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Conceptualizing Learning from the Everyday Activities of Digital Kids

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Abstract

This paper illustrates the intensified engagement that youth are having with digital technologies and introduces a framework for examining *digital fluency* – the competencies, new representational practises, design sensibilities, ownership, and strategic expertise that a learner gains or demonstrates by using digital tools to gather, design, evaluate, critique, synthesize, and develop digital media artifacts, communication messages, or other electronic expressions. A primary goal of this paper is to identify promising perspectives through which learning is conceptualized, and to share the methodological challenges in investigating digital fluency in both individual and collaborative learning activities that take place in complex naturalistic settings and socially-constructed online worlds. A review is provided of the current and prospective research methods that researchers use to capture, document and study the compelling ways in which children and young people are using digital technologies such as Information and Communication Technologies (ICTs), social networking software, video games, multimedia authoring tools, and mobile phones in everyday life to learn and play. The paper argues for a need to study the authentic, inventive, and emergent uses of digital technologies and interactive learning environments among youth to contribute to advancement of theories of everyday learning and to build a deeper understanding of how learning occurs in out-of-school settings from a practise-oriented perspective rather than

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2
3 a knowledge-centred one. Implications for instructional practise are also discussed in
4
5 addition to ethical and pragmatic issues that will need to be addressed in the study of
6
7 digital kids.
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10 11 12 **Introduction – Vignette of a Digital Kid** 13

14
15 This vignette¹ featuring a twelve-year old boy and thirteen-year old girl is provided so the
16
17 reader can gain common footing to illustrate the intensified engagement that takes place
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19 between youth, digital technologies, and online environments, as well to demonstrate the
20
21 complexity of activities and relationships involved in conceptualizing learning in out-of-
22
23 school learning contexts.
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28
29 James is a twelve-year old boy who first learned how to use a personal desktop computer
30
31 when he was two years old. Having grown up with a home computer with multimedia
32
33 story book CD-ROMs designed for early literacy and other commercially available
34
35 educational software (e.g., Reader Rabbit™, KidPix™, Oregon Trail™), James is
36
37 familiar with different genres of digital-based experiences: adventure games, drawing
38
39 tools, information search, and online reading. James is an example of a *digital kid*, an
40
41 avid consumer of traditional media, electronic games, and web-based information
42
43 (Oblinger, 2003). When James was ten years old, multi-user web sites such as Whyville
44
45 (www.whyville.net) and Neopets (www.neopets.com) were available on the Internet for
46
47 children. These play-based activity spaces allowed children to play online games, text
48
49 chat with other children, win virtual tokens, and purchase virtual prizes depicted as
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56
57 ¹ This vignette is based on direct observations made by the researcher of youth in homes, museums, and
58
59 conversations with parents of digital youth.
60

1
2
3 everyday objects – face parts, pet food, snacks, or clothing (Foley & Kobaissi, 2006). In
4
5 these online spaces, text messages are exchanged with other online participants who
6
7 happen to be in the space at the same time, and virtual objects can be traded with other
8
9 community members. James is no stranger to authoring online content. Using the built-in
10
11 web editor in Neopets, James learned how to create basic web pages and customize the
12
13 appearance of the online environment. He regularly looks for songs on the Internet and
14
15 downloads them so he can listen to them while doing other online activities. Outside of
16
17 school, if no parental restrictions or limits are placed on time, James uses the computer
18
19 before and after school to play online games and chat with friends during the game
20
21 playing. His daily routine involves checking electronic mail on ‘MyYahoo’, playing
22
23 online adventure conquest games, chatting with friends via text messages, printing out
24
25 typed homework assignments, and emailing his assignment to his teachers. His mobile
26
27 phone is used as an appliance to help him accomplish daily tasks – finding out what time
28
29 it is, looking up bus schedules, and calling parents and friends to arrange meetings and
30
31 transportation around town. He also uses his mobile phone for entertainment, playing
32
33 games, taking photos, and sending to and receiving messages from his school friends. He
34
35 made the mistake of giving his mobile phone number to a girl at school who now sends
36
37 him text messages over five times a day, sometimes during school hours. James is not
38
39 unlike other young people in the UK and in Japan that use an embedded digital camera on
40
41 a mobile phone to annotate a photo they have taken, communicate via text messaging to
42
43 show their physical location, socialize, and make plans to meet friends (Kindberg,
44
45 Spasojevic, Fleck, & Sellen, 2004; Ito, 2004). New media tools enable James to create a
46
47 broad range of personal expression and to share these digital expressions with a wider
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3 audience, who in turn, take his original ideas and work, and create shared expressions in a
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5 variety of new and unexpected ways.
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10 Being in the US, James gains access to the Internet via a computer at school, in the public
11
12 library, and via a shared family computer at home. Like the other 44% of teens in the US
13
14 (Lenhart & Madden, 2005; Lenhart, Madden, & Hitlin, 2005), James owns multiple
15
16 personal media devices including a mobile phone and a Nintendo Gameboy™. Both
17
18 devices have games and ways to communicate wirelessly via text messaging with other
19
20 players. His preferred activities include simultaneously watching television while
21
22 browsing the internet from a home desktop computer to stay connected with online
23
24 friends and research personally-meaningful information such as clues to adventure
25
26 games, strategies to game play, or to review popular songs (e.g., MP3s) available for
27
28 online purchase.
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34
35 James' friend, Sarah is 13, and also spends time playing online games on her family's
36
37 home computer, but she prefers to spend more of her leisure time socializing with her
38
39 school friends via text messaging and building her web profile in MySpace.com, an
40
41 online social networking space, in which Sarah can create an online identity and describe
42
43 her likes and dislikes for certain music, foods, as well as describe of how she would like
44
45 others to perceive her online. These features are typical of online social identity spaces
46
47 (Donath & Boyd, 2004.) Her web profile featured in the software also allows Sarah to
48
49 publish her favorite website links and post them as a collection of bookmarks that reflect
50
51 her interests and preferences, providing another way for others to view her online identity
52
53 and learn about her interests. Her daily routine involves logging into an email programme
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3 immediately upon coming home after school and chatting with friends online to stay
4
5 connected with her circle of school friends. While she uses Internet tools such as an
6
7 online translation programme to complete her Spanish homework, Sarah's primary use of
8
9 the Internet is to have informal conversations with her peers.
10
11

