. I begin by describing the curriculum objectives, research questions, and learning environment of the maker lab for maker girls; followed by a comprehensive review of the 2008, 2009, and 2011 summer research and design camps. Section two is dedicated to the presentation of my study design. I address innovative DBR strategies for data collection and creation, data selection processes, study parameters and limitations, and issues of accountability and validity. In the third section, I trace the research literature that played key roles in guiding, structuring, and running *101 Technology Fun*, including an in-depth review of how children's stories are generated, interpreted, and represented in two exemplary scholarly works: *Points of Viewing Children's Thinking* (Goldman-Segall, 1998) and *A Visual Narrative Concerning Curriculum, Girls, Photography, etc,* (Bach, 1998). Finally, the fourth sections details the protocols and procedures for assembling research findings utilizing a montage format.

4.1 THE SETTING: A MAKER LAB FOR MAKER GIRLS

My study begins with the premise that engaging girls with the hands-on, heads-on, hearts-on, and feet-on experiences as designers and researchers of technology can be personally and culturally transformative in pro-feminist, pro-social, and empowering ways, rather than simply reproducing existing gender and generational roles (Artifact 7, Artifact 76). Females continue to be under-represented and under-achieving in technology-related studies and professions, especially the industries that design and develop new technological

innovations (e.g., AAUW, 2000; CEA, 2006; DuBow, 2011; ESA, 2014; Girls Action Foundation, 2011; Hill, Corbett & St. Rose, 2010; Honey et al, 1991; Leonard, 2003; Lewis, 1987; Steeves, 2014; Turkle, 1988; Wajcman, 1998, 2004; Weinberg, 1987). Mirroring this under-representation, technology-intensive courses in the K–12 system enroll low percentages of girls, if not required (Braundy, 2012; Braundy, O'Riley, Petrina, Dalley & Paxton, 2000; Bryson, Petrina, Braundy & de Castell, 2003; Hill, 2009).

From my well-informed perspective as a designer, media and technology studies educator, mother, and researcher, I believe that girls need affirmation and support for maintaining their sense of femininity within a historically masculine culture of technology that continues to dominate such that females distance themselves from technology fields, careers, symbolism, and ideologies. As a result of their disenchantment, girls are not developing the confidence, literacies, and tools that are necessary for them to fully benefit from and participate in advancing our increasingly mediated and technologically dependent society (AAUW, 2000; Legewie & DiPrete, 2014; Sandberg, 2013; Sandberg & Grant, 2015). Hence, the DBR setting of my study, the *101 Technology Fun* maker lab, was created to offer girls a confidence-building learning environment for exploring media and technology through hands-on design, invention, and imagination (Hill, 2010; Rusnak, 2014a, 2014b).

I worked closely with the HWL research team to develop and supervise the maker lab and series of research camps. Five one-week sessions were conducted during the summers of 2008, 2009, and 2011 in various technology-rich labs on the UBC campus (see Table 1 in Chapter 1). Foundational to the *101 Technology Fun* methodological approach is a practice that respects child participants as valuable co-researchers and seeks to give voice to youth who, despite being visibly present in social science research, are seldom privileged as

authorities in their own right (Bach, 1998; Goldman-Segall, 1998; Haynes, 2008).

The specific dataset selected for my dissertation includes the 30 girls (ages 10 to 13) from the 2009 and 2011 summer camps, not the 2008 pilot study. I recruited my team from three culturally diverse elementary schools located in a densely populated and transient area of Vancouver, Canada (see Appendix A: Vancouver School Board Letter of Approval). I would be remiss to not acknowledge privilege in light of the fact that many children in today's world are currently growing up without access to the media and technology-rich learning environment of my study, many who have never even placed a telephone call (Hafkin, 2006). I am well aware that the *101 Technology Fun* maker lab is a special educational opportunity for select girls to design and innovate with the latest popular technologies, hence I do not claim that my team's designworks and fieldwork are representative of all girls.

The co-researchers in my study (see Chapter 2) are from a wide range of class, ethnicity, religious affiliation, and racial composition, including Caucasian, Chinese, East Indian, Greek, Japanese, Jewish, Romanian, Spanish, Thai, and Turkish. As self-reported in their individually completed *Adolescent Self-Perception Inventory*[4] (Ziffer, 2010), my team members believe they are imaginative, optimistic, open to new ideas and experiences, good listeners, non-judgmental, well-understood, and as smart as other girls their age. Although some of the co-researchers express difficulty in dealing with unexpected changes and overcoming their anxieties, they are generally excited about their futures (Tables 5, 6).

Table 5. 101 Technology Fun Co-researchers' State of Mind (Ziffer, 2010)

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[4] The Adolescent Self-Perception Inventory (ASPI) is a self-report measure for adolescents consisting of a 105-item Response Booklet and a 32-item Personal Strengths form. Developed by Psychological Assessment Services, the ASPI encourages honest introspection of specific executive functions, learning skills, resources, and strengths needed for academic achievement and personal well-being.

STATE OF MIND	% Not at all	% Not very often	% Pretty often	% Almost always
1. I don't think I'm as smart as most people my age	55	35	10	0
2. I lack self-confidence	40	50	10	0
3. I am really stressed	45	40	15	0
4. I am anxious a lot of the time	45	45	10	0
5. I have a lot of problems	50	25	25	0
6. Nobody understands me	55	25	20	0
7. I feel like a failure	60	30	10	0
8. People expect too much of me	25	40	30	5
9. I think the future looks bad for me	60	25	15	0
10. I don't let people know what I'm feeling	30	45	15	10

Table 6. 101 Technology Fun Co-researchers' Personal Strengths (Ziffer, 2010)

PERSONAL STRENGTHS	% Not a strength	% Sort of a strength	% Pretty much a strength	% Very much a strength
1. I have an optimistic outlook	0	25	60	15
2. I accept people for who they are	0	20	50	30
3. I feel loved	0	20	30	50
4. I think of different ways to solve problems	0	25	45	30
5. I have an active imagination	0	10	20	70
6. I'm open to new experiences	0	5	40	55
7. I'm open to new ideas	0	25	35	40
8. I can deal with unexpected changes	5	30	45	20
9. I can overcome my doubts or worries	5	35	45	15
10. I'm a good listener	0	20	30	50

For my pilot study in the summer of 2008, I recruited 29 children (ages 7 to 13, with mixed gender and experience) as co-researchers to explore gaming and robotic technologies by creating artifacts and sharing stories about their learning (July 7–11 and July 14–18). Employing Goldman-Segall's (1998) "digital media ethnography" and "points of viewing" theory for capturing children's voice, visibility, and vitality, my co-researchers and I collected a diverse and descriptive dataset with concrete examples of how youth experience and understand the technology in their everyday lives and learning circumstances. Digital media ethnography enabled me to discern underlying patterns and structures of how children learn technology, not solely as objective phenomena, but as transformative experiences of knowledge production, social communication, ethical awareness, identity construction, and creative expression (Petrina, Feng & Kim, 2008; Rusnak, Petrina, Feng & Wang, 2010).

On the first day of camp, I divided my team into small groups of three for an explicit learning session about the research process and to practice using the video recording devices. For the duration of the camp, the co-researchers were actively involved in videotaping child-technology interactions, recording detailed field notes, and conducting interviews with each other, which the youth particularly enjoyed (Artifact 8). Open-air adventures were planned, in addition to free time in the maker lab, to facilitate a socially motivating and friendship-driven research setting that included places to play and time to "explore a world of creative possibilities with experienced technology teachers" (see recruitment brochures, Artifacts 48 and 49). Daily activities involved data collection from three primary modes of engagement:

1. Designing and programming robots using Lego Mindstorms NXT.

2. Playing simulation and popular entertainment games.

3. Sharing stories about technology and learning experiences through individual, small group, and whole group interviews led by both child and adult authorities.

Artifact 8: Research Interviews at the UBC Rose Gardens

Building upon Denner et al.'s (2005) "girls creating games" strategies and Kelleher's (2006) socially motivating environment for using "computer programming as a means to the end of storytelling," I redesigned the maker lab and design camp to be a *girls only* learning environment with a fun and friendship-driven setting for the co-researchers to make their own computer games based upon their interests and play preferences. Research has only begun to build a body of work that evidences the value of making and playing games for learning (within a milieu where games are immersive and pervasive) (Petrina, Rusnak, Eklund, & Kocher, 2010). I narrowed the scope of the study to examine how girls construct

new knowledge and relationships with media and technology through their computer game design experiences (Denner et al., 2005; Gee & Hayes, 2009; Kafai, 2006; Kelleher, 2006). A team of 11 girls (ages 10 to 13) participated in *101 Technology Fun* 2009 (including five co-researchers from the 2008 pilot study), this time positioned in empowering roles as game designers with real-world design challenges, heuristics, and constraints (July 27–31). The design brief: to create an interactive game for girls to play with their mothers. My team's design solution: *momME*, the world's first ARG designed from the hearts and minds of tween-aged girls to commemorate Mother's Day.

As described in Chapter 2, *momME* is a massively collaborative, high social, low tech, and player-friendly game specifically designed to celebrate the special bond between mothers and daughters (and even grandmothers). *momME* leverages the short form video as a storytelling device, the casual game as a motivational device, and the social network as a focus for interaction and learning. This live game event does not introduce or require new technology, rather it focuses on delivering a participatory narrative experience using the internet as the central binding game platform, along with some amalgamation services to coordinate the game updates and player-generated artifacts across multiple social platforms and networked publics (e.g., blogs, emails, Facebook, Flickr, online tagging, telephone calls, texts, Tumblr, Twitter, video chat, and wikis). My team specifically focused on creating an ARG because it does not require them to develop advanced programming skills; rather, the game elements can be easily created using a variety of media interfaces and networked technologies that are readily familiar to girls (Rusnak, 2010b, 2014; Szulborski, 2005). Additionally, the production focus of an ARG is on writing an intriguing and immersive storyline, and as Kelleher's (2006) research evidences, using a storied framework is

motivating strategy to generate girls' excitement and confidence for making computer and video games (see Section 5.2 for further analysis).

My study continued in the summer of 2011 (July 18–22 and July 25–29), building upon the successes of my previous camps and Allhutter's (2012) feminist theory of "mind scripting" as a tool to get girls to identify and question how they are positioned within existing techno-cultural discourses (Artifact 9). Another lively team of 19 new co-researchers (girls ages 11 to 13) participated in a makerspace design community with learning labs in animation, movie making, robotics, and web design (Artifacts 10–12). One additional team member took part in all three camps. I supported the co-researchers in their roles as designers and challenged them to create and solve real-world design problems; take risks and experiment with new ideas; develop and question their voices; and pursue their media and technology-related interests (Hill & Smith, 2005; Wilson, 2013). As the girls were learning, thinking, and playing at summer camp, their participation was scaffolded (e.g., design challenges matched design skills and progressed from simple to complex) but not constrained by my guiding research structures and goals (Cross, 2006; Petrina, Feng & Kim, 2008).

Artifact 9. Mind scripting Interviews at *101 Technology Fun*
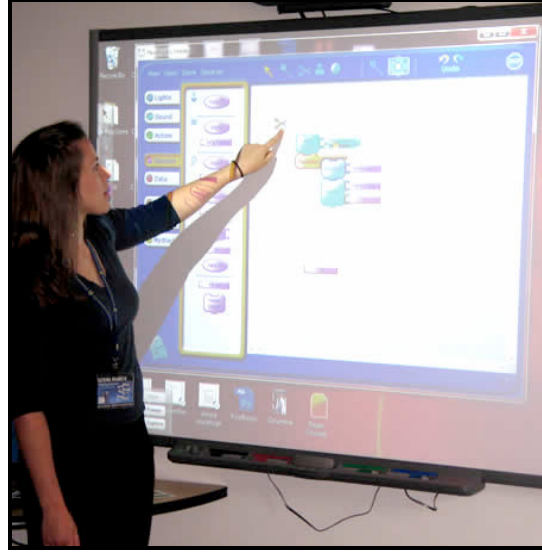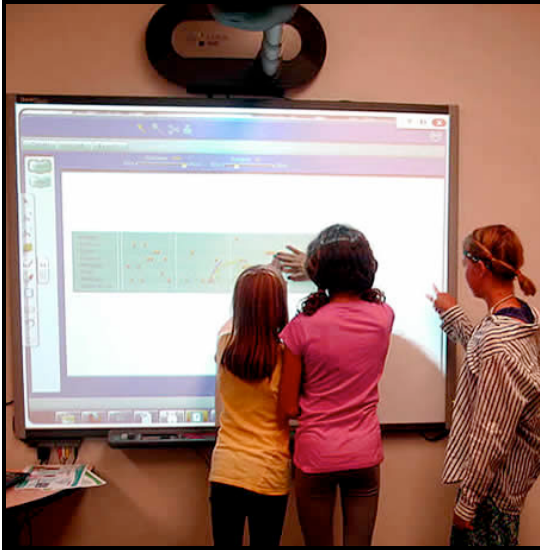
Artifact 10: Smart Girls Programming Robotics Using a Smart Board
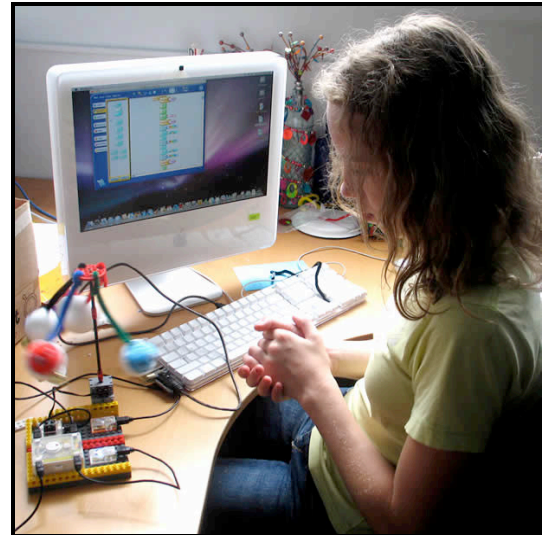
Artifact 11: Girls Crafting and Building Robotics
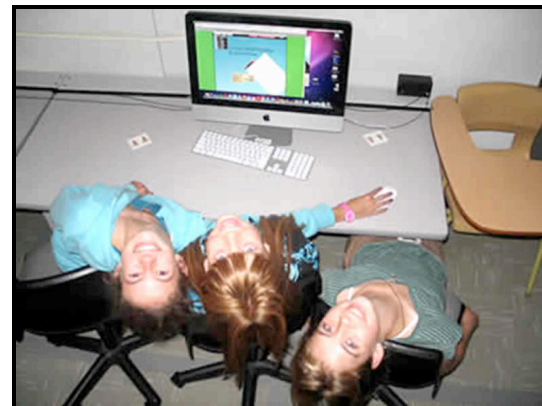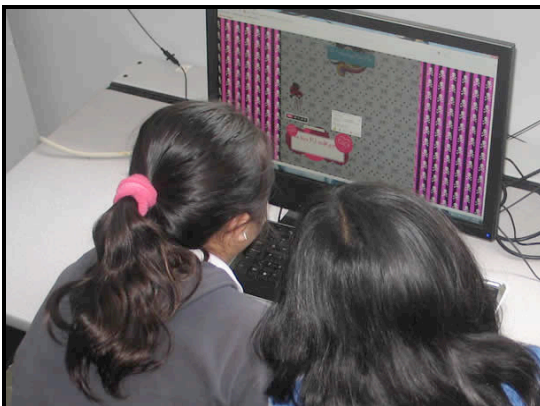
Artifact 12. Girls Having Fun and Designing Websites

Previous studies identify the age range of 10 to 14 demographic as the optimal time for working with girls to support their media and technology-related interests and to encourage a positive disposition towards technology careers (Denner et al., 2005; Farmer, 2008; Kearney, 2006). Hence, the *101 Technology Fun* design pedagogy is committed to affirming all of the wonderful things that girls of this age are, just the way they are, and the amazing things that they are capable of achieving when they are provided with equitable education in technology. Utilizing innovative approaches to data collection and creation, I investigate how a team of girls create and innovate with media and technology (rather than how they simply use it). DBR is valued as integral to my study's transformative potential. Engaging girls as designers and researcher partners serves as an emancipatory practice that allows them to resist stereotypical notions of girlhood and to transgress their doubly insubordinate status in the technology sphere. Both gender and generational dynamics have historically marginalized girls' involvement (Ashcraft, Eger & Blithe, 2012a, 2012b; Turkle, 1988; Wajcman, 1998). Five key curriculum objectives of *101 Technology Fun* include:

1. To design a learning environment that supports girls' technological and creative capacities using a variety of media and technological forms.

2. To educate girls to question and challenge the oppressive stereotypes and inequalities regarding females and technology.

3. To develop girls' confidence and self-esteem based upon their technological abilities and accomplishments (rather than physical appearance).

4. To increase girls' agency and capability to play more active roles as the designers, researchers, and producers (rather than just users) of technology.

5. To generate new possibilities for scholarly inquiry with (not on) girls as co-researchers.

While big or grand narratives may be articulated, my findings focus on the more modest and localized "little stories" (e.g., Lyotard's *petits récits*) and agentive artifacts that

the co-researchers contribute, evidencing their innovative capacity (e.g., girls interacting with media and technology to independently create artifacts that express their concerns, desires, and pleasures) (Goldman-Segall, 1998; Lyotard, 1984). The primary research questions are:

- How do girls, through their artifact making and *designerly* practices, story themselves and express their understandings of technology (e.g., how do girls articulate their experiences of *girlhood in-interaction-with technology*)?

- What are the impacts and effects of adopting *designerly* roles (e.g., game designer, graphic artist, media producer, and robotics engineer) in terms of developing girls' capabilities in media and technology?

Two secondary questions, relevant to the research purpose and problem, are addressed:

- How do we educate tween-aged girls to identify, interrupt, and transform the oppressive stereotypes in technology culture about who girls are, what they *should* be and how they *should* act (e.g., how do we get girls to understand and the taken-for-granted beliefs, norms, and value systems within well-established and hegemonic techno-cultural discourses)?

- How do we empower today's girls to grow up as a new generation of tech-savvy leaders of change who possess the tools, capabilities, and initiative to take sensible risks in designing more equitable and sustainable technology futures?

Highlighting the need for girls' voices to be recognized and given influence in the educational research concerning their own lives, my study exposes some of the gendered risks and opportunities, generational barriers, technological ingenuity, and transformative learning that girls articulate and reflect upon as they create and innovate with media and technology (within a design-studio learning environment outside of formal school settings). By employing a DBR and participatory approach, my co-researchers and I worked collectively to generate design problems of significance; cross-pollinate and refine ideas; iterate and take creative risks; develop prototypes and critique projects in development; troubleshoot coding errors; write robust code; and generally have fun (Hill, 2010; Rusnak, 2014a, 2014b; Wilson, 2013).

DBR was pivotal in helping me through iterations of the *101 Technology Fun* maker lab setting or infrastructure. In DBR, the common approach is to begin with a prototypes or design that takes a material form, whether in the form of application, device, software or hardware, and then proceed through a series of tests and iterations of the design (Gutica, 2014; Wang, 2012). I used DBR in this way, with the infrastructure of the learning setting serving as the design of interest (Wilson & Schwier, 2009). We documented and studied the infrastructure and made iterative changes across the 2008, 2009, and 2011 summer camp learning environments. However, the infrastructure was secondary to the primary unit of analysis, which was *girls-in-interaction-with-technology-and-stories* (Petrina, Feng & Kim, 2008). Although my research makes contributions to the infrastructural design, including setting and tone, and curriculum design for empowering girls in media and technology, this is secondary to the use of storymaking (Chapter 3) as the primary methodology supported by a range of ethnographic techniques (e.g., focus group interviews, audio and video recording of interactions and interviews, observations, journal reflections, and field notes) as well as novel techniques such as mind scripting (Artifact 13) (Allhutter, 2012). For data production and collection, storymaking went hand in hand with other forms of artifact designing and making (Goldman-Segall, 1998).
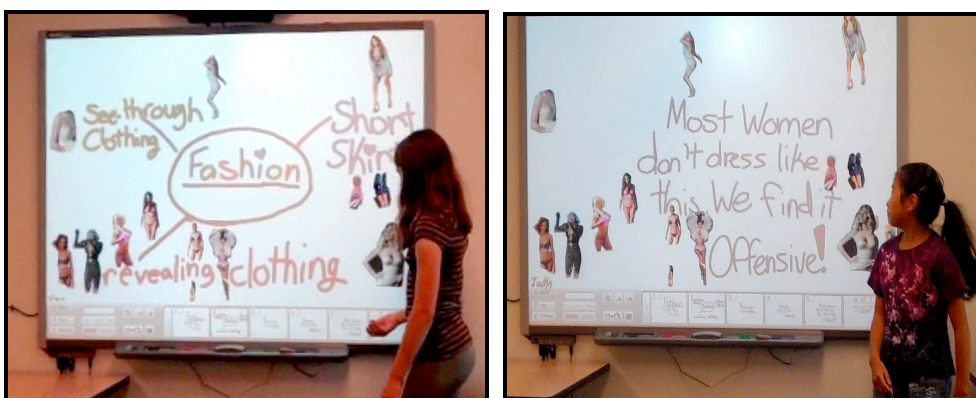
Artifact 13. Critiquing Girlhood in Media and Technology Culture

4.2   GIRLS COLLECTING & CREATING DATA (ARTIFACTS & STORIES)

Girls are the knowledge makers and keepers in my study, exploring a range of technologies by creating artifacts and sharing stories using a variety of media forms (e.g., animation, avatar, cartoon, diary, documentary, game, interview, photograph, public service announcement, survey, video, and website) (Artifacts 13–15). As reported by feminist scholars, including Bach (1998), Denner et al. (2005); Farmer (2008), and Kearney (2006), presenting girls with meaningful experiences to engage with the tools and creative practices for making media and technology their own (on their own terms and in their own ways) supports the development of a new generation of female youth who have the capability to question, remake, and transform technology culture (e.g., rather than simply receiving and reproducing male-dominated traditions and hierarchies). Hence, the *101 Technology Fun* camps are design-based and girl-centered such that all team members have meaningful opportunities to submit their ideas and contribute to: the study design, camp curriculum and schedule of events, data collection and creation, data selection, data analysis, and the assembly of shared research findings.

Artifact 14. Two Co-researchers Documenting *iLife Diaries*

Artifact 15: Analyzing Girl/Media/Technology Relations

Data collection and creation at *101 Technology Fun* was an ongoing and evolving process, extending over three summers. My co-researchers and I collaboratively generated a dynamic and complex dataset using innovative DBR methods including: story and artifact making; design thinking challenges (e.g., gaming, media, and robotic problems); conducting interviews and videotaping girl/media/technology interactions; analyzing interview sessions using mind scripting techniques (Artifact 13); collectively creating a wikispace to share our fieldwork and designworks; logging *iLife Diaries* (Artifact 14); self-reporting the *Adolescent Self-Perception Inventory* (Ziffer, 2010); directing and producing PSAs depicting how girls are portrayed in the media (Artifact 15); making *ME Documentaries*; pre and post study surveys; and writing technology affirmations (in which girls identify particular strengths in the work of their peers) (Table 7). As my study is designed to spark girls' interests and to get them to discover the innovator from within, drawing from a range of research methods using a wide-angle lens of analysis allows for authentic and diverse representations of my team's experiences and expressions of media and technology (e.g., beyond the taken-for-granted, already-interpreted or hegemonic techno-cultural discourses) (Denner et al., 2005; Freeman & Mathison, 2009; Goldman-Segall, 1998; Petrina, Feng & Kim, 2008).

Table 7. Data Collection & Creation Activities at 101 Technology Fun

MODULE	DATA COLLECTION & CREATION ACTIVITIES
Designworks I	▪ Design challenge: to decode and reprogram a Friend-Bot to navigate an obstacle course (e.g., Artifact 16). ▪ Design challenge: to design and program a unique robotic creation using *Pico Cricket* robotics, recycled gems, and colorful craft materials (e.g., Artifacts 10, 11). ▪ Design challenge: to demonstrate robotics to a live audience of peers, parents, and UBC technology education teachers.
Designworks II	▪ Design challenge: to create an interactive game for girls to play with their mothers (e.g., the *momME* game, Artifacts 47–56).
Designworks III	▪ Design challenge: to write, direct, produce, and edit a personal *ME Documentary* about who girls are and the meaning of media and technology in their lives (e.g., Artifact 88). ▪ Design challenge: to make a short PSA representing how the media portrays girlhood (produced by girls for an online audience of girls ages 10 to 13) (e.g., Artifacts 19–39). ▪ Design challenge: to create a cartoon or glog poster that expresses what the world of media and technology looks like from a girl's point of view (e.g., Artifacts 40, 68). ▪ Design challenge: to collectively create a website to share *101 Technology Fun* research and designworks (e.g., Artifact 89).
Girl/Technology Interviews	▪ Generating research questions concerning girls and technology (collected at home and during camp) (e.g., Artifacts 43, 44, 46). ▪ Conducting girl/technology interviews (in pairs, small groups, and with our complete team) (e.g., Artifacts 5, 8, 45, 54, 84–87). ▪ Photographing and videotaping girl/technology interactions using handheld Flip video cameras (e.g., Artifacts 74, 81, 82).
Mind Scripting Sessions	▪ Analyzing girl/technology interview sessions using Allhutter's (2012) mind scripting techniques (e.g., Artifact 9). ▪ Getting girls to identify and question how they are positioned (by themselves and others) within techno-cultural discourses. ▪ Provoking my team to identify, negotiate, and generate insights about their unconscious gender biases and how girls are held back (by themselves and others) within technology culture.
Technology Affirmations	▪ Inviting girls to identify particular strengths and technological achievements in the work of their peers (e.g., Appendix H).
Technology Research	▪ Self-reporting the *Adolescent Self-Perception Inventory* measuring learning skills and state of mind (e.g., Tables 5, 6). ▪ Recording a daily *iLife Diary* (e.g., Artifact 14, Table 8). ▪ Pre-camp technology interests and skills survey (e.g., Table 3). ▪ Post-camp video reflections of learning at *101 Technology Fun*.

Although I facilitated all of the large group discussions, the majority of our research data were gathered from pair interviews conducted daily using hand-held Flip video cameras. My team members took pride in their roles as co-researchers: they confidently wore their name badges (see Artifact 4) and often preferred to conduct their pair interview sessions in the library to appear smarter with books in the background. I believe that girls benefit from video reflecting. Providing them with alternatives to written summaries helps to improve their oral communication skills while creating rich artifacts of and for learning (Freeman & Mathison, 2009; Petrina, Feng & Kim, 2008). Some of the interview questions that were discussed and debated by the co-researchers during our recorded conversations include:

1. What is the Internet doing to your brain?

2. If you could rid the Earth of one game, which would it be and why?

3. Why is it almost natural for a girl to care so much about how she looks?

4. Do you know of any special tricks or marketing techniques that advertisers use to get girls to buy their brands?

5. Have you ever been cyber-bullied or have you heard stories about anyone who has? Were you ever the bully?

6. Why have girls been under a male's control since a few centuries ago?

7. What do you think the world would be like without technology?

8. How do you feel about having a job in technology when you grow up?

9. As girls, what do you think society values more? Beauty, brains or body?

10. What does technology have to do with the Earth and its environment?

11. Why do men have better jobs in technology than women?

12. What will the world look like in 2000 years? Will there be real teachers or only technology voices on a computer? Will there be any more schools?

If tap head once?
then robot body on / close eyes

If touch upper back?
then step forward / else stand still

If touch lower back?
then step back / else stand still

If grab shoulders?
then stop quick / else stand still

If touch left shoulder?
then turn left / else stand still

If touch right shoulder?
then turn right / else stand still

If tap head twice?
then open eyes / robot body off
stopall

Friend-Bots

Tech 101 agents, your mission is to:
- find a partner
- learn their name
- decode the program along the side margin
- beta test the default program
- debug and reprogram your Friend-bot as you wish!

Warning: this message will self-destruct !!!

Top Secret Challenge
With your fellow Tech 101 agents, create a path for an obstacle course out of nearby objects. Test your Friend-bots in the obstacle course. Take turns and see whose Friend-bot is programmed best.

Artifact 16. Friend-Bot Design Challenge created by *101 Technology Fun* Supervisor Katrina Branden.

