Chapter 8

A Failure to Connect: The Elusive Relationship between Broadband Access and Children's Information Seeking in American Academic Research

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Abstract

Purpose – The purpose of this study was to determine the extent to which academic researchers consider the relationship between broadband access and children's information seeking in the United States. Because broadband has been cited as an essential element of contemporary learning, this study sought to identify gaps in the attention given to the role of broadband in the information seeking environment of youth.

Approach – The researchers conducted a mixed method synthesis of academic research published in peer-reviewed journals between 1991 and 2011 that reported the information seeking of children aged 5–18 years. Quantitative and qualitative data were gathered from leading databases, analyzed separately, and conclusions drawn from integrated results.

Results – The results of this study indicated that broadband is rarely considered in the design of children's information seeking published in peer-reviewed research journals. Only 15 studies showed any presence of broadband in study design or conclusions. Due to the small number of qualifying studies, the researchers could not conduct the

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synthesis; instead, the researchers conducted a quantitative relationship analysis and qualitative content analysis.

Practical implications – Given the focus of policymaking and public discussion on broadband, its absence as a study consideration suggests a crucial gap for scholarly researchers to address.

Research limitations – The data set included only studies of children in the United States, therefore, findings may not be universally applicable.

Originality/value – Despite national imperatives for ubiquitous broadband and a tradition of information seeking research in library and information science (LIS) and other disciplines, a lack of academic research about how broadband affects children's information seeking persists.

Keywords: Children; youth; broadband; imposed query; information seeking; homework

8.1. Introduction

Benchmarked as one of the worst rates of broadband access and home connectivity among industrialized countries (Organisation for Economic Co-operation and Development [OECD], 2012; Windhausen, 2008), Americans are now at a disadvantage to compete educationally and commercially in a global information economy. Perhaps the most profound illustration of this policy paucity is the persistent 30% of households in the United States that lack high-speed broadband connectivity (Horrigan, 2012; National Telecommunications & Information Administration [NTIA], 2012; OECD, 2012) and reports that informal and formal learning online is drastically hampered by inadequate bandwidth (Ezell, Atkinson, Castro, & Ou, 2009; Windhausen, 2008).

Although the use of digital technology expands through the growth of mobile and handheld devices, The Pew Internet and American Life Project reported that 26% of teens 12–17 years of age did not access the Internet using mobile technology (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). While this recent Internet study described increasing use of mobile technology for teens, penetration of use was distinguished by economic and ethnic boundaries. Significantly fewer black teens than white teens owned a desktop or laptop computer (Madden et al., 2013) and mobile technologies do not enable the complex information manipulation allowed by a broadband-enabled computer.

Although broadband has been cited as an essential element of contemporary learning (Gartner Consulting, 2003; Windhausen, 2008) and federal investments in upgrading and expanding availability exist, Internet access in public libraries, homes, and schools has remained relatively flat. Lacking this key affordance, many U.S. citizens are prevented from engaging in activities that promote engagement, citizenship, and lifelong learning. Many of these effects are manifested in "information seeking," the currently preferred term used to describe the many ways in which human beings interact with information, in particular, the ways in which people seek and use information (Bates, 2010).

The larger currents affecting the spread of broadband connectivity have especially disadvantaged schools. Currently, national initiatives that promote the development of 21st century learning focus strongly on children's abilities to find, use, evaluate, analyze, communicate, and create information in activities that require immersive, simultaneous Internet use (LEAD Commission, 2012; U.S. Department of Education, 2013). Although the effect of poor connectivity on children's information seeking may seem obvious or insignificant, to date, the extent to which broadband as either an element of study design or as an expressed study finding has not been specifically examined in American academic research. Cursory review of the mounting broadband literature suggested that very little focus had been given to the impact that access to and adoption of broadband had on information seeking of children. Given this apparent dearth of scholarly work, the present study sought to determine whether and how broadband was considered in research design or reported in research findings. Results gained from this study have implications for the role of broadband access in the information seeking of children aged 5–18 years engaged in schoolwork, in either a self-directed or an imposed query mode (Gross, 2006).