12
13
14 Both James and Sarah choose to spend their time in recreational online activity spaces.
15
16 James and Sarah are typical of most digital kids that use digital technologies for leisure to
17
18 play games (Gee, 2003). They have mastered the technical and online colloquial
19
20 vernaculars such as 'side-scrolling', 'faqs', 'brb', 'ttyl', 'AFAIK', 'cheats', and 'mods'
21
22 are used in their everyday language. One massive multi-user role-playing game that
23
24 Sarah and Jamie enjoy is one where they can select a job from a list of professions (e.g.,
25
26 cross bowman, cleric, blacksmith, etc.) and see how well they can make a living in an
27
28 online virtual village. Players are rated on attributes such as strength, dexterity, fame,
29
30 intelligence, and luck in the online community by other online players. Progress in the
31
32 game is based upon accumulating virtual tokens, experiences gain while accomplishing
33
34 specific job-related tasks, as well as receiving performance ratings by other players in a
35
36 complex system of reputation-building, decision-making, and resource management that
37
38 characterize the game. Feedback on and assessment of Sarah's and James' performance
39
40 in the game, given by the game system as well as other online players that mentor their
41
42 progress, is immediate and relevant to the task they are carrying out, and the outcomes
43
44 allow players to make informed decisions about the next level to achieve.
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54 James and Sarah both represent a new generation of children and young people
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56 sometimes called "millennials" that have grown up in a digital, electronic, and 'wired'
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2
3 world since the invention and spread of the Internet and the World Wide Web, (Murray,
4 1997), and the growing ubiquity of wireless mobile networks (Brown, 2000). They not
5 only use digital tools as part of their everyday routine activities to support
6 communication, school assignments, way finding around town, and play, but also use
7 ICTs, multimedia software, and authoring tools to rapidly create and exchange
8 personally-meaningful messages, custom tools, and digital media artifacts across
9 distributed social networks and online communities (Cheskin, 2004). In 2002, more than
10 78% of children between the ages of 12 and 17 were online in the US, growing to 87% in
11 2005 (Lenhart, Madden, & Hitlin, 2005). In the UK, 41% go online on a daily basis
12 (Livingstone & Magdalena, 2004) and 90% of young adults own mobile phones
13 (Crabtree, Nathan, & Roberts, 2003). According to van Schie and Wiegman (1997) an
14 average of seventy percent of Dutch children in the 7th and 8th grades had played
15 electronic video games out-of-school in a given week (75% boys, 63% girls) and
16 comparable results were found throughout Europe and North America (Goldstein, 1994).
17 As early as 2001, 95% of the 15-24 year olds in Japan owned web-enabled mobile phones
18 (Thorton & Houser, 1994). While Internet and online media use are more commonly
19 documented and researched during school hours and in formal settings, one would expect
20 even more use to occur outside of school hours among children in the middle class given
21 that children have more free time and opportunities for technology access through
22 libraries, homes of friends, and Internet cafes.
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53 Popular books titled 'Don't worry mom, I'm learning!' and 'Everything Bad Is Good for
54 You: How Today's Popular Culture Is Actually Making Us Smarter' argue in favor of
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technology-based interest-driven activities and play with technology, especially digital-based video games, because they benefit development and learning (Prensky, 2006; Johnson, 2005). Yet, a large societal concern exists among adults including parents, school administrators, education policy makers, and teachers alike that this engagement with and attraction to media and digital-based ways of playing are actually interfering with children's development, health, and schooling, influencing social behaviour, and consequently distracting youth's attention away from learning new content, participating in civically-minded activities, and acquiring future workplace skills. The possibilities of Internet addictions, gambling, cyber bullying, online thefts, and exposure to pornography, are some of the many risks posed by engaging in networked digital technologies (BBC Online, 2006; Children's Partnership, 2005; Kaiser Family Foundation, 2005; Keith & Martin, 2005; Thornburgh & Lin, 2002). Teachers have also reported that participation in online activities such as games and online chat communities promote and further unwelcomed student behaviours, such as distraction from school assignments, disenfranchisement from society, and other problems that plague youth's development. Within the noise of conflicting opinions, how do citizens, especially educators, make sense of the role and use of digital technologies in the lives of youth?

