

Traditional Literacy Skills and Internet use among 8 to 12 year old Children

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Biographical Note

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Abstract

During childhood, the nature of the relationships between literacy skills and internet use may vary as a function of context of use and specific internet application. Ninety children in third through sixth grade attending an elementary school in western Canada completed a 15 items rating scale of their internet use across home, school and community contexts. Children's literacy skills were assessed with standardized measures of reading fluency and sentence comprehension and teacher ratings of reading and writing ability. Results suggest that internet use during childhood is a complex behaviour that varies across children and across contexts. Instant messaging and community-based internet use during childhood were associated with decreased literacy skills while other applications used at home and school were associated with increased literacy skills

Keywords: techno-microsystem, digital literacy, internet, children, technology, literacy

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The rapid and widespread adoption of internet technologies by children, as is generally the case with technological innovation (Quigley & Blashki 2003), has created considerable public and educator anxiety (Collins & Halverson, 2009; Seiter, 2007). Currently, there are two contradictory anxieties surrounding children and the internet; first, that the internet may harm children, for example, by exposure to inappropriate content and, second, that children without internet access are cognitively and socially disadvantaged (Johnson 2010a). International anxiety surrounding the digital divide (Lebens, Graff, & Mayer, 2009; Livingstone & Helsper, 2007; Warschauer & Matuchniak, 2010), increasingly complex school internet literacy curriculum (Casey & Bruce, 2011) and social policy initiatives directed toward enhancing childhood internet access (Becker, Crandall, Fisher, Kinney, Landry, & Rocha, 2010; Hutchinson & Henry, 2010) reveal the extent to which internet use during childhood is perceived as developmentally appropriate (if not required).

Internet use is a complex construct (Johnson & Kupla, 2007) and children differ in their patterns of online behaviour (Johnson, 2011a; Rideout, Foehr, & Roberts, 2010). Johnson (2010b) identified three types of young internet users: *home-based users* demonstrated extensive, comprehensive and enjoyable use of the internet at home coupled with limited and less enjoyable internet use at school; *school-oriented information seekers* mainly visited websites, both at home and at school, but school access was preferred; and *school-oriented communicators* primarily used email, both at home and at school, but school use was preferred. There is mounting evidence that various uses of the internet during childhood are associated with various positive and negative learning and developmental outcomes (Greenfield & Yan, 2006; Seiter, 2007). DeBell and Chapman (2006) concluded that internet use promotes cognitive development in children, “specifically in the area of visual intelligence, where certain computer activities -- particularly games -- may enhance the

ability to monitor several visual stimuli at once, to read diagrams, recognize icons, and visualize spatial relationships” (p. 3). Reportedly, at-home online learning and communicating (but not playing and browsing) were associated with advanced child development in expressive language and metacognitive planning (Johnson, 2009). Lee, Bartolic and Vandewater (2009) found that, among young school-age children, time spent reading was negatively related to time spent playing digital games. In this regard, meaningful discussion of the effect of internet use on children requires precise description of the exact nature of that use. According to Johnson (2011b), “internet use during the early school years is related to children’s sense of self and mediated by context” (p. 48).

The term *internet* is already somewhat antiquated as innovative digital technologies have emerged rapidly including, most notably, web-enabled mobile devices (e.g., phones) to communicate and access information, once exclusive functions of computers (Kemp, 2011). Equally, children use digital technologies across of range of environments (i.e., home, school and community) and for a variety of purposes or tasks such as playing games, completing school assignments and emailing friends (Rideout et. al., 2010). Johnson (2010c) recently proposed the *ecological techno-microsystem* which conceptualized child social, emotional, cognitive and physical development as the consequence of ongoing reciprocal and spiralling interactions between child characteristics and use of communication, information and recreation digital technologies across home, school and community environments. Such a conceptual framework is useful in considering the complexity of internet use during childhood and the extent to which different uses of digital technology may have differing effects on learning and development (Hofferth, 2010). For example, unlike school classrooms, homes differ widely in the availability of various digital devices and the degree of parental control of children’s use of those technologies (Valcke, Schellens, Van Keer, & Gerarts, 2007). As evidenced by the mounting literature on the digital divide, not all children

have home access to digital communication and information technologies (Lebens et al., 2009; Livingstone & Helsper, 2007; Warschauer & Matuchniak, 2010). In a comprehensive cross-sectional and longitudinal analysis, Lee and colleagues (2009) reported that family income significantly predicted children's use of digital technologies, although Johnson (2010a) concluded that “in general, indices of home internet use accounted for more of the variance in children’s cognitive development than did indices of socioeconomic status” (p 176). Given increasing evidence on the potential developmental and learning benefits of internet use, lack of home access for some children is of increasing concern. It may not be the case that school access can rectify any disadvantage associated with lack of home connectivity.

While a more inclusive and descriptive term may be *digital technologies* (Margaryan, Littlejohn, & Vojt, 2011), currently and across home and school contexts, the term *internet* endures perhaps because mobile digital devices are not yet endorsed nor utilized in childhood education (Thurlow, 2006). Many issues arise with respect to children and emerging digital technologies, not the least of which concerns the very nature of the skills required to function effectively in the new digital age (Collins & Halverson, 2009).