The co-researchers' input was important for the successful development of our team-generated interview guides as we integrated many of their research questions (which the girls were encouraged to bring to camp each day). For example, after successfully completing their Friend-Bot Design Challenge (Artifact 16), the co-researchers divided into pairs and each interviewer/interviewee reflected upon the following five questions:

1. Do you have any stories of how technology has helped your friendships or how it has caused problems?

2. How would you describe communicating with your Friend-Bot?

3. While programming your Friend-Bot, how did you adapt your voice, touch, and attitudes to deal with this human technology?

4. Can you tell me about a problem that you encountered in building your robot and then describe how you solved it?

5. Do you have any other stories to tell me about how you learned to program your robot?

With a rotating schedule of events, I designed the data collection and creation activities of my study to be dynamically responsive to and inclusive of the co-researchers' unique skills, self-directed goals, and previous experiences with media and technology (Hill, 2010; Petrina, Feng & Kim, 2008). Because I wanted my team to discover and utilize their technical capabilities and strengths, I designed a confidence-building learning environment to support their interests, motivations, and talents (Denner et al., 2005; Goldman-Segall, 1998). Rather than employ a rigidly structured and fixed curriculum, our summer camps and maker labs were project oriented, non-hierarchical, relational, and guided by a philosophy that we are smarter together than apart because we are all working together on the same research team (Hill & Smith, 2005; Rusnak, 2010a, 2014b). For example, the *101 Technology Fun* steps to success (Artifact 17) is a pedagogical practice by Denner et al. (2005) that I built

upon to encourage the co-researchers to take ownership and responsibility for independently solving their creative, intellectual, and/or programming problems that occur as they are making designworks and conducting fieldwork (e.g., generating data for this study).

101 Tech Fun Steps to Success

PROBLEM SOLVING!

HOW to make your own games, movies, robots

STEP 1 Identify to yourself what is going wrong or not working right. Figure out what is not happening that you want to happen.

STEP 2 Go back and repeat a few steps. Start over and try again.

STEP 3 Demonstrate the problem to your team members. Be specific. Ask them questions and carefully examine their code.

STEP 4 If steps 1, 2 or 3 do not work, then talk with Kat or PJ.

Artifact 17. Problem Solving Steps to Success (Denner et al., 2005)

The *101 Technology Fun* makerspace was characterized by an effective balance of flexible and formal design activities. The activities were derived from or built upon those commonly found in design and technology elementary classrooms (Bottrill, 1995; Druin, 1999; Hill & Anning, 2001). Hill and Smith (2005) discuss how individual learners have unique and multiple literacies, capabilities, and interests in technology. Hence, our camp pedagogy was based upon a friendship driven and authentic learning environment with open-ended design problems relevant to the real-world contexts of girls' lives (Denner et al., 2005; Wilson, 2013). Key examples of our design-based and girl-centered curriculum include:

1. Challenging the co-researchers to employ their dynamic and iterative design processes while creating PSAs about tween-aged girls in the media, thereby provoking my team to explore new identities as social activists advocating on girls' issues and promoting girls' rights.

2. Challenging the co-researchers to design, construct, take apart, and program robotics to perform a range of creative functions, thereby developing my team's awareness and understanding of how the robotic technologies in their everyday worlds are designed (and can be re-designed).

3. Increasing the co-researchers' participation in innovating, designing, and playing pro-social and pro-feminist games (e.g., the *momME* game), thereby generating empowering and nourishing stories, artifacts, choices, experiences, identities, and roles for my team of girls to construct themselves with.

4. Developing a community website to share *101 Technology Fun* research and design-works, thereby recognizing and legitimating my team's experiences in designing with a variety of media and technological forms.

5. Creating significant opportunities for the co-researchers to develop new media and technology literacies in roles as experts within a university setting. For example, my team demonstrated the creation and programming of robots to a live audience of technology education teachers.

6. Inviting parents to a premiere screening of the *101 Technology Fun ME Documentaries* and PSAs, thereby building the community's media and technological literacy, as well as reinforcing the importance of educating girls in the technology sphere.

As poeticized by Walt Whitman (1855/1993, p. 454): "There was a child who went forth every day, and the first object [s]he looked upon and received with wonder or pity or love or dread, that object [s]he became… and these become of him or her that peruses them now." While it is no secret that today's children are inhabited by, immersed in, dependent upon, and growing up in an increasingly mediated and technologically constructed society, the challenge in this study is getting girls to question the oppressive media messages and technology stereotypes that they are bombarded with and acculturated by each and every day. Hence, as the co-researchers collected and created research data during our summer camp, I asked that they do so with a consideration for how much their identities (e.g., how they see themselves and how others see them) were based upon pre-constructed messages that have attitudes, interpretations, and conclusions already built in (Bach, 1998; Farmer, 2008).

Mind scripting sessions were important for educating my team members to identify and negotiate the well-established techno-cultural hegemonies and hierarchies in their lives and learning circumstances (e.g., to make visible the invisible gender stereotypes) (Allhutter, 2012). I want the co-researchers to increase their awareness of how to leverage the power of media and technology in socially responsive, pro-feminist, and empowering ways, such that girls can learn to control their interpretations of what they see and experience, and become conscious decision makers, rather than letting technology culture blindly oppress them. Therefore, data collection and creation activities at *101 Technology Fun* enable my team to participate as the designers and researchers of technology by respecting their perspectives and supporting them to contribute to the cultural conversations about what the future of technology could be like. For example, girls' artifacts, stories, and design expressions serve as valuable sources of inquiry, insight, innovation, and wonder.

4.3 GIRLS BUILDING UPON FEMINIST TECHNOLOGY & YOUTH EMPOWERMENT APPROACHES

This research contributes towards understanding girls' participation in, artifacts from, and stories about technology (Rusnak, Petrina, Feng & Wang, 2010). Employing feminist technology and girl empowerment approaches, my theoretical framework builds upon the scholarly work of:

1. Allhutter's (2012) deconstructive feminist theory of mind scripting, a tool that I use to get girls to identify and question how they are positioned (by themselves and others) within existing techno-cultural discourses.

2. Bach's (1998) girl-centered research principles for respecting and representing the complex, dynamic, and subjective realities of girls' lives.

3. Denner et al.'s (2005) "girls creating games" design strategies for empowering middle-school girls with technology and fostering the creative contributions of youth in educational research.

4. Freeman and Mathison's (2009) social constructivist approach for engaging children and youth as true partners in researching their learning, growth, and development.

5. Goldman-Segall's (1998) "points of viewing" theory for capturing children's unique expressions and experiences of technology within technology-rich immersive spaces.

6. Petrina, Feng & Kim's (2008) well-grounded theories and techniques for researching technology, cognition, and learning across the lifespan (e.g., navigating ethical and consent issues, designing dynamically responsive learning environments, integrating DBR methods, and analyzing the person(s)-in-interaction-with-technology).

While these scholars and colleagues occupy a variety of theoretical positions, I carefully selected them because they are all deeply committed to learning from the voices and experiences of children as valuable research partners, not research objects. Additionally, their work serves to counter traditional positivist research by developing new ways of inquiring into the complexity of youth cultures and youth learning, especially in relation to media and technology (e.g., the unique DBR and participatory approach of this study).

Two exemplary works played key roles in guiding, structuring, running, and analyzing the findings from the *101 Technology Fun* maker labs and design camps: Ricki Goldman-Segall's (1998) *Points of Viewing Children's Thinking* and Hedy Bach's (1998) *A Visual Narrative Concerning Curriculum, Girls, Photography, etc*, Hence, I will review: (1) how and why these scholars work with youth as co-researchers; and (2) how children's artifacts and stories are generated, interpreted, and represented in their scholarly books, which are each based upon the respective author's award-winning doctoral dissertation.

In *Points of Viewing Children's Thinking*, Goldman-Segall's (1998) shares her unique ethnographic methods for provoking and privileging children's learning and thinking within technology-rich immersive spaces. The author argues that today's children— the knowledge makers of tomorrow's future— must be set free as epistemologists in their own right and be included as active contributors to their knowledge environments (e.g., supported to construct their own meanings, perspectives, and truths). Not only does Goldman-Segall's research examine epistemological emancipation, it also creates new epistemological links between education, ethnography, media, and technology (e.g., she works with both children and various electronic media as her reflective knowledge partners).

Story is the central focus of Goldman-Segall's (1998) research, and she often refers to herself in her own story as a digital media ethnographer working with children's stories. She stresses the importance of locating our stories in relation to many other versions such that we can learn from one another, occupy different points of viewing, and come to deeper and more collective understandings. Trying to understand the "often digital, atomistic, and random nature of how we construct and combine knowledges" (p. 4), the author is less concerned with eliciting the one authoritative master story of all, and more interested in generating

multiple versions of child-constructed digital stories, and then studying the connections and contradictions between them. Because she believes that knowledge is pluralistic and techno-culturally constructed, Goldman-Segall advises that researchers who work with children and youth should take efforts to position themselves as one voice amongst many within the greater community of educational inquiry.

Points of Viewing Children's Thinking (Goldman-Segall, 1998) is organized into three sections: storyreading, storymaking, and storytelling. The first section (storyreading) offers a detailed description of the author's innovative methods for using various digital media as her "reflective cultural and knowledge partners" in order to analyze, observe, read, and record children's stories (p. 268). She situates her research within an extensive review of relevant scholarly works as well as the schools, students, and teachers who influence and inform her multimedia ethnography. While many scholars struggle with the evolving nature and function of story, Goldman-Segall remarks that story and experience are interdependent and unbounded for children who, at an early age, can make and tell stories quite naturally and with relative ease. Hence, story is a powerful method for: (1) researching how children come to know and make sense of their digital, home, and school worlds; and (2) empowering marginalized groups by giving them voice in the issues that influence their lives and learning circumstances. Further, she believes that stories are a living form of resistance to traditional research paradigms of domination and control (e.g., quantitative methods that yield inflexible results and finite conclusions) as stories have the transformative potential to push beyond the rigid constraints and fixed procedures that can limit mainstream methodological approaches.

In section two (storymaking), Goldman-Segall (1998) explains her multifaceted approach for creating video learning portraits with and about children as they use computers

and digital media technologies to express themselves. Her research purposes do not seek to figure out finite findings or ultimate meanings, rather she strives to build layers of interpretation and combine various points of viewing such that a broader understanding can emerge: "the goal would not be to convince others that one voice is the best voice; it would be to hear the various voices that make up the configuration and to base one's action on finding was of making sense of various points of viewing so that the actions taken represent more than one person's perspective" (p. 261). Digital media and technologies are cultural partners in Goldman-Segall's storymaking: "they are not just tools used by our culture; they are tools used for making culture" (p. 268). She carefully explains many issues associated with storymaking for the multimedia ethnographic researcher, including issues of access, authorship, censorship, ownership, and validation of stories with multiple voices, in addition to the complications of research that involves children expressing themselves in creative ways other than written or oral language (e.g., art, drama, digital media, and video).

In section three (storytelling), Goldman-Segall (1998) presents her in-depth case studies and story excerpts to evidence children's learning and thinking as they interact with each other and technology in media-rich learning environments. Additionally, the author provides a companion website (www.pointsofviewing.com) where readers/viewers can interact with a video gallery of children's learning portraits through a digital commons platform such that: "ethnography becomes a process of mediation and artistry rather than simply a matter of disclosing scientific findings" (p. 268). Anyone with web access is invited to share their concerns and comments using their own ethnographic lenses, which then generates further layers of meaning to the children's stories, allowing for all kinds of conflicting, dynamic, and relational interpretations, as well as to gain appreciation for the

messiness and complexity associated with this type of research.

Goldman-Segall (1998, p. 4) refers to the process of encouraging multiple and diverse readings of data within an online environment as *multilogueing* instead of the more limiting concept of dialoguing as she explains:

We are less interested in the one master story, the so-called truth, and more interested in multiple versions and connections between them. We want to expand our points of viewing by including others' points of viewing. The purpose of this research is to learn from girls, to question the nature of how we construct and combine knowledges and make sense of experiences.

The *101 Technology Fun* research approach utilizes Goldman-Segall's methodological, ethical, and political considerations for engaging youth as valuable partners in educational research concerning their learning, meaning making, and knowledge re/construction processes. *Points of Viewing Children's Thinking* is a theoretically rich work that informs the contextual and multi-layered approach that I chose to interpret and represent the diverse dataset created and collected by the co-researchers. In the next section, I will discuss how my study builds upon Goldman-Segall's work to foster the creative and intellectual contributions of my team. For now, I turn our attention towards Bach's (1998) research.

A Visual Narrative Concerning Curriculum, Girls, Photography, etc. is a visual deconstructive project in which Bach (1998) boldly challenges the "evaded curriculum" within the daily lives of adolescent girls. From her post-structural and feminist position, she calls into question the concealed stories and authoritative cultural scripts that are miseducative and limiting for girls and girl culture. Bach argues that girls experience the world through bodies that are marked by invisible socially constructed labels. In order to

understand the *girl-in-body* as a site of meaning making and to make known how the bodies of girls become coded, identified, and signified, Bach invites four artistic girls (ages 16–17) to each take a series of 80–120 still photographs that document, reflect, and imagine their lives (both in and outside of school). These photographs represent "memory around which we construct and reconstruct life" (p. 34) and are "stories assigning strong feelings, thinking, and deeply held beliefs told and retold over time" (p. 38).

Bach (1998) conducts intimate heart-to-heart conversations with each of her participants to discuss their photographs and to discern the unseen work of body politics, media, language, power dynamics, sexuality, and social pressures in shaping the lived bodily experiences of girls. Speaking about the often unspeakable, Bach does not feign a neutral objective researcher voice; rather, her work is political as she makes public the visual representations of her participants' private experiences, including girls' desires, pains, and pleasures that are not traditionally portrayed in the politically correct and sanitized texts of traditional scholarly writing. Bach troubles the dominant stories of the *good girl, the bad girl,* and the *happy family*, as well as the "evaded school curriculum" which avoids important life experiences such as bodily functioning, gender/power relationships, and the valuing of personal feelings. Hence, she argues fervently for a "curriculum of experience" that reinforces self-knowledge and emotional expressiveness through which "girls might become independent, free in mind and body" (p. 26).

I am inspired by the quality of Bach's writing that is intellectually masterful and courageously autobiographical as she offers her own life as research text through her photography and poetry. Bach does not seek production of a tidy linear narrative in her study. Rather, she creates an emotionally intense story that is like a treasure box full of girls'

intimate expressions, memories, movements, photographs, and secrets. She respectfully honours the complex, dynamic, and subjective realities of girls' lives by creating a corresponding research text that is complex, layered, "positioned with gaps, possibilities, and the etc" (p. vii), and then invites readers to make sense of it all. Bach intentionally destabilizes her authorial voice as the researcher-presumed-to-know by continually questioning her theories and research practices. As she empowers girls to be the image-makers of their stories, she often expresses concern about misrepresenting them through her adult research lenses and filters.

To highlight the voices of the participants in her study, Bach (1998) presents three notebooks with their transcribed research conversations. The left-hand column emphasizes the girls' words in bold font and the right-hand column provides an italicized mixture of Bach's miscellaneous field-notes, interpretations, questions, and academic citations. Added to this polyphonic research text are poems and photographs that juxtapose with the side-by-side presentation of text such that the boundary between data and analysis are irreducibly blurred. Bach's post-structural and deconstructive approach is appropriate for her scholarly intent, including: (1) to motivate girls to critically examine their lives and reclaim their stories; (2) to interrupt and mess-up the taken-for-granted, disempowering, and dysfunctional scripts of girlhood (p. 24); and (3) to generate new "rereadings and possibility for a discourse of the evaded in the lives of girls" (p. vii).

Bach's (1998) approach towards narrative analysis is unconventional because her deconstructive work disrupts traditional scholarly formats found in research publications on girls, culture, and curriculum. She employs a reflexive practice that allows for risk by continually calling attention to the limits of her research and by inviting readers to also

question the interpretive dynamics at play within her study. Her exploratory, poetic, and persistently self-questioning work will not satisfy readers who want finite truths that can be legitimized by statistical measures. While Bach is concerned with sharing an authentic re/presentation of girls' visual narratives, I can not help but question how her open-ended knowledge claims are interpreted by readers/viewers. How do they respond to Bach's provocative analytical approach that admits uncertainties and is juxtaposed with unsettling interpretations that are often in conflict with each other instead of converging? Are her complex visual research narratives too challenging and too much work to make sense of for an academic audience who are used to getting clear and generalizable facts, not multiple truths from multiple perspectives? What happens if her scholarly work is distorted, ignored, misrepresented, and/or institutionally dismissed?

Dobson (2006) assesses readers' ability and preparedness to engage with complex narratives by exploring their engagement with a multi-layered, multi-voiced, and unorthodox fictional story by Alice Munro (1999) titled: *The Love of a Good Woman* (of relevance, Munro is also the award winning author of *Lives of Girls and Women,* an unsettling short story with frank subject matter concerning feminist ideas and experiences). As in Munro's fictional work, Bach's (1998) scholarly work "represents the layered and complex nature of human imaginings in narratives that are similarly layered and complex" (Dobson, 2006, p. 66). Like Munro's readers, Bach's readers must actively participate in the re/interpretive processes by employing their own "imaginative energies in a variety of ways, seeking to understand myriad perspectives, as well as the interrelations between these perspectives" (Dobson, 2006, p. 66). Being comfortable with Bach's research means accepting her theoretical position that there are no fixed rules for assigning meaning to girls' bodily

experiences, as well as the importance of provoking girls to make and share their own stories. From the beginning to the ending of her book, Bach continually poses questions about the "already interpreted" notions concerning girlhood and girl cultures. "Between frames and across contexts, in gaps, overlaps, areas of suspicion and transitivity," Bach advocates for multiple re/readings of girls' stories (including her own), fully aware that every story and photograph can be viewed differently from different perspectives, contexts, and times (p. 104). What matters most for Bach's research is, "not how to make re/presentation, but how to avoid re/presentation" (p. 33).

In the following section, I discuss how my work with girls builds upon Bach's (1998) work with girls, most notably: (1) Bach's narrative methods for bringing forth the breadth and depth of youth knowledge, and her principles for engaging girls as legitimate co-researchers in investigating their dynamic lives and learning circumstances; and (2) Bach's two-column format for analyzing and synthesizing the continuities, discontinuities, interconnections, tensions, and transformative possibilities that occur in conjunction with the content, context, form, and impact of a complex youth dataset (e.g., visual, verbal, and textual materials from multiple sources).

4.4   GIRLS ASSEMBLING THE 101 TECHNOLOGY FUN RESEARCH MONTAGE

During my fourth year of doctoral studies, I was blessed to give birth to a beautiful boy. I spent the better part of a subsequent one-year maternity leave walking to calm my son and listening to the co-researchers' interviews and mind scripting sessions, ever wandering and wondering about the best way to analyze the volume of data they collected and created. How do I portray my team's diverse experiences learning by design? How do I share their

exuberance and fascination for programming robots, creating games, and making their own movies? How do I be true to what girls are still figuring out for themselves (e.g., who they are and who they want to become)? How do I reveal what technology means for their lives, such that relevant others (e.g., peers, parents, teachers, and scholars) can come to know from girls' perspectives and learn how girls see themselves in a more-than-human-world?

To make sense of the co-researchers' fieldwork and designworks created during the *101 Technology Fun* maker labs, I must carefully analyze their dataset in a way that embraces the ambiguities, complexities, imaginaries, and subjectivities of the *girls-in-interaction-with-technology-and-stories,* the key unit of analysis, wherein artifacts and stories are made, shared, and reproduced (Petrina, Feng & Kim, 2008). Informed by Freeman and Mathison's (2009, pp. 162–163) guiding principles for interpreting diverse datasets, my first task was to sort our data into sense-making themes or patterns. I identified four distinct yet inter-related elements or themes that characterize my team's artifacts from and stories about technology: agency, ingenuity, self-interpretation, and self-efficacy. My procedure for data analysis was guided by Seidel's (1998, p. 1) inductive approach to QDA: "a process of noticing, collecting, and thinking about interesting things" whilst repeatedly engaging and re-engaging with the dataset. After identifying the girls' predominant questions and concerns, themes emerged which I used as a framework to synthesize their fieldwork and designworks:

1) **Agency:** *girls having influence and power*
   - What are media girls supposed to do? Seeing ourselves and others
   - From agentive artifacts to destructive expectations of perfection
   - From girls' QCT (questions concerning technology) to girls' QCG (questions concerning girls)

2) **Ingenuity:** *girls being clever, original, and inventive*
   - Who knew this kind of gameplay could exist? Girls innovating games
   - From technology innovators to technology entrepreneurs

3) **Self-interpretation:** *girls making sense of self in-interaction-with technology*
   - Who says girls aren't beautiful? And why can't they be smart?
   - From appropriating to remaking girl/technology stereotypes
   - From who girls are to what they want to become

4) **Self-efficacy:** *girls believing in or judging their technological capabilities*
   - From thinkering to empowering girls through technology
   - What are the changing the roles of girls in media and technology?
   - Why do girls need to know their perspectives matter and are significant in media and technology cultures?

As the interpretation of each individual piece of data emerged in connection with the entire collection, I was challenged with how to form a whole yet polyphonic research text (without dilution, conformity, or privileging one perspective as absolute). Hence, I build upon Bach's (1998) two-column montage approach to analyze and synthesize our inquiry findings in a visual and designerly way. This is significant because appearance, decoration, and style are all important elements in the work and lives of the co-researchers. Moreover, the montage format allowed me to embed multiple storylines, thereby representing the unlimited play of interpretations (of interpretations of interpretations) and the dynamic re-designing of identities, cultures, and knowledges within the context of my study. I do not believe there is one ultimate or unquestioned way of understanding the complexity and diversity of girl/media/technology relationships. My objective was to present shared (but not necessarily consensual) understandings in the pursuit of "rigor as well as relevance" (Lather, 1986, p. 67) regarding the production of personal and cultural knowledge that contributes towards developing technology futures that are wide open with possibility and opportunity for girls to change the world in both big and small ways (Rusnak, 2014a, 2014b).

The format and approach of my analysis/synthesis is unconventional and innovative: findings are introduced through girls' artifacts and stories, inviting personalized and complex

subtexts that are unlikely to be discerned from large-scale studies or quantitative surveys (e.g., Allhutter, 2012; Freeman & Mathison, 2009; Mallan, 2003). I analyze and synthesize our dynamic dataset using a mulit-faceted montage approach mutually constructed with the co-researchers, thereby situating them as leaders of change or change makers in the cultural shaping of technology discourse. One dimension of analysis (the left-hand column) honours and details my team's original data collected and created during our maker labs and design camps (e.g., codes, critiques, diaries, drawings, interviews, photographs, storyboards, surveys, questions, and quotations). This serves two major purposes: (1) to represent the girls' work with minimal interpretation, thereby increasing confidence in the trustworthiness of our study data; and (2) to respect and honour my team's and diversity to the greatest extent possible, rather than suggesting that they share one standardized or homogeneous identity (Bach, 1998; Goldman-Segall, 1998; Scott, 2007). The co-researchers' fieldwork and designworks in the left-hand column effectively address my first research question: How do girls, through their artifact making and *designerly* practices, story themselves and express their understandings of technology?

The specific dataset selected for my study focuses on the catalytic or generative artifacts and stories that empower, energize, focus, and re-orient my team and I (Goldman-Segall, 1998; Lather, 1986). By selecting data elements with (not for) girls, I use the inquiry process as a means towards the empowered transformation of my team, drawing close attention to the catalytic validity of our artifact and story practices (Kovach, 2009; Rusnak, 2014a, 2014b). Lather (1986) characterizes catalytic validity as "by far the most unorthodox [of validities] as it flies directly in the face of the essential positivist tenet of researcher neutrality" (p. 67). Within the *101 Technology Fun* community of design-based inquiry,

artifacts and stories become catalytic or generative when they are transformed into new actions, attitudes, or behaviours that evidence activism, growth, insight, learning, or liberation in my team (e.g., the data that reveal distinct changes in the co-researchers' sense of technological self-efficacy, self-motivation, and/or self-interpretation). Individual girls are addressed to the degree that they are in-interaction-with technologies or each other in artifact production and storymaking. Similarly, artifacts are addressed inasmuch as they relate to stories made or told by the co-researchers. Hence, the artifacts were and are catalytic for storymaking and, symmetrically, the stories were and are catalytic to artifact production and sharing, emphasizing interdependencies as the focus for analysis (Kovach, 2009; Lather, 1986; Mallan, 2003). This grounds my qualitative research approaches and techniques and corresponds with my commitment to increase girls' understanding of gender/technology inequalities, hegemonies, hierarchies, and marginalization issues such that they can individually and collectively effect and stimulate change (Allhutter, 2012; Sandberg, 2013).

A second dimension of analysis (the right-hand column) represents how I, as a highly involved co-researcher, co-designer, and co-learner, connect and make sense of my team's data from the first dimension. This includes key details about the data production contexts, including personal, interpersonal, and situational information, as well as discussion, field notes, questions, statistics, and theory integrating the *girls-in-interaction-with-technology-and-stories* (Bach, 1998; Freeman & Mathison, 2009; Petrina, Feng & Kim, 2008). I hyphenate my unit of analysis to represent a co-constitutive phenomenon that needs to stand as a whole. Technology and stories are entangled with and inseparable from girlhood and the production of girl culture, within the context of my study (Farmer, 2008; Kearney, 2006; Rusnak, 2014a, 2014b). The information and interpretation in the right-hand column provide

valuable insights that address my second research question: What are the implication of

adopting *designerly* roles in terms of developing girls' capabilities in media and technology?

Specifically, the interconnected montage approach functioned to:

1.   Layer my team's stories and artifacts in producing a contextualized, deeply
     nuanced, multi-dimensional, and multi-perpectival understanding of girls.

2.   Show what my intelligent and talented co-researchers can make with media and
     technology, framing them as experts, innovators, interactive designers, change
     makers, concerned citizens, savvy programmers, and video pros (e.g., debunking
     stereotypes of girls as passive users/consumers or media victims).

3.   Capture my team's affective states, ambiguities, complexities, emotions,
     imaginaries, and subjective truths in diverse media forms (e.g., audio, image,
     game, text, and video), thereby offering diverse perspectives that are catalytic,
     divergent, dynamic, partial, and transformative (e.g., making stories expands the
     notion of normative and makes us think anew).

4.   Create an unbounded research text that generates multiplicity in perspectives,
     re/readings, storylines, and understandings, thereby seeking resonance and
     discordance with other voices at a personal level. I invite all readers/viewers to
     become storymakers who use their imagination and intelligence to piece together
     the girls' artifacts and stories, our field-notes and interviews, and key scholarly
     theory, thereby making each re/reading of my thesis a new story (e.g., we all see
     and interpret the same things quite differently).

"Data do not speak for themselves" (Freeman & Mathison, 2009, p. 150); hence I

invite all of my co-researchers and readers/viewers to be storymakers (e.g., not merely

passive recipients of authorial analysis) in uniquely interpreting and questioning my

theoretical reflections and study findings, which is only one intelligible representation

amongst many possible versions. As Seidel (1998) argues "the answers we look for are not in

the codes, but in ourselves and our data" (p. 14). Like Bach (1998), I advocate for alternative

re-readings of my work, which is key to this study's transformative potential, leading to new

kinds and forms of understanding. By listening to each other and including our shifting

subjectivities, we can come to know from many viewpoints and remain open to knowledge

that is partial, dynamic, and constructed by different perspectives, contexts, and times (Allhutter, 2012; Freeman & Mathison, 2009). Smith and Sparkes (2008) offer a productive distinction between story analysis and storytelling, wherein I add storymaking: "Rather than adopting the standpoint of a story analyst, a different preference one might adopt toward conducting narrative analysis is that of a storyteller [or storymaker]. Unlike story analysts that conduct an analysis of stories, for storytellers [or makers] analysis is the story" (p. 21).

TO MAKE A LONG STORY SHORT

Linking my participatory and designerly methodology to the feminist technology and girl-empowerment theoretical framework that I build upon, this chapter discussed the *101 Technology Fun* approach, including: (1) data collection and creation methods; (2) data selection processes; and (3) procedures for analyzing and synthesizing study findings utilizing a creative montage approach. Drawing upon research practices that are respectful, sensitive, and inclusive of girls, the purpose of this chapter was also to generate scholarly reflection about what it means to do research with (not on) youth and to raise important questions concerning children's rights and roles in the knowledge made about their lives and learning circumstances (Bach, 1998; Goldman-Segall, 1998; Scott, 2007). Descriptions were provided to share how I support my team members to become technology thinkers and makers who design, create, question, and innovate in their own ways, on their own terms, and for their own purposes (Rusnak, 2010a, 2014b).