With the demands for greater accountability, evidence-based research, and data-driven decision making in education, what research and usable knowledge is available to education practitioners and the public that demonstrates the value of learning that involve digital-mediated environments in out-of-school settings? To date, there has been no systematic longitudinal study of kids' cumulative experience with digital media from

1
2
3 childhood to adulthood, nor understanding of the cumulative effects of digital media
4 upon cognition, learning, and development (Lyman et al., 2005). Given that future
5 scientists and engineers will likely come from this current and future generation of digital
6 kids who are spending more time out-of-school engaged in online play, it will be
7 important to understand the impact and relationship between digital play, formal learning,
8 and science education generally. Moreover, the study of the everyday activities of digital
9 kids has the potential to contribute to the advancement of theories of everyday learning
10 and to build a deeper understanding of how learning occurs in out-of-school settings
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24 **Framing Everyday Activity as Digital Fluency**

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26 Using a frame of *digital fluency*, one can begin to describe the new practises that a
27 learner gains or demonstrates by using digital tools to gather, design, evaluate, critique,
28 own, synthesize, and develop digital media artifacts, communication messages, or other
29 electronic expressions. This is not to be confused with computer literacy or definitions of
30 technological fluency that are typically associated with mastering computer productivity
31 skills, manipulation of electronic data and applications, and assessment of those skills for
32 workforce preparation purposes. This extends prior information technology fluency
33 frameworks (i.e., access, manage, integrate, evaluate, critique, create, communicate,
34 assess) to frame fluency as constructing new representational practises, design
35 sensibilities, ownership, and strategic expertise gained, taking a practise-oriented
36 perspective rather than a data, information, or knowledge-centred perspective. While
37 digital kids may be learning disciplinary content during their play, this is not their main
38 goal when engaged in these activities. A digital fluency framework recognizes that
39 learning is voluntary participation in a complex and distributed system of people,
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3 settings, objects, and interactions, but given the electronic medium, differs from standard
4
5 conceptualizations of an activity system in important ways. Digitally fluent youth
6
7 demonstrate and become more expert in the following practises:
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- 10
11
12 • Digital kids *build on their own skills and knowledge*, and that of other
13
14 participants, enabling them to reason from their own experience and create new
15
16 ones. In the case of James and Sarah, what they learn, in part, is gleaned from
17
18 their peers and available online information.
19
- 20
21 • Digital kids *take on different identities and multiple roles* – James and Sarah
22
23 choose different online representations of themselves in online profiles or as
24
25 avatars and choose which information they want presented to others.
26
27
- 28
29 • Digital kids *voluntarily spend time* working on a set of technology-based skills
30
31 and becoming fluent in them over time. James and Sarah do not always use
32
33 computers to learn how to type using typing software programmes with the
34
35 primary intent of learning how to use technology, but are immersed in games and
36
37 activities that are meaningful and authentic to them, and require typing skills to
38
39 accomplish their goals. With respect to settings, learning occurs not only in a
40
41 physical context, but also in a virtual context that is dynamically created by the
42
43 participants through continual interaction in the space. An ad hoc social network
44
45 is formed with others that sometimes share a common goal or interest. The
46
47 common ground of learning is continually shifting as actors move from one
48
49 location to another, gain new resources, or enter new conversations.
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- 52
53 • Digital kids are *co-constructing a social reality and establishing norms*
54
55 *for participation*. Digital kids are concurrently developing online practises of
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2
3 multi-tasking, judging online information based on social reputation, comparing
4
5 multiple online information sources, and trying out new online identities (Dede,
6
7 2005). These online practises are fluid and emergent given they are defined by the
8
9 participants online. As part of this social reality, learners participate in transient
10
11 online communities. The distributed members of the community are constantly
12
13 changing – James and Sarah can be engaged in an online game with other online
14
15 participants for several months, but yet easily abandon that community for
16
17 another more engaging or popular one.
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- 22 • Digital kids take *ownership of media creations and online expression*. Here,
23
24 ownership has blurry boundaries because of the distributed nature of how
25
26 electronic media is easily created and exchanged via the Internet. Digital kids
27
28 often embrace remix culture to produce meaning through the creation of objects,
29
30 messages, representations, and other online expressions based on the re-use of
31
32 other electronic expressions.
33
34
- 35 • With respect to objects and representations, digital kids consume multimedia that
36
37 was created by others and created by themselves, engaging in ‘two-way literacies’
38
39 in cultural production of knowledge (Ito, 2005). Digital media production tools
40
41 and free web-based authoring tools are enabling youth to create multimedia
42
43 stories, join online hobby communities, and create personally meaningful virtual
44
45 objects in 3D online worlds, using not only text, but images, video, and other
46
47 media. The digital objects created are dynamically changing in their
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49 representations as they are created and changed by online learners.
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- Digital kids demonstrate fluency by simultaneously operating and managing multiple devices and multiple media types including cell phones, the Internet, and television. This multi-tasking behaviour and attention switching is common.
- Digital kids *work on complex problems* that require *distributed teams* to solve. In the video games that James plays, he engages resources and expertise provided by other online players as well as develops new game strategies.

This beginning framework for digital fluency can help organize the contemporary practises of digital kids to systematically study the design and affordances of activity spaces to support digital youth experiences, meaningful play, and youth development.

Theoretical Perspectives on Studying Digital Kids

To study digital fluency among youth, various approaches and theoretical frameworks can be used, drawn from decade long developments in science education, developmental psychology, anthropology, and social cultural studies. These frameworks range from examining individual development of cognition and intellectual capacities (NRC, 1999), literacy, language development, skill acquisition, and disciplinary content learning to examining interpersonal relationships, whole activity systems, and situated communities of practise.

While researchers from different disciplinary traditions are conceptualizing learning from multiple perspectives, the framing of learning by digital kids' learning from a social cultural and play perspective appears to offer a promising approach.