Childhood Literacy in the Digital Age

Digital literacy, a general term used to refer to the ability to access, manage, integrate, evaluate, create and communicate with digital information and communication technologies (Stripling, 2010), should not be confused with traditional literacy in the digital age.

According to Mills (2010), “digital communication has transformed literacy practices” (p. 246). Kinzer (2010) argued “that literacy is being redefined as a result of the use of digital media” (p. 51). In promoting digital technologies (e.g., blogs, wikis, podcasts and social bookmarks) to facilitate student reading and writing skills, Richardson and Mancabelli (2007) noted that fundamental assumptions regarding text no longer hold true (e.g., edited final

versions, copyright and authority of source). In past decades, teaching children to read and write has been riddled with controversy (Gibson, 2008); the consequence of emerging digital technologies on literacy standards and practices has fuelled the flame (Locke, 2008).

Numerous studies have demonstrated that use of internet technologies improves children's capacity to read and write (Baron, 2009). Simply stated, "the more a child uses the internet, the more he/she reads" (Jackson et al., 2007, p. 188). According to Rowen (2005), "email, instant messaging and electronic conferencing provide writers with an immediate and much larger audience" and "educators need to tap into students' inherent interest in these methods of creating and sharing writing" (p. 22). In comparing children's speed and fluency of written composition, Crook and Bennett (2007) concluded that there were "grounds for investing more in helping children towards greater confidence in visual-manual control of the keyboard" (p. 313). Jackson and colleagues (2006) provided low income children with home-based internet access and continuously recorded time online. "Findings indicated that children who used the internet more had higher scores on standardized tests of reading achievement and higher grade point averages 6 months, 1 year, and 16 months later than did children who used the internet less" (p. 429).

But in the context of digital communication, particularly real-time short messaging systems (SMS) also referred to as *instant messaging* (IM) or *text messaging* (TM), new forms of written language have emerged (Kemp, 2011). Used in chat rooms and on mobile phones, *textese* or *digitalk* includes initials for common phrases (e.g., lol for laughing out loud), homophones (e.g., gr8 for great), abbreviations (cuz for because), symbols for emotions and the omission of words, vowels, punctuation and capitalization (Drouin, 2011). Anecdotes from teachers, widely reported in the media, describe textisms "as having an adverse effect on children's written language production" (Powell & Dixon, 2011, p. 58). Turner (2010), however, argued that the abbreviated language conventions used in digital communication are

not deficient but, rather, “just a different language used in special contexts” (p. 41). Wood, Jackson, Hart and Wilde (2011) studied 9- and 10- year-olds who had not previously owned a mobile phone. Children were randomly assigned to a control condition (i.e., not give a mobile phone) or a treatment condition (i.e., given a mobile phone only enabled for TM). Their results demonstrated that “text messaging does not adversely affect the development of literacy skills within this age group, and that the children’s use of textisms when text messaging is positively related to improvement in literacy skills, especially spelling” (p. 28). Durkin, Conti-Ramsdent and Walker (2011) found positive relationships between textism density, number of types of textism and measures of adolescent literacy. Coe and Oakhill (2011) noted that children who were good readers used more textism in their TM than children who were poor readers. Kemp and Bushnell (2011) reported that better literacy skills were associated with greater textese reading speed and accuracy among 10 to 12 year old children and concluded that there was “growing evidence for a positive relationship between texting proficiency and traditional literacy skills” (p. 18).

Statement of the Research Issues

From an ecological perspective, internet use during childhood occurs in three contexts (i.e., home, school and community) and includes a variety of context-specific applications (e.g., email, IM, gaming and visiting websites) that vary across children and across situations. During childhood, the nature of the relationships between traditional literacy skills and internet use may vary as a function of context and specific application. For example, do patterns of relationship between traditional literacy skills and online communication vary for school-based and home-based internet use? Are literacy skills differentially related to childhood use of the internet at home compared with use in the community?

Methods

Participants

Children in third through sixth grade ($n = 111$) attending an elementary school in western Canada were invited, via parental consent, to participate in the study. Because a degree of literacy was required to complete reading tests, children in first and second grade were not invited to participate in the study. Ninety-six signed consent forms were returned to the school and included parent-reported family demographic information. Due to student absenteeism during data collection, 90 students were included in the sample. Of these students, 20 were in third grade, 22 were in fourth grade, 17 were in fifth grade and 31 were in sixth grade. Thirty-one children indicated that they were female, 44 indicated that they were male and gender data was missing for 15 children. As reported by parents, children ranged in age from 100 to 155 months (mean = 127.6, $SD = 15.6$). Almost 90% of parents reported traditional family structure, 2.5% reported single-parent families and 10% reported that their family was blended. Approximately 70% of mothers and 100% of fathers were reportedly employed, full or part-time. Six percent of mothers reported high school incomplete; 31.3% reported completing high school and almost 63% reported some post-secondary education. With respect to fathers, 14.7% reported high school incomplete, 50% reported high school complete and 35.3% reported some post-secondary education. Mean total family income was approximately \$80,000.