WHAT IF YOU HAD ONE DAY TO ALTER THE FUTURE OF GIRLS

SOME ASSEMBLY REQUIRED
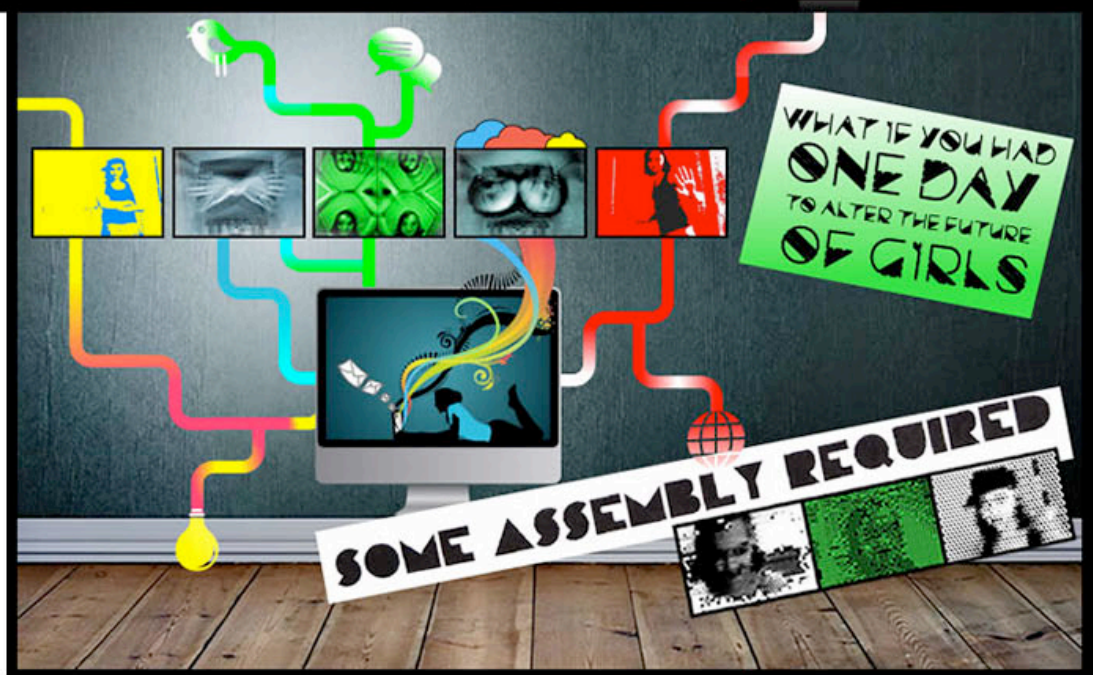
analyzing stories concerning girls, technology, design

5

CHAPTER 5: ANALYZING STORIES
CONCERNING GIRLS, TECHNOLOGY & DESIGN

In this chapter, I utilize a conversational montage approach to analyze and synthesize key findings concerning *girls-in-interaction-with-technology-and-stories* at *101 Technology Fun*. Importantly, each element is selected (by the co-researchers and I) not only to tell my team's story, but also to show why we tell their story (e.g., to counter stereotypes that girls are culturally unproductive and that media and technology research is the privileged domain of adult male scholars) (Denner et al., 2005; Farmer, 2008; Rusnak, Petrina, Feng & Wang, 2010). Within this montage analysis, I am committed to representing my team members' lively, multilayered, and personal stories about their learning experiences as designers and researchers of technology. I do not want to create yet another methodological framework that acts as a standardized template for filling in, shaping, and creating girls (Bach, 1998)

My preference was to write four themed sections (rather than one large chapter), reporting on my team's agency, ingenuity, self-interpretation, and self-efficacy. Each section of the montage offers a piece of a wider picture: when taken together they create complex stories of how girls cultivate new affinities towards and capabilities in media and technology. The co-researchers, whose names have been modified for privacy considerations, resonate throughout this portrait as powerful voices that adopt, adapt, blend, reject, remake, and rethink diverse techno-cultural discourses and understandings. Scrolling on the left side are the girls' catalytic artifacts, insights, comments, stories and texts. Scrolling on the right, in conversation with the co-researchers, are my artifacts, insights, comments, stories and texts. In articulation, the parts and whole represent key findings. Following each section is a small story, or a few stories, that emerge as fairly representative of the theme.

agency

girls / influence / power

BE YOURSELF

be yourself

be yourself

be yourself

BE YOURSELF

Be yourself
cuz everyone
else is taken!

Artifact 19. "Be yourself!"

5.1

5.1.1 AGENCY: GIRLS, INFLUENCE, POWER

What are media girls supposed to do? Seeing ourselves and others

The following Public Service Announcement "The Media?" (Artifacts 20–39) is brought to you by the 101 Technology Fun team of co-researchers (July 2011, 4.5 minutes):

Artifact 20. PSA: The Media? I

Jayden: The world is filled with many problems. A big problem is the media. Girls everywhere have low self-esteem because of this. They look in a magazine for three minutes and feel bad about themselves. This commercial shows how everything is being affected. How girls are mistreated and how the media is bad.

Artifact 21. PSA: The Media? II

Salina: *(reading from her script)* **Welcome to Mother Earth. The land of waving flags, flying bullets, and unsettling noise. Green valleys, soybean crops, mountain peaks, desert storms, inaugurations, declarations, and starving children. The land of crime, poverty, oppression, racism, and the unequal distribution of wealth. A land of pig-headed, over-confident, self-assured, ego-centric, self-**

In her influential work, *Girls Make Media*, Kearney (2006) finds that girls with agentive experiences as media producers are less vulnerable to manipulation by commercialized media and also more informed about the effects of the media on the re/production of knowledge and the re/formation of gender roles.

Educational research by Farmer (2008) and Lipkin (2009) further documents how girls involved with the process of creating their own media works are more likely to expose and question the ways that they are positioned by the dominant storylines in technology culture (Artifact 19).

Building upon the scholarly work of Farmer (2008), Kearney (2006), and Lipkin (2009), I presented the *101 Technology Fun* team with the design challenge to produce a short Public Service Announcement (PSA) with three enabling constraints: made by girls, for girls, and about girls. More specifically, the PSAs were to be: 1) written, directed, and edited by girls; 2) produced for a specific audience of girls ages 10 to 13; and 3) themed about girls and the technology in their lives and worlds.

The Media? exemplifies how girls can experience and effect their own agency, influence, and power by producing PSAs and contributing their stories to transform media and technology culture. The co-researchers arrived to camp with much to say in a big and bold way. My role was to set up a technology-rich and friendship driven learning environment for them to work in, and then to stay out of their way and let them create. I did not interfere

righteous people who are blind and insensitive to the weak and the poor. Blinded by their determination and their compulsive behaviour and the daily struggle for non-essential commodities.

The camera slowly zooms in to focus on the stern facial expressions of each actor/co-researcher as they take turns speaking:
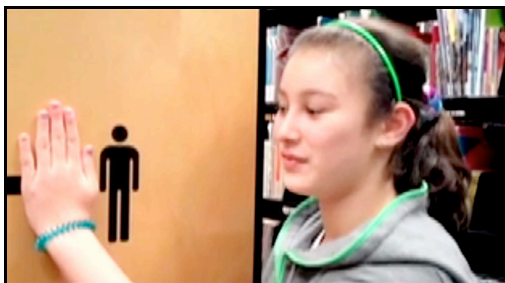
Jayden: Is
Kim: this
Aslin: what
Jordan: you
Salina: want?

Artifact 22. PSA: The Media? III

Kim: Girls are slowly disappearing. After all the hard work that we did to almost be equal. Now that we have the right to vote. Would you want that to happen?

Jayden: Three billion people don't look like the people we see in magazines and *(she holds up a pink sticky note that says, "only a couple people do!")* **only a couple people do.**

with my team's content choices, creative practices, or design decisions. I was ever-present, however, following them to document the making of their media works (Rusnak, 2009b, 2010a).

Placed in roles as media producers, the co-researchers worked together in small groups (3 to 5 girls) and had one lively day (about 8 hours) to brainstorm, research, storyboard, script, rehearse, shoot, and edit. The different stages in their design processes were achieved by iteration and intuition, not as a linear or required sequence of steps. My team had exclusive *girls only* access to three learning labs: one located in the UBC Education Library and two on the second floor of the Scarfe Education Building.

The materials that the co-researchers chose to use from the labs included: a Smart Board for brainstorming (which also became an actor in the *Watch What You Wear* PSA); large sheets of recycled paper for storyboarding; high definition hand-held Flip video cameras for filming; iMovie for editing; and a wide assortment of used magazines for researching. I equipped the labs with *Adbusters, chickaDEE, Cosmo Girl, OWL, People Weekly, Seventeen, Shape, TIME, Today's Parent,* and *Wired*. Raywin brought one issue of *National Geographic Kids* and Aslin contributed several issues of *Vogue*.

One of my field-notes reminds me of the moment when Aslin, sounding very grown up and important, confided in me that, **"*Teen Vogue* is just not the same as *Vogue*."**

I encouraged the co-researchers to believe in the unique and special power of producing their own stories (Mallan, 2003). Although I expressed my genuine

Aslin: Do I look like this?

Artifact 23. PSA: The Media? IV

Jordan: Does anyone look like this?

Aslin: *(confidently reports)* **Seven out of eight people in magazines are photoshopped.**

Artifact 24. PSA: The Media? V

Kim: *(reading from her script)* **These days a banana is not just a banana. Wake up in the mindscape of North America. Where twelve billion display ads, three million radio commercials, and two thousand million television commercials are dumped into the collective subconscious daily. You are the test subject in the largest psychological experiment ever carried out on the human race. But this experiment is unusual in one fundamental way: no one is keeping track of the results.**

The screen fades to black and the following question appear in bold white letters: "What is a media girl supposed to do?"

interest and excitement to see their work, I purposefully did not offer my assistance or biased opinions. I wanted to authenticate their voices and to find out what they are capable of, so I made myself as invisible as possible, more like a fly on the wall than an educational researcher. My intent was to absorb and inhabit the design worlds of girls, appearing inconspicuous yet looking with my eyes wide open, ever trying to capture their stories about and interactions with technology (Goldman Segall, 1998).

As I analyze *The Media?* (Artifacts 20–39), I hear my team speaking with agency and without hesitation. They are mocking popular media culture with their assertive voices and intelligence. It is a real thrill for me to see girls soaring on the power of their words and to watch their PSAs come to life. Girls' media works that challenge the dominant identities and dubious ideals that they feel pressured by mainstream media to believe in and become (Farmer, 2008; Kearney, 2006).

Of interest to me is the question: where does girls' agency stem from? Young girls are not typically portrayed as powerful or influential in media culture.

As I think about my team's editing challenges, scripting revisions, and creative breakthroughs, I'm reminded of the "ruby slippers principle" from the popular movie *The Wizard of Oz*:

> Dorothy: Oh, will you help me? Can you help me?
>
> Glinda the Good Witch: You don't need to be helped any longer. You've always had the power to go back to Kansas.
>
> Dorothy: I have?

The camera slowly zooms in on seven bold words from an Adbusters counter-narrative and the heads of nineteen models that the girls cut out from magazine advertisements: **CONSUME, ACQUIRE, EAT, DRESS. DRIVE, DRINK, FUCK.**
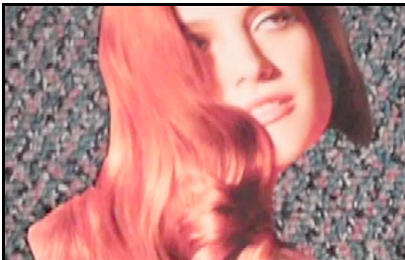

Artifact 25. PSA: The Media? VI
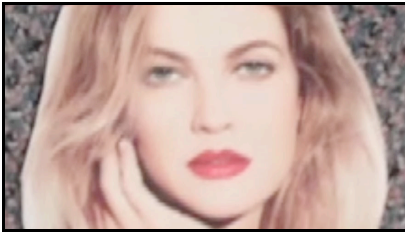
Artifact 26. PSA: The Media? VII

Artifact 27. PSA: The Media? VIII

Artifact 28. PSA: The Media? IX

Scarecrow: Then why didn't you tell her before?

Glinda the Good Witch: Because she wouldn't have believed me. She had to learn it for herself.

Like the fictional Glinda the Good Witch, Farmer (2008) reports that most tween-aged girls do not yet know how powerful they are. Developmentally, they are at an emotionally intense stage of negotiating their sense of self-esteem and self-worth.

As they explore their identities, girls are trying to distinguish who they are, both to themselves and others. They are trying to figure out where they belong in the dominant media storylines that they are growing up with and being acculturated to believe (Kearney, 2006; Lipkin, 2009).

Instead of fitting into limiting stereotypes, how might we empower girls to be agentive agents in re/creating and shaping media and technology cultures? This is important identity work as today's girls (ages 8 to 18) average nearly 11 hours of media and technology multitasking each and every day, a considerable affective and cognitive investment (Rideout, Foehr & Roberts, 2010).

As content creators, my team bring forth some of the entrenched stereotypes and limiting labels that hold females back. For example, *The Media?* (Artifacts 20–39) reveals the internal and external pressures that these five girls feel to conform to the perfect *media girl* ideal. Someone they perceive as a homogenous photoshopped identity who is limited to doing seven basic things: "CONSUME, ACQUIRE, EAT, DRESS, DRIVE, DRINK, FUCK" (*Adbusters*, 2004) I worry about the girls remixing and mashing up the F-words here, including feminism.
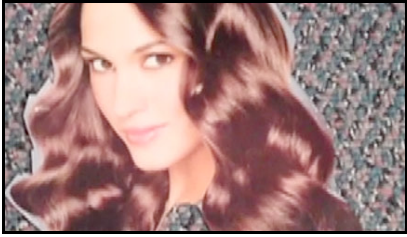
Artifact 29. PSA: The Media? X

Artifact 30. PSA: The Media? XI

Artifact 31. PSA: The Media? XII
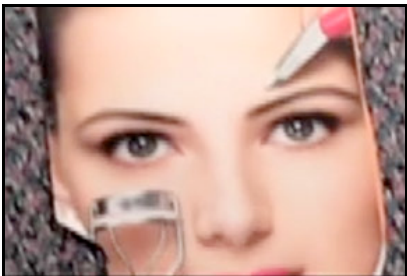
Artifact 32. PSA: The Media? XIII

Artifact 33. PSA: The Media? XIV

Aslin: *(exclaiming loudly with contempt)*
All of these people are photoshopped!

By producing and sharing their PSAs with other girls, my team are expanding the mainstream media storylines that circulate in and around their lives. They are also exerting their autonomy and influence by challenging some of the oppressive gender stereotypes that undermine female roles in technology culture (Farmer, 2008).

As Kearney (2006) argues, increasing girls' agency is key in feminist approaches towards achieving gender equity and opportunity within the technology sector. However, when I asked if they thought of themselves as feminists, the girls responded with silence. Aslin finally spoke up: **"Do you mean 'themish' people?"**

Although she believes in girls' rights and gender equity, Aslin's response indicates that she is only ten years old and likely has not lived enough of her life to feel comfortable self-identifying with the feminist movement. Hence, my team and I discussed how feminism (or Aslin's "theminism") is different for each person and you are not required to be an expert. I explained that *101 Technology Fun* is a feminist project because it seeks to give girls equitable opportunities to design, learn, and play with technology.

It is my honour and privilege to support the co-researchers to be their most agentive and powerful selves as they experiment with new roles as the designers and producers of technology culture. I am wary, however, of over-valuing the transformative potential of their production work given that these girls are growing up within the constraints of a limiting patriarchal framework (e.g., girls do not develop outside of cultural frames and roles) (Turkle, 1988). Further, their knowledge of the media may not be
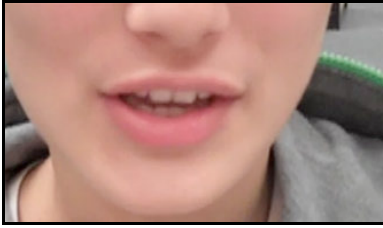
Artifact 34. PSA: The Media? XV
Jayden: Be yourself

Artifact 35 PSA: The Media? XVI
Salina: Be yourself

Artifact 36. PSA: The Media? XVII
Kim: Be yourself

Artifact 37. PSA: The Media? XVIII
Aslin: Be yourself

Artifact 38. PSA: The Media? XIX
Jordan: Be yourself

as comprehensive at it appears in their PSA. Although the co-researchers were attentive in giving voice to each member of their team, they did not feel remiss about appropriating *Adbusters'* views as their own (e.g., they spoke verbatim from this edgy magazine without referencing the source of their intelligence).

Mallan (2003) theorizes how girls are covered with cultural antennae and sensitive receptors that absorb media-generated images, roles, and storylines, which both penetrate and sit on the surfaces of their bodies. As producers of their own PSAs, the co-researchers draw upon the themes, plots, values, and characters contained in other cultural tales that have also been remade and retold.

For example, the co-researchers readily remediated a quote found in magazines and the web: **"be yourself, everyone else is already taken"** which is routinely and often mistakenly, attributed to Oscar Wilde. This is cultural disassembly and the girls readily able to remix these things to demonstrate senses of agency (Bleeker, 2006). Its message resonated positively with their understanding of self in relation to other people's activity. Like Bach (1998), I believe that this inter-textual characteristic of girls' story and artifact making makes their work generative, remarkable, and transformative.

In my study, quite often the distinctions between girls, stories, and technology merge together (Rusnak, 2010a, 2014b). I am looking for reciprocal relationships in order to understand technology from girls' perspectives on and places in it. Hence, I share some of my team's salient artifacts and stories such that they may resonate with readers. It is difficult for girls to feel agentive and powerful unless we listen to them and value their work (Sewell, 1992).

The screen fades out to black and then the following message appears: "Be Yourself, because everyone else is taken."

Be Yourself,
because everyone
else is taken
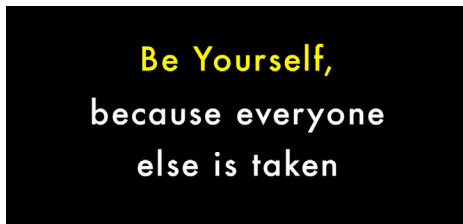
Artifact 39. PSA: The Media? XX

I wonder, however, about the unspoken, the silence of the unsaid, and the power of those who get to speak. I am concerned about misrepresenting my team through my limited adult-researcher lenses and filters (Bach, 1998). I am certainly not the voice of my 'voiceless' co-researchers as Roy (2004) argues: "There's really no such thing as the 'voiceless'. There are only the deliberately silenced, or the preferably unheard."

5.1.2 AGENCY: GIRLS, INFLUENCE, POWER

From agentive artifacts to destructive expectations of perfection

Artifact 40. "You don't have to be size 0 or −1 to look good."

Halina: A girl in my class said that she once saw a mannequin in a store that was size –1 or 000. The clothes were cinched tightly at her back to fit her.

Chani: Girls try to impress people. If they look more like girls in magazines then they will be more accepted.

After screening all of the girl-produced PSAs, my team and I participated in a group mind scripting session (Allhutter, 2012). In addition to giving each other praise and positive affirmation for their work, the co-researchers were very interested to continue sharing and analyzing their personal struggles with hegemonic media and technology discourses. As Salina remarks: **"the questions and stuff we talked about, normally we don't at home or with our friends or at school."**

Within this section of the co-researchers' mind scripting transcript, please note that I have inserted three salient artifacts from storyboards that the girls generated whilst making their PSAs (Artifacts 40–42).

In *Teen Girls and Technology,* Farmer (2008) finds that the more skillfully girls are able to produce their own content, the better they are able to critique not only their own media productions, but also to understand the broader scope of techno-cultural norms, values, and stereotypes that are embedded in mediated messages about girls and girlhood (e.g., Artifact 40).

Salina: When they pick the girls to wear the clothes on the commercials, they only pick the beautiful girls. Even though you are not similar to her.

Jordan: Lots of time they will use people who have been photoshopped and stuff and they will alter them and then you think, "If I use this, then I will look like them."

Jayden: No, you don't have to look like those people. Like, just stop and think. Just looking at a magazine can change your perspective of who you are. Media tests your self-confidence. Ads target children because they are the most emotionally vulnerable. Don't fall for it!
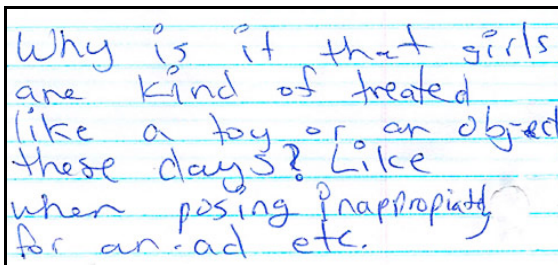
Artifact 41. Why is it that girls are kind of treated like a toy or an object these days? Like when posing inappropriately for an ad, etc.?

Raywin: Yeah, I ordered the magazine *Kids* by *National Geographic* and they had before and after. Before they took a random girl with nice hair but not nice skin. After they used Photoshop to take away all her measles and acne, so she looked perfect and fake like a Barbie doll.

I think it's really upsetting that they photoshop everyone. There can't be one model that is normal looking to advertising something.

As I analyze my team's analysis about their experiences as media producers, what strikes me most profoundly is the juxtaposition of the girls' innocence with their internalized anxiety concerning the effects of the media in and around them: **"The media is everywhere all around us. It's not just on your laptop, and it has a very good and bad influence on girls"** (Jordan).

Jill's critique of the media is not what I typically hear tween-aged girls talking about: **"You have to be anorexic and skinny and dress like a slutty child. Make sure your eyes are as big as fuck too."** Her internal tensions and external concerns do not fit into the dominant and stereotypical discourses of femininity that tend to be confining and passive for girls (Turkle, 1988; Wajcman, 1998, 2004).

As I contemplate what Jill's biting words reveal, I wonder about other fears that she may be concealing (e.g., Artifacts 40–42). What else does she (and the other girls in my study, including my dear daughter) truly think and feel about growing up in today's media and technology culture, but dare not say?

I thanked Jill for having the courage to share her private experiences concerning the over-sexualization and objectification of girls in today's media. I am bothered by what I hear and also by the stories that remain silent: why don't my team members talk about being too creative, intelligent, skilled, or talented?

Instead, my team express their insecurities and self-doubts concerning the intense cultural pressures put on girls to conform to particular images and standards, asking me questions like: **"Who or what did the popular girl look like when you were**

Meledy: The thing I find upsetting is when you go to Safeway or whatever grocery store you go to, there are ten thousand magazines right before the checkout with pretty girls and women who have their zippers all of the way down or low cut shirts or clothing that is really inappropriate and then you go, "What's that?"

And so I hide myself in a cooking magazine cuz I don't want to look at them, and I'm not kidding. But they are everywhere and it's really hard to avoid cuz they are all always catching your eyes. And you are always taking a second look.

Why do they put them there in the first place? To make you want to open the magazine and then to make you want to buy it and the stuff advertised inside. Well that's my pet peeve. It's like insane.

Chani: I find this so offensive! These girls are losing their dignity. Most women don't dress like this. I wish this would stop.

Kim: Girls and boys in clothing stores are always in a kissing pose and all lovey-dovey with each other. It's like they are advertising love or something, not clothes. Another thing is that TV people are all photoshopped but when you go to the store and actually look at the products, they are not as good.

Jordan: Yes, but we have the responsibility to change this! We won't ever be able to truly change how the media controls us, but we can change how the media portrays us.

Salina: Yeah, like we can believe in ourselves and ignore the media.

our age? What do you think society values more: beauty, brains, or body? Why is it almost natural for a girl to care so much about how she looks? Do more or less than 50% of all the girls in Vancouver care more about their grades than their looks?"

The co-researchers asked me many thought provoking questions, yet I was hesitant to answer given my influencing position as an authority figure and role model. Also, I was aware that the video camera was always rolling, forever recording my words and actions as part of this study. Hence, I thanked each girl who asked me a question, instructed her to record it on paper, and promised that we would discuss it together during our next group interview or lunch break.

As my team responded to each other's questions, they seemed to shift confidently from one viewpoint to another, positioning themselves in diverse and complicated ways. For example:

- Halina expresses concern about the unrealistic standards of beauty that are normalized when, **"all the girls in the ads are edited to look picture perfect."** Although she feels controlled and manipulated by popular media culture, Halina has also learned how, **"fun and effective making a PSA can be to tell other girls what we think about the media."**

- Jordan is disturbed by girls' lack of importance: **"Why is it that girls are kind of treated like a toy or object these days?"** Aslin, however, feels empowered by her new role as a media producer: **"I'm really interested to make videos about how girls are being affected by what they put on ads and the Internet."**

Aslin: We can pride ourselves on not being photoshopped!

Raywin: It's not just the media. People expect us to be beautiful. Men expect us to be beautiful.

Jordan: Who says girls aren't beautiful? And why can't we be smart?

Then she laughed. "Just Kidding. You have to be anorexic and skinny and dress like a slutty child. Make sure your eyes are big as fuck, too."
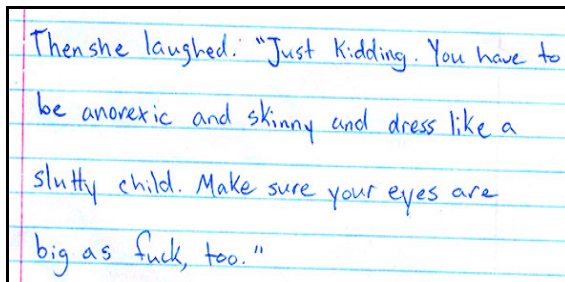
Artifact 42. Then she laughed: "Just kidding. You have to be anorexic and skinny and dress like a slutty child. Make sure your eyes are as big as fuck too."

Kim: A girl doesn't want to be the only one who doesn't care about what she looks like.

Chani: Girls are worried about fitting in and being popular. Am I fitting in or being down-casted by the popular people? It's not enough to just be yourself these days.

Meledy: It's hard to be yourself when so many other girls who are completely not themselves. Like they are also having difficulties trying to figure out who they are.

Jill: We should all just live in computers.

A round of laughter is shared, serving to lighten up the heaviness of our conversation.

- Jayden is knowledgeable about the ways media undermines girls' self-confidence**: "just looking at a magazine can change your perspective of who you are."** Alternatively, Kim exclaims how: **"making videos really helped me to feel important about myself."**

- Salina theorized that in the media: **"girls are seen like a package, like a cleaning lady, or someone to help make more population."** I wonder…

My team's reflections and questions evidence their awareness of how media and technology shape their developing sense of self, yet they are still struggling with lack of agency and the confidence to be themselves. Three mounting issues for my team include: (1) pressures to conform to traditional gender roles; (2) unrealistic photoshopped standards of beauty; and (3) normalized expectations to be perfect *super-girls*. These cultural fictions tell compelling tales about girls' abilities, attitudes, and behaviours. Many conform to and perform these roles, but they are not necessarily who girls are or how they want to be (AAUW, 2000; Lipkin, 2009).

Turkle (1998) and Kearney (2006) find that in order to engage more girls as producers of technology culture, it is essential to open up multiple ways for them to be. Girls need opportunities, encouragement, and support to explore their ideas and interests such that they can discover what they are good at and how they can achieve their own influence and power (Denner et al., 2005).

Girls also need to know that their artifacts, stories, and viewpoints are valued, for these are primary sources from which their identities are formed (Mallan, 2003).