Play in New Cultural Worlds

One perspective is to conceptualize the actions of digital kids as a form of play, examining the characteristics and types of play that is self-initiated, inventive, and spontaneous (cf. Hutt, 1973; Hyder, 2004) and the agency, intentionality, and seriousness with which young adults take on play-like activity or 'deep play' (Geertz, 1973). Extensive studies have been conducted on children at play and the ways that play contributes to cognitive, language, and social development that can be applied to the study of online environments. For example, digital kids are developing competencies in goal-oriented tasks such as those required of online games or simulations, and appear to learn and practise decision-making and important life skills. Prior research on child development, language development, and the prevailing social practises that children engage in as they participate in the formation of new cultural worlds and systems of activity (Corsaro, 2003; Nesper, 1997; Kyratzis, 2004) could also contribute to understanding youth development in digital learning environments. This perspective specifically helps us understand the cultural worlds and practises that children and youth constitute and manage for their own purposes. The aforementioned 'play' image is consonant with this image of technology-mediated, self-constituted culture. It is an alternative to some views of technological fluency that presume that youth should only or primarily are socialized into the established technological practises of adults (e.g., skills associated with workplace competence). An increasing number of studies help confirm the perspective that new technologies serve an important developmental function in the formation of youth microcultures (e.g., specialized online communities (Egan, 2000)) or

1
2
3 practises in using mobile phones (Ito, 2004; Kasesniemi & Rautiainen, 2002) that first
4
5 and foremost serve the interests and needs of youth.
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7

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9 Part of play has also been associated with opportunities for role-playing and identity
10 formation activities – the experience of exploring and trying on alternative identities and
11 gender swapping (Turkle, 1999). With the open system architecture of new video games,
12 personal expression, invention of new characters and adopting multiple identities (e.g.,
13 avatars, names, costumes, play objects, worlds) are possible. Because online
14 environments collapse certain physical boundaries in which learning and interaction
15 occur, one lens to view activity is from a cultural geographies perspective. This approach
16 considers children's shifted negotiations of space and time (Green, 2002; Holloway &
17 Valentine, 2000). In cognitive studies of digital literacy, the specific representations that
18 learners create including their annotations, interpretations, and the reasoning behind them
19 can also be examined (c.f. DiSessa, 2000). The digital environment provides unique
20 opportunities to capture the inscriptions, digital artifacts, and persistent representations
21 created by youth and examine these over time.
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42 **Socio-Cultural Views of Digital Fluency**

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45 Given that many of these online and digital-based youth activities take place in
46 collaborative spaces between peers and groups, socio-cultural views of learning that draw
47 upon activity theory, situated learning, and theories of distributed cognition are useful
48 and promising approaches for examining the social networking, game play, identity
49 formation, and collaborative practises in communities that are central to conceptualizing
50 learning and activity of digital kids. Socio-cultural approaches allow comparisons of
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3 learning activity between settings with levels of activity ranging from a micro-genetic
4 level to the cultural influences of whole institutions (Engelström, 1996). Social cultural
5 researchers are also studying the physical and human resources offered in a situated
6 context and the access to these resources to better understand the interests and
7 experiences of learners with different kinds of computing uses in an ‘learning ecology’
8 (Barron, 2004)
9

19 *Social networking*

20
21 Because social cultural perspectives emphasize examining cultural linguistics, language
22 development, and discourse practises, researchers of digital kids study the conversations
23 and social exchanges that takes place in online spaces such as online bulletin boards, text
24 chat screens, online diaries such as ‘blogs’, as well as in the physical spaces and
25 interactions among children in groups that gather around a screen, electronic media, or
26 networked technologies. Learning is, thus, not seen as the acquisition of knowledge by
27 individuals so much as a process of social inclusion, social participation, and engagement
28 in the communication practises of a community. To understand a social network,
29 researchers can examine who a learner considers a friend and the ways in which an
30 individual becomes of legitimate member of a group or online community of practise (cf.
31 Wenger), his or her intent participation in a community (Rogoff, 1996; 2003), how
32 “repertoires of practise” form among them, and how language develops within a group of
33 participants Guttierez, 2002). For example, the practise of argumentation as one form of
34 discourse in a community of learners is being studied across multiple contexts of
35 everyday science (Bell, Bricker, Lee, Reeve, & Zimmerman, 2006).
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Game play and games research

The context of online games to study learning has recently been capturing the attention of researchers and educators. Because of their motivational hold on youth from compelling narratives, activity structure, scaffolding, dynamic feedback, high quality imagery, and collaborative nature, electronic game playing is seen as a possible venue for understanding how to create engaging learning environments and how to prescriptively design technology-mediated activity spaces and other games for education (see Barab, Warren, & Ingram-Goble, 2006; Gee, 2003; Mitchell & Savill-Smith, 2004). Digitally-based environments provide multi-generational spaces where dominant and non-dominant groups together can gather to engage in participate in online learning communities, engage in collaborative problem solving, craft situated identities, and form new identity groups (Steinkuehler & Chmiel, 2006). Researchers, social scientists, and philosophers of education are studying language, representations, and collaborations that take place in massively multiple player online role playing games (e.g., World War Craft, City of Villains, Civilization III), and in specific cases, designing online game environments for the purposes of study learning, discourse, and development (Gee, 2003; Squire and Jenkins, 2004) Game and literacy researchers like Gee find that well-designed video games support and embody important learning principles that can contribute to the design of other motivating learning environments (Gee, 2003). Games encourage the players to experiment with different ways of learning and thinking, necessarily situating learning in a social and cultural world. Online games are also effective learning environments in that they present complex problems to solve, often require collaboration to make progress, and provide scaffolding in the game design for active construction of

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3 knowledge. Rather than focusing learning “content” in game or worrying about what
4
5 kinds of content (good or bad) people are learning with video games, Gee argues that
6
7 what they are doing is often good learning. The learning potential comes from the actions
8
9 and decisions made by the player in a complex system of resources, social interactions,
10
11 negotiations, and spatial navigation. Game expertise has been linked to the behaviours
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13 such as self-monitoring, problem-solving, principled decision-making, qualitative
14
15 thinking, and superior short and long-term memory (VanDeventer & White, 2002).
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20 21 22 *Online Identity Development*