8.1.1. Research Questions

Because anecdotal and fragmented reports have suggested that broadband access is a key determinant of information seeking, this study proceeds from an overarching question: What is the nature of academic research concerning broadband and children's information seeking in the United States?

This overarching question was examined through four specific research questions:

RQ1. To what extent has broadband emerged as a factor in the design and results of studies of children's information seeking?

RQ2. Which information seeking emerged in studies that did consider broadband?

RQ3. Which sites, locales, participant socioeconomic status (SES), and participant genders have researchers considered?

RQ4. How has the role of broadband changed over time in studies of children's information seeking?

8.2. Literature Review

Broadband has been described as the "great infrastructure challenge of the early 21st century" (Federal Communications Commission [FCC], 2010b, p. 3), on par with prior challenges such as a transcontinental railway, an interstate highway system, and the provision of electricity to all communities in America (FCC, 2010a). Unlike these previous occurrences, however, broadband is more than an infrastructure creation problem; the nation's broadband infrastructure is a patchwork of delivery technologies and service providers and requires management and enhancement to ensure that the connectivity is available, stable, and robust. However, "broadband speed has emerged as the single most commonly cited metric for characterizing the quality of broadband offerings" (Bauer, Clark, & Lehr, 2010, p. 5). In the context of this study, broadband is defined as "high-speed Internet access that is always on and faster than the traditional dial-up access" (FCC, n.d.).

In this section, we provide an overview of U.S. broadband policy, of home and school access, and of children's use that considers speed but also includes additional factors that affect access and use.

8.2.1. Broadband in the United States

As early as 1987, the United States was on the forefront of high-speed networked telecommunications with the National Science Foundation's NSFNET project. This decade long initiative not only linked education and research institutions via a robust national data network, NSFNET also changed the work of educators and researchers so profoundly that demand quickly grew for connectivity in schools, libraries, government organizations, and homes. In response, the federal government forwarded a number of initiatives designed to make Internet connectivity more accessible and affordable. Once technology had advanced sufficiently to allow citizens to

envision uses of broadband in every aspect of their lives, the demand for high-speed, continuously available, high-capacity connectivity grew (Frazer, 1996).

8.2.1.1. Universal Service Fund The Universal Service Fund (USF) was created by the Federal Communications Commission (FCC) in 1997 to meet the universal service goals mandated by Congress in the 1996 Telecommunications Act. The 1996 Act states that all providers of telecommunications services should contribute to federal universal service in some equitable and nondiscriminatory manner; there should be specific, predictable, and sufficient federal and state mechanisms to preserve and advance universal service; all schools, classrooms, health care providers, and libraries should have access to advanced telecommunications services; and finally, that the Federal-State Joint Board and the FCC should determine those other principles that, consistent with the 1996 Act, are necessary to protect the public interest.

Although the USF has been credited with infusing $20 billion into schools and libraries, demand for funding has remained strong despite controversial elements of the policy. Early detections of fraud and abuse resulted in increased accountability and auditing layers and revealed that often, some funding was wasted through poorly executed good intentions and occasional malfeasance. In 2011, the FCC approved a six-year transfer process that would transition money from the USF to a new $4.5 billion a year Connect America Fund for broadband Internet expansion, effectively putting an end to the USF by 2018.

8.2.1.2. National Broadband Plan In 2009, Congress directed the FCC to provide the critical infrastructure needed to deliver broadband Internet connectivity to every citizen in the United States. This National Broadband Plan (NBP) lays out short- and long-term goals to ensure that "every American has access to broadband capability" (FCC, 2010b). The NBP aims to improve competition among broadband service providers with innovative policies designed to ensure efficient development of infrastructure; to address income inequities preventing adoption through streamlined universal service assistance; and, to reform laws and standards as well as provide incentives for all stakeholders under governmental influence including educators, health care providers and insurers, and, government service agencies (FCC, 2010b). The NBP also includes a strong emphasis on raising awareness about broadband's benefits, especially for citizens who may be slow to adopt it for reasons other than cost and access. To wit, in an attempt to appeal to many communities experiencing the stagnant economic performance, the FCC touted broadband's potential to yield economic benefit in the NBP's initial paragraph.