5.1.3 AGENCY: GIRLS, INFLUENCE, POWER

From girls' QCT to girls' QCG
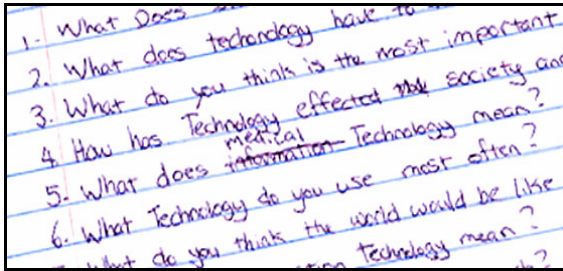
Artifact 43. Girls' Questions Concerning Media and Technology

1. **What do you think started the domino chain reaction of all the new technology?**

2. **What will the world look like in 2000 years? Will there be real teachers or only technology voices on computers? Will there be any more schools?**

3. **What do you think the world would be like without technology?**

4. **How does the Smart Board work?**

5. **What does technology have to do with the Earth and its environment?**

6. **What is the Internet doing to our brains?**

7. **How has technology affected society and its surroundings?**

8. **Why is it that girls are kind of treated like a toy or an object these days, like when posing inappropriately in an ad?**

9. **Why are woman always draped over men in advertisements?**

10. **Why do people have to look odd in order to go in ads, like fake?**

What role do girls play in the educational research concerning their own lives and learning circumstances?

I believe that scholarship on girls and technology is built most equitably and sustainably from diverse questions, theories, and viewpoints (e.g., AAUW, 2000; Bach, 1998; Bryson, Petrina, Braundy & de Castell, 2003; Cassell & Cramer, 2008; Denner et al., 2005; Edwards, 2002, Farmer 2008; Gee & Hayes, 2009; Hafkin, 2006; Kearney, 2006; Kelleher, 2006; Turkle, 1988).

Foundational to my study is a perspective that respects girls as legitimate and knowledgeable experts in how they learn about and come to understand the media and technology in their daily lives and worlds as real and meaningful (Rusnak, 2010a). I designed *101 Technology Fun* using a unique methodology (the TEAM approach) which gives power and voice to female youth who are often studied in social-science research, but seldom privileged as authorities in their own right.

In order to create a supportive learning environment that develops girls' affinities towards and capabilities in technology (rather than one which uncritically endorses the dominant masculine discourses), the co-researchers need to try new roles, question gender stereotypes, and figure out for themselves how things might be different for girls within media and technology culture. As Christensen (2007, p. 5) cautions: "True death equals a generation living by rules and attitudes they never questioned and producing more children who do the same."

Artifact 44. Questions Concerning Girls

1. **Why is it almost natural for a girl to care so much about how she looks?**

2. **Why have girls been under a male's control since a few centuries ago?**

3. **Have things like poverty got better or worse for girls over the years?**

4. **Why do girls talk about boys so much?**

5. **Do you think girls now dress better than the ones in the 1880s? Why do you think today's women are starting to show more and more skin?**

6. **Truly how many real friends do you have? Now truly, how any friends do you have on Facebook? Why do you think the numbers are so different?**

7. **How many women do you think are in the world's richest 100 people? Only around two. Why do you think this is?**

8. **As girls, what do you think society values more? Beauty, brains or body?**

9. **What are the deciding factors that make mean or popular girls exist?**

10. **Why do men have better jobs in technology than women?**

Hence, on the first day of camp, I assigned the girls in my study new roles as the designers and researchers of technology, presenting each with a personalized name badge (see Artifact 4 in Chapter 2) and a professional portfolio to contain their fieldwork and design work. I provided daily opportunities for my team members to contribute their own media and technology research questions, and to critique the questions of each other.

The girls took further initiative to write down their questions at home and bring with them to camp the next day. In total, my team of 19 co-researchers (from the 2011 summer camps) generated over 300 questions, all hand-written in a variety of colors on variously sized sheets and slips of paper (e.g., Artifacts 43, 44, 46).

Although I emphasized the development of research questions specifically pertaining to media and technology (e.g., the theme of our summer camp and subject focus of my study), the girls took further initiative to generate important research questions concerning girlhood and relevant questions for myself (PJ).

In my team's column, I share forty questions taken from our camp interview guides (which the girls and I developed together each day for both our large group and pair inquiry sessions). Additionally, in Section 5.4 of this study, I report my team's thought provoking responses to one of their research questions: "**What is the Internet doing to our brains?**"

Questioning was fun at *101 Technology Fun* and conducting interviews was a popular activity (e.g., Artifacts 45). For example: **"discussing things in a group is the most fun"** (Jayden); and **"it's fun being with a bunch of girls and having**
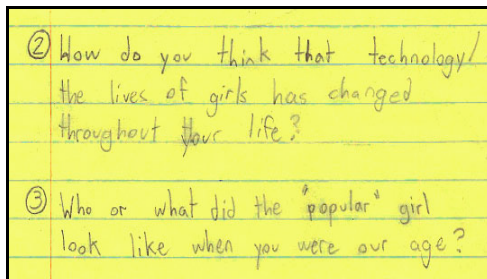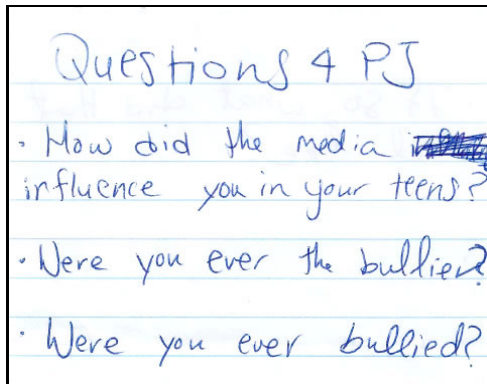
Artifact 46. Questions Concerning PJ

1. **How did the media influence you in your teens?**

2. **Were you ever the bully?**

3. **Were you ever bullied?**

4. **When did you get interested in studying technology?**

5. **Why did you start your research?**

6. **How do you think that technology/ the lives of girls have changed throughout your life?**

7. **Who or what did the popular girl look like when you were our age?**

8. **Were you ever the popular girl? If so, what did it feel like? If not, were you a stick out/loner?**

9. **Were you alive when computers were invented?**

10. **Why did you choose to teach technology?**

talks about the media, and learning how girls are being affected by what they put in ads" (Aslin).

Artifact 45. Team Interview

The co-researchers examine technology from a variety of angles, ranging from simple and recurring questions concerning technology to original and complex inquiry. The girls' questions reveal their desire to contemplate and participate in developing the future of our technological society, asking: **"How do technical things work (e.g., Smart Board or microwave)? How has technology affected society and its surroundings? What does technology have to do with the Earth and its environment? What do robots and artificial intelligence mean to society?"**

My team enjoyed thinking hard about challenging issues, asking important research questions concerning: anthropomorphism, beauty, cultural values, cyber bullying, friendship, gender inequity, personal goals, peer pressure, popularity, and technology ethics. There are considerable gender stereotypes and generational misconceptions, however, which limit the co-researchers' ability to believe their concerns are of significance (Farmer 2008; Kearney, 2006). Do girls' research questions matter? Who listens to girls? Why should we pay attention to girls' questions concerning technology?

Girls' Questions Concerning Robotics

1. **Why does the typical cartoon robot always have a face?**

2. **Will the world be taken over by robots?**

3. **How have robots helped us in the past?**

4. **What kind of people work with robots?**

5. **What do robots and artificial intelligence mean to society?**

6. **How have robots helped us in the past?**

7. **Are mature robots able to smell? Are robots able to have our five senses? Do robots have feelings?**

8. **Would a fridge or a microwave be considered a robot or a technology?**

9. **Who invented the first robot and why?**

10. **Where in the world are robots the most common and what are they used for?**

Heidegger (1971, 1977) teaches me that asking questions is very important work. The quality and meaning of our lives depends upon which questions get asked and who gets to do the answering. If the majority of today's media and technology inquiry is based on research done by adult men, this results in a serious lack of female and youth perspective in fostering industry innovation and in building more equitable futures (Ashcraft, Eger & Friend, 2012a, 2012b; Denner et al., 2005). Further, if girls do not learn to bring forth and think through media and technology questions for themselves, then (for better or for worse) the answers will be inevitably forced upon them.

Asking questions and encouraging design inquiry at a young age will help girls to develop the kind of lifelong learning capabilities and self-initiative that that are necessary for them to fully benefit from and to participate in advancing our increasingly connected, media-driven, and technologically dependent society (Farmer, 2008; Kearney, 2006; Rusnak, Petrina, Feng & Wang, 2010). Further, it may also lead towards the development of a remarkable generation of female designers, engineers, and inventors.

In this section, my co-researchers and I articulated how and why agency emerged as a salient theme quite early on during our interactions and investigations at *101 Technology Fun* (Emirbayer & Mische, 1998). Herstory, their story, mystory, and our stories are similarly made and marked by desires to gain confidence, overcome insecurities, channel rage toward positive ends, and just feel good about ourselves. We shared stories about make-up, beauty, body diversity, and photoshop. Our stories are made-up of artifacts, signs, and messages as much as the models in the magazines the girls

used are made-up of the same. Meledy's little story is touching, when she recalls grocery shopping with her mother, where she sees "10,000 magazines right before the checkout with pretty girls and women with their zippers all the way down or low cut shirts or clothing that is really inappropriate," and she goes, "What's that?" And then she picks up a cooking or cupcake magazine, which acts as a mask or screen to hide behind. Her story makes us smile, but we all feel or have felt the same as Meledy. We have all stood in her uncomfortable shoes at one time or another, maybe we picked up a packet of gum and fiddled with the packaging instead. Her poignant story makes us pause as it pulls on our heart strings and moves mothers to wonder what is so readily placed in front of our children in a store or on a movie, reality TV, and the web? Yet when we think about it, Meledy's story is a story of agency. By sharing her artifacts, stories, and viewpoints, she finds strength in the power of her voice. By co-producing a PSA to critique the portrayal of females in the media, she is able to break down gender barriers, rewrite stereotypes about girlhood, and inspire other girls to see that they can create change too.

ingenuity

girls / cleverness / inventiveness

Artifact 47. The momME Alternate Reality Game

5.2

5.2.1 INGENUITY: GIRLS, CLEVERNESS, INVENTIVENESS

Who knew this kind of gameplay could exist? Girls innovating games

Artifact 48. "We are all part of each other and technology and everything."

Pei-Ling: It would be really cool in the future if we could start off all over again, except not at caveman time, but when people started figuring out how to make technology and cars. We wouldn't make the same mistakes like global warming and cigarettes. People liked the smell and thought they tasted good, but then got addicted. Now we keep making smokes even though they are poison.

Destinee: And pollution. If someone threw a cigarette on the ground when I was born, it would still be there cuz it takes twelve years for it to totally degrade or whatever until it's totally gone.

Pei-Ling: Yeah, like how people let go of balloons on purpose just for the fun of it. To see them float away, but after a few months they might be killing an animal. Nobody really notices because people are thinking more about themselves now than nature.

Cassidy: Actually, some people think more about nature than about people.

Thursday, July 17, 2008: my team and I are in the maker lab discussing some of their technology research questions (Artifact 48). This interview session was recorded with the assistance of Bob-Bot, a Lego Mindstorms robot created by the co-researchers. He holds the Sony recording device in his helping hand, placed near the pulsing digital heart that the girls programmed to beat on his chest. Please note that this transcript is an excerpt from a longer group conversation about one of my team's research questions: **"What does technology have to do with the earth and its environment?"**

Lark shared how: **"we are all part of each other and technology and everything."** Hence, I told the girls about a paper I was working on, and asked them to consider how they might be: "being-thinged by technological things thinging" (e.g., simultaneously inhabited by, dependent upon, immersed in, and yet indifferent to the technology in their lives) (Rusnak, Petrina, Feng & Wang, 2010).

The girls were not troubled by the bigness of this research question. Instead, my team instantly began to imagine new scenarios for living and being with technology differently. This quickly led to an idea for a new kind of computer game that they wanted to make and play. Rather serendipitously, during this interview session, I found myself encouraging the team as they brainstormed creative concepts for a game prototype.

Although none of the co-researchers had any previous game design experience, I was truly inspired by their intense interest

People are starving, but we are trying to save the baby seals. Why not save the people, or save both?

Lark: Like Pei-Ling was saying earlier, if there was a time in the future where we could start off again, except not caveman times. We would know that if we started to do all this stuff again, then it would cause global warming. So we could start over with technology that wouldn't cause pollution, like solar powered cars, and then we could still have the stuff we have now.

PJ: What if we make a game, and in this game we are able to start off fresh and re-imagine the world differently, to create a place like the one that you are talking about?

Cassidy, Destinee, Lark, Pei-Ling: *(in unison)* Yeah! Oh Yeah! That would be so much fun! Totally Cool!

Pei-Ling: If people play this kind of game and are having fun, then they might think that: "Whoa, maybe we can actually do this!" And the more people who play this game, the more people who will think about taking care of the planet. And maybe in the future sometime, they will actually start doing it.

Lark: Or maybe in the game you get to make something that helps the earth or fights pollution in the world.

Destinee: With technology that is better for the earth, not just what we want and we need and everything like that. Better technology where before we do something, we really have to think twice, to think more about everybody, not just yourself or a few people, but everybody and everything.

and unique ideas. Hence, I worked with the HWL team at UBC to re-design *101 Technology Fun* as an empowering maker lab research setting for tween-aged girls to make their own games, and thereby create new relationships with media and technology through their design processes (Denner et al., 2005).

Cassidy, Destinee, Lark, and Pei-Ling returned with excitement to the 2009 camp, along with seven additional team members. They took on the design challenge of creating an interactive game for girls to play with their mothers. Their design solution: the *momME* game (Artifact 47).

I was prepared for the co-researchers to resolve their design challenge by creating games using *Flash* (the multimedia authoring program that I am most proficient with), *Scratch* (a visual drag and drop programming environment), or an online game creator like *Sploder.* Once the girls started to collaborate and put their ideas in motion, however, I learned that they did not desire to make small-scale games. Rather, the co-researchers wanted to create a big game, one for females all around the world to play together. Hence, I helped my team to structure their ideas into the format of a high social, low-tech alternate reality game (ARG).

momME is designed from the hearts and minds of these tween-aged girls to commemorate Mother's Day. It is a social media game that weaves together a boldly adventurous plot, positive social energy, feminine power, and fun. The ARG honours the creative energy that builds, bonds, and nurtures life. The primary goal and focus of gameplay is to celebrate the special the relationship between mothers and daughters (Rusnak, 2014a, 2014b).

Artifact 49. "We smile when we walk and we giggle when we talk!"

Lark: Hi, I'm Lark reporting to you all live from *101 Technology Fun***. Today is July 28, 2009 and I see that something very strange is happening in** *(long pause for dramatic effect)* **the education building at UBC.**

Artifact 50. Something Strange and Unusual is Happening at UBC

Teams of mothers and daughters (and even grandmothers) must work together to save Mother's Day from its 'looming demise' by undertaking collaborative game challenges. These game missions engage players in creating personalized media works of song, dance, photography, and story, and involve community-building experiences like organizing collective action and interviewing neighbors. *momME* missions include:

- Role-playing adventures (e.g., the mothers playing the daughters, and the daughters playing the mothers);

- Dancing to music from unique locations (e.g., a rooftop);

- Responding to quests such as, "find a way to use your talent and expertise to make a difference in someone's life";

- Answering questions like, "if you had only one wish to change the world, what would it be?"

The co-researchers do not introduce any new technology in their ARG. Instead, teams complete game missions using their preferred networked publics and familiar social platforms (e.g., blogs, photos, texts, tweets, videos, web comics, or even a phone message left on the 1-800-*momME* number). Players interact with each other as they watch, listen, read, comment, and search for online artifacts and information tagged *momME*. Players can also create missions for other teams to complete, thereby contributing user-generated fun and challenge.

By making an open-ended and flexible alternate reality, players (and viewers) can engage with the game fiction in the same ways that they interact with media in actual reality. By using familiar social networking sites and the real world as a game platform, technology does not get in

Destinee: Hi, I'm Destinee and I'd like to give everybody this update. We have unexpectedly discovered a secret network of trolls called *The Infinite Evil.* Nobody else has this knowledge, but the signs are everywhere.

Jodi: Darkness and decay.

Marie: Everything is grey.

Adrienne: Faces filled with worry.

Antonia: Forgetfulness and fear.

Miranda: Shadows and stillness.

Jackie: No more fun or good cheer.

Tami: No more rainbows or picnics.

Cassidy: Not enough hugs.

Lark: The trolls have come back to life after a 1000–year sleep. We know this. *The Infinite Evil* can't ever been seen, but they are infinite in number. They are digital and viral.

Artifact 51. Two Co-researchers Witnessing A Terrible Happening at UBC

Cassidy: Beware, cuz they are spreading fast through every electronic device. Like the one you have turned on, like right now...

the way of play and the *momME* experience becomes accessible to as wide an audience as possible (e.g., not only skilled gamers or those with high bandwidth) (Denner et al., 2005; Szulborski, 2005).

Further, the ARG format does not require my team members to develop advanced or intimidating programming skills. Rather, the production focus is to create an intriguing and immersive storyline that takes place in real time and dynamically evolves according to players' ideas and actions (Rusnak, 2010b).

As Kelleher's (2006) girl-centered research with *Storytelling Alice* evidences, utilizing storytelling is "a means to the end of computer programming." Hence, a story framework is a motivating strategy for sparking girls' interests to design, develop, produce, and play their own games (Artifacts 49–53).

By developing a player-generated design approach, my team re-conceptualizes the traditional distinction between game production and game play. *momME* is the collective effort of many mother/daughter teams co-creating an online Mother's Day celebration. This is a unique approach from the dominant game production model where only a few designers or artificial intelligence are in control (Gee & Hayes, 2009).

Crucial to the successful development and running of *momME* are all the game players who must unite forces to: analyze the evolving story; complete game challenges; create missions for other teams; search for information and artifacts tagged "*momME*"; and coordinate real-life with online-reality events.

Antonia: Their song is silence. They worship darkness. They are your worst nightmare.

Marie: *The Infinite Evil* just can't stand anything good!

Jackie: They hate to see mothers and daughters with all of their beauty and love.

Miranda: They want to silence all of happiness and laughter in the world.

Adrienne: They are secretly trying to make Mother's Day the most disgusting and depressing day ever.

Jodi: We need you to help us defeat the trolls before it's too late! Please help us to save Mother's Day!

Artifact 52. Two Co-researchers Defeated by "The Infinite Evil"

My team's photographic works (Artifacts 30–34) reveal their creative expressivity and affective intensity as they develop the storyline for the momME game. They are role-playing that Mother's Day is dead… well, almost.

momME's collaboratively constructed framework ensures that its storylines, characters, actions, and goals are authentic and relevant for the physical and virtual realities of girls' lives. Hence, game play in *momME* is a meaningful experience that females can identify with as uniquely their own (Rusnak, 2010a, 2014a, 2014b).

Whereas many traditional games are designed to help people escape from reality, *momME* is designed to make reality more engaging (Petrina, Rusnak, Eklund, & Kocher, 2010).

Like many forms of technology, games are rich cultural artifacts with much potential to teach, transform, inspire, and influence what and how girls learn about technology and gender (Petrina, Feng & Kim, 2008). The co-researchers in my study are leading the way towards new understandings of social gaming with their progressive visions and immersive ideas for getting mothers to have fun gaming with their daughters (Rusnak, 2010b).

Within one week, eleven girls at a summer camp invented a new kind of play for a new audience of players. *momME* is explicitly designed for female gamers (a group too often marginalized as tangential) who are gaming together for their own social, creative, and intellectual pleasures (Denner et al., 2005).

momME is not merely an innovative ARG designed by girls, for girls, but also an online community environment to give females nourishing storylines, identities, ideas, and experiences to construct themselves with and nurture real-life relationships (Lipkin, 2009).

I believe that it is important for females to create new kinds of games that transcend

Destinee: We need teams of daughters, mothers, grandmothers, aunts, sisters, and all of their friends to solve secret missions. We need everybody to join forces and help us defeat *The Infinite Evil's* wicked plot.

Pei-Ling: Fathers and sons can play too, without any penalty. We need everybody to get creative in ways that express love and respect for each other and our world.

The co-researchers' goal is for momME teams worldwide (of all ages and cultures) to generate thousands of meaningful artifacts, stories, and community-building experiences that will be archived on the momME website as a living cultural legacy of collaborative, non-violent, and inter-generational game play.

the traditional game narratives and gender stereotypes lurking within a gaming industry as yet dominated by a masculine culture of play (Gee & Hayes, 2009).

Increasing girls' participation in designing innovating, and producing games is essential to ensure that their experiences, needs, and desires are represented in ways that result in productive outcomes for both the lives of girls and our technology futures (Kearney, 2006).

Please note that analyzing *momME* poses a unique intellectual challenge because I neither want to take credit for the girls' ideas, nor do I intend to misrepresent their diverse and intelligent voices. Speaking on behalf of myself is a sufficiently complicated endeavor that involves many identities and perspectives.
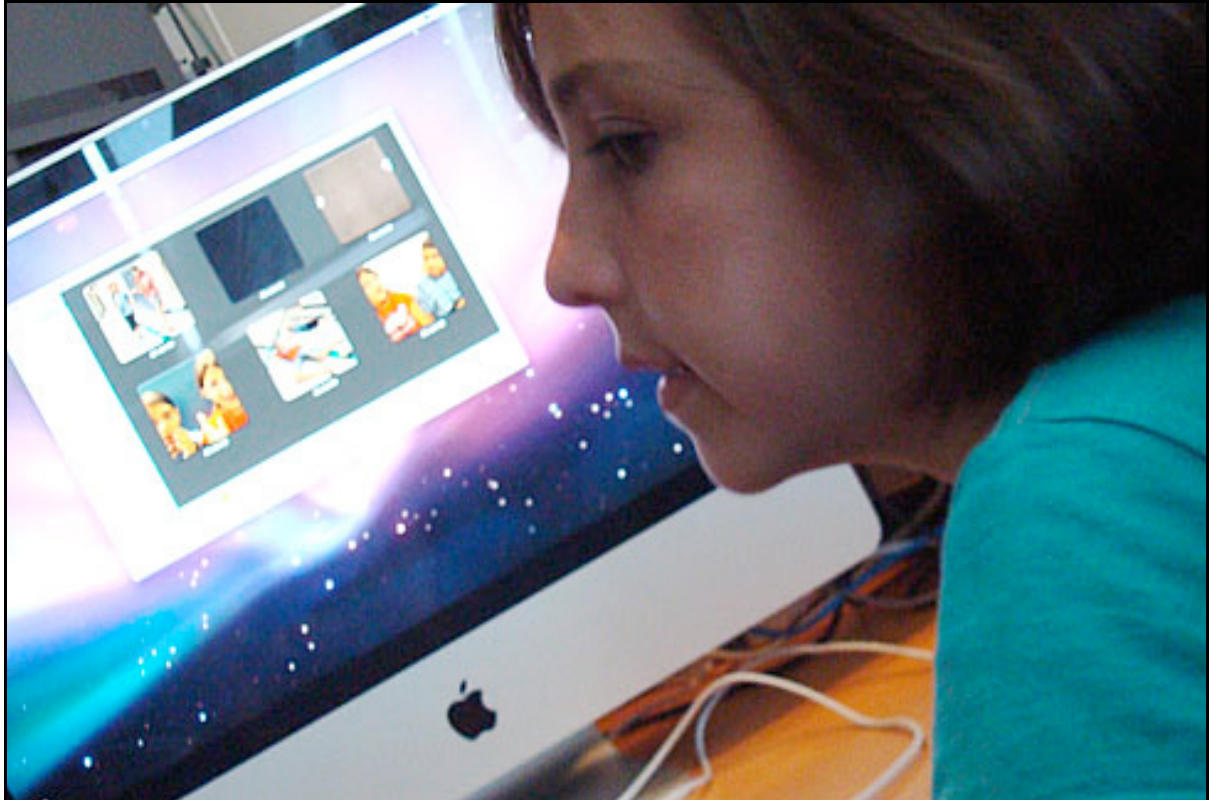
Artifact 53. Editing the *momME* ARG

5.2.2 INGENUITY: GIRLS, CLEVERNESS, INVENTIVENESS

From technology innovators to technology entrepreneurs

Artifact 54. Analyzing How Girls Learn at 101 Technology Fun

Destinee: Did you ever think that you would be able to pull off making a Mother's Day game?

Cassidy: I didn't really think that I could actually make an alternate reality game, and even if I did, within a week?

Lark: Like on the first day, PJ just started asking us questions. Then we somehow got onto the topic of this Mother's Day game and then we just started having ideas!

Pei-Ling: My favourite feature is the *Heart Phone* because you can type in someone's number and instant message them.

Destinee: My favourite is the *Heart Meter* and *Code Shoppe*. As you play the game you can find secret codes and then enter them to win cool prizes for yourself and your mom.

The "Heart Meter" measures the currency of care in the momME game economy. Each time a team completes or creates a

On the last day of *101 Technology Fun*, July 29, 2009, I asked my eleven co-researchers to interview each other about what and how they learned during their immersive experiences as game designers (Artifact 54). Lark, reflecting upon her design processes, reveals the power of collaboration in effecting technological innovation and change: **"Like on the first day, PJ just started asking us questions. Then we somehow got onto the topic of this Mother's Day game and then we just started having ideas!"**

As Destinee analyzes her favourite game features, she evidences how her technological ingenuity has transformed into technological confidence and skill. For example, she knows there will be further problems with *momME,* but she is confident that her team is ready to provide support: **"if people feel that the phone doesn't work properly then players will complain, but we can fix it."**

The ingenuity of *momME's* design and plot demonstrates my team's ability to transcend the status quo and co-innovate new gaming experiences for girls that are empowering, meaningful, challenging, and fun. *momME* is further significant in focusing attention to girls' perspectives on and participation in game design.

While analyzing my team's interview transcripts, what I find to be most significant is their newfound autonomy, boldness, and pride in their creative work as designers. As Cassidy reports: **"I didn't really think that I could actually make an alternate reality game, and even if I did, within a week?"**

mission, they earn "loving dollars" (e.g., virtual points) that collectively accumulate to unravel "The Infinite Evil's" sinister plot. Players are also rewarded with badges, music, magic artifacts, virtual pets, and cool collectable items to show off and trade. The "Heart Meter" gives value to the everyday acts of kindness and love that are too often taken for granted.

Artifact 55. Inventing momME Missions and Game Characters

Cassidy: Well, my favourite part is all the brainstorming because you think about lots of things and then you share them with a group of friends. It's really fun *(e.g., Artifact 55).*

Destinee: Maybe when people play our game they can see if there are any changes that they would make. Like if

By challenging themselves creatively and intellectually, and by mastering new technological skills, the co-researchers experienced a strong sense of personal growth and collective success (Kelleher, 2006). As Pei-Ling analyzes: **"I didn't think I'd ever be interested in making games, but I do really like it now."**

My team was excited to release their ARG on the Internet and play it with their mothers and friends. They wanted to be seen in their new and powerful roles as game designers (Artifacts 55–56). They wanted others to know that they are and getting involved with important work in creating new online games, thereby expanding technology culture (Denner et al., 2005; Farmer 2008; Kearney, 2006).

This was, however, my team's alternate reality, within the *momME* alternate reality— because in actual reality— the girls did not complete development of their game within the camp timeline. The co-researchers created a game concept far beyond the resources and scope of the *101 Technology Fun* makerspace.

While the *momME* game design experience empowered my team to become unique and valuable contributors towards technological innovation, development, and change, I've learned that it is insufficient to cultivate girls' innovative mindsets without also developing their entrepreneurial spirits (Brown, 2009). Further production on *momME* is pending on my ability to secure sufficient funding to run the ARG.

While funding was a major challenge, the co-researchers successfully developed a strong awareness of what design is and how to use it as a powerful tool for generating new solutions to complex

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people feel that the phone doesn't work properly then players will complain, but we can fix it.

Cassidy: Well, usually lots of people are looking for new games to play because when I go on the computer, like I've been to all my sites and it's sorta getting boring to just keep playing them over and over again and again. So, I think a lot of people will want to try out our game, and hopefully they'll like it.

Artifact 56. "Who knew this type of game choice could exist?"

problems. Further, the girls experienced growth (individually and collectively) in terms of increasing: creative confidence, teamwork and team building skills, technological ingenuity, empathy for others (e.g., the *momME* players), and the know-how to critically evaluate the human-made world (Brown, 2009; Cross, 2006; Homer-Dixon, 2000).

I believe these design mindsets, abilities, and sensitivities are essential to give today's girls the ability to create positive changes in themselves and in our future worlds that will have: "challenges and opportunities beyond what we can predict, with new possibilities and problems that will demand creativity, ingenuity, responsibility, and compassion" (OWP/P Architects et al., 2010). Having maker-confidence makes a difference in increasing girls' sense of power and accomplishment in media and technology.