Measures

Three clusters of child variables were measured: 1) child-reported use of the internet, 2) child-completed standardized reading achievement and 3) teacher evaluation of child skill in reading and writing. While issues of validity are apparent, the most commonly used strategy for determining use of the internet during middle childhood is self-report (Johnson, 2007). Child-reported internet use and standardized reading achievement was determined with a test

booklet developed specifically for the study and completed by each child, toward the end of the school year, in the classroom with the teacher present. The test booklet included 15 items that rated extent of internet use (never or hardly ever, once or twice a month, once or twice a week, every day or almost every day) in general (i.e., I use the internet ____) and in terms of specific activities (i.e., email, instant message, play games and visit websites) across home, school and community. Community internet use items included the phrase “at someone else’s house” which was explained to children as using the internet at the house of a friend, child care provider, cousin and so on. Children asked questions (grandma’s place) and the researcher assured the children that that was someone else’s house. The test booklet also included items adapted from the Woodcock Johnson Test of Academic Achievement Reading Fluency subtest which measures the ability to quickly read and comprehend simple sentences. The student is presented with a series of simple sentences and must circle whether each sentence is true or false (e.g., People eat grass). The student is required to complete as many items as possible within a 3-minute time limit. Finally, the test booklet included items adapted from the Wide Range Achievement Test Sentence Comprehension subtest which measures the ability to gain meaning from words and to comprehend ideas and information contained in sentences through the use of a modified cloze technique (e.g., I have a dog. He likes to go for a ____). The third cluster of measured child variables, teacher evaluation of child skill level in reading and writing, was determined with a simple rating scale. Toward the end of the school year and having received parental permission, teachers rated the level of reading and writing competency for each participating child on a 5-point scale ranging from 1 (very low) to 5 (very high). Correlational analysis determined relationships between child-reported uses of the internet across home, school and community environments and child literacy skills as determined by standardized reading tests and teacher ratings.

Results

Table 1 provides a summary of children's ratings of the 15 internet use items, five uses across school, home and community environments. Using the internet at school at least a few times each week was reported by over 83% of the children; only 9% reported never or hardly ever using the internet at school. Using the internet at home was less common than using the internet at school with approximately 20% of children reporting never or hardly ever using the internet at home. With respect to using the internet at school and at home, visiting websites and playing games were most commonly reported by children. Online communication (i.e., email and instant messaging) were more likely to occur at home than at school. Among the sample of participating children, community use of the internet (i.e., at someone else's house) was uncommon; 13.4% of children reported using the internet at someone else's house at least a few times each week. As summarized in Table 2, rate of child-reported internet use tended to increase with child age and grade level, with few exceptions. In general, community-based use of the internet was less associated with child age than was home and school use and instant messaging outside of school did not evidence a relationship with child age or grade level. Only one child-reported internet use varied as a function of gender; girls were significantly more likely than boys to report using email at home.

Table 3 presents significant correlations between the 15 internet use items and the two standardized measures of reading skills, reading fluency and sentence comprehension. Perhaps because relatively few students reported community-based use of the internet, no significant correlations emerged between such use of the internet and measures of standardized reading skills. In general, as frequency of internet use increased at home and school, standardized reading fluency and sentence comprehension for the sample of participating children tended to increase, with one notable exception. As child report of

instant messaging at school increased, standardized measures of reading achievement tended to decrease. Although teacher ratings of students' literacy skills were consistently associated with the students' standardized measures of reading (Table 4), the pattern of correlations between teacher-reported of child literacy and child-reported internet use (Table 5) was different than the pattern of correlations between standardized measures of child literacy and child-reported internet use (Table 3). All significant correlations between teacher rating of child literacy skills and child report of internet use were negative. For example, as report of internet use at someone else's house increased, teacher ratings of child literacy tended to decrease. Consistent with inverse relationships between instant messaging at school and standardized reading achievement, as child report of instant messaging at school increased, teacher evaluation of child literacy skills tended to decrease.

Discussion

Among the sample of participating children, using the internet at home and school was normative (Table 1). For the most part, children commonly reported visiting websites and play games online both at home and at school. As expected and implying the validity of children's ratings of the internet use items, reported uses of the internet at home and school were positively related to child age and grade level (Table 2). Use of the internet at home and in the community for IM did not increase as a function of child age suggesting that some other variable/s mediated such use, although family demographics did not explain any of the variance in any of children's self-reported level of IM. For the sample of participating 8 to 12 year old children, IM is a type of internet use that does not entirely conform with explanations of other types of use (e.g., email, gaming and accessing websites). It may be that specific community relationships (e.g., with child care providers), specific family characteristics (e.g., parenting style) and/or specific child characteristics (e.g., level of emotional independence) create situations where children are more likely to use the internet

to IM. Compared to school-based internet use, child age/grade and community and home use of the internet evidenced weaker relationships and, again, family demographics did not explain any of the variance in children's self-reported level of internet use at home or at someone else's house. Although child maturity (i.e., age) was associated with most applications of home- and community-based use of the internet, non-school use was less influenced by this child characteristics than was school-based use. With respect to internet use, teachers may interpret level of child maturity as most strongly indicating appropriateness of use, followed by parents and then by community members. Current elementary school practices (e.g., age-grouped classes and standardized curriculum) may be exerting more control on children's use of the internet than occurs in less controlled contexts (e.g., home and community). If digital communication is a contemporary extension of oral communication, elementary schools may be limiting children's opportunities to practice and development new forms of communication.