23
24 Youth can self-define their online personae or identities through different pictures,
25
26 narratives, symbols, and other representations, as well as through their online interactions
27
28 and behaviours. Most teens use different screen names and many pretend to be different
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30 people (Lenhart, Rainie, & Lewis, 2001.) Identities can form through the creation of
31
32 personal profiles listing friends, professional contacts, favorite websites, image
33
34 collections, and other personally-meaningful digital information. Race, gender, and
35
36 economic status which can be self-defined or made anonymous, no longer become
37
38 important markers of status in a community, but instead other attributes are valued such
39
40 as serving as a knowledgeable and accurate source of information, possessing a skill level
41
42 in an online game, or having a reputation of being helpful amongst others in an online
43
44 community. By examining the symbols, representational choices, and electronic
45
46 discourse, one can gain insights into the identity formation and development of youth and
47
48 their social relationships to others. To better understand the social phenomena of online
49
50 identity creation, specialized interactive online environments have been created to
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2
3 specifically study the construction of online identities especially among youth in informal
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5 setting (Bers, 2001.)
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9
10 Identity can be argued as an important lens for studying digital fluency. Because online
11
12 identities are self-defined and constructed online through representations that user
13
14 selected which can be different than their physical appearance, they often provide another
15
16 way to examine how youth develop views of self, society, gender, and race.
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18

19 20 21 **Methods and Tools for Studying Digital Kids** 22

23
24 Communications networks, whether organized by the mobile phone or the Internet, are
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26 changing the scale, national boundaries, institutional rules, scope and dynamics of kids'
27
28 social worlds and activities. The notion of studying learning in a given setting will
29
30 require expanding to include these virtual spaces and new geographies. Settings,
31
32 interactions, social relationships, media messages, practises, and conversations made by
33
34 digital kids are intertwined with digital media and digital technologies. If the activities of
35
36 digital kids are conceived as new distributed systems of activity and the creation of new
37
38 social cultural practises, methods used to study them will require innovative and
39
40 progressive approaches that leverage multiple mixed-methods, computationally-based
41
42 data collection tools, and comparative analyses. Table 1 provides a categorization of
43
44 common and innovative methods being used to study digital youth: quiet capture, active
45
46 elicitation, and cooperative inquiry. Quiet capture methods include both
47
48 computationally-based and qualitative approaches to document the interactions of digital
49
50 kids as they use online technologies. For example, web traffic software can be used to
51
52 capture 'click stream' data: keystroke interactions, the duration of webpage visits,
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3 frequency of use, and the popularity of frequented websites by using “cookies”, a piece
4 of code that is downloaded to the user’s machine and scripted to collect specific data.
5
6 Clickstream data shows which keys were typed, which pages of a computer programme
7
8 were visited and in what order, as well as how long the user remained at each page.
9
10 Commercially available software installed on a youth’s personal computer (e.g.,
11
12 SpectorSoftware, TypeRecorder™) can be configured to capture digital images of the
13
14 whole computer screen every few seconds without interrupting the activity of the learner.
15
16 Similarly, a computer-based tool called Morae™ can be used to continuously record a
17
18 computer screen, while also capturing the facial expressions and utterances of the
19
20 participant via digital video capture. New pen-based capture systems (e.g., Anoto Pen)
21
22 used on regular paper to capture and record inscriptions are another approach (see
23
24 Maldonado, Lee, & Klemmer, 2006). Quiet capture approaches have the benefit of not
25
26 interfering with the activity of the participant, but also require consent by the research
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28 participant, and can create issues related to data reduction and shared interpretations of
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30 practise.
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41 A second category of methods, referred to as active elicitation shown in Table 1, involves
42
43 the researcher conducting clinical interviews, structured tasks, and tests with youth users
44
45 – normative practise in cognitive studies and science education research. The value in
46
47 active elicitation is needed validation of quiet capture data methods, though because this
48
49 typically takes place in controlled or lab settings, the research data can only speak
50
51 indirectly to learning as it occurs in everyday settings. In addition to analysing the verbal
52
53 talk of digital kids, their typed messages, user-created graphic annotations, and media
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3 work products can be examined in the context of actions made in the online environment
4
5 using tools like Progress Portfolio that allow learners to take digital snapshots of their
6
7 computer screens (Loh, Radinsky, Reiser, Gomez, & Edelson, 1997).
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12 A final category of methods includes what can be referred to as “cooperative inquiry”
13
14 approaches to research, which necessarily engages youth to voluntarily participate in the
15
16 data collection about themselves and/or others. For example, design researchers at the
17
18 Art Center in Pasadena interviewed eleven pairs of “tweens” between the ages of 10 and
19
20 12 asking youth to photograph events or objects that were of significance in their life
21
22 which included their rooms, backpacks, friends, family, and daily activities (Art Center
23
24 College of Design, 2004), (cf. Brenda Laurel.) The data that resulted was a mix between
25
26 digital story telling and an online diary, providing insights into what was important in the
27
28 lives of these kids. The use of diaries is another approach to gathering data about the
29
30 conversations and activities of digital kids. Parents can participate as researchers by
31
32 keeping diary reports to document the questions raised by their children in everyday
33
34 activities (Callanan & Oakes, 1992). Online diaries can be embedded in the flow of
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36 online activities to periodically prompt a participant to enter in learning moments or
37
38 events that are meaningful to the participant (Vavoula, 2005).
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48 Computer scientists from the human-computer interaction field have created ‘technology
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50 probes’, an online data collection tool in the form of an online ‘pal, an avatar
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52 customizable by children (Druin, 2002; Hutchinson et al., 2003). By examining how the
53
54 children choose to design their online avatar and what they tell their avatar during a play
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3 activity provides insights into the child's design process. These approaches outweigh
4 active elicitation approaches, especially with younger children who have difficulty
5 articulating their learning and rationale for activity (Van Kesteren, Bekker, Vermeeren &
6 Lloyd, 2003; Dix, 2003). In a similar approach one uses a video camera that sits near the
7 participant. The participant is encouraged and coached to talk directly to the camera and
8 the camera becomes an audience for the designs being produced (Lamberty & Kolodner,
9 2005) Goldman-Segall has raised the issue of performing for the camera as a potential
10 distraction (Goldman-Segall, 1999), but in this method, talking to the camera is
11 encouraged and exploited as a feature. In a technique called Video Traces, research
12 participants who are visitors in museums interact with an exhibit while being videotaped.
13 After their interaction with the exhibit, visitors are asked to view the videotape of
14 themselves and further elaborate and provide insights into their thoughts and actions
15 (Stevens & Hall, 1997). Other innovative tools have been developed such as DIVER
16 which is used to understand not only individual activity, but whole activity systems and
17 situated contexts using multiple, coordinated digital video camera capture, and digital
18 video interaction analyses (Pea, 2006). The capture of whole contexts and practises
19 through a 'guided noticing tool' can help focus on relevant activities in order to study
20 activity in real-world spaces and leverage established interaction analyses methods (Pea,
21 2006; Jordan & Henderson, 1995). Another form of data capture involves the use of
22 embedded online assessments that are programmed to trigger a pop-up question at key
23 points in an online game or simulation (Owston, Kushniruk, Ho, Pitts, & Wideman,
24 2005).
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These cooperative inquiry research methods have the quality of allowing the participant to engage in research and design, and contribute to the collection and interpretation of data through their own activity and their own accounts. The advantages of engaging children as data collectors and curators of their own artifacts, knowledge, and insights is that data can be more easily collected in everyday settings, and carries the intentionality, authenticity, and perspective of the digital kids themselves.