In this section, we make and share our little stories of a big game called *momME*. It's a story of ingenuity in that we mind scripted the world's first ARG for mothers and daughters to play together, enacted it in various ingenious ways, and then cleverly threaded what did and did not happen into herstory, their story, mystory, and our stories. On the right side of the ledger is mystory, but *momME* never happened. And on the other side of the ledger is their story, wow we actually made a game and *momME* happened. On balance, what happened? Is it not common for fact and fiction to merge in technology culture?

Don't the guys also make and co-tell stories about media and technology? Think of the tale of the bridges of Robert Moses, the so-called 'master builder' of New York City. Moses supposedly designed the bridges on Long Island parkways to give freedom to all metropolitan residents. As Langdon Winner (1980) tells the story, Moses instead designed

the bridges low, to detour and eliminate bus traffic, as buses could ostensibly carry the lower classes (e.g., racialized residents) to pristine Long Island beaches (pp. 123–125). Never happened say Woolgar and Cooper (1999) and they have the ticket stubs to prove it. New York's poor immigrants and a cross-section African Americans, Hispanics, gays and lesbians all ride buses on the parkways to Long Island beaches everyday. So what is the real story? Whose story shall we believe? Moses'? Winner's? Woolgar and Cooper's? After all, boys have more confidence and thereby exaggerate more than girls, correct? That is the story the evidence tells. Or at least this is the verdict suggested by the Sudocrem press release and television ad, *For All of Life's Little Dramas,* which can be viewed on You Tube (www.youtube.com/watch?v=b-gn0szhRz4&feature=youtu.be).

self-interpretation

girls / sense / significance

Artifact 57. "You Look Fine"

5.3

5.3.1 SELF-INTERPRETATION: GIRLS, SENSE, SIGNIFICANCE

Who says girls aren't beautiful? And why can't they be smart?

The following Public Service Announcement, "How Media Can Effect" (Artifacts 58–68) is brought to you by the 101 Technology Fun co-researchers (July 2011, 2.4 minutes):

Artifact 58. How Media Can Effect I

Kara: Real people don't look like this. Why should we try?

Artifact 59. How Media Can Effect II

Cassidy: I don't look like this. You don't look like this. Does anybody look like this?

Robyn: The media makes girls think they have to be flawless. The media puts them down and makes them think they are never good enough and unless if they buy this and wear that, then they will always be a loser.

Crystal: Why can't I be beautiful?

The co-researchers, in *How Media Can Effect* (Artifacts 58–68), critique how today's media culture unfairly portrays and trivializes girlhood by emphasizing the traits of exterior beauty and sexuality as more important than character, intellect, or talent (Kearney, 2006).

Whilst creating the attitude, imagery, and message that they want to portray in their PSA, the team identifies and makes negotiable their underlying beliefs and value systems, most notably including:

- Their definition of beauty;

- Their version of girlhood;

- Their fears of inadequacy and being valued by appearance alone;

- Their struggles with societal labels and self-acceptance; and

- Their resistance towards the unrealistic standards of beauty depicted by media and technology culture.

Telling the power of story, political activist and author Arundhati Roy (2003) exclaims: "Our strategy should be not only to confront empire, but to lay siege to it. To deprive it of oxygen. To shame it. To mock it. With our art, our music, our literature, our stubbornness, our joy, our brilliance, our sheer relentlessness— and our ability to tell our own stories. Stories that are different from the ones we're being brainwashed to believe."

Storying themselves differently than the taken-for-granted media stories and stereotypes that limit who girls are based

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Artifact 60. How Media Can Effect III

Subtitle: HOW MEDIA CAN EFFECT

The camera slowly pans across the tear-streaked faces and slumped bodies of four miserable and unhappy looking girls.

Artifact 61. How Media Can Effect IV

Artifact 62. How Media Can Effect V
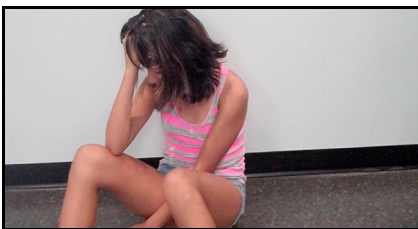
Artifact 63. How Media Can Effect VI
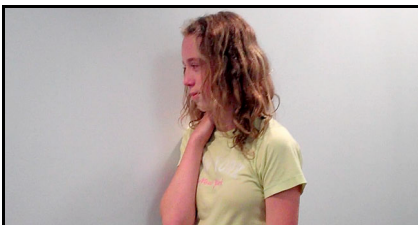
Artifact 64. How Media Can Effect VII

on narrowly defined interpretations of physical attractiveness, my team members clearly want others to know that they are smart, capable, important, and beautiful. For example: **"girls are beautiful for who they are"** (Cassidy); **"beauty is in what we choose to see"** (Kara); and **"the most beautiful thing about us can be our intelligence"** (Robyn).

I applaud the co-researchers for having the honesty, maturity, and vulnerability to share their need for both personal and cultural acceptance of their inner being and outer beauty (Bach, 1998; Lipkin, 2009). My team, however, refuses to allow their attitudes, expectations, and self-worth to be determined by popular media's 'ridiculous' standards of beauty for girls (Kearney, 2006). As Kara rants: **"Real people don't look like this. Why should we try?"**

I am proud of my team's ability to brainstorm catchy quotes and subtitles that show off their beautiful minds: **"you look fine"** (Artifact 57); **"media tricks you, don't fall for it";** and **"don't let media define you, define yourself."** These agentive "little stories" can be told by girls to each other to challenge the oppressive media discourses that exclude, marginalize, and hold females back from being their best and most empowered selves (Lyotard, 1984; Sandberg, 2013).

How else might we get girls to identify and overcome the pitfalls of media stereotyping, in order to allow for conscious identity making? (Farmer, 2008; Schwartz-Cowan, 1995).

Design offers an opportunity for my team to reflect upon and remake the hegemonic media stories that perpetuate self-

Subtitle: *(text fades in with shimmering purple and white stars flashing in the background):* **IT DOESN'T HAVE TO BE THIS WAY!**

Artifact 65. How Media Can Effect VIII

The camera slowly zooms in to focus on the stern facial expressions of each actor/co-researcher as they take turns speaking:

Kara: But

Crystal: what

Robyn: is

Cassidy: beauty?

Kara: How come girls always feel that they have to improve on their beauty? How come girls feel that they always have to impress everybody? How come girls can't see their inner beauty? Girls are beautiful.

Cassidy: Girls are beautiful for who they are.

Kara: What

Crystal: about

Robyn: inner

Cassidy: beauty?

Subtitle: Media tricks you, DON'T FALL FOR IT

The camera individually pans across the smiling faces of four girls who exuberantly take turns to exclaim:

depreciating ways of being, doing, and thinking, and thereby restrict girls' attitudes, behaviours, interests, motivations, opportunity, and potential (Bach, 1998; Callero, 2003). For example, by making and sharing *How Media Can Effect* (Artifacts 58–68) the co-researchers contribute their poignant views to counter normative notions about girls and girlhood, boldly proclaiming: **"IT DOESN'T HAVE TO BE THIS WAY!"** and **"girls are beautiful, whether the media agrees or not."**

Participatory and creative inquiry during the design and production of their PSA triggers my team to examine and make known, in a fun and tangible way, the processes by which they make sense and significance of themselves in-interaction-with techno-cultural expectations, norms, and values (Goldman-Segall, 1998; Rusnak, Petrina, Feng & Wang, 2010).

Kara, for example, brings forth awareness of how gender hegemonies and hierarchies and are subtly shaping her meaning-making practices: **"How come girls always feel that they have to improve on their beauty? How come girls feel that they always have to impress everybody? How come girls can't see their inner beauty?"**

Robyn contributes her understanding of how the media turns girls' fears of inadequacy into profit. She explains how media manipulates them to over-obsess about their appearance and buy into the misconception that that they will never be pretty or good enough: **"The media makes girls think they have to be flawless. The media puts them down and makes them think they are never good enough and unless if they buy this**

Kara: Girls are beautiful!

Crystal: Girls are beautiful!

Robyn: Girls are beautiful!

Cassidy: Girls are beautiful!

Artifact 66. How Media Can Effect IX

Artifact 67. How Media Can Effect X

Subtitle: GIRLS ARE BEAUTIFUL Whether the media agrees or not.

Artifact 68. How Media Can Effect XI

Kara, Crystal, Robyn, and Cassidy: *(simultaneously shouting)* **Girls are beautiful!**

Subtitle: DON'T LET MEDIA DEFINE YOU. Define Yourself

and wear that, then they will always be a loser."

Robyn's criticism provokes me to consider: Am I good enough? Am I smart enough? Despite the fact that I am a well-educated adult, I still wrestle with the self-destructive "Am I" questions, especially as a working mother trying to balance my career and family (Callero, 2003). I am reluctant to admit how often I mentally berate myself about alleged shortcomings in my roles as a designer, mother, scholar, teacher, researcher, wife, and friend.

Although I am the lead designer of the stories that I make and tell to myself, these stories are neither made in a vacuum nor separate from the cultural pressures of our technologically connected and media-driven world (Farmer, 2008; Lipkin, 2009; Vadeboncoeur, 2005).

Today's generation of girls are limited by self-interpretations that are objectified, unrealistic, and certainly not ideal (Weber, 2007). Unequivocally, our female youth have complex tensions to negotiate as they work to establish their identities in relation to the continual layering of discourses that comprise technology culture (Ashcraft, Eger & Friend, 2012a; Wajcman, 1998, 2004).

As the co-researchers reveal, however, girls are capable of being independent learners and teachers, knowledge creators, and design thinkers who have the passion, motivation, and tools to define and solve design problems of their own volition. Tech-savvy girls who can participate in creating more equitable, sustainable, and flourishing technology futures for all (Brown, 2014; Hill, 2010).

5.3.2 SELF-INTERPRETATION: GIRLS, SENSE, SIGNIFICANCE

From appropriating to remaking girl/media/technology stereotypes

Artifact 69. "I ❤ Justin."

Artifact 70. Hegemonic Femininity at 101 Technology Fun

Friday, July 29, 2011 and my ten energetic co-researchers and I are gathered together on the big hill overlooking the SUB (student union building). The air is warm and moist as we enjoy a delicious sushi lunch amidst UBC students doing homework and relaxing. We watch as a lively hacky sack game ensues with much laughter and human agility. Two lovers sitting next to our circle begin kissing shamelessly. We see them, but they are oblivious to the world outside of their passionate embrace. A Flip video camera gets passed around from girl to girl as we analyze our PSA learning experiences.

At *101 Technology Fun*, new knowledge is generated through girls' artifact production, storymaking, and designerly practices. I challenge my team to define and solve their own design problems based upon personal interests and issues important for girlhood (Cross, 2006).

Engaged in roles as designers, the co-researchers are supported to develop their technology confidence (e.g., a sense that girls can change the human and more-than-human worlds) as well as their innovative mindsets and creative expression. These qualities are also culturally formed (Denner et. al, 2005).

"Design is thinking made visual," as famously proclaimed by legendary designer Saul Bass (Brown, 2009). Hence, my team's design works (e.g., gaming, PSA, and robotics challenges) help them to become aware of the sense-making processes, mental scripts, and implicit understandings that guide and influence

Four co-researchers creating a music video during break time at camp (Artifacts 71–72):

Artifact 71. "I love you like a love song, baby!"

**It's been said and done. Every beautiful thought's been already sung
And I guess right now here's another one
So your many things, they play on and on, with the best of 'em
You are beautiful, like a dream come alive, incredible!**

the ways they interact with (and are manipulated by) our designed world.

Upon identifying and making visible their position-takings, my team can then begin to analyze and question their complex knowledge of media and technology culture. According to feminist technology scholars Kearney (2006) and Wajcman (1998, 2004), unquestioned beliefs and taken-for-granted knowledge are subtle yet powerful techniques for maintaining masculinist hegemonies, hierarchies, and ideologies. Girls are not forced to take up mainstream storylines and positions, however, they can also choose to expose, resist, and transgress them (Rusnak, Petrina, Feng & Wang, 2010).

I led daily mind scripting sessions for my team to examine their design works (Allhutter, 2012). Their co-analysis of *How Media Can Effect* generated a deep conversation on the impact that technology has on girlhood and girls' quality of life. The co-researchers speak knowledgeably about the pressures that girls feel to conform to a particular image or standard: **"Growing up today is really tough with all the images of what a girl should look like"** (Crystal).

While my team is conscious and critical of the ways girls are positioned by techno-cultural stereotypes, they also take pleasure in playing with these positions (Farmer, 2008; Kearney, 2006). For example, one of the co-researchers spent the entire day at *101 Technology Fun* with "Justin" (her boyfriend or day dreamin' of Justin Bieber) written boldly upon her face and little pink hearts decorating her cheeks (Artifact 69). Utilizing their new skills as content creators, my team members initiated and performed a virtual wedding ceremony to Justin (Artifact 70).

A centerfold, miracle, lyrical
You've saved my life again
And I want you to know baby

I, I love you like a love song, baby
I, I love you like a love song, baby
I, I love you like a love song, baby
And I keep hittin' re-peat-peat-peat-peat-peat-peat

Artifact 72. "And I keep hittin' re-peat-peat-peat-peat-peat-peat!"

Additionally, during break time, the girls delighted in producing music videos of themselves singing popular 'girly' songs like Selena Gomez's: *I, I love you like a love song baby* (Artifacts 71–72).

Hegemonic representations of femininity are often irresistible, as my team's artifacts and stories reveal (Anderson, 2010; Leonard, 2003; Lipkin, 2009).

In roles as designers, playing with grown-up female identities, the co-researchers come to understand technology as a site of creative expression, identity construction, and knowledge production. Their design works are problematic, however, revealing how my team appropriate and reinforce stereotypical notions of femininity that tend to be confining, passive, and self-fulfilling for girls, thereby restricting their opportunities to benefit from and contribute to technology culture (Callero, 2003; Camp, 2001; Wajcman, 2004).

5.3.3 SELF-INTERPRETATION: GIRLS, SENSE, SIGNIFICANCE

From who girls are to what they want to become

PJ: How do you feel about having a job in technology when you grow up?

Anne: I think a job in technology would be fun and I would be happy. So if I had that job, I think it would be to work on robots or to use the computer to do something useful, like to make a website.

Taslim: Probably not. It's exciting, but I wouldn't want to do it every single day and screw up.

Claudia: I think it would be really hard but tons of fun.

The co-researchers bring forth mixed feelings and misguided understandings about the possibility of future work in the technology sector. Only six out of nineteen girls report high interest, for reasons such as: **"you get to be really creative and there are lots of things to make that other people haven't created before"** (Meledy); **"makes you think and gives you knowledge"** (Daniela); **"tons and tons of fun"** (Jayden); and **"so much you can do, a wide range of stuff"** (Crystal).

The majority of my team, however, displayed ambivalent feelings or negative views towards technology careers and

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Cassidy: I think that making a T.V. or computer would be so much fun, just like making our robots.

Halina: I don't really know if it's for me cuz it seems like a lot of hard work. Like I know any job is hard work, but if it involves sitting at the computer for the whole day, well that would make me really angry and I'd need to get out! So if it involves sitting in front of a computer and stuff, then not really.

Raywin: I think it might be fun, but I don't think I'd want to sit my but on that chair all day cuz then I'll just keep eating, and my butt will get huge. And it won't fit inside my locker. It barely fits in the locker as it is *(she laughs, recalling a playful moment at camp when all the girls hid in their lockers to play a joke on one of the camp instructors).*

Crystal: I think it'd be really cool. There is so much you can do, a wide range of stuff. Like in game design you could build your own world and everyone else would live in it. It's not like it's just in your head. You build it and then everyone is like, "I want to go into Cassidy's World," if that's what your game is called.

Aslin: I probably wouldn't cuz I'm probably not that good at it. I want to be someone who is smart and well loved by everyone and kind and a good person in society.

Kim: I'm not the computer kind of person, I like this camp, but I wouldn't want to spend time on the computer 24/7. I'd like to have a good career and a nice family and live peacefully.

roles. Their responses reveal how they have already embraced some of the deeply ingrained (yet unseen) cultural prejudices regarding females working in the predominantly male world of technology (Ashcraft, Eger & Friend, 2012a, 2012b).

Despite the fact that all of the co-researchers enjoy and are dependent upon technology, these pleasures and preferences do not directly carry forward into their opinions of work and study in this field. For example, Robyn and Salina doubt they have: **"enough patience to deal with it,"** especially if it involves: **"sitting in front of a computer all day"** (Halina). Likewise, Kara does not want to be: **"working in a department place."**

Four team members make obvious their (inaccurate) perceptions that girls have to adapt to the specific norms and values of professional technology culture, instead of expecting it to change to meet the needs of females (Sandberg, 2013). Questioning if they have the capability and intelligence to succeed: **"I wouldn't want to do it every single day and screw up"** (Taslim); **"I'm not very good at math. So maybe I should do something else?"** (Chani); **"I'm probably not that good at it"** (Aslin); and **"I'm not the computer kind of person"** (Kim).

Taslim, Chani, Aslin, and Kim approach technology careers from a deficit-oriented perspective, attributing lack of interest to their perceived lack of skill (AAUW, 2000; Kearney, 2006, Weber, 2007). Although these girls have limited knowledge about what technology jobs entail, they have formed the belief that they will not succeed or be happy in these roles. They fail to see how the technology sector offers key opportunities to fulfill key life aspirations and goals, such as:

Jordan: I think it would be fun to do on the side, but I like teaching and writing a lot better.

Jill: It's an interesting possibility, but I don't really know. I just want to go with my life and figure it out.

Daniela: Well, having a job in technology makes you think and gives you knowledge, but… *(doubtful pause)*

Salina: I think it could be interesting, but I'm not sure that I would have all the patience. I think it's something fun to do in the summer, but I don't know that I'd want to have a career in it.

Kara: I think it could be fun, but I wouldn't want to be working in a department place.

Robyn: It's a possibility. I don't think I have enough patience to deal with it, so probably not.

Lily: I think it'd be pretty interesting, but maybe not my first choice.

Jayden: I think it sounds like tons and tons of fun. It just sounds so interesting to me.

Meledy: Well, it's really interesting. I like the whole aspect of it cuz it's really cool and you get to do new things that are really fun. It would be really cool to be a game designer cuz you get to be really creative and there are lots of things to make that other people haven't created before. It's hard but actually fun too.

Chani: I want a job with making robots, but I'm not very good at math. So maybe I should do something else?

- **"I want to be someone who is smart and well loved by everyone and kind and a good person in society"** (Aslin);

- **I'd like to have a good career and a nice family and live peacefully"** (Kim); and

- **"I want to be friendly, considerate, kind, compassionate. I want to be loyal and a good citizen"** (Chani).

Most of the co-researchers are interested in meaningful work that involves helping others and improving the world, however, they are unaware that technology careers can help them do so. They are uninformed about technology's impact on their lives and futures. Additionally, they are already negotiating a dilemma that many females struggle with: the choice to have either a professional career or a family, but not both (Lipkin, 2009; Sandberg, 2013).

During our final mind scripting session at camp, I worked with my team to get them to further analyze the gender oppression and technology stereotypes that they identified in their design artifacts and interview transcripts (Allhutter, 2012). Many of the girls were surprised to discover their own unconscious biases, and to learn how these constructions are not only negotiated individually, but also shaped by the societal, educational, and familial expectations and norms that circulate in their everyday lives.

Instead of fitting into disempowering and patriarchal templates, how can we get girls to expand technology culture so that it benefits from and builds upon their perspectives, needs, and values (Farmer, 2008)? As Doyle (2013) implores, our "human family is crying out for world's women to step up and lead."

In this section, we make and tell stories of self-interpretation and how the co-researchers make sense and significance of their identities as they are growing up in a technological age (Callero, 2003). At *101 Technology Fun*, how girls learn (by design) is very important. It is not really a question of whether girls like to design (most of them do) as much as a question of how, when, and why they learn to become innovators, leaders of change, and producers of technology (thereby overturning traditional gender and generational stereotypes). In this way, in addition to self-interpretation, we make and tell little stories of self-interpolation. The girls made stories of how they interpolate themselves into the design and production of media and technology. For example, in creating a PSA, the girls position themselves in the media as actors, scriptwriters, directors, and editors. But they also place themselves into roles they already play and know all too well: girls being vulnerable to media. In her role as storymaker in *How Media Can Effect,* Robyn summarizes this as a new media story: "The media makes girls think they have to be flawless. The media puts them down and makes them think they are never good enough and unless if they buy this and wear that, then they will always be a loser." This little story of vulnerability has big effects.

self-efficacy

girls / capability / leadership

Making your own robot is so much fun!
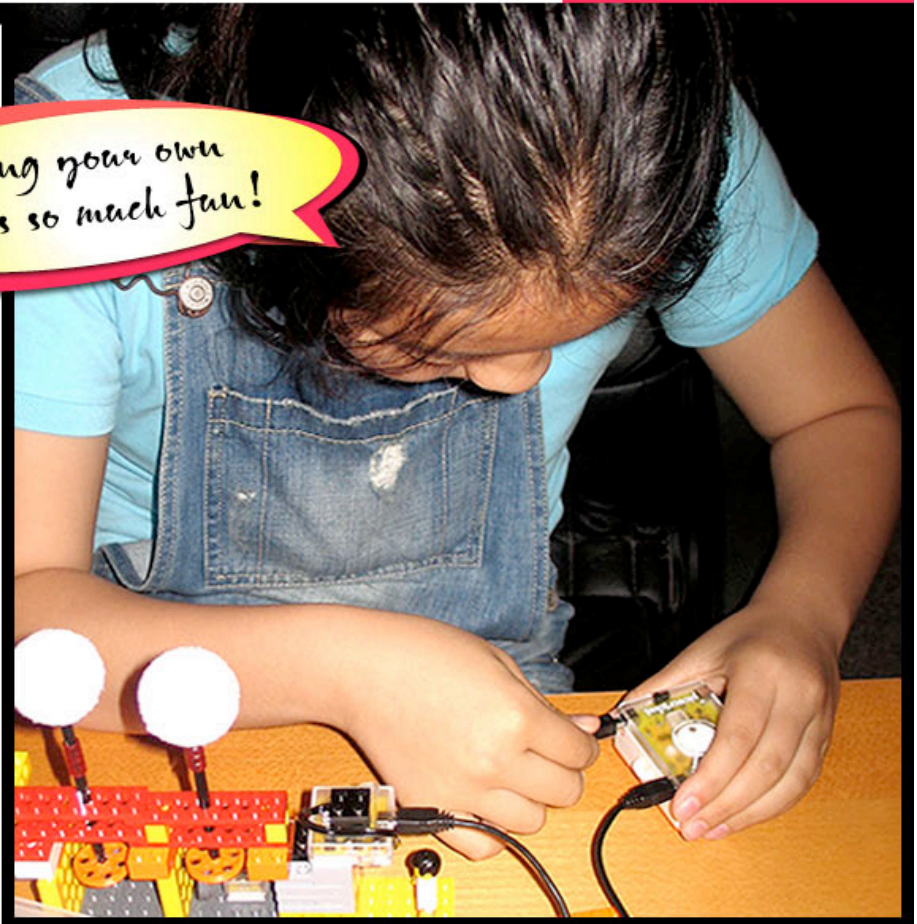
Artifact 73. Constructing Cyborg

5.4

5.4.1 SELF-EFFICACY: GIRLS, CAPABILITY, LEADERSHIP

From thinkering to empowering girls through technology

Artifact 74. Pico Cricket Robotics

Halina: Hi, this is Halina interviewing Jill for *101 Technology Fun*. Jill, tell me about your robot creation.

Jill: Well, my partner Halina and I created a robot using the *PicoCricket* set made by Lego. So there are all these Lego pieces and different objects like a sound sensor, 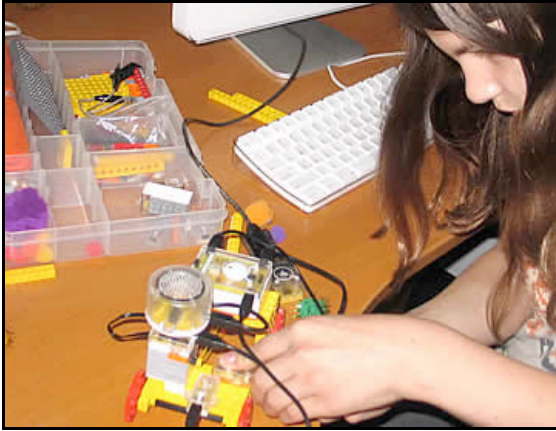touch sensor, sound box, colorful lights, and robot motors *(e.g., Artifacts 73–74)*. We invented a robot that we called Cyborg. We were going to program it to walk and talk, but instead we made it have arms that spin just like propellers. We recorded its very own theme song and we are really quite proud of it.

Our Cyborg moves when you make a loud clap *(she claps loudly)*, then it will play the theme song, and then the motor turns off after the song is finished playing. It has flashing eyes that light up and change colors while the song is playing.

Halina: What are the best things about the robot that you made?

In this interview session, Jill and Halina are discussing how they learned to design, build, and program their own robot (please note that I have inserted Artifacts 74–77 to illustrate their transcript). Although I facilitated all of the co-analysis group sessions, every day at camp the co-researchers interviewed each other in pairs using hand-held Flip video cameras. I believe that the girls benefit from video reflecting. Providing them with alternatives to written summaries helps to improve their oral communication skills whilst creating rich artifacts of and for learning (Petrina, Feng & Kim, 2008).

I presented my team with the design challenge to design, build, and program robotic creations using *PicoCricket robotics* (www.picocricket.com), recycled gems, and colorful craft materials. Next, I encouraged them to work in pairs to inspire, support, and learn from each other (Denner et al., 2005; Kafai, 1995, 2006). Further, I offered the girls an opportunity to demonstrate their robots to a live audience of peers, parents, and UBC technology education teacher candidates.

What kind of robots do girls make and share when they are challenged and supported with a technology-rich and friendship-driven learning environment? I am well aware that privileged few have the opportunity to belong to a community that empowers girls to design and innovate with technology (Hafkin, 2006). Indeed, none of my 20 co-researchers could recall any personal experiences with building or programming robots before participating in the *101 Technology Fun* makerspace. Hence, I do not claim that

Jill: The best part is how we sort of thought our robot would walk and then it started flying!

Halina: Describe each step that you went through to create your project.

Jill: First, we planned out we were going to do. Second, we thought about how we were going to do it. Then we got all the materials and started building the contraption. Then we added gears. Then we programmed it on the computer. Then we rebuilt it and re-programmed it, and then rebuilt and re-programmed it, and then rebuilt and re-programmed it, and then *(she pauses for dramatic effect)***… and then it broke!**

Things fell apart and we fixed them. More things fell apart and then we fixed them again too *(laughter).*

Artifact 75. PicoCricket's Colorful Drag-and-Drop Code

their robotic works and design processes are representative of all girls. Rather, in this analysis, I focus on the growth and development of my team's sense of technological self-efficacy. This reveals how the girls view their agency and ability to accomplish technologically challenging activities (McDonald & Siegall, 1992).

Jill's conversation reveals both the fun and frustration that she experienced whilst creating her very first robot, which she and Halina named Cyborg. She is designing by a process of thinkering (e.g., thinking or figuring out how to do things by tinkering), which permits her to set, and re-set, her self-directed robotics goals according to her evolving personal interests and technical abilities (Bottrill, 1995; Cross, 2006; Turkle, 1988).

Thinkering or "building to think" allows Jill to break down her robotics goals into a series of small steps with appropriate levels of challenge that are neither too difficult nor too boring. This builds her confidence as she accumulates one small success after another (Brown, 2009). Not only is Jill comfortable to take creative risks, she is also willing to learn from her mistakes (e.g., she maintains a healthy sense of humor about the numerous times that she reprogrammed and rebuilt her robot in order to make it work).

Jill is fascinated with figuring out how to make her robot work better. As she takes her Cyborg apart and experiments with different options for improving it, she is learning that technical skills and abilities are acquired, not characteristics or talents that special people are born with.

Jill is also learning that robots and other human-made technologies are not 'magic' rather, they are designed for specific

Halina: What was the most frustrating or hardest part of making your robot?