Although correlational strength was moderate between standardized and teacher-generated measures of child literacy (Table 4), at best, approximately 40% of the variance in teacher ratings could be explained by standardized reading scores or vice versa. Teachers' ratings of children's reading and writing ability had different influences than those on children's performance on the group-administered pencil-and-paper subtests of reading fluency and sentence comprehension. It may be that group administration or the very nature of standardized reading tests is less accurate in measuring reading skills than were teachers who have had almost an entire school year to evaluate the literacy skills of their students. Alternatively and as frequently demonstrated (de Boer, Bosker, & van der Werf, 2010; Malouff, 2008), teacher evaluations are influenced by extraneous student characteristics. The moderate correlation between objective and subjective measures of child literacy skills is of particular importance given the vastly different patterns of relationships between alternate

measures of traditional literacy and child-reported uses of the internet across home, school and community contexts.

In general, as school-based internet use increased, standardised reading achievement tended to increase (Table 3). To a lesser extent, the same could be said of home-based internet use. Playing online games at school was more strongly associated with improved standardised reading than was playing online games at home. It is likely that children access different sorts of online games in school versus home environments. School-based games may be more curriculum-focused and thus more likely to facilitate reading skills.

Alternatively, students who are good readers may be provided with increased opportunities to play computer games at school compared to children who are less reading proficient.

Similarly, visiting websites at school was more strongly associated with improved standardised reading than was visiting websites at home. It may be that children access different sorts of websites in school versus home environments. Teacher-endorsed websites may be more curriculum-focused and thus more likely to facilitate reading skills.

Alternatively, students who are good readers may be provided with increased opportunities to visit websites at school compared to children who are less reading proficient. School-based internet use may more often be a reward or free-time activity than home-based internet use.

Nonetheless, home-based internet use did, in most cases, correlate with children's standardised scores of reading skill suggesting a positive relation regardless of context.

Apparently, "the more a child uses the internet, the more he/she reads" (Jackson et al., 2007, p. 188).

Lack of significant relationships between specific child-reported uses of the internet and standardized scores of reading skills (Table 3) may be an artefact of sample size. That is, because relatively few children reported community-based internet use, email at school and IM at home, correlational strength did not reach significance. By the same token, low

incidence internet uses that significantly correlated with reading scores might be interpreted as particularly consequential. Although only one child reported IM at school every day or almost every day, five children reported IM at school once or twice a week and six reported IM at school once or twice a month, such children tended to score lower on both measures of standardized reading achievement than did the majority of children ($n = 78$) who reported never or hardly every IM at school. Additionally, IM was the only home-based use of the internet that did not correlate with standardized scores of reading fluency and sentence comprehension.

Research on the literacy benefits of real-time text-based communication has focused primarily on mobile phone use during childhood (Coe & Oakhill, 2011; Kemp & Bushnell, 2011; Powell & Dixon, 2011; Wood et al., 2011). It may be that using the internet to IM, particularly at school, attracts children who are less competent readers. Indeed, it seems unlikely that IM at school by elementary school children would be endorsed by their teachers. Family demographic variables (i.e., parental level of education and income) did not explain any of the variation in children's standardized reading scores or IM in any context. For the sample of participating 8 to 12 year old children, IM is a use of the internet that is not of obvious benefit to children and, in fact, particularly when occurring at school, is associated with student literacy limitations. Elementary school children who use the internet to chat may be less competent than their peers whose use of the internet may be described as more conventional. In comparing visual and verbal reasoning ability and various uses of the internet, Johnson (2008) noted that "students who reported avoiding dangerous uses of the internet (i.e. visiting chat rooms) were cognitively superior to those who frequently engaged in such online behaviour" (p. 391).

In general, teacher ratings of children's reading and writing ability were less likely than standardized measures of children's literacy to correlate with child-reported uses of the