Table 1: Overview of Methods used to Collect Data about Digital kids

Category	Approaches	Sample tools
Quiet Capture	"Cookies" Click streams (Log files) Screen capture, inscription capture Eye Tracking	WebTrends™ Spector Software TypeRecorder™ Morae™ Anoto™-based pens
Active Elicitation	Clinical interviews Verbal protocols and Talk alouds Sequestered tasks Test performance Design portfolios Ethnographic interview	Progress Portfolio
Cooperative inquiry	Self- reports Ethnography Technology probes Photo journal Participatory design Parent Diaries Digital Video Design informants Portfolios	Progress Portfolio VideoTraces DIVER Virtual Usability Lab

	Embedded online assessment	
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Challenges and Barriers to Research on Digital Youth

The study of everyday practises of digitally-mediated environments and digital kids presents rich opportunities to examine out-of-school learning and usable knowledge to help refine theories of learning and to help inform practitioners of the ways in which digitally-mediated technologies engage youth. However, because of the nature of activity that occurs largely out of the school classroom and/or out of formal institutional contexts, several challenges and barriers arise. Measuring educational progress is difficult because the goals for education are largely absent and/or there are no shared educational outcomes. A cultural tension continues to exist between institutional views of academic learning with the everyday learning that takes place among digital kids. Some promising work is being conducted to bridge the gap between kid's voluntary leisure activities and academic learning, examining closely the interactions of digital kids in online game play and the mapping of those interactions to standards of scientific literacy (Steinkuehler & Chmiel, 2006).

As literature reviews have found, defining what constitutes learning from informal settings is both conceptually and politically complex (FutureLab, 2004). When the majority of practise and interactions occur in complex settings outside the school classroom, and also take place in extended virtual social worlds across multiple physical and online settings, what counts as learning and the assessment of educational progress