Jill: The very most frustrating part was when the lights wouldn't turn on our robot, but everything else would work. Once we figured out how to program the lights to turn on, well then nothing else would work *(she pauses)*…

Finally we got it so that everything was working, including the motors, music, and the lights, and then *(she takes another long pause)*… **and then the lights turned off** *(she playfully shakes her head and laughs).*

Halina: Yeah, that was really annoying and so was putting the wheels on. Especially when we put one wheel on and then the other kept popping off. OK, can you tell me about a problem that you had to solve making your robot?

Jill: We wanted our robot to have wheels and arms to pull itself, but the arms didn't work. So we added glue at the bottom hoping it would stick, but then it got stuck which we didn't want. So then we kept the glue, took off the arms, and then put the arms upon its head like a propeller. They still didn't move but they looked really cool.

Halina: What advice do you have for friends working on a robot projects like yours?

Jill: You need to be patient and to plan out what you are doing before you start. I find it's very important to take your time on the programming because if you don't, then your whole robot won't work. The robot programming has to be perfect *(e.g., Artifact 75).* **We tried so**

purposes with much time and effort spent in research and development (Bottrill, 1995). As Halina reflects: **"I really learned from building the robots, especially the programming, cuz you could really see how the robot would develop. You could really choose what you wanted to do with it"** (Artifact 75).

Scholarly experts in media and technology and learning advocate that my team's hands-on and design-based ways of learning are desirable for 21st century education and innovation, and essential for developing understanding of and appreciation for the designed world (Cross, 2006; Denner et al., 2005; Farmer, 2008; Gee & Hayes, 2009; Kafai, 2006; Kelleher, 2006; Kimbell & Stables, 2010; Petrina, Feng & Kim, 2008).

As the co-researchers engage in thinkering practices, they are not only transforming an artifact from one thing to another (e.g., turning sensors and recycled materials into personalized robots who perform a range of creative functions), they are also remaking their relationships with technology. For example, Jordan realized how her one-week participation in the *101 Technology Fun* makerspace community increased her interest in and capabilities for programming robotics: **"I didn't think I'd ever be interested in making robots, but I do really like it now. It's hard, but it's actually fun too."**

Thinkering, storymaking, and repurposing are all acts of transformation whereby tween-aged girls can expand their gender and generational roles in technology culture (Bach, 1998; Goldman-Segall, 1998). For example, Jill, Halina, and their team members are all positioned as technology experts when they demonstrate their unique robotic works to a class of

many ways but most of them didn't work, so I'm happy our robot finally worked by the end of camp. I definitely recommend going into detail on the programming. I can tell you that it's not easy. It's really hard, but tons of fun too.
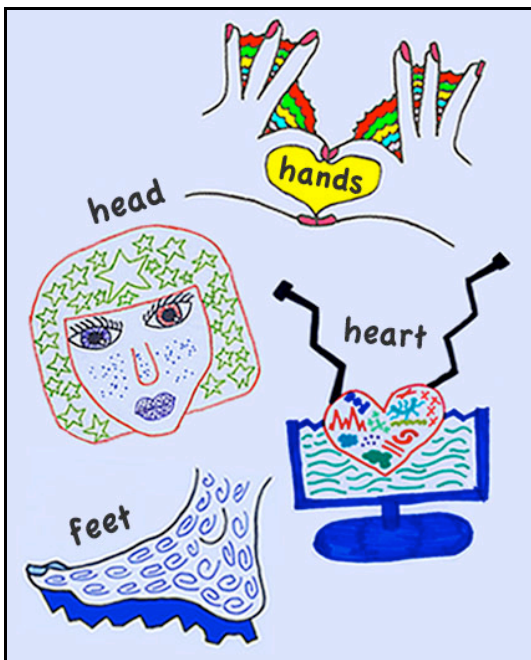
Artifact 76. Miss Martha's Hands, Head, Heart, Feet (cross-reference with Artifact 7)

UBC technology education teachers (15 men and 3 women). As Jill playfully reports: **"Yeah, I also liked when the teachers came in for a demonstration and then we set our robots on them! So the adults were all bouncing up and down to make sure they wouldn't step on our robots. It was really funny to see all of those adults making fun of themselves! While we were awesome."**

Not only are my team contributing their expertise to technology culture as they teach adult authority figures, they are also creating an audience to affirm their new roles as accomplished robot designers and programmers. Being seen by peers is essential for storymaking girl culture as it provides the framework for building cultural knowledge (Mallan, 2003).

As an introductory activity, I challenged the co-researchers to design (but not build or program) a prototype for a robot that (in their opinion) would inspire other girls' interests in robotics. My purpose was agentive: to ignite my team's sense of technological self-efficacy, not to represent girls in all their diversity, experience, and perspective. Allow me to introduce Miss Martha, an example of my team's robotic prototyping (Artifact 76).

Martha's head is designed for decoration and camouflage. Her hands function to perform basic tasks with webbed fingers to help her fly. The base and structure of her body are calloused feet (to protect her skin) with built in shoes to increase her speed. Martha's heart is used for thinking. She has Google antennas because her heart is the smartest part of her body. Creative juices help her to think with and through her heart. Please engage your imagination to picture what Martha looks like and discover what else she can do.

Halina: Do you have any other stories to tell about what you learned making your robot?

Jill: Well, I liked building my robot in a room with a group of girls and using lots of craft supplies and recycled stuff that I didn't know could be used to make a robot, which is really cool.

Halina: Yeah, I had so much fun. And I really liked when we all started dancing together in the lab when we took a break from making our robots (Artifact 77).

Artifact 77. Girls Singing, Dancing, and Building Robots

Jill: Yeah, I also liked when the teachers came in for a demonstration and then we set our robots on them! So the adults were all bouncing up and down to make sure they wouldn't step on our robots. It was really funny to see all of those adults making fun of themselves! While we were awesome.

Girls, like my team's prototype for Miss Martha, do not have a fixed homogeneous identity. Rather, they are in an ongoing state of being designed in-interaction-with technology and stories (Rusnak, 2010a).

As I think about the specific capabilities and characteristics that the co-researchers attributed to Martha, it strikes me that girls have tremendous ability and ingenuity that often goes unrecognized (Lipkin, 2009). Pipe cleaners, tin foil, lights, motors, and sensors can easily become a robot through the hands, hearts, imaginations, and efforts of a girl.

In roles as designers, all of the girls in my study figured out how to successfully build and program their own robotic creations. Within one week, all of the co-researchers advanced from having no robotics experience to confidently presenting their work for a challenging audience of parents, peers, and technology teachers. As Raywin exclaimed: **"Girls can do robotics!"** While these findings of self-efficacy do not surprise me, I believe they are significant.

Today's girls need encouragement to tinker, to discover how technologies work, to explore the designed world, and to take on technology leadership roles (e.g., the *101 Technology Fun* robotics challenge). Three decades of educational research evidence that without opportunity and support to explore a diversity of roles, it is difficult for girls to develop their technological self-efficacy or to discover what unique skills and ideas they can contribute to technology culture (AAUW, 2000; DuBow, 2011; Hill, 2010; Kearney, 2006; Leonard, 2003; Lewis, 1987; McDonald & Siegall, 1992).

Artifact 78. Recruitment Brochure (2009)

Artifact 79. Recruitment Brochure (2011)

5.4.2 SELF-EFFICACY: GIRLS, CAPABILITY, LEADERSHIP

What are the changing the roles of girls in technology?

Artifact 80. Research Interviews at the UBC Education Library

PJ: What are your suggestions for improving *101 Technology Fun*?

Meledy: The camp has everything you need to learn. I liked the camp. It was really fun!

Jill: I like that the camp is not repetitive. You do different things, you eat at different places, you have different activities, and you meet different people.

Halina: I liked how we all got to use the computers every day and we always learned new stuff. I will totally come back next year.

Aslin: I like that we went to the village for lunch and ate outside together. It's fun being with a bunch of girls and having talks about the media, and learning how girls are being affected by what they put in advertisements.

Salina: Yeah, it is so much fun to be together with a group of girls with my same interests. All the other girls were friendly and helpful. I like how we got to do the projects and interviews outside when it was a nice day.

One of my roles in this study was to create a fun and supportive technology-rich learning environment (makerspace) that:

- Empowers girls as valuable researchers and designers who can and will excel;

- Respects and promotes girls' rights and roles concerning the knowledge made about their lives, opportunities, and learning circumstances;

- Offers a growth-minded setting where girls feel safe to take risks, make mistakes, and innovate in their own ways, for their own purposes.

I do not support a specific interpretation or way for girls "to be" with technology. Rather, my study seeks to open up diverse possibilities and opportunities that respond directly to my team's identified needs and interests. I am dedicated to nurturing a sense of belonging, fostering creativity, and respecting their ideas, opinions, and intelligence, such that they will be more confident to speak out.

My intent is to provoke the co-researchers to: learn more about gender stereotypes; question their assumptions and taken-for-granted knowledge; and figure out for themselves what might be wrong with media and technology culture such that they can transform it (Farmer, 2008). Hence, an essential curricular component of *101 Technology Fun* is collecting and responding to my team's daily feedback on their learning progress, group dynamics, design processes, and project challenges (e.g., Artifact 80).

Within this analysis, the co-researchers offer many valuable suggestions for

Kim: What I liked the most about this camp was that I learned way more about the computer than I ever thought I could learn. I think that I have seen a lot more of what you can do with technology, especially after all the discussions we had *(e.g., Artifact 80).*

Raywin: Worst thing is the camp ending.

Aslin: I agree with Raywin. I want to stay longer. Like more days. Two weeks.

Jordan: The camp should be longer and we should get more free time to play on the computer and to do what we want. Not knowing exactly what we have to do, just creating stuff, like our own websites.

Meledy: Yes, but we should start later like around 11 a.m. and end later at 9 or 10 p.m.

Kim: We should never leave! It should be an overnight camp. We'll bring sleeping bags!

Several girls are quick to simultaneously make excited exclamations in agreement with Kim: **Oh Yeah! Can we, PJ? We'll have so much fun! Can we sleep over tonight? Awesome! Can I bring my cousin? Awesome!**

PJ: A sleepover camp is a great suggestion! I can already imagine many new and exciting possibilities for all of us. I will find out if we can get permission. Does anyone have other ideas for improving *101 Technology Fun***?**

Jayden: I'd like to have more time to make more videos because making the videos and discussing things in a group

improving the *101 Technology Fun* summer camp learning experience. Unequivocally, their unique and creative critiques have positively enhanced the development and success of our research program. For example, my team from the 2009 camp informed that the recruitment brochure I produced was 'boring' and visually unappealing (Artifact 78, designed *without* the expertise of girls).

Hence, three energetic co-researchers worked with me to create a more colorful and enticing advertisement for the 2011 camp (Artifact 79, designed *with* the expertise of girls). A visual comparison of the two designs reveals the striking difference it makes to actually work with and listen to your target audience (Freeman & Mathison, 2009; Goldman-Segall, 1998; Haynes, 2008).
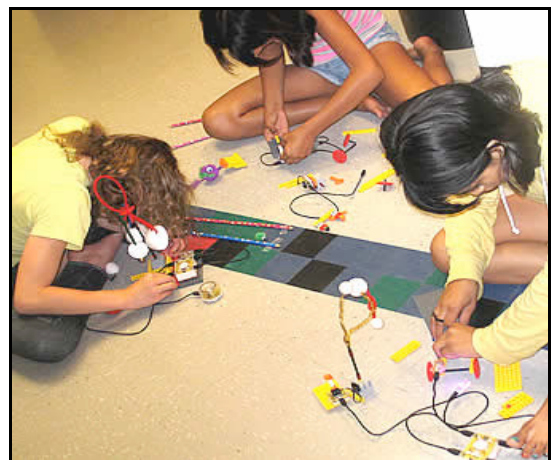
Artifact 81. Girls Learning, Playing, and Programming

Many of the co-researchers independently (e.g., without me directly questioning them) took initiative to analyze perceived changes in their sense of technological self-efficacy, resulting from their new roles as designers and researchers at *101 Technology Fun*. For example, Jordan self-reflects: **"I didn't think I'd ever be**

is the most fun.

Cassidy: It would be cool if we could keep the robots cuz it's kinda tough to destroy your work (several girls nod in agreement).

Halina: I really learned from building the robots, especially the programming, cuz you could really see how the robot would develop. You could really choose what you wanted to do with it.

Salina: I hadn't thought about this before camp, but technology is everywhere and that kind of surprised me, cuz it shows how much people use technology. The stuff we've learned is really interesting.

Raywin: Before camp, I thought technology was like screwing pieces of motherboard together, but now I've learned it's a bigger and broader thing. Now I understand technology more and how it affects me.

Jordan: Yeah, at first I didn't pay much attention to, well I didn't really care about technologies or sometimes I didn't really know what technologies were, but then this summer camp made me focus on the technologies everywhere in my life and learning more about them.

Jayden: I don't think anything should be changed. This camp is educational and fun.

Salina: At first I thought technology was really boring and useless, but I've learned it is really fun. I think it's cuz of the *Pico Crickets*. Blogs are really exciting too.

Jordan: I didn't think I'd ever be

interested in making robots, but I do really like it now. It's hard, but it's actually fun too." Likewise, Halina realizes: **"I really learned from building the robots, especially the programming cuz you could really see how the robots would develop and you could really choose what you wanted to do with it"** (e.g., Artifact 81).

Because I put much time, thought, and effort into designing the *101 Technology Fun* makerspace to be a friendship-driven learning community, I was not surprised when my co-researcher Salina explained: **"At first I thought technology was really boring and useless, but I've learned it is really fun."**

I predicted that my team member's analyses might be similar to Jordan's enthusiastic observation: **"I didn't think I'd ever be interested in making robots, but I do really like it now. It's hard, but it's actually fun too."** Likewise, Aslin reported that she enjoyed making new friends and learning new things: **"It's fun being with a bunch of girls and having talks about the media, and learning how girls are being affected by what they put in advertisements."**

I did not expect, however, to be humbled by my team's perceptive critiques of the 2011 research camp recruitment flyer (Artifact 79). As my co-researcher Jill contemplates: **"Well, I was kind of upset with the camp pamphlet. I think the brochure had all this cool stuff so I was kind of disappointed with what we didn't do. What we did was fun and exciting, but we didn't get to do all the things! So either the brochure needs to be shorter and less welcoming to focus on the things we are going to do, or else the camp should do more."**

interested in making robots, but I do really like it now. It's hard, but it's actually fun too.

Jayden: Programming the robots was a lot easier than I thought it would be. I thought it would be a lot harder to program it.

Meledy: I wish we had more technology subjects to do, more video projects, and longer time to finish them.

Kim: Yeah, next year's camp should do more videos over a longer time and we should do more animation.

Chani: I've also learned more about being a girl. This camp helped me to think more about myself, how I can be aware and not be too influenced by media *(e.g., Artifact 82).*

Artifact 82. "Watch what you wear!"

Jill: Well, I was kind of upset with the camp pamphlet. I think the brochure had all this cool stuff so I was kind of disappointed with what we didn't do. What we did was fun and exciting, but we didn't get to do all of the things! So either the brochure needs to be shorter and less welcoming to focus on the things that we are actually going to do, or else the camp should do more.

Halina: Yeah, you advertise so much in

I did not intend for our *101 Technology Fun* brochure to be misleading (e.g., advertising but not offering virtual world building opportunities). Although I had prepared these modules, I scaled back our weekly curriculum to better accommodate the skill level of my team. The girls' applications indicated that they all lacked previous design experience with media and technology, and I was concerned that the original camp schedule would be too challenging and intimidating.

The co-researchers, however, were not over-stimulated. Many arrived early and stayed late to continue working on their projects. They were excited for more design challenges and wanted to make the camp longer: "**Worst thing is the camp ending**" (Raywin); **"I wish we had more technology subjects to do"** (Meledy); and **"We should never leave! It should be an overnight camp"** (Kim).

To the best of my knowledge, none of the girls complained about all the interviews and surveys that we did each day. Rather, they wanted to analyze their videos and take part in tallying up data from the *iLife Diaries* (Appendix G) and questionnaires. My team enjoyed their newfound power and purpose as designers and members of a technology research team.

While participating in *101 Technology Fun*'s makerspace community, my team learned how to use diverse forms of media and technology to express their concerns, desires, interests, and talents. This enabled them to become more confident in their sense of technological self-efficacy (McDonald & Siegall, 1992).

Our design-studio learning environment served to further the development of tech-savvy girls who resist and reconfigure

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your brochure but we didn't get to do it all. Like, I'd love to get to do the cyberspace virtual world thingy, but we didn't really get into it.

Kim: What we did was really fun, but I was looking forward to doing all of the things on the pamphlet. I'm still excited to do more. This camp is ending too soon! We should come back and make our own virtual world. We can sleepover and get to meet the other girls in this study *(a few girls smile and nod)*

PJ: Thank you for bringing to my attention a major concern with the recruitment flyer for *101 Technology Fun (Artifact 79).* You have opened my eyes to see that it contains misleading and incorrect information. How very humbling. The original camp program offered one themed module per day: animation, game design, movie making, robotics, and virtual worlds.

I decided, however, that this challenging schedule would not permit sufficient time for daily research activities, free play, lunch breaks, and presentations. Hence, I scaled back the camp curriculum by eliminating the learning labs in animation and virtual world building. Regrettably, I did not consider that most of you would want to continue working on your projects for a few more hours after the scheduled end of camp (3:30 p.m.), often pre-arranging permission from your parents to stay in the lab with me until 7 or 8 p.m.

Please accept my sincere apology for under-estimating your capabilities and enthusiasm for technology, media, and design. Your attention to detail, energy, determination, and fun-loving work ethic are inspiring and remarkable.

(rather than simply receive and reproduce) the conventional gender and generational dynamics of technology culture (Hill & Anning, 2001; Wilson, 2013).

Artifact 83. Studying With (Not On) Girls as Co-Researchers

In roles as researchers and designers, my team evidence some of the changing roles of female youth in-interaction-with technology culture, including: girls critique and produce media; girls innovate new kinds of games; girls build and program robots; girls design and develop websites; girls research, teach, and question technology; and girls influence and transform technology culture.

Girls are often overlooked, ignored, and under-represented in the technology sphere as a result of their age and gender (AAUW, 2000; Farmer 2008). Hence, my team generated many salient artifacts and stories that allow others to view media and technology from girls' perspectives on and place in it (Artifact 83).

The co-researchers' artifact and story making practices facilitated an 'inward turn' that provoked them to: 1) become increasingly aware of their interactions with technology; and 2) self-reflect upon who they are, where they have come from, and who they want to be.

5.4.3 Self-Efficacy: Girls, Capability, Leadership

Why do girls need to know their perspectives are significant in media and technology cultures?
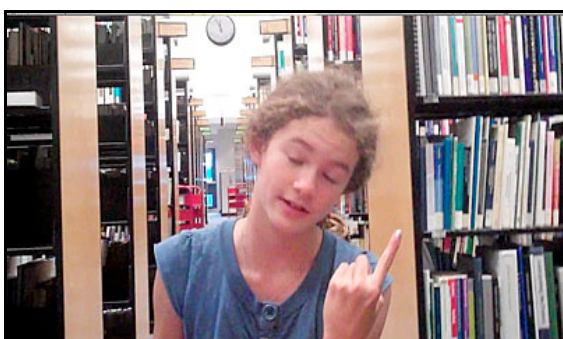
Artifact 84. "What is the Internet doing to our brains?"

Jill: What is the Internet doing to our brains? This is what I think. Over the long term, there are some pros and cons to having the Internet so involved in our lives. I think that not only does it do stuff to our brain, but it also does stuff to the world around us. So, I'm going to talk a little about that too.

I think that it makes us impatient, but it also gives us more access to resources, so it could make us more knowledgeable. It's bad for the environment cuz it uses up energy and it's made up of plastic and stuff that doesn't decompose very well.

I think it could decrease your chance of getting a cold or a cough cuz you are inside the whole day if you are on it all

Ten. Eleven. Twelve. Thirteen. To what extent can the epistemological authority of my young co-researchers be recognized? Weber (2007, p. 6) analyzes how we (as a society) view technology and young people, reporting that: "both are valued, both are also mistrusted."

While today's tween-aged girls are not typically an influential political force, I believe that they have an embodied openness and originality of perspective that calls into question unexamined adult ways and stereotyped assumptions about technology culture: "Grown-ups never understand anything by themselves, and it is tiresome for children to be always and forever explaining things to them" (Saint-Exupery, 2000, p. 2).

At *101 Technology Fun*, how girls learn is significant (e.g., learning by the hands-on, heads-on, hearts-on, and feet-on experiences as designers and researchers of technology). I want the co-researchers to know that their perspectives matter and contribute towards creating a more diverse and equitable technology culture. As Doyle (2013) laments: "Another year has now passed with the collective intelligence of the other half of the human race— female brainpower, perspective and life experience— barely tapped."

Hence, I utilize a girl-led approach in both my study design and camp curriculum. Instead of teaching the co-researchers what to think, I gently provoke them to think for themselves, and I am always respectful of what they have to say. Rather than asking my team to answer a specific pre-determined interview guide, I support

the time. It could increase your problems with anxiety, eye problems from looking at the screen, arthritis, and make you impatient. Those are my thoughts, but I'm eager to hear what everyone else says.

Artifact 85. "Do we look smarter with books in the background?"

Aslin: Hi I'm Aslin, and I'm going to share my answers about what the Internet is doing to our brains. So the Internet sends us both good and bad messages. It can be helpful and useful to us by making research for school easier, helping us easily connect over email and social networking sites like Facebook, Twitter, and Skype. It can make it easy to look up almost anything you don't know, like an address or directions to

and challenge them to generate their own research questions. They also interview each other in pairs and further analyze their interview sessions using mind scripting techniques (Allhutter, 2012).

As they question their thinking about and relationships with/against technology, the co-researchers are also getting to know the power and strength of their own voices. Further, they are becoming aware of how they want to be perceived by others in technology culture. For example, my team from *101 Technology Fun* 2011 (camp two) conducted most of their interviews in the UBC Education Library such that they might appear more intelligent and grown-up looking with shelves full of books and academic journals in the background (e.g., Artifacts 84–85).

As my team share their personal knowledge and perspectives with each other about, **"What is the Internet doing to our brains?"** they are doing three important things. Firstly, the girls are taking ownership of their voice and experiencing themselves as powerful agents of change in their lives.

Secondly, they are contributing their colorful perspectives and forward-looking thinking to the findings of my study, thereby challenging the dominant techno-cultural scripts written for girls. Thirdly, they are developing the intellectual interest and confidence to take on future roles in areas of technology innovation, leadership, and research (e.g., a sense that girls can influence or transform the more-than-human worlds) (Bleeker, 2006; Rusnak, Petrina, Feng & Wang, 2010).

Their discussion about the consequences and side effects of Internet usage exemplifies the energetic exchange of ideas, compelling arguments, and

somewhere. You can just look it up on the Internet and you'll get the answer more easily and much faster than anywhere else.

But it is also bad cuz there are tons of scams and bad ads and really bad websites that sometimes kids end up looking at and they are not good for them. You can also get easily distracted from your work and then you end up doing something you shouldn't be doing on the Internet.

It can be dangerous because there are online predators and cyber bullying and just really bad things. You can also get really frustrated and upset by being on for too long. People also tend to get angry if they are in front of a screen all day. So if we have a good balance on the Internet, then we can use it better and more safely. That's all that I have to say. Thanks.

Kim: Well, first of all, I'm Kim. I think the Internet is… well, if we just keep going on the way that we are continuing, then I think that we're going to be really impatient and irritated almost all the time. We won't do as many things and we won't think as hard because we'll just use the Internet and look stuff up. We won't think.

I think that the Internet fries your brain if you are on too long. If you are like going on for 1.5 hours or more, then you just keep going on and on and on and on. And some people get angry. Some people get impatient. Some people get addicted. So, yeah.

Halina: What does the Internet do to your brain? Well, I think it makes our

inquisitiveness that my team generated during their mind scripting and interview sessions at *101 Technology Fun*. The co-researchers reveal multiple aspects of how technology is experienced by girls, and the worlds in and around them, including the Internet as:

1) *Object or Artifact*: frustrating pop-up ads (Cassidy); lies and photos girls are not supposed to see (Salina); scams, bad ads, and really bad websites (Aslin, Jayden); made up of plastic and stuff that doesn't decompose very well (Jill).

2) *Activity or Process*: knowing how to use the Internet to search for information (Jill); researching for school (Salina); communicating and messaging with friends and family (Aslin; Jordan).

3) *Place*: a dangerous space with online predators and cyber-bullying (Aslin); fun location to play games and find new friends (Jordan); popular networked publics like Facebook, Google, Skype, Tumblr, Twitter, and YouTube (Aslin, Jayden, Jordan).

4) *Knowledge*: fast and smart (Aslin, Kim); intelligent resource of addresses, directions, facts, and almost anything humans don't know (Aslin; Jill); super ultra-fast information (Cassidy).

5) *Physical Affliction*: inflicting eye problems from looking at the screen too long (Jill, Jordan, Meledy); making people tired so they don't have energy or desire to do anything else (Halina); causing arthritis and poor circulation in our feet and arms (Halina; Jill).

thinking shallower, like PJ's book *("The Third Teacher: 79 Ways You Can Use Design To Transform Teaching And Learning" by OWP/P Architects et al., 2010).* **It makes us have shallower thoughts and it sorta makes us tired, so we don't want to do anything else. I think that computers are affecting our brains by like turning them into mush. Whenever we go on the computer our heads begin to hurt, our eyes begin to feel really tired, and I feel sometimes like my feet and arms are lead.**

Artifact 86. "The Internet's turning us into fast twitching airheads. It's NO joke! Future generations won't think."

Meledy: I'm Meledy and I think that the Internet makes you less creative. I think you get really frustrated and your eyes get really tired when you go on it too much. I don't think it's really good to go on it for more than like three hours at a time. Like, that's a lot for me. So I only go on there for one half hour, maybe.

Raywin: More and more people are using the Internet, watching T.V. and

6) *Mental Affliction*: degrading our intelligence (Jayden); making us grouchy and depressed (Raywin); turning us into an angry, frustrated, impatient, and irritated, generation (Aslin, Cassidy, Jill, Kim, Salina); decreasing our creativity (Meledy); frying our brains into mush (Halina, Kim); distracting us from work and study (Aslin, Jordan); increasing our problems with anxiety (Jill); infantilizing our brains and turning us into little children unable to communicate (Jayden).

7) *Volition or Will*: the Internet wants to take over our brains and the world (Cassidy); people don't have to think as hard because they can use the Internet to look stuff up (Halina, Jill, Kim); life on the Internet moves much more quickly than real life (Meledy, Salina); our love for the Internet is turning into addiction and obsession (Aslin, Jayden, Raywin).

Given the opportunity to articulate and share their viewpoints, the co-researchers speak confidently with little hesitation. Their interviews and analyses reveal that they are particularly troubled with the unintended consequences of increased Internet use for both girls and society. As Halina exclaims: **"The Internet's turning us into fast twitching airheads. It's NO joke. Future generations won't think"** (Artifact 86).

Halina's concern is highlighted by the fact that many of her friends spend several hours every day online. Girls her age are increasingly accustomed to constant Internet access through their own personal and portable devices. For example, in a national survey of *Young Canadians in a Wired World,* Steeves (2014) reports that 99% of Canadian children (grades 4 to 11)

using all these electronics, so they don't really go outside to take walks or to play with friends anymore. If you stay inside too long you might get grouchy and depressed cuz the sun has the vitamin D that makes you happy.

Some people just have trouble getting off like, "I'm going to just watch this one and then I'm done." And then it's like, "five more and then I'm done..." so it can get really addicting. People aren't just addicted they are obsessed cuz they can't live without knowing everyone's Facebook status.

Salina: This is Salina. I think the Internet is sending both positive and negative messages to our brains. Positive cuz you can do research for school and negative cuz there are a lot of lies and things you shouldn't see cuz you are not supposed to see. Also, the Internet may make us impatient cuz the technology on the computer moves so much more quickly than real life. Like, if you go to the library, it takes way longer than using the Internet. And I notice when people are on for too long cuz they start to get angry from looking at the screen for too long.

Jordan: Hi, what I want to say is that when we use too much Internet, first we will hurt our body, and hurt our eyes, and hurt our intelligence. And then, we will be not smart. And second, when a lot of people go to the Internet to play on Facebook, like to talk with friends and to play a little bit of games, sometimes you don't know who you are talking with. And if you tell something not very good or if you tell too much, then some bad thing might happen to you.

have multiple platforms to access the Internet; 59% have their own cell phone; and 39% sleep with them during the night.