internet (Tables 5 and 3). For example, teacher ratings of child literacy skills did not correlate with any home-based use of the internet as reported by children while standardized reading scores, as often reported (Blanchard & Moore, 2010; DeBell & Chapman, 2006; Hofferth, 2010; Jackson et al., 2006), significantly related to most home-based uses of the internet. Teacher evaluation of child literacy was influenced by child attributes that did not influence standardized reading scores, perhaps child attitude and classroom behaviour. Inverse relationships emerged between teacher evaluation of child literacy skills (or general classroom functioning) and child-reported community-based internet use. Although only two children reported using the internet at someone else's house every day or almost every day, 10 children reported using the internet at someone else's house once or twice a week and 26 reported using the internet at someone else's house once or twice a month, such children tended to score lower on both teacher-generated measures of literacy than did the majority of children ($n = 53$) who reported never or hardly every using the internet at someone else's house. Additionally, although no children reported IM at someone else's house every day or almost every day, only three children reported IM at someone else's house once or twice a week and nine reported IM at someone else's house once or twice a month, such children tended to score lower on both teacher-generated measures of literacy than did the majority of children ($n = 78$) who reported never or hardly every IM at someone else's house. Such relationships were not explained by family demographics. Elementary school children who reported using the internet at someone else's house, particularly for IM, may function in the classroom differently than children who do not use the internet outside of home and school. Individual difference child variables (e.g., independence, risk taking, need for cognitive stimulation and socialization) and/or family characteristics (e.g., parenting style, child care arrangements) may contribute to children's use of the internet in the community as well as to child classroom behaviour and attitudes. Teachers tended to negatively evaluate such

behaviour and attitudes. For example, parents who allowed their children to IM without supervision may also be generally more lenient which may result in children less able to function in controlled classrooms.

Collectively, results of the current investigation suggest that internet use during childhood is a complex behaviour that varies across children and across contexts. IM, although reported by a small subset of participating children, was associated with decreased literacy skills as determined both objectively (i.e., standardized measures of reading fluency and sentence comprehension) and subjectively (i.e., teacher ratings of reading and writing ability). Factors influencing children's use of the internet to IM and the nature of that use require further investigation. Unlike home and school internet use, community-based use of the internet by children was not associated with increased skills in traditional literacy skills as measured by standardized tests of reading. Correspondingly, community-based use of the internet by children was associated with decreased child traditional literacy as measured by teacher evaluation of reading and writing. Factors influencing children's community-based use of the internet and the nature of that use require further investigation.

Current findings validate, to some extent, the theoretical and empirical utility of the ecological techno-microsystem (Figure 1). A specific communicative use of the internet (i.e., IM) may influence and be influenced by child developmental characteristics, particularly cognitive and social, over time and in spiralling and reciprocal exchange. Child characteristics cause a child to engage in IM which, in turn, influences child characteristics (e.g., classroom behaviour) which cause the child to engage in specific uses of the internet and so on. Furthermore, community-based internet use during childhood appears to influence and be influenced by variables not necessarily implicated in internet use at home and school. Warschauer and Matuchniak (2010) noted that more than half of America adolescents report using the internet at a friend's house or in the library, "though there is scant research

documenting what teens do in these locations” (p. 190). From an ecological perspective, children’s community-based internet use, particularly for real-time communication, requires description, examination and evaluation of consequences. This is particularly critical given the extent to which elementary school children are adopting mobile phones (Rideout et al., 2010). Community-based use of digital communication and information technologies may soon be the norm for children.

Limitations and Subsequent Research

The current findings increase understanding of the relationships between literacy and patterns of internet use during middle childhood. As is the case with all research, measuring variables and sampling a population must be considered in interpreting findings. Alternate measures of children’s use of the internet and reading ability may not replicate current findings. Further, the current sample was small and limited to one school and four teachers. It is unlikely that such a sample produced findings that can be generalized to all 8 to 12 year old children in all industrialized nations. From a research design perspective, a major concern of small sample size is failure to find statistical significance (Kim & Livingston, 2010). In this regard, the number of highly significant results to emerge from analysis of the current data suggests the relationships reported, for the current sample, are robust and real. Nonetheless, contemporary technologies change rapidly and access issues such as internet connectivity vary across regions and over time (Hofferth, 2010). Study replication is required with large and diverse samples of children. While correlation analyses allow for speculation regarding explanations of such associations, the current investigation did not include detailed information on the dynamics of internet use across home, school and community contexts. Subsequent qualitative research may provide more detail on the ways in which, for example, teachers use internet access as a form of student reward. With respect to children and the

internet, research must be ongoing due to our increasingly digitalized society and the increasing ubiquity of connectivity (Kim, Miranda, & Olaciregui, 2008).

References

- Baron, D. (2009). *A better pencil: Readers, writers, and the digital revolution*. New York: Oxford University Press.
- Becker, S., Crandall, M. D., Fisher, K. E., Kinney, B. Landry, C., & Rocha, A. (2010). *Opportunity for all: How the American public benefits from internet access at U.S. Libraries Institute of Museum and Library Services (IMLS-2010-RES-01)*. Institute of Museum and Library Services. Washington, D.C.
- Blanchard, J., & Moore, T. (2010). *The digital world of young children: Impact on emergent literacy*. New York: Pearson Foundation. Retrieved from <http://www.pearsonfoundation.org/PDF/EmergentLiteracy-WhitePaper.pdf>
- Casey, L., & Bruce, B. C. (2011). The practice profile of inquiry: Connecting digital literacy and pedagogy. *E-Learning and Digital Media*, 8(1), 76-85.
- Coe, J. E. L., & Oakhill, J. V. (2011). 'txtN is ez f u no h2 rd': The relation between reading ability and text-messaging behaviour. *Journal of Computer Assisted Learning*, 27, 4-17. doi: 10.1111/j.1365-2729.2010.00404.x
- Collins, A., & Halverson, R. (2009). *Rethinking education in the age of technology: The digital revolution and schooling in America*. New York: Teachers College Press.
- Crook, C., & Bennett, L. (2007). Does using a computer disturb the organization of children's writing? *British Journal of Developmental Psychology*, 25, 313-321. doi: 10.1348/026151006x143164
- DeBell, M., & Chapman, C. (2006). *Computer and Internet use by students in 2003*. National Center for Educational Statistics. U.S. Department of Education, Washington, DC. Retrieved from <http://nces.ed.gov/pubs2006/2006065.pdf>.