8.2.1.3. National Education Technology Plan Soon after the release of the NBP, in 2010, the U.S. Department of Education released *Transforming American Education: Learning Powered by Technology*, also known as The National Education Technology Plan (NETP), which set a national agenda for digital learning. Digital learning is defined as educational programs and technology that "enable engaging individual learners' personal interests by connecting web learning resources to learning standards, providing options for adjusting the challenge level of learning tasks to avoid boredom or frustration, and bridging informal and formal learning in and outside of school" (U.S. Department of Education, 2010, p. 17). The NETP presents five goals with recommendations for states, districts, the federal government, and other stakeholders. The goals pertain to learning, assessment, teaching, infrastructure, and productivity.

The infrastructure goal reflects the U.S. Department of Education's vision for an education system enabled by the same kind of "cyberinfrastructure" that the (National Science Foundation [NSF], 2007) has promoted to undergird scientific research. The NETP's digital learning vision also mimics the rhetoric surrounding NSFNET's catalyzing of Internet use in non-research contexts nearly 25 years earlier. Indeed, the Department of Education's conception of digital learning parallels the FCC's definition of broadband, that is "a crucial element of … an infrastructure for learning is always on and makes learning opportunities available to learners, educators, and administrators regardless of their location, the time of day, or the type of access devices" (U.S. Department of Education, 2010, p. 52). The NETP concludes that research and development on technology and learning is essential for scaling of effective practices and reducing education costs.

8.2.2. Broadband Deployment in the United States

Thirty years of U.S. broadband policy initiatives have resulted in an environment that can be assessed from many angles including availability, access, adoption, and infrastructure. For the purposes of this review, the focus in this chapter is on youth access to broadband at home and school, but it begins with a general look at the evolution of the state of broadband adoption in the United States

8.2.2.1. Home broadband In its *Eighth Broadband Progress Report*, the FCC (2012) reported that broadband availability has significantly increased but that one in six Americans still lacked home access to broadband at the FCC's acceptable speed threshold. This means that almost 19 million Americans, in over 7 million households, did not access broadband at

home (FCC, 2012). Still, over the last decade, home broadband adoption has risen steeply from slightly less than 4% to almost 64% of homes having high-speed connections. Broadband adoption has risen to 5.6 million homes despite variations in income, race and ethnicity, gender, employment status, and location (NTIA, 2012). While these reports reflect adults in the home who access broadband, since many of these adults are parents and because parents are financial gatekeepers, understanding home broadband adoption is key to exploring the nature of children's use of technology for schoolwork and at home (Livingstone, 2003; Livingstone & Helsper, 2007).

Availability does not result in adoption. At the time of the crafting of the NBP, 100 million Americans did not have household broadband; 14 million did not even have broadband infrastructure access; and up to 10 million school age children did not have home access (FCC, 2010b). This slow adoption has been attributed to a lack of federal effort to streamline policy and incentivize industry to make broadband available and affordable. The impact of nonresponsive, complicated national policy initiatives is stagnant home broadband adoption. While many citizens may be eager to bring broadband into their homes, it seems that a sector of the public does not recognize the potential of broadband to add value to their lives.

In 2010, researchers at Connected Nation, a broadband consulting company, compared early adopters to new adopters in a 2010 representative nationwide survey (Joshi, Lane, McGovern, Noriega, & Walker, 2011). The researchers reported new adopters tended to be female; live in a rural area; have a low annual income; and be Hispanic or African-American. In contrast, late adopters used fewer applications and were online less frequently unless enrolled in online education. As the authors observed, some users required a significant amount of time to recognize the value of household broadband, especially in delivering high-quality digital content for educational purposes. Household broadband adoption enhances users' Internet skills, even if home Internet is used for entertainment rather than practical endeavors (Hsieh, Rai, & Keil, 2008; Van der Heijden, 2004; Venkatesh & Brown, 2001).