To get the co-researchers thinking about how much time they spend using the Internet, each girl recorded daily *iLife Diaries* for one week (Table 8). They reported an average 8.4 hours per week socializing with real-life friends and family. This was almost double the time they reported engaging with the Internet, popular media and technology (4.8 hours per day). My team's findings are low compared to a large-scale and longitudinal study of Generation M^2, which reports that today's youth (ages 8 to 18) average nearly 11 hours of daily media and technology multitasking (Rideout, Foehr & Roberts, 2010).

Although my team under-emphasized their use of the Internet, they did share many stories reflecting their personal struggles about spending too much time online. For example, Jill explains: **"It's fine when you are without the Internet. But once you turn it on, then you are kind of obsessed. Like if I write an email to someone, I wonder when will they reply so I check constantly. But then if I don't check it at all that day, I can go all day without it, and all the next day and for as long as I want. But once I check it, then I can't stop. I sort of get shallower, and I go into this zone where I go: Ahhhh, okaaay, now what?"**

Jill is negotiating her own interpretations of technology based on her personal experiences and interactions. How and where do girls learn to question and think deeply about the effects of growing up in-interaction-with an increasingly connected and technology dependent society? My

I think a lot of people like to play games online to find new games and friends. I think that to play a little bit is not a problem, but to play the whole day and then not study is not very good. So too much Internet is not a very good thing. But if we play a little bit, then it doesn't matter. So yeah. I don't think I need to play too much on the computer or play too much Internet.

Jayden: What is the Internet doing to our brains? I think that our love for the latest technology could be turning into addiction. Facebook is infantilizing our brains, turning us into little children who are unable to communicate. Google is degrading our intelligence. I think that it's insane that grade three students are given iPads and five year olds are given cell phones. This should change.

Cassidy: Hello, Cassidy. I think the Internet will make us way faster and I'm not sure if that is a good thing. It could be super fast, like ultra fast, and we could get really impatient, and then we would all zoom around. We'd always be frustrated and stuff.

And then with all those pop-up ads that are included in the Internet package, well they could make us waaaaay more frustrated. Like we'd have a cloud hanging over our heads the whole day or whole year or our entire lifetime. We'd totally be an irritated generation.

I think what the Internet does is get you addicted to it. And the more addicted you get, it stimulates your brain cells and washes them all out so you become stupid and then… *(she pauses for dramatic effect)* **and then it takes over the world! Sometimes we rely too much**

primary goal in getting my team to debate their technology research questions and complete *iLife Diaries* (Appendix G) is such that they might experience how their perspectives matter and are significant in girlhood and technology culture.

I strive to meet girls where they are at by respecting their fieldwork and design works, and citing them as valuable experts in the educational research concerning their lives and learning circumstances. Parents, educators, and relevant others can also make a positive impact by listening, sharing, and questioning girls' opinions, thereby participating in an ongoing feedback system in which girls can learn that their views are important and being respected (Farmer, 2008; Kearney, 2006).

Adding girls' diverse perspectives to the dominant mix of media and techno-cultural discourses is necessary to counter narrow and totalizing ways of being with media and technology: "When differences are dismissed, a hierarchy of privilege which clearly demarcates the empowered voices from the disempowered, is established (Mallan, 2003, p. 261).

101 Technology Fun directs full attention towards girls' voices, not in a token or peripheral way, but by empowering them to have real and meaningful involvement in critiquing and developing the direction for their technology futures.

As my team members demonstrate, girls are capable of significant achievements when supported with a fun and friendship-driven environment to experiment with media and technology (Rusnak, 2014a, 2014b). How can we most effectively empower today's girls with equitable opportunities to be amazing in technology culture? What social and technological

on the Internet. It might not have all the information we need, which might affect your brain.

infrastructures provide the best support for advancing girls' intelligence, leadership, and innovative capacity?

Table 8. *iLife Diary* Results. Estimated time spent doing daily activities, recorded by 19 co-researchers in their 5-day *iLife Diaries* (101 Technology Fun, camps 2 & 3, 2011).

iLIFE DIARY ACTIVITIES	TOTAL HOURS/WEEK	AVERAGE HOURS/WEEK/GIRL	AVERAGE HOURS/DAY/GIRL
1. eating	178.6	9.4	1.9
2. sleeping	782.9	41.2	8.2
3. grooming	95.2	5.0	1.0
4. playing music	28.5	1.5	0.3
5. playing sports/exercise	108.1	5.7	1.1
6. reading books/zines	117.6	6.2	1.2
7. drawing/making art	100.7	5.3	1.1
8. cleaning room/chores	38.2	2.0	0.4
9. doing things with family	387.4	20.4	4.1
10. doing my own thing	364.9	19.2	3.8
11. hanging out with my friends in real life	408.8	21.5	4.3
12. hanging out with my friends in virtual life	30.3	1.6	0.3
13. watching tv/YouTube	165.1	8.7	1.7
14. listening to music	77.9	4.1	0.8
15. texting/talking on phone	47.7	2.5	0.5
16. socializing on Facebook	79.8	4.2	0.8
17. playing videogames	28.2	1.5	0.3
18. editing movies/images	30.3	1.6	0.3
TOTAL: all activities [1–18]	3070.0	161.6	32.3
TOTAL: friends/family [9 + 11]	796.2	41.9	8.4
TOTAL: media/tech [12–18]	459.3	24.2	4.8

In this section, the girls make and tell and stories of self-efficacy (McDonald & Siegall, 1992). These are kind of small, everyday stories of the Rosie the Riveter "Yes We Can" type. In Rosie's day, women and girls rolled up their sleeves and got the job done. The job for many females being the one a man was doing before fighting in World War II. A cherished story in this section captures the design process or at least certainly the girls' "we can design" experiences. In telling a little story about learning how to make a robot, Jill says: "we rebuilt it and re-programmed it, and then rebuilt and re-programmed it, and then rebuilt and re-programmed it, and then… and then it broke!" Now this little story of perseverance and pushing beyond limits is one that the most advanced and influential engineers in the world can attest to: the never-ending story of reevaluating, rebuilding, and reprogramming.

Rosie's iconic story symbolizing the strength and power of womanhood continues today and the *101 Technology Fun* co-researchers contribute towards the creation of confident and self-determined cultural role models for girls. As Jill tells the story: "We tried so many ways but most of them didn't work, so I'm happy our robot finally worked by the end of camp. I definitely recommend going into detail on the programming. I can tell you that it's not easy. It's really hard, but tons of fun too." Is this not also a little day-in, day-out story of females redesigning masculine culture to provide a way so that other girls and women may succeed or at least have the chance to try to change systems of oppression? "We rebuilt it and re-programmed it… I definitely recommend going into detail on the programming."

And then there's the self-efficacy story of the brochure, pamphlet, or postcard that we created to recruit the girls. Our story is we were happy with and proud of our engaging design work. We did not at all ever think we were advertising what we would not deliver.

Well, maybe we over did it with the "fun" part, especially with the "extreme fun" part! Some girls, however, chose to differ. Some told a little story of a big letdown. Jill's story cut to the chase: "Well, I was kind of upset with the camp pamphlet. I think the brochure had all this cool stuff so I was kind of disappointed with what we didn't do." Halina joined in with hers: "Yeah, you advertise so much in your brochure but we didn't get to do it all. Like, I'd love to get to do the cyberspace virtual world thingy." Kim has a mixed story of fun plus letdown: "What we did was really fun, but I was looking forward to doing all of the things on the pamphlet." These girls tell a little story of curriculum and what sociologists call the "selective tradition." We can never do all that is there, so someone has to choose. "What is included and what is excluded?" is always the question, or another side to the story.

achievements

Artifact 87. Girls In-Interaction-With Techno-Cultural Hegemonies

6

CHAPTER 6: CONCLUSIONS, CONTRIBUTIONS & FUTURE RESEARCH

If we want to learn more about girls,

Then we need to listen to their stories.

If we want girls to be leaders, innovators, and change makers,

Then we need to *educate* and *empower* them to change their stories.

This dissertation was guided by the following research questions: How do girls, through their artifact making and designerly practices, story themselves and express their understandings of technology? What are the impacts and effects of adopting designerly roles in terms of developing girls' capabilities in media and technology? To investigate these two questions, I worked closely with the HWL team to develop *101 Technology Fun*, a series of maker-culture design camps offering girl-led learning labs in robotics, media production, game design, and web development. In this final chapter, I summarize the study design which builds upon the scholarly work of Allhutter (2012), Bach (1998), Denner et al. (2005), Freeman and Mathison (2009), Goldman-Segall (1998), and Petrina, Feng, and Kim (2008). Next, I reflect upon my scholarly journey as a co-designer, co-learner, and co-researcher. The following four sections highlight the research contributions and catalytic or generative stories that emerged, including: (1) defining the Tween Empowerment & Advocacy Methodology (TEAM), a design-based and participatory approach for scholarly inquiry with (not on) youth as co-researchers; (2) characterizing standards for girls' media and technology literacy; (3) transforming hegemonic technology culture in pro-social, pro-feminist, and empowering ways; and (4) expanding the already-interpreted and oppressive notions concerning media and technology. Finally, I discuss the study limitations and offer my recommendations for future investigation, concluding with: What remains for girls? What endures? What hopes?

6.1   SUMMARY OF THE 101 TECHNOLOGY FUN MAKER LABS & DESIGN CAMPS

For centuries, societal norms and gender stereotypes have influenced who girls are, what girls *should* do, and how girls *should* behave, thereby limiting their participation in the technology sphere (Farmer, 2008; Honey et al., 1991; Turkle, 1988; Weinberg, 1987). Perceived gender barriers about girlhood remain powerful. As a result of the popularized and well-established association of technology with masculinity, many females are continuing to disidentify with or distance themselves from media and technology fields, careers, studies, symbolism, and ideologies (AAUW, 2000; Ashcraft, Eger & Friend, 2012a, 2012b; Camp, 2001; Denner et al., 2005). Hence, today's girls are not developing the confidence, initiative, interest, literacies, and tools that are necessary for them to fully benefit from or participate in advancing our increasingly mediated and technologically dependent society (Cassell & Cramer, 2008; DuBow, 2011; Kearney, 2006; Legewie & DiPrete, 2014).

From my standpoint as a media and technology studies specialist and teacher, designer, mother, and educational researcher, I argue that girls need affirmation and support for maintaining their sense of femininity and feminism within a historically masculine culture of technology that continues to dominate (Rusnak, 2010a, 2014b). Accordingly, I designed my research to be a site of cultural production (e.g., a series of maker culture research camps) in which tween-aged girls, through their artifact making and designerly practices, are supported to explore and express their understandings of *girlhood-in-interaction-with-technology*— in their own ways, on their own terms, and for their own purposes— not as consumers, child-users, or "surrogate boys or men" (Kearney, 2006; Petrina, Feng & Kim, 2008; Wajcman, 1998, 2004). I believe that if we want to learn more about girls, then we need to listen to their stories. There is an act of generosity in listening, witnessing, and

valuing their personal stories. Secondly, I believe that if we want girls to be leaders, innovators, and change makers, then we need to *educate* and *empower* them to change their stories. The two key terms here are education and empowerment. In my study, the co-researchers need empowering experiences to build their technical skills and confidence. They also need educational experiences where they learn how to identify, critique, question, and transform the oppressive stereotypes about females in technology culture (Rusnak, 2010a, 2014a, 2014b; Rusnak, Petrina, Feng & Wang, 2010).

Drawn from the research origami artifact at the end of Chapter 1, the following succinctly summarizes the research design. The **interpretive paradigm** or underlying premise is that my co-researchers, readers, and viewers are all important storymakers in uniquely interpreting the study findings: "the answers we look for are not in the codes, but in ourselves and our data" (Seidel, 1998, p. 14). This includes a **story epistemology** based on an understanding that design opens up space for girls to make and share their own stories, as empowering alternatives to the dominant or taken-for-granted ones (Bach, 1998; Denner et al, 2005; Kearney, 2006; Kelleher, 2006). Girls' stories evidence how they make meaning and construct knowledge about the media and technology in their lives and worlds (Goldman-Segall, 1998; Petrina, Feng & Kim, 2008).

The **theoretical framework** includes: (1) Allhutter's (2012) deconstructive feminist theory of mind scripting; (2) Bach's (1998) girl-centered research principles for representing the complex, dynamic, and subjective realities of girls' lives; (3) Denner et al.'s (2005) "girls creating games" strategies; (4) Freeman and Mathison's (2009) constructivist approach for engaging children as "true partners" in researching their learning, growth, and development; (5) Goldman-Segall's (1998) "points of viewing" theory for capturing children's unique

expressions of technology; and (6) Petrina, Feng, and Kim's (2008) theories and techniques for researching technology, media, and learning across the lifespan.

The **methodological approach** is grounded in the realities of my team's artifacts and personal stories, along with DBR and participatory ways of gaining more knowledge about girls' experiences in maker culture (e.g., using their own words and expressions). The **key unit of analysis** is *girls-in-interaction-with-technology-and-stories*. The **strategies of inquiry** include data selection processes focused on the artifacts and stories that are catalytic or generative within our makerspace and community of designerly inquiry. Within the multifaceted **montage analysis**, the co-researchers' fieldwork and designworks represented in the left-hand column address the first research question of this dissertation, and the information and interpretation offered in the right-hand column answers the second research question (both columns are also in conversation with each other). My **key research values** strive to respect, honour, care for, and be sensitive towards girls and girlhood (Bach, 1998; Rusnak, 2010a, 2014a, 2014b).

6.2   MY SCHOLARLY JOURNEY AS A CO-DESIGNER, CO-LEARNER & CO-RESEARCHER

Mindful that multiple inequalities exist in collaborative researcher-participant partnerships, problematic questions that I keep asking myself include: How do I construct and represent girls' learning experiences as designers and makers of technology? How do I examine my team's artifacts and stories for bias, distortion, omission, contribution, and significance without influencing or over-shadowing youth expression (Freeman & Mathison, 2009)? How do I listen with sensitivity and attunement to synthesize the co-researchers' designworks and fieldwork without reinforcing their marginality or perpetuating one

homogeneous and idealized identity for girls (e.g., over-generalizing or over-emphasizing the commonality of their unique capabilities, interests, goals, motivations, skills, and talents) (Bach, 1998; Lipkin, 2009)?

As I challenge the dominant scripts in the making of girl/media/technology culture, I heed Goldman-Segall's (1998, p. 260) caution:

> When multiple voices are heard on an electronic platform, we are still stuck with the problem of validating what is being said. Whose interpretation do we trust? Who has the final word, the authority to decide on action? How do we validate and authenticate an electronic story or interpretation of a group of stories in light of the elasticity of the medium?

Who stories girls' worlds? Who are the experts in studies about girls' lives and learning circumstances? How do I remain reflexive about my inquiry practices such that I do not impose my views of techno-cultural change upon my team? How am I changing as I empower the girls in my study to become change makers?

My doctoral research story is a long one. It's true that life never stands still, nor waits until you have finished your PhD and have time to properly manage. Key lessons learned? Expect challenges and know there are always solutions. The first three years of my doctoral studies revolved around my tween-aged daughter and our adventurous life together on the UBC campus. I walked my daughter to school in the morning, and she came to my office after school to pick me up (often staying late to finish her homework or play games with friends). When I taught the course Design and Technology Education Across the Curriculum (2008, 2010, 2011), I assembled a 'tough' team of technology experts (my daughter and a few friends her age) to evaluate the teacher candidate's final projects. Not only was my

daughter involved with my teaching, she was part and parcel of the *101 Technology Fun* camps, she even came up with the name! And then, to my unexpected delight, a special man captured my heart and mind. United in love we married, bought a townhouse with the intent to settle down, and I gave birth to my second child. Hence, the next three years of my doctoral studies program revolved around two rewarding yet time-consuming jobs: the privilege of taking care of my baby boy, and the joy of thesis writing during the quiet of the night and the in-between spaces (e.g., nap time).

What is the ideal scholarly writing environment? A design question that I often pose to teacher candidates asks them to imagine their ideal learning environment and describe what it might look like. How is it situated within its school, neighborhood, city, cultural landscape, religious community, political climate, country, and world? In order to have sufficient resources to raise my children and complete my thesis, with a husband who works overseas for over half the year, I moved in with my in-laws, all three sets of them! I pause to recollect some of my eclectic thesis-writing spaces: my father Dave's old smoking room transformed into a makeshift office; my father John's hand-crafted basement bar converted into a standing desk; my mother Denise's lovely flower garden with the antique rocking chair for reading, thinking, and solitude; and dozens of libraries throughout BC, Saskatchewan, and Manitoba. I rose early to write along with the marvelous sunrise on the balcony of my father Dale's luxury penthouse, hours before my family awakened. I wrote in my car while waiting to drive my daughter home from work. I edited drafts while watching my son play at Roaming Rascals recreation centre. Finally, I completed my last chapter in-between visiting family and touring Kenya and Uganda. My thesis, husband, children, and I are well traveled.

To my knowledge, nobody has ever questioned my commitment to complete my

dissertation; however, many close friends and family members have questioned my sanity for spending a considerable amount of time writing "her paper" instead of getting a "real job." Doing my best to raise my children and write my thesis are important goals for me, and how I am able to use my skills and talents to contribute to society in small but profound ways. This is a life choice that I feel lucky to have the opportunity to make, in order to become the person who I want to be. "You can't be what you don't see," argues Marie Wilson of the White House Project, an initiative to increase female representation in public life and generate new role models (Anderson, 2010). Like my team of co-researchers, I had to believe in myself and do things in my own time and on my own terms. Like the girls in this study, I am a dynamic and designerly work in progress, a rich cosmopolitan of other subjects, systems, spaces, events, artifacts, and stories. As a result of participating in *101 Technology Fun*, I have most importantly learned (and keep learning) to trust the design process (e.g., to not be narrowly focused on outcomes); how to fear less and dream more; and the importance of cultivating professional, familial, and collegial relationships. My confidence, intelligence, and resilience have remarkably increased, and I have truly enjoyed all of the makerspaces, family spaces, and thesis spaces throughout my PhD journey.

6.3   CONTRIBUTION 1: GIRLS EXPANDING THEIR OPPRESSIVE NOTIONS CONCERNING MEDIA & TECHNOLOGY

This research makes several important contributions. Firstly, getting girls to examine their artifact production, storymaking, and designerly practices offers new dimensions to current understandings of how media and technology shape our notions of girlhood and girl culture, and hence the ways that girls see themselves in-interaction-with hegemonic techno-cultural discourses (Allhutter, 2012; Farmer, 2008; Goldman-Segall, 1998; Kearney, 2006).

The co-researchers successfully developed new technical skills during our girl-centered summer camps and maker labs, including: producing *ME Documentaries* and PSAs concerning girls in the media; designing the *momME* game for females of all ages and cultures to play together; co-creating a website to share *101 Technology Fun* research and designworks; programming their first robotic creations (e.g., robotic pet, robotic cake, and robotic amusement park); and confidently demonstrating robotics to an audience of peers, parents, and technology education teacher candidates. For example, Jill boldly reported: "Yeah, I liked when the teachers came in for a demonstration and then we set our robots on them! So the adults were all bouncing up and down to make sure they wouldn't step on our robots. It was really funny to see all of those adults making fun of themselves! While we were awesome." The most profound achievement of this study on girls and maker culture, however, is getting my team members to question and think differently about the representation of females in media and technology culture.

The *101 Technology Fun* experience played a vital role in assisting the co-researchers to contradict mainstream identities (with respect to technology and gender) and expand their visions of being a girl in a technology-driven world (e.g., who they are and what they can and want to do). My team members shared stories like: "I've learned more about being a girl. This technology camp helped me to think more about myself, how I can be aware and not be too influenced by media" (Chani) and "the questions and stuff we talked about, normally we don't at home or with our friends or at school" (Salina). As evidenced in their designworks and fieldwork, the co-researchers were able to recognize, negotiate, and transform some of the taken-for-granted ways in which they position themselves into (and are positioned by) well-established techno-cultural discourses. For example, in a group mind scripting session,

Jayden informed her colleagues to take pride in being themselves: "You don't have to look like those people. Like, just stop and think. Just looking at a magazine can change your perspective of who you are. Media tests your self-confidence. Ads target children because they are the most emotionally vulnerable. Don't fall for it!"

Like Kearney (2006) and Sandberg (2013), I believe that all females need to be able to understand and redefine how they are held back (and how they hold themselves back) within patriarchal technology culture that has been defined so narrowly that many females do not believe that they fit in. The enduring question, however, as posed in my study is: how do we educate today's girls to identify, disrupt, and overcome the pitfalls of gender exclusion, marginalization, and oppression? This kind of education is important for girls, to allow for transformative and conscious change making and storymaking. Leading examples of how I endeavour to achieve this empowered identity making with the co-researchers during *101 Technology Fun* include:

1. Asking girls to generate their own research questions concerning media and technology; collaboratively constructing interview guides; and conducting research interviews in pairs using handheld Flip video cameras, thereby giving all of the team members leadership roles (where all ideas and voices can be heard) and meaningful opportunities as designers, learners, researchers, and teachers (Denner et al., 2005; Freeman & Mathison, 2009; Goldman-Segall, 1998).

2. Employing mind scripting techniques for educating girls to analyze and closely attend to the embedded knowledges and stories that are at the heart of their research interviews, thereby educating the co-researchers to further articulate and interrogate how they learn *about, from, through, and with/against* media and technology (Allhutter, 2012; Petrina, Feng & Kim, 2008).

3. Organizing whole group mind scripting sessions in which the co-researchers identify and negotiate gender/technology inequalities and stereotypes that they have experienced and oftentimes enforce in their lives, thereby making 'invisible' values, norms, and belief systems 'visible' in order for the girls to explore beyond the real and/or perceived boundaries in media and technology cultures (e.g., expanding space for new stories to be made and told by girls to each other) (Bach, 1998; Allhutter, 2012; Farmer, 2008; Goldman-Segall, 1998; Mallan, 2003).

4. Providing girls with a meaningful opportunity to individually and collectively contribute to the study and advancement of media and technology cultures by participating as co-researchers in an educational research project, thereby empowering my team to become valuable producers of knowledge (overcoming traditional gender and generational hierarchies) rather than being mere consumers or child users (Denner et al., 2005; Kelleher, 2006; Kearney, 2006; Petrina, Feng & Kim, 2008; Rusnak, Petrina, Feng & Wang, 2010).

5. Enlivening the co-researchers' technological imaginations by placing them in a technology-rich lab and (with little guidance) challenging them to define and solve design problems of their own concern and volition, thereby sparking girls' interests in technology, supporting their self-directed goals, enabling them to become independent thinkers and makers, and encouraging them to discover the innovator from within (Bottrill, 1995; Druin, 1999; Goldman-Segall, 1998; Hill & Smith, 2005; Kafai, 1995, 2006).

6. Generating feedback from peers and writing technology affirmations in which girls identify particular strengths in the work of their peers, thereby building the co-researchers' self-confidence and self-esteem based upon their technical skills, abilities, and accomplishments (rather than physical appearance or popularity) (Denner et al., 2005; Lipkin, 2009; Rusnak, 2014a, 2014b).

6.4 CONTRIBUTION 2: GIRLS TRANSFORMING TECHNOLOGY CULTURE IN PRO-FEMINIST, PRO-SOCIAL & EMPOWERING WAYS

The second contribution of this research shows how girls can effect personal and cultural change in pro-feminist, pro-social, and empowering ways when they are given opportunities, tools, and support (e.g., Braundy, 2011). The series of intensive, albeit fun and friendship-driven, technology camps were intended to support the co-researchers to become capable makers and independent thinkers who can: define and solve design problems, pursue their media and technology-related interests and concerns, and question some of the gender stereotypes in hegemonic techno-cultural discourses. Future research will follow up on these girls to explore long-term influences of their experiences with the research and design camps. While this study evidences the creative and intellectual contributions that girls are capable of

achieving when supported with equitable education (e.g., the *101 Technology Fun* maker lab), it also finds that girls are not being challenged as makers, leaders, and innovators in technology culture: "At first I thought technology was really boring and useless, but I've learned it is really fun" (Salina); "Before camp, I thought technology was like screwing pieces of motherboard together, but now I've learned it's a bigger and broader thing. Now I understand technology more and how it affects me" (Raywin); and "I liked building my robot in a room with a group of girls and using lots of craft supplies and recycled stuff that I didn't know could be used to make a robot, which is really cool" (Jill). The co-researchers lack opportunities at home and school where they feel comfortable to geek out as makers and express themselves with technology. They also lack mobile, physical, and virtual makerplaces and makerspaces to collaborate, interact, and share resources and ideas.

During *101 Technology Fun*, our physical and virtual learning environments both enabled and constrained how the co-researchers learned *about, for, from, and with/agains*t technology. My role was to create a design-studio learning environment that would empower girls as innovators, so the pedagogical focus was on girls, ingenuity, and agency (Denner et al., 2005; Kearney, 2006; Kelleher, 2006; Wilson, 2013). A salient goal of my study was to nurture design ability in diverse learners, hence our technology curriculum and pedagogy emphasized design processes (e.g., iterating, prototyping, refining, and testing) rather than striving for predetermined end products or innovations (Hill, 2010). I presented my team with design challenges and gave them control over their learning experiences within the technology-rich maker lab; and they, in turn, took responsibility and ownership over their design processes and projects (e.g., developing animations, games, media, and robotics). For instance, consider Halina's advice to other girls who want to build and program robots, "It

takes a lot of patience, like there are some parts where you just want to rip it up, so just try and stay calm, and when things don't work just go over the steps and say, ok did I do this right? Did I forget to do this? Is it missing anything?" Design enabled my team to contribute their voices to the cultural conversations about what the future of media and technology should be like (e.g., their artifacts and stories that call for destinies of inclusion, liberation, promise, and meaningful opportunity for all). For example, in the opening montage of Jill's *ME Documentary* she speaks with confidence and certainty: "I think that technology will help me to document my life . . . My friends say that I live life through a camera lens because I'm always there taking pictures and recording videos to keep and make memories."

My research finds that utilizing a design-based approach is an effective way to foster independent learning, problem solving, and critical thinking in female youth. Building upon and integrating designerly ways of learning will be helpful in the long term to develop girls' achievements, attitudes, goals, and interests in technology because we do not simply realize educational innovations: we *design* them, albeit often without inclusive or sustainable processes (Hill & Smith, 2005; Petrina, 2000a, 2010; Wilson, 2013). Brown (2014) argues that design thinking has great potential for improving today's educational infrastructure (which rarely get looked at from a design perspective): "What happens if you radically redesign this system, or what happens if we radically evolve this system over time in order to meet some purpose that we're clear about and in order to meet the needs of the participants in this system in a better way than we've being doing it?"

Redesigning today's classroom learning environments to best meet the needs of increasingly diverse student populations involves many uncertainties and complexities. As history tells, changing the ways that society and educational institutions view learning in

order to bring in curricular and pedagogical innovation is a complicated endeavor riddled with constant tensions between the new learning approaches and well-established classroom practices (Kimbell & Stables, 2010). Given the current educational orientation towards increasing accountability, rising academic standards, fixed outcomes, and quantifiable assessment, designerly ways of teaching and learning no doubt provoke much uncertainty with their experiential and explorative focus on design processes and practices instead of emphasizing end products (Bottrill, 1995; OWP/P Architects et al., 2010; Hill, 2010). Additionally, design-based approaches enable a critical look at environmentally insensitive and patriarchal values often promoted by technological innovation, which may be a hard proposition for some to accept (e.g., neither education nor technology is neutral or unbiased) (Berman, 2009; Berger, 2009; Brown, 2009; Cross, 2006).