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2
3 poses challenges for the researcher. More recently, multi-institutional and cross-
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5 disciplinary research initiatives and investments have been made to understand learning
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7 in informal settings and new systematic studies are being conducted to investigate
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9 learning that cuts across formal and informal learning contexts with a handful of studies
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11 that focus on digital cultures and fluency (Martin, 2004; CILS; NSF LIFE Centre;
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13 FutureLab). In addition, design-based learning sciences researchers are crafting play
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15 spaces that specifically leverage the features of informal play and gaming to support
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17 academic learning (Barab, Warren, & Ingram-Goble, 2006).
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24 Ideally, research should lead to sharable theories that can both advance an understanding
25
26 of everyday learning and also communicate relevant implications to education
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28 practitioners, however, a fragmented view of digitally-mediated learning exists and the
29
30 existing research based is far from coherent. Part of the fragmentation exists because of
31
32 the differences in deep-seated beliefs about how to define educational progress that can
33
34 reconcile classroom learning and schooling practises with everyday learning in digital
35
36 play. In addition, researchers from different disciplinary traditions are often working at
37
38 different levels of analyses and interaction, in some cases in absence of any learning or
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40 instructional theory, making it difficult to weave a coherent view that illuminates the role
41
42 that digital learning is playing in youth's lives. Researchers studying digital kids come
43
44 from fields that include communication and media studies, semiotics and literacy,
45
46 information technology, psychology, anthropology, women studies, and library sciences
47
48 to name a few. In constructing a learning framework to understand digital kids, there is
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50 also a limitation in viewing learning as simply communication or transmission of
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52 established knowledge from one peer to another, when children are concurrently
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3 inventing practises, tools, and online tool use in more short-lived time frames – youth
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5 practises are dynamic and shifting. Young people and children interact with media while
6
7 on the go with web-enabled mobile phones, ubiquitous Internet access, and technology
8
9 access in their learning landscape. Because learning is complex, mobile, and outside an
10
11 institutional context, experimental conditions and methods are not easily achievable.
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13 Alternative approaches, like design-based research (DBR, 2004; Bell, 2004) offer a
14
15 promising orientation towards examining emergent practises and engagement. With more
16
17 collaboration across disciplinary boundaries as well as concerted efforts by researchers to
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19 make explicit those theories and practises that are foundational to their work, there is
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21 some hope to making more coherent the current pluralistic views of digital learning and
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23 play.
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32 Research based on social cultural approaches will likely capture the complex features of
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34 this learning, but will require recognition that the context shifts in online environments,
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36 objects, and representations creating the need for innovative embedded computer-based
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38 methods and a willingness by learners to collect and interpret data through cooperative
39
40 inquiry with researchers. A risk in specifically creating environments to support learning
41
42 are the epistemological beliefs held by digital kids that educationally-designed software
43
44 has an agenda which is not their own and thus presents a barrier to authentic use.
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46 Reconciling the social priorities of youth with school culture and teaching agendas may
47
48 be difficult to achieve. Moreover, conceptualization of learning is typically framed from a
49
50 knowledge-centred perspective and academic exercise rather than a practise-centred
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52 perspective. Knowledge gains, learning content, and skill acquisition are the goals and
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3 transfer and assessment of that transfer of knowledge via online tools counts as normative
4 progress in education. However, with a shift towards practise-centred perspective,
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6 learning is then conceptualized as moving from novice to expert practises, and novices
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8 participate in apprenticeship situations while performing tasks and being scaffolded in the
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10 presence of experts in a learning community.
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16 Methodological challenges also exist. While automated online tools and digital video
17
18 based-approaches are available to capture user keystrokes, mouse clicks, computer
19
20 screens, and user and community activity, researchers face the challenge of selecting
21
22 points of viewing (Goldman-Segall, 1999), and data reduction – making judicious
23
24 choices about which data sets to select to view, and how to analyze and interpret a largely
25
26 quantitative database of information with nuanced interpretations of social uses,
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28 learning, and end-user meaning.
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35 **Implications for Educational Practises**

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37 Because children can competently perform complex tasks outside of school with digital
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39 technologies, but may not display these skills on school-type tasks, it will be important
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41 for both research and practise to understand the nature of learning in out-of-school
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43 settings and how to build upon the practises of youth in digitally-mediated learning
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45 environments to support learning in multiple settings including school classrooms
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47 through teacher professional development.
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54 An on-going tension remains with the everyday practises of digital kids and the culture of
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56 schooling and the expectation that computers should contribute to learning. Games,
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3 Internet research projects, and personally-relevant media projects, like successful project-
4 based learning experiences, take extended time periods that do not always fit well into the
5 structure and timing of schools. When computers are engaged in the classroom, teachers
6 may continue to view computers as workplace skill development tools, digital games as
7 leisure activities or a motivational stick (“you can play games if you finish your work”)
8 or text chatting and blogging as distractions to learning, rather than opportunities to build
9 new forms of literacy or opportunities for discourse. The differences and difficulties in
10 fitting the Internet-based practises of youth into the norms, expectations, and constraints
11 of classroom curricula, scheduling, and teaching are well documented (Schoefield, 2006).
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27 While digital kids have appropriated technologies and established set of practises and
28 competencies that may exceed the level of fluency with information technologies than
29 their parents, caregivers, and educators, adults still play an important educational role in
30 the lives of digital kids. For example, in using tools like blogs and wikis to publish their
31 thoughts, opinions, and ideas to the World Wide Web, digital kids will need help from
32 educators to understand the broader context of their activities, the public nature of posting
33 personal information and thoughts, and the ramifications of writing opinions and
34 experiences that can be read years later by potential employers, colleagues, and friends.
35 Educators can shape how technology is viewed, ensuring responsible, safe, and ethical
36 practises are followed in its use and in the online environments, continuing to support
37 children in their cognitive, social and moral development, however, recognizing that
38 adults have different cultural histories and relationships with digital technology.
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3 Digital kids clearly demonstrate ‘repertoires of practise’ and it is important to both study
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5 how practises developed in one setting migrate to other settings, as well as how to
6
7 support the continuity of these practises across informal and formal settings. For
8
9 example, the use of cell phones among teens is part of their everyday practises (e.g.,
10
11 exchanging text messages, playing games, verifying information) that are carried into
12
13 formal settings, causing educators and schools to question and in some cases, ban their
14
15 use in schools. Teachers and school administrators will bear the burden of re-establishing
16
17 classroom norms, formulating new rules of engagement, and/or finding new ways to use
18
19 cell phones for productive learning in schools. The boundaries of learning spaces and
20
21 who has control over the technology will have to be revisited and renegotiated. In
22
23 addition, the role of educators, parents, and caregivers becomes one of stewards of
24
25 activity – helping to recognize, bridge, and link everyday thinking and activities of digital
26
27 kids from school to home, and from every activity to classroom activities in a reciprocal
28
29 “two way literacy.” Another approach to linking practises across settings is to leverage
30
31 the Internet and digital medium as a repository and evolving collection of learner ideas.
32
33 Children can use networked digital media, digital libraries, and online web-based
34
35 portfolios to create digital artifacts and persistent electronic representations that preserve
36
37 individual and collaborative activity that can be revised, built upon, and reflected upon
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39 over time and accessible from home and school, serving as another way to build
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41 continuity of practises between informal and formal learning environments. Researchers
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43 have suggested that allowing students, especially at risk students, to personalize the
44
45 medium in games would allow these learners to relate to the curriculum and to youth
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47 cultures (Mitchell & Savill-Smith, 2004).
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5 Focus of instruction should be not solely on the content, but about those collaborative
6 practises and intellectual capacities digital kids can bring and be empowered to bring to a
7 learning situation. Thus, recognizing that computers are not limited to being knowledge
8 transmission and knowledge-centred tool, but often are an activity-centred tool for
9 supporting children's deep and embedded practises with peers and educators in a
10 horizontal participation structure with reciprocal roles (Rogoff, Matusov, & White, 1996;
11 Rogoff, 2003; Lave & Wenger, 1991). Educators have to necessarily become informed
12 facilitators of digital technologies to build upon existing activity structures and social
13 relationships. For example, in the use of online games, the practise of making predictions
14 in an online game, planning a strategy, and testing its outcome, and reflecting upon a next
15 move mirrors the steps in inquiry-based science investigations. In online game play,
16 teachers can serve as facilitators in the process of making strategies explicit, stimulating
17 reflection, group discussion, and writing skills.
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37 With Internet based computers and devices, the geographies of childhood are changing.
38 Youth are spending more time at home in front of computers, narrowing their physical
39 geography, yet being able to reach out to anyone anywhere in the world (Facer, Furlong,
40 Furlong, & Sutherland, 2003). Social proximity via the computer becomes more
41 meaningful for children than physical proximity for learning and socializing. From a
42 practise standpoint, educators have the responsibilities of ensuring ethical uses of
43 technology and fostering learners to take a responsible role in their use to avoid hacking,
44 flaming, online theft, plagiarism, online bullying, and injuries to others. Adults also have
45 the responsibility to promote and encourage outdoor physical activity. Monitoring and
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3 safety also includes knowing who else is online and monitoring the online social groups
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5 and relationships that children participate.
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10 Another implication for practise is promoting gender equity in participation when
11
12 implementing digital-based learning environments among youth. Researchers have found
13
14 that the physical space around computers requires monitoring and turn-taking to ensure
15
16 girls and boys get equal time and access (Ching, Kafai, & Marshall, 2000.) Similarly, in
17
18 homes, studies have shown that having a computer at home does not necessarily mean
19
20 having access to one and that the computers should be treated as a resource involving
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22 time and space which has to be negotiated amongst all family members (Holloway &
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24 Valentine, 2003).
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30 **Ethical Considerations of Research with Minors**