- de Boer, H., Bosker, R. J., & van der Werf, M. P. C. (2010). Sustainability of teacher expectation bias effects on long-term student performance. *Journal of Educational Psychology, 102*(1), 168-179
- Drouin, M. A. (2011). College students' text messaging, use of textese and literacy skills. *Journal of Computer Assisted Learning, 27*, 67-75. doi: 10.1111/j.1365-2729.2010.00399.x
- Durkin, K., Conti-Ramsdent, G., & Walker, A. J. (2011). Txt lang: texting, textism use and literacy abilities in adolescents with and without specific language impairment. *Journal of Computer Assisted Learning, 27*, 49-57. doi: 10.1111/j.1365-2729.2010.00397.x
- Gibson, M. (2008). Beyond literacy panics: Digital literacy and educational optimism. *Media International Australia, 128*, 73-79.
- Greenfield, P., & Yan, Z. (2006). Children, adolescents, and the Internet: A new field of inquiry in developmental psychology. *Developmental Psychology, 42*, 391-394.
- Hofferth, S. L. (2010). Home media and children's achievement and behavior. *Child Development, 81*(5), 1598-1619.
- Hutchinson, A., & Henry, L. A. (2010). Internet use and online literacy among middle grade students at risk of dropping out of school source: *Middle Grades Research Journal, 5*(2), 61-75.
- Jackson, L. A., Samona, R., Moomaw, J., Ramsay, L., Murray, C., Smith, A., & Murray, L. (2007). What children do on the Internet: Domains visited and their relationship to socio-demographic characteristics and academic performance? *CyberPsychology and Behavior, 10*, 182-190.
- Jackson, L. A., Von Eye, A., Biocca, F. A., Barbatsis, G., Zhao, Y., & Fitzgerald, H. E. (2006). Does home Internet use Influence the academic performance of low income children? *Developmental Psychology, 42*, 429-435.

- Johnson, G. M. (2007). The Internet Vocabulary Test for Children: Preliminary development. *Internet Research, 17*, 235-248.
- Johnson, G. M. (2008). Verbal and visual reasoning in relation to patterns of internet use. *Internet Research, 18*, 382-392.
- Johnson, G. M. (2009). At-home internet behavior and cognitive development during middle childhood. *Technology, Instruction, Cognition & Learning, 6*, 213-229.
- Johnson, G. M. (2010a). Internet use and child development: Validation of the ecological techno-subsystem. *Educational Technology & Society, 13*, 176-185.
- Johnson, G. M. (2010b). Young children's Internet use at home and school: Patterns and profiles. *Journal of Early Childhood Research, 8*, 282-293.
- Johnson, G. M. (2010c). Internet use and child development: The techno-microsystem. *Australian Journal of Educational and Developmental Psychology, 10*, 32-43.
- Johnson, G. M. (2011a). Internet activities and developmental predictors: Gender differences among digital natives. *Journal of Interactive Online Learning, 10*(2), 64-76.
- Johnson, G. M. (2011b). Self-Esteem and use of the internet among young school-age children. *International Journal of Psychological Studies, 3*(2), 48-53.
doi:10.5539/ijps.v3n2p48
- Johnson, G. M., & Kupla, A. (2007). Dimensions of online behavior: Toward a user typology. *CyberPsychology & Behavior, 10*, 773-780.
- Kemp, N. (2011). Mobile technology and literacy: Effects across cultures, abilities and the lifespan. *Journal of Computer Assisted Learning, 27*, 1-3. doi: 10.1111/j.1365-2729.2010.00401.x
- Kemp, N., & Bushnell, C. (2011). Children's text messaging: Abbreviations, input methods and links to literacy. *Journal of Computer Assisted Learning, 27*, 18-27. doi: 10.1111/j.1365-2729.2010.00400.x