Although the makerspace learning environment of this study builds upon the past few decades of design education research and practice, much more fieldwork remains to be done to: connect design learning to academic standards and subject matter; evidence best practices for integrating design thinking into classroom settings with general education teachers (who are not design and technology specialists); understand how we might prepare teachers to model and facilitate equitable and sustainable design ethics; and assess what students are learning such that their design efforts and innovations can be evaluated by others (Bottrill, 1995; Kimbell & Stables, 2010; Wilson & Schwier, 2009). Many enduring questions remain, hence more longitudinal research is needed to examine: how do we educate future innovators (beyond mere conformists or consumers) who are confidently prepared for life's opportunities and responsibilities? What if we mainstream the notion that it is a high priority for schools to develop girls' innovative mindsets and entrepreneurial spirits? What if we

redesign today's classrooms and curricula to support girls to experiment with technology based on their interests and talents? How do we empower girls to believe in themselves and their technological capabilities? "How come girls feel that they always have to impress everybody?" (Kara). "How come girls always feel that they have to improve on their beauty?" (Kara). "Who says girls aren't beautiful and why can't we be smart?" (Jordan). What if we change the conversation or story from what girls can't do to what they can?

Perhaps what we need to do more of (at home and school) is to simply give girls opportunities to be remarkable and to make stuff that is remarkable or unremarkable, where they are encouraged to do their best work and get recognized for it. Educators can help their students to develop new affinities towards and capabilities in technology simply by the way they teach. Teachers can help to empower girls in technology culture if there is a sincere intention to create classroom spaces where marginalized students can make and share new stories that offer a range of positions on gender, media, and technology, such that they are encouraged to move out of their comfort zones and start questioning the authoritative scripts about girlhood (e.g., stories that serve to produce and perpetuate gender hierarchy and dysfunctional technology stereotypes). Our female youth need learning places and makerspaces that respect and value their diverse voices as much as possible, not only in a peripheral or token way, but actually giving them meaningful involvement in developing a broader vision of themselves and others, and of their technological futures (Hill, 2010).

I draw great satisfaction knowing that our *101 Technology Fun* labs and time together increased the co-researchers' beliefs in their ability to succeed at technologically complex and challenging activities, as Jordan reflects, "I didn't think I'd ever be interested in making robots, but I do really like it now. It's hard, but it's actually fun too." Likewise, Kim adds,

"What I liked the most about this camp was that I learned way more about the computer than I ever thought I could learn. I think that I have seen a lot more of what you can do with technology, especially after all the discussions we had." Within our safe, supportive, and girl-led learning environment, my team members were eager to take on new roles as leaders, researchers, and designers, however, I worry that their little stories will be overshadowed by big stories, media stereotypes, and techno-cultural discourses that work to control young females and suppress their confidence, designs, and dreams. What happens when girls publicly advocate for gender equity to become the norm in media and technology cultures?

On September 21, 2014, Emma Watson (actress and U.N. Goodwill Ambassador) delivered a powerful speech explaining why feminism is good for everyone, openly inviting men to get involved in the new U.N. initiative called *HeForShe:* "I want men to take up this mantle. So their daughters, sisters and mothers can be free from prejudice but also so that their sons have permission to be vulnerable and human too— and in doing so be a more true and complete version of themselves" (Duca, 2014). In response to Watson's feminist campaigning, anonymous members on the 4chan message boards (www.4chan.org) set up a website with the intent to pressure her out of public life by threatening to release private nude photos. The 4chan network of Internet trolls want to silence Emma Watson and prevent her from doing tremendous good in the world. Similarly, in the *101 Technology Fun momME* game, *The Infinite Evil* network of Internet trolls want to silence the tremendous joy that mothers and daughters bring into the world. Women critical of anti-feminist and patriarchal game content, gameplay, and game design/development practices, including Anita Sarkeesian and Brianna Wu, have been forced into hiding due to death or rape threats. On

October 20, 2014, Brianna wrote in fear: "Every woman I know in the industry is terrified she will be next" (Wu, 2014).

McDonald (2014) comments on the darker side of advocacy: "It's just the latest in a long history of online efforts to intimidate, belittle, threaten and cow women into hiding and shutting up— the message, of course, being, *If you dare to do or say something we don't like, we'll expose you in return.*" I am left to wonder about all of the untold stories, oppressions, silences, threats, bullying, and attacks against feminists who, like Emma Watson, Anita Sarkeesian, and Brianna Wu, have the confidence to publicly critique patriarchy and fight for global gender equity. Without a doubt, we need strong and influential females (of all ages) who can turn disempowerment into a form of self-empowerment. Females who have the self-efficacy and self-determination to lead the way in innovating the media and technology that is transforming our world, such that one day girls' opportunities to fully benefit from and participate in advancing technology culture will no longer be a cause to fight for, but rather the norm (Duca, 2014; Kearney, 2006; Sandberg, 2013; Sandberg & Grant, 2015; Wu, 2014).

6.5 CONTRIBUTION 3: GIRLS DEFINING STANDARDS FOR MEDIA & TECHNOLOGICAL LITERACY

Baker (2004, p. 27) finds that one similarity among different forms of literacy is "developing mastery and confidence, culminating in a critical transformation or changed relationship with the subject matter." This research contributes a matrix of four interrelated components of media and technological literacy for girls, which are transformative within affective, cognitive, and experiential domains: *agency* (girls having influence and power); *ingenuity* (girls being clever and inventive); *self-interpretation* (girls making sense and significance of self in-interaction-with technology); and *self-efficacy* (girls believing in or

judging their technological capabilities). Indeed, *how* a group of girls story changes in their sense of technological self-efficacy, self-interpretation, ingenuity, and agency is one of the most important findings of this study. Characteristics of a media and technologically literate girl should include but not be limited to these four components.

The International Technology Education Association (ITEA) published the first large scale and extensively reviewed standards for technological literacy (STL) in 2000, specifying 20 benchmarks (e.g., technological knowledge, ways of thinking, and capabilities) that identify what all K–12 students should be able to know and do. Technologically literate learners are defined as problem solvers who can appreciate "the interrelationships between technology and individuals, society, and the environment" (ITEA, 2003, p. 10) and understand "the nature, behaviour, power, and consequences of technology from a broad perspective" (ITEA, 2005, p. 1). Powerful advocates are working diligently to promote the development of media and technology literacy, calling for the study of technology (e.g., designing and making products, systems, and environments to solve everyday problems) to be a core-course requirement for all students in formal school settings (e.g., Braundy, O'Riley, Petrina, Dalley & Paxton, 2000; Bryson, Petrina, Braundy & de Castell, 2003; Farmer, 2008; Hill, 2009; Hill & Anning, 2001; Hill & Smith, 2005; Hill, Corbett & St. Rose, 2010; ITEA, 2000, 2003, 2005; Pearson & Young, 2002; Petrina, 2000b, 2007).

Like the co-researchers, many people of all ages have a basic understanding of what technology is (beyond computers): "I didn't really know what technologies were, but then this summer camp made me focus on the technologies everywhere in my life and learning more about them" (Jordan) and "I hadn't thought about this before camp, but technology is everywhere and that kind of surprised me, cuz it shows how much people use technology"

(Salina). Hence, the important need for technology education (which is not the same as educational technology) which is the only school subject dedicated to educating technologically literate citizens: "students engage in cognitive and psychomotor activities that foster critical thinking, decision making, and problem solving related to the use, management, evaluation, and understanding of the designed world" (ITEA, 2005, p. 9). While the STL provide an important vision and foundation for establishing a lifetime of learning about technology, implementing these content standards in school systems remains a difficult and daunting challenge (ITEA, 2005).

Developing the multiple literacies of today's youth involves the advancement of meaningful, relevant, and sustainable approaches for design and technology education or STEM beyond historical teacher-directed pedagogy and curriculum that emphasizes unquestioned skill and knowledge acquisition (Hill, 2010; Petrina, 2000b, 2007; Wilson, 2013). Contemporary methods and practices for teaching media and technology include: student-centered design projects; contemplative classroom discussions that foster critical thinking about technological problems and solutions (e.g., environmental literacies and responsibility in the human built world); and authentic learning contexts that develop relationships between students, schools, families, community partners, local businesses, and the school board) (Brown, 2009, 2014; Hill & Smith, 2005; Hill, 2010; Kimbell & Stables, 2010; OWP/P Architects et al., 2010; Rusnak, 2014a, 2014b; Wilson & Schwier, 2009).

Media and technological literacy is transformative (including a wide range of positive and negative effects) within our world of accelerating and complex change, for example: "there is so much you can do, a wide range of stuff. Like in game design you could build your own world and everyone else would live in it" (Crystal); "I think that our love for the

latest technology could be turning into addiction. Facebook is infantilizing our brains, turning

us into little children who are unable to communicate. Google is degrading our intelligence"

(Jayden); and "the Internet's turning us into fast twitching airheads. It's NO joke. Future

generations won't think" (Halina). As the *101 Technology Fun* co-researchers report, our

futures are dependent upon a global citizenry that can understand and question the power,

premises, promises, and problems of human innovation (e.g., how media and technology

shape culture society, and the environment, and in turn are shaped by them).

6.6 CONTRIBUTION 4: GIRLS GENERATING NEW POSSIBILITIES FOR SCHOLARLY INQUIRY WITH (NOT ON) YOUTH AS CO-RESEARCHERS

The fourth achievement of this research involves the formation and development of

the Tween Empowerment & Advocacy Methodology (TEAM). Characterized by tween

fieldwork, designworks, makerspaces, and storymaking, this DBR and participatory approach

offers new possibilities for the study of youth cultures and youth learning, especially in

relation to media and technology (Hill & Smith, 2005; Kearney, 2006; Petrina, Feng & Kim,

2008). TEAM builds upon and refines ethical research practices that are sensitive toward and

inclusive of girls, and raises important questions concerning children's rights and roles in the

knowledge made about their lives and learning circumstances (Bach, 1998; Goldman-Segall,

1998; Scott, 2007). For example, analysis of the co-researchers' stories, artifacts, design

practices, and research reflections were interwoven with theoretical and empirical

understandings to contribute a detailed working portrait of how a team of girls learn *about,*

from, through, and with/against media and technology (bearing the locale and maker culture

of *101 Technology Fun*) (Bach, 1998; Goldman-Segall, 1998; Weber, 2007). What stands out

most about the TEAM approach is the inclusion of girls' diverse voices as we worked

towards a shared understanding of the research questions, in our stories, designworks, fieldwork, and, most importantly, in the development of action or contribution to technology culture (Rusnak, 2014a, 2014b).

TEAM data analysis is characterized by the conversational montage framework, which invites catalytic and generative re-readings of the *101 Technology Fun* team's work, highlighting the premise that we need inquiry with (not on) girls as co-researchers. Giving the girls representation and voice through the TEAM approach, the study findings are organized into four distinct yet interrelated storylines or themes that characterize the co-researchers' artifacts and stories: agency, ingenuity, self-efficacy, and self-interpretation. The montage analysis utilizes a two-column dialogue format to empower the girls to speak for themselves (to the greatest extent possible). I do not position myself as the authoritative voice of my team members: "We know of course there's really no such thing as the 'voiceless'. There are only the deliberately silenced, or the preferably unheard" (Roy, 2004).

The artifacts that my team made and shared are significant productions of meaning, and therein provide an opportunity to see with the embodied openness, curiosity, and originality of perspective that is characteristic of children's thinking (Goldman-Segall, 1998; Haynes, 2008). By engaging with and listening to my team's stories, both imaginative and lived experiences, I was able to gain access to their perspectives and values. Opening up a storymaking space did not dismiss other powerful discourses, rather, I situated them alongside the co-researchers' work. As Weber (2007) advocates, we need many detailed accounts of how media and technology shape our notions of girlhood and girl culture (and thus the ways that girls see themselves and others) in order to test the largely theoretical or survey-based research that dominates the literature.

Although findings are based on a small team and are not intended to be representative of all girls (who have an extraordinary range of perspectives on and participation in media and technology), they nevertheless offer new insights into current understandings of the ways that contemporary girls story themselves through their design, media, and technology practices (Denner et al., 2005; Kearney, 2006). The co-researchers' experiences are of course their own, and not necessarily that of other girls, particularly those less privileged with socio-economic circumstances that impede access to advanced digital technologies and cutting-edge educational opportunities like the *101 Technology Fun* makerspace camps (Hafkin, 2006). Issues of race, ethnicity, developmental ability, religion and belief, sexuality, and social class inequalities recur worldwide and must be addressed in future research concerning *girlhood-in-interaction-with-technology*. More attention to amplifying the global voices and vantage points of female youth will help to validate their contributions to technology culture and to increase awareness of the double discrimination that girls face because of gender and age (DuBow, 2011; Honey et al., 1991; Wajcman, 1998, 2004; Weinberg, 1987).

Although my co-researchers and I raised more questions than we answered, I hope that they are articulated in artifact and text to motivate further scholarly inquiry, action, and advocacy. Together, we made some powerful, albeit little, artifacts and stories. Recall Jill's robot story: "We tried so many ways but most of them didn't work, so I'm happy our robot finally worked by the end of camp. I definitely recommend going into detail on the programming. I can tell you that it's not easy. It's really hard, but tons of fun too." How do we assure girls and women that media and technology can change? "We rebuilt it and re-programmed it… I definitely recommend going into detail on the programming."

6.7   WHAT REMAINS FOR GIRLS? WHAT ENDURES? WHAT HOPES?

Deeply respectful of girls' creative, intellectual, and technological capabilities, this study of maker culture reveals some of the gender stereotypes, generational barriers, feminine intelligence, transformative learning, and youth ingenuity that girls articulate and reflect upon as they create and innovate with technology. Our need to educate girls to analyze how they learn *about, for, from, and with/against* technology is paramount due to the scale and speed of cultural changes wherein today's girls are now expected to engage with a range of technologies for education, literacy, social status, and future career success (Farmer, 2008; Rusnak, Petrina, Feng & Wang, 2010). As a result of participating in *101 Technology Fun*, the co-researchers were able to identify and question how girls are storied (and how they story themselves) in media and technology cultures. Our purpose was not to create the one best possible story or single narrative for all girls. Rather, the girls in this study were challenged to make their own "little stories" to share with each other within the camp (and the world beyond). While girls cannot escape big stories or hegemonic techno-cultural narratives, they can resist and transform themselves (Allhutter, 2012; Mallan, 2003).

Supporting girls with an infrastructure and platform to develop new affinities towards and capabilities in media and technology (and thereby contradict disempowering cultural stereotypes) is an important contribution of the *101 Technology Fun* makerspace. DBR was essential to achieve my study's transformative outcomes: engaging girls as designers and research partners challenged my team to identify oppressive and marginalizing notions about girlhood and to examine their unconscious gender bias and beliefs about who girls are, what they *should* be, and how they *should* act. Girls need to be able to understand media and technology cultures and the way they are designed in order to change them to fit females,

incorporating and building upon feminine perspectives and values, rather than adapting to a predominantly male world of technology (Denner et al., 2005; Kearney, 2006).

A fifth finding, and one I want to explore in further research, is the long-term effects and influences of the co-researchers' learning experiences as designers and researchers at the *101 Technology Fun* makerspace. Together we developed and utilized a girl-led maker lab and confidence-building platform, and the girls moved in and out of various roles with humbling energy, ideas, originality, and vision. While my team readily adopted roles as innovators, producers, and storymakers, their artifacts and stories also reveal how girls appropriate and reinforce oppressive notions of media and technology cultures that serve to justify, produce, and perpetuate gender and generational stereotyping. Future research efforts (e.g., the private Facebook group for the *101 Technology Fun* team members) will continue to document how these girls apply the design mindsets and technical skills that they learned in our maker lab to their everyday lives and learning circumstances. For example, their high school and post-secondary course selections, future career choices, civic engagement for pro-social change; intergenerational collaboration for pro-feminist change, and commitment to action on global issues of importance to them.

Within the *101 Technology Fun* makerspace and design community, artifact and storymaking were powerful practices for provoking my team members to explore beyond mainstream identities and to create new stories about their lives and learning circumstances. The approach we took is gender-specific. Artifacts and stories can project disenfranchising stereotypes that hold girls back in media and technology or STEM, or they can act as a catalyst for girls to transform their own context and ignite change (Ashcraft, Eger & Friend, 2012a, 2012b; Braundy, 2011; Kearney, 2006; Sandberg, 2013; Sandberg & Grant, 2015). To

my co-researchers: I look forward to learning about the transformative stories that you will make and share as change makers and leaders who take collective action to shape our media and technology futures. I await the opportunity to experience what you will design and invent to address the diverse challenges of making our world a more equitable, harmonious, and sustainable place, with meaning, purpose, and quality of life for all. I hope that you continue to challenge yourselves creatively and intellectually, and endeavor to get behind important causes that benefit girls and girl culture.

bibliography

Artifact 88. 101 Technology Fun "ME Documentary"

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appendices
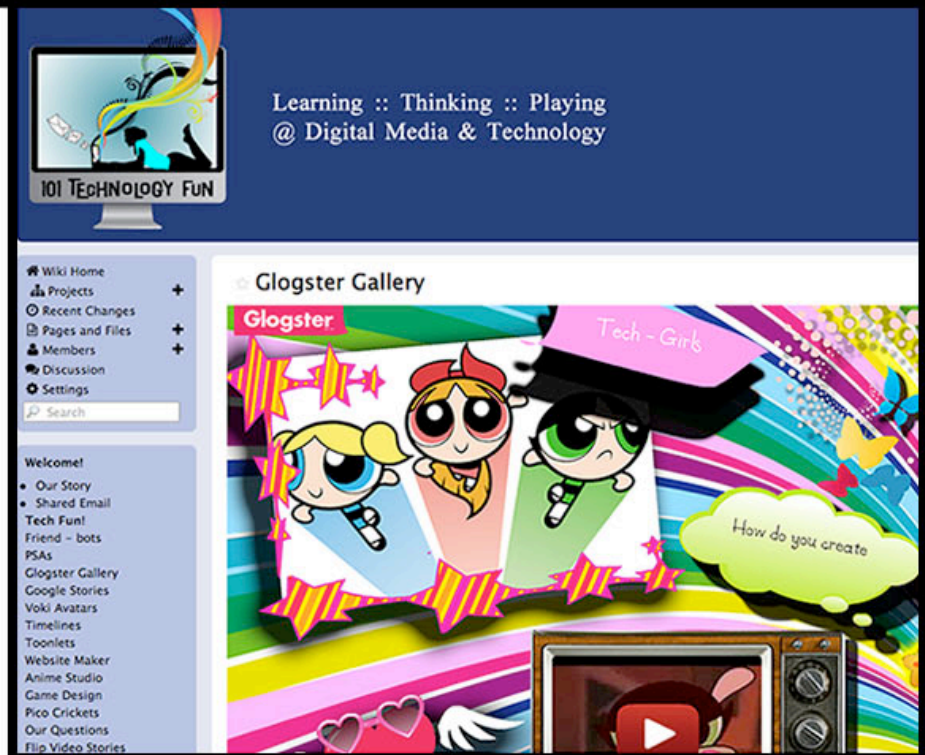
Artifact 89. 101 Technology Fun Wikispace
[www.101techfun.wikispaces.com]

APPENDIX A: VANCOUVER SCHOOL BOARD LETTER OF APPROVAL

Vancouver School Board

School District No. 39 (Vancouver)
ASSOCIATE SUPERINTENDENT
1580 West Broadway
Vancouver, B.C. V6J 5K8

May 2, 2011

P. J. Rusnak
Department of Curriculum and Pedagogy
Faculty of Education, UBC
2125 Main Mall
Vancouver, B.C. V6T 1Z4

Dear P.J. Rusnak,

RE: Learning Thinking Playing @Digital Media and Technology

Thank you for your research proposal "Learning Thinking Playing @Digital Media and Technology".
On behalf of the VSB Research Committee please accept this letter as approval for you to complete
your research in Vancouver schools. You have permission to contact parents and students in the
Vancouver district. We request that you contact the Principal at the school first and provide them with
a copy of this letter.   Please note that teachers and administrators are very busy with many obligations
and that schools have the right of refusal to participate in any research studies. Also, the Vancouver
School District does not find subjects for researchers.

The VSB Research Committee would be very interested in learning of your results and its implications
for students. When your research is completed please send us an abstract of the results.

Thank you for focusing your work within the Vancouver School District. I wish you the best of luck
as you proceed with your inquiry.

Sincerely,

Dr. Valerie Overgaard, Associate Superintendent
Learning Services

2011 SUMMER CAMP

Student Information

Participant Name: _____

Parent/Guardian Name: _____

Address: _____

Phone Number: _____

E-mail Address: _____

Participant Birthday: _____

Emergency Contact

Emergency Contact Name 1: _____

Emergency Contact Phone 1: _____

Emergency Contact Name 2: _____

Emergency Contact Phone 2: _____

Medical Information

List any medications used by participant: _____

List any medical conditions or allergies: _____

Family doctor (optional): _____

Doctor phone (optional): _____

BC Care Card #: _____

Summer Camp Dates

Program is scheduled 9:00 – 3:30 (supervision is available until 5pm)
Please choose only one week:

☐ July 18–22
☐ July 25–29

In a few sentences, please tell us why you want to participate in this summer camp.

_____

_____

_____

_____

_____

_____

_____

_____

More information: www.101technologyfun.com

Submit your completed application form to: www.101technologyfun.com

Alternatively, mail your completed application to:

PJ Rusnak
101 Technology Fun Team Supervisor
Faculty of Education, EDCP
University of British Columbia
Scarfe Building, 2125 Main Mall
Vancouver BC, V6T 1Z4 Canada

APPENDIX C: LETTER OF INVITATION AND INFORMATION

University of British Columbia
Department of Curriculum & Pedagogy

Letter Of Invitation And Information
How We Learn (Technology Across the Lifespan)

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18 July 2011

101 TECHNOLOGY FUN RESEARCH STUDY

Your child is invited to participate in a research study of how children interact with media and technology, including robotics, digital devices and electronic games. We are interested in the cognitive demands of these technologies. This study addresses learning over time and the total time necessary for children to participate in the study is approximately 6 hours per day for five days.

The aim of this letter is twofold. First, it describes the purpose and method of the research study. Second, it requests that you agree, in writing, to allow your child to participate in the study. Please indicate your decision on the attached *Assent Form*.

This study addresses learning over time and will be primarily based on observation of your child's interaction with learning and technology. Simple interview questions about these interactions will be asked of your child. Additionally, your child will have the opportunity to ask research questions (refer to the attached Interview Guide). Parents are welcome to attend any and all of the interactive technology fun activities and/or interview sessions.

Results of this research will be used in graduate theses and we intend to publish the findings of the study in professional journals and report them at conferences. At no time will the actual identity of the participants be disclosed. Participants will be assigned pseudonyms and these only will be used in publications. We will maintain the strictest levels of protocols towards any and all information revealed in confidence. Agreement on your part in no way obligates your child to remain a part of the study. Participation is voluntary, and you may choose to withdraw from the study at any time.

If you have any questions or desire further information with respect to this study, you may contact Dr. Stephen Petrina. If you have any concerns about the treatment of children or rights as a research subject, you may contact the Research Subject Information line in the UBC Office of Research Services.

Thank you for your interest in this study.

Sincerely,

Dr. Stephen Petrina

APPENDIX D: PARENT/GUARDIAN ASSENT FORM
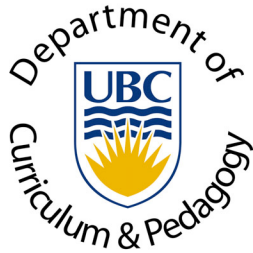
University of British Columbia
Department of Curriculum & Pedagogy

Parent/Guardian Assent Form
How We Learn (Technology Across the Lifespan)

Investigators
The principal investigator for this study is Dr. Stephen Petrina, a member of the Department of Curriculum Studies. This research will be used for graduate theses of Mirela Gutica, Peter Halim, Lauren Hall, Juyun Kim, Dai Kojima, PJ Rusnak, Fareed Teja, Lana Trey and Yifei Wang, students in the Department of Curriculum & Pedagogy, Faculty of Education.

Study Purpose and Procedures
The purpose of this research is to provide an understanding of how children interact with media and technology, such as robotics, digital devices and electronic games. We are interested in the cognitive demands of these technologies. This study addresses learning over time and the total time necessary for children to participate in the study is approximately 6 hours per day over a period of 5 days.

Confidentiality
The child's identity will be kept strictly confidential. All documents will be identified only by code. Physical hard copies will be kept in a locked filing cabinet. Electronic copies will be encrypted and protected by password. This data will be kept in the research office in the Neville-Scarfe building on the UBC campus and will be accessed only by research team members.

Contact Information
If you have any questions or desire further information with respect to this study, you may contact Dr. Stephen Petrina. If you have any concerns about the treatment of children or rights as a research subject, you may contact UBC Office of Research Services.

Assent
Your child's participation in this study is entirely voluntary and you may refuse to participate or withdraw from the study at any time. Visual data analysis will be conducted only with your assent or consent of the use of photos and video clips. Please use the attached form for providing assent for the use of images or visual data.

Signature   **Date**

Printed Name of the Parent/Guardian signing above

APPENDIX E: PARENT/GUARDIAN RELEASE FORM

University of British Columbia
Department of Curriculum & Pedagogy

Parent/Guardian Release Form
How We Learn (Technology Across the Lifespan)

I hereby authorize my child's participation in this *101 Technology Fun* (UBC Gaming and Robotics Camp). I know of no physical or mental problems that may affect my child's ability to safely participate in this Camp. By signing this document, it is my intention to exempt and relieve UBC, its instructors and employees, agents and servants from any and all liability for personal injury. I am aware that UBC does not provide medical/accident insurance for the enrolled participant and I understand that the responsibility to arrange such insurance, or to otherwise cover any medical costs, is mine.

I hereby authorize the staff of the *101 Technology Fun* to act on my behalf in the case of illness or injury involving my child. I agree that UBC and/or its instructor(s), agents, employees, servants or any of them, shall not be held liable for any injuries or damages which may arise out of the Camp's activities, regardless of cause, unless such injuries or damages result expressly from the sole negligence of UBC and/or its instructor(s), agents, employees and servants while acting within the scope of their duties.

Student's Name (please print)_____

Age_____

Parent or Guardian's Name (please print)_____

Phone Number_____ **Email Address** _____

Emergency Contact_____

_____   _____
Signature of Parent/Guardian   **Date**

APPENDIX F: VISUAL ANALYSIS ASSENT FORM

University of British Columbia
Department of Curriculum & Pedagogy

Visual Analysis Assent Form
How We Learn (Technology Across the Lifespan)

USE OF IMAGES (PHOTOS OR VIDEO SEGMENTS)
FOR RESEARCH AND PRESENTATION

Principal Investigator:
Dr. Stephen Petrina, Professor
Department of Curriculum & Pedagogy
University of British Columbia

Co-Investigators:
Mirela Gutica, Peter Halim, Lauren Hall, Juyun
Kim, Dai Kojima, PJ Rusnak, Fareed Teja,
Lana Trey, Yifei Wang

Purpose:
The purpose of this research is to provide an understanding of how kids learn technologies such as robotics, digital devices and electronic games. We are interested in the cognitive demands of these technologies. This study addresses learning over time and the total time necessary to participate in the study is approximately 6 hours per day over a period of 5 days.

Assent:
Your signature here means that you assent to appropriate use of images of your child for research and presentation associated with this project. Your child's participation in this study is entirely voluntary and you may withdraw from the study at any time. Visual data analysis will be conducted only with your assent of the use of photos and video clips. Please use this form for providing assent for the use of images or visual data in this research.

Please check the box indicating permission:
I will have the opportunity to review and approve all of the photographs or videotape segments of my child before they are used in any research reports and/or communications about this project and

❏ I CONSENT to the use of photographs or videotape segments to document my child's learning.

❏ I DO NOT CONSENT to the use of photographs or videotape to document my child's learning.

Student's Name (please print)_____

Student's Parent or Guardian's Name (please print)_____

Signature_____ **Date** _____

APPENDIX G: iLIFE DIARY ACTIVITIES

iLIFE ACTIVITIES	TIME	FEELINGS/MOODS/MOTIVATIONS
1. eating		
2. sleeping		
3. grooming		
4. playing music		
5. playing sports/exercise		
6. reading books/zines		
7. drawing/making art		
8. cleaning room/chores		
9. doing things with family		
10. doing my own thing		
11. hanging out with my friends in real life		
12. hanging out with my friends in virtual life		
13. watching tv/YouTube		
14. listening to music		
15. texting/talking on phone		
16. socializing on Facebook		
17. playing videogames		
18. editing movies/images		
19. other		
20. other		
21. other		

iLife Diary Activities, Feelings, Moods, and Motivations

Please estimate the minutes or hours that you spend on each activity per day. Draw or write about your feelings, moods, and motivations.