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32 Research in online contexts or in learning contexts that crosses institutional boundaries
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34 (e.g., mobile cell phone use, Internet accounts, cyber assessments) that govern different
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36 norms for the protection of human subjects will need to be addressed. Digital kids are
37
38 posting information in online blogs that schools, courts of law, and other institutions are
39
40 using as evidence. One issue that will need attention is working through issues with
41
42 institutional review boards for human subjects for minors. For example, research that
43
44 falls outside of school time in which children's online behaviours and activities are
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46 captured, or youth are asked to be self-documenting their activities by writing in online
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48 diaries and photographing their parents, siblings, and home life poses new challenges.
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50 Children become informants not only of their own activity and educational practise, but
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52 as informants of others and other aspects of family life creating issues of risk, ethics, and
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3 privacy. Some promising examples of camera-based multimedia studies and playing in
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5 public spaces that have passed institutional review boards do exist which is promising (cf.
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7 Philip Bell at Univ. of Washington, Coe Leta Stafford at IDEO, personal
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9 communication).

10 11 12 13 14 15 **Summary**

16 Studies about out-of-school informal learning experiences and interest-driven activities
17
18 are sparse in comparison to studies of design and use of technology for schooling and
19
20 legitimate educational activities. While different disciplinary traditions offer a range of
21
22 methods to the study of digital kids, only a few science education researchers are taking
23
24 this opportunity to leverage what is already known about learning, inquiry, collaboration,
25
26 personal relevance, and social supports in schools to examine and design out-of-school
27
28 settings. At this moment, there is a pluralistic approach to studying digital fluency that
29
30 may benefit from coordinating and comparing observations and analyses. Drawing from a
31
32 repertoire of approaches that include design-based research strategies offers a beginning
33
34 to the study of digital kids' emergent practises given that most environments and tools
35
36 being used by digital kids were not purposefully designed for education or learning
37
38 research. To get a comprehensive picture, research will need to study learning across both
39
40 school and out-of-school settings and activity spaces for work and recreation, and how
41
42 practises from one setting are reified and adopted in another.
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51 Digital kids have multiple opportunities to take a more active role in defining and
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53 choosing what activities they engage in, when they do so, and with whom in everyday
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55 settings. The boundaries of learning and play are formed by learning events in online
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spaces created by digital kids and their social norm, practises, beliefs which typically are intergenerational, culturally inclusive, fluid in arrangements, and collaborative. Research will need to view ICTs, mobile phones, Internet, games, not only as a resource for learning, but also a context for studying activity and practises of digital kids. Adults' views on what counts as learning and legitimate learning activities will need to be reconceived and renegotiated in light of the practises of children as we learn how digital kids develop interests, knowledge, and expertise in non-academic domains. As more studies are conducted and aggregated across activity spaces of digital kids, a research-informed view of the influences of digital technologies on learning and the contributions of digitally-mediated environments in everyday activity can be better assessed and conceptualized as valuable learning activity.

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