- Kim, P., Miranda, T., & Olaciregui, C. (2008). Pocket school: Exploring mobile technology as a sustainable literacy education option for underserved indigenous children in Latin America. *International Journal Educational Development*, 28, 435-445.
doi:10.1016/j.ijedudev.2007.11.002
- Kim, S., & Livingston, S. A. (2010). Comparisons among small sample equating methods in a common-item design. *Journal of Educational Measurement*, 47(3), 286-298.
- Kinzer, C. K. (2010). Considering literacy and policy in the context of digital environments. *Language Arts*, 88(1), 51-61.
- Lebens, M., Graff, M., & Mayer, P. (2009). Access, attitudes and the digital divide: Children's attitudes towards computers in a technology-rich environment source. *Educational Media International*, 46(3), 255-266.
- Lee, S. J., Bartolic, S., & Vandewater, E. A. (2009). Predicting children's media use in the USA: Differences in cross-sectional and longitudinal analysis. *British Journal of Developmental Psychology*, 27(1), 123 -143. doi:10.1348/026151008X401336
- Livingstone, S., & Helsper, E. (2007). Gradations in digital inclusion: Children, young people and the digital divide. *New Media & Society*, 9, 671-696.
- Locke, K. (2008). Access denied: Reading writing and thinking about techno-literacy. In T. Brabazon (Ed.), *The revolution will not be downloaded: Dissent in the digital age* (pp. 3-10). Oxford: Chandos.
- Malouff, J. (2008). Bias in grading. *College Teaching*, 56(3), 191-192.
- Margaryan, A., Littlejohn, A., & Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education*, 56(2), 429-440.
- Mills, K. A. (2010). A review of the 'digital turn' in the new digital literacy studies. *Review of Educational Research*, 80(2), 246-271.

- Ortiz, R. W., Green, T., & Lim, H. (2011). Families and home computer use: Exploring parent perceptions of the importance of current technology. *Urban Education, 46*(2), 202-215. doi: 10.1177/0042085910377433
- Powell, D., & Dixon, M. (2011). Does SMS text messaging help or harm adults' knowledge of standard spelling?. *Journal of Computer Assisted Learning, 27*, 58-66. doi: 10.1111/j.1365-2729.2010.00403.x
- Quigley, M., & Blashki, K. (2003). Beyond the boundaries of the sacred garden: Children and the internet. *Educational Technology Review, 11*, 70-77.
- Richardson, W., & Mancabelli, R. (2007). High-tech inspires the read/write website. *The Education Digest, 72*(9), 14-18.
- Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). Generation M²: Media in the lives of 8-18 year-olds. Menlo Park: CA: Kaiser Family Foundation. Retrieved from <http://www.kff.org/entmedia/upload/8010.pdf>
- Rowen, D. (2005). The write motivation: using the internet to engage students in writing across the curriculum. *Learning and Leading with Technology, 32*(5), 22-23, 43.
- Seiter, E. (2007). *The internet playground: Children's access, entertainment, and mis-education*. New York: Peter Lang.
- Stripling, B. (2010). Teaching students to think in the new digital environment: Digital literacy and digital inquiry. *School Librarian Monthly, 26*(8), 16-19.
- Thurlow, C. (2006). From statistical panic to moral panic: The metadiscursive construction and popular exaggeration of new media language in the print media. *Journal of Computer-Mediated Communication, 11*, 667-701.
- Turner, K. H. (2010). Digitalk: A new literacy for a digital generation. *Phi Delta Kappan, 92*(1). 41-46.

- Valcke, M., Schellens, T., Van Keer, H., & Gerarts, M. (2007). Primary school children's safe and unsafe use of the internet at home and school: An exploratory study. *Computers in Human Behavior*, 23, 2838-2850. doi:10.1016/j.chb.2006.05.008
- Warschauer, M., & Matuchniak, T. (2010). New technology and digital worlds: Analyzing evidence of equity in access, use, and outcomes. *Review of Research in Education*, 34, 179-225. doi: 10.3102/0091732x09349791
- Wood, C., Jackson, E., Hart, L., Plester, B., & Wilde, L. (2011). The effect of text messaging on 9- and 10-year old children's reading, spelling and phonological processing skills. *Journal of Computer Assisted Learning*, 27, 28-36. doi: 10.1111/j.1365-2729.2010.00398.x

Table 1

Percentage of Children Selecting each Response-Option for Internet Use Rating Scale Items

Internet Use Item	Response-Option			
	Never	Monthly	Weekly	Daily
School Internet Use				
I use the internet at school.	9.0%	7.9%	68.5%	14.6%
I use email at school.	67.8%	6.7%	21.3%	3.4%
I instant message at school.	86.4%	6.8%	5.7%	1.1%
I use the internet to play games at school.	20.2%	27.0%	48.3%	4.5%
I visit websites at school.	18.2%	21.6%	51.1%	9.1%
Home Internet Use				
I use the internet at home.	20.2%	22.5%	24.7%	32.6%
I use email at home.	57.3%	12.4%	15.7%	14.6%
I instant message at home.	71.6%	9.1%	11.4%	8.0%
I use the internet to play games at home.	25.8%	21.3%	31.5%	21.3%
I visit websites at home.	29.5%	22.7%	28.4%	19.3%
Community Internet Use				
I use the internet at someone else's house.	57.3%	29.2%	11.2%	2.2%
I use email when I am at someone else's house.	80.7	14.8%	4.5%	0.0%
I instant message when I am at someone else's house.	86.2%	10.3%	3.4%	0.0%
I use the internet to play games at someone else's house.	60.2%	28.4%	8.0%	3.4%
I visit websites when I am at someone else's house.	62.5%	28.4%	9.1%	0.0%

Note.

Never = never or hardly ever

Monthly = once or twice a month

Weekly = once or twice a week

Daily = every day or almost every day

Table 2

Correlations between Child-Ratings of Internet Use and Child Age and Grade Level

Child-Rating of Internet Use	Child Age	Grade Level
School Internet Use		
I use the internet at school.	.46***	.48***
I use email at school.	.35***	.40***
I instant message at school.	.30**	.27**
I use the internet to play games at school.	.49***	.52***
I visit websites at school.	.47***	.55***
Home Internet Use		
I use the internet at home.	.26*	.33**
I use email at home.	.37***	.34**
I instant message at home.		
I use the internet to play games at home.	.33**	.33**
I visit websites at home.	.28**	.35**
Community Internet Use		
I use the internet at someone else's house.		
I use email when I am at someone else's house.	.29**	.27**
I instant message when I am at someone else's house.		
I use the internet to play games at someone else's house.		.20*
I visit websites when I am at someone else's house.	.31**	.28**

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 3

Correlations between Child-Ratings of Internet Use and Standardized Reading Skills

Child-Rates of Internet Use	Standardized Reading Scores	
	Fluency	Comprehension
School Internet Use		
I use the internet at school.	.41***	.43***
I use email at school.		
I instant message at school.	-.35***	-.35***
I use the internet to play games at school.	.29**	.32**
I visit websites at school.	.39***	.37***
Home Internet Use		
I use the internet at home.	.25**	.20*
I use email at home.	.19*	.19*
I instant message at home.		
I use the internet to play games at home.	.18*	.18*
I visit websites at home.	.22*	.25**
Community Internet Use		
I use the internet at someone else's house.		
I use email when I am at someone else's house.		
I instant message when I am at someone else's house.		
I use the internet to play games at someone else's house.		
I visit websites when I am at someone else's house.		

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 4

Correlations between Standardized Reading Scores and Teacher Ratings of Literacy Skills

Standardized Reading Scores	Teacher Ratings of Child	
	Reading	Writing
Reading Fluency	.57***	.58***
Sentence Comprehension	.58***	.49***

*** $p < .001$

Table 5

Relationships between Child-Ratings of Internet Use and Teacher-Ratings of Literacy Skills

Child-Rated Internet Use	Teacher Ratings of Child	
	Reading	Writing
School Internet Use		
I use the internet at school.		
I use email at school.		
I instant message at school.	-.36***	-.34**
I use the internet to play games at school.		
I visit websites at school.		
Home Internet Use		
I use the internet at home.		
I use email at home.		
I instant message at home.		
I use the internet to play games at home.		
I visit websites at home.		
Community Internet Use		
I use the internet at someone else's house.	-.23*	-.22*
I use email when I am at someone else's house.		
I instant message when I am at someone else's house.	-.20*	
I use the internet to play games at someone else's house.		
I visit websites when I am at someone else's house.		

* $p < .05$ ** $p < .01$ *** $p < .001$

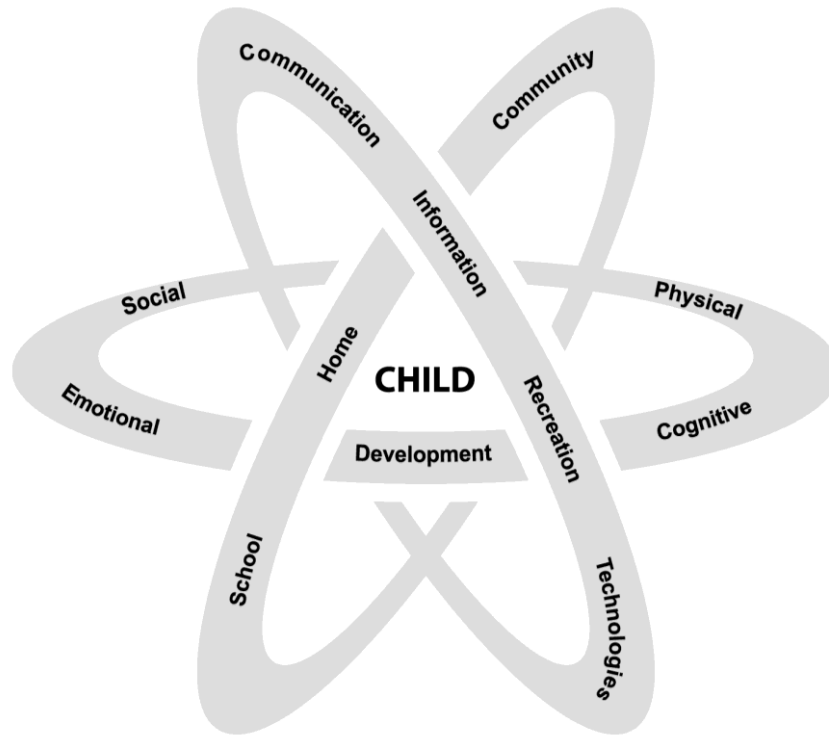


Figure 1. The Ecological Techno-Microsystem (Johnson, 2010c)