A host of causes could account for the apparent plateau of the dissemination of expensive broadband service too hard to reach communities: a much larger expanse of expensive, physical infrastructure has yet to be installed and home broadband installation requires additional technologies and skill. For these reasons and likely many others, a lack of coherent national broadband policy has very real consequences for home adoption.

No study conclusively points to effective adoption promotion strategies or to the value of broadband either as a policy directive or a personal choice. However, with the migration of institutional education to digital platforms, including virtual classrooms, online and distance learning, and

digital textbooks in K-20 classrooms, the barriers to household adoption loom as significant concerns to educators and parents.

Children's Internet use at home. According to the 2010 Current Population Survey (CPS), about one quarter of households with children had Internet access (NTIA, 2012). Mardis (2013) conducted an integrated secondary analysis of Census and NCES data and found that the presence of home broadband had compelling relationships with student achievement, even when a major predictor of student achievement, SES, was considered. These findings were affirmed by Selwyn, Potter, and Cranmer (2010), and Livingstone and Helsper (2007), whose research had similar results:

> In other words, children from lower SES homes who have home internet access use it just as much as those from higher SES homes: it seems that providing home internet access in low SES households helps to close the gap in use, potentially reducing disadvantage .... SES differences in amount of use disappear if just those with home access are compared .... We conclude that providing home access can alleviate but not overcome the relative disadvantage of coming from a low SES household in terms of the breadth of internet use, this warranting continued attention to socioeconomic disadvantage in relation to internet use. (pp. 7,12,13).

These findings were not surprising in light of other research that refutes contemporary perceptions that children use the Internet at home purely for leisure purposes (Tripp, 2011) and youth self-reports of engaging in risky online seeking (Livingstone & Helsper, 2007). Many researchers have found that the top three reasons children use their home Internet connections are completing schoolwork, gathering information about hobbies, and communicating with peers (Livingstone & Helsper, 2007; O'Keeffe, Clarke-Pearson, & Council on Communications Media, 2011) and that each of these applications offers powerful potential to redress technology and information skills not gained in school (Livingstone & Helsper, 2010). When parents understood the impact broadband could have on student learning and how students with broadband at home were at an educational advantage, they were more willing to invest in it, even if they had concerns about online safety (Cranmer, 2006).

Results of other research conducted with youth (Selwyn, 2006) yielded surprising results: although students recognized that their home technology environments and their school technology environments were often in stark contrast, for the most part, students accepted their schools as technology-limited environments. They expressed resignation and few expectations that schools could or should be places where technology is integrated widely and

deeply. Selwyn's (2006, 2011) research suggested that students who were "net-savvy" also grew to be "school-savvy"; students saw their schools as places where technology was only as good as its educational applications required. This pragmatism was balanced by children's interest in using technology at home and a lack of home technology was seen as a far worse condition than poor school technology (Lewin, Mavers, & Somekh, 2003; Livingstone, 2003). Lacking opportunities at school, in some instances, children did not develop the capacity to envision how the Internet would help them find information, communicate with others, or entertain themselves (Holmes, 2011; Livingstone & Helsper, 2007; Project Tomorrow, 2012).

A synthesis of prior research suggested that regardless of time or context, home broadband has clear advantages for student learning but adoption was hindered by parents' lack of perceived value (Livingstone & Bober, 2006). An absence of home broadband access also affected children's desire to use the Internet at school because they had not experienced online activities enough to understand how the Internet might be helpful and did not possess enough skills to confidently accomplish desired tasks. Studies of how well Internet use at school related to Internet use at home found that when students performed sophisticated activities on the Internet at school, they were able to further the case for broadband's value at home. These studies pointed to the need for curriculum, not connectivity, to be the constant linking home and school experience for maximum student benefit (Lewin et al., 2003).

8.2.2.2. School broadband Many calls have been made to fundamentally redefine the meaning of schooling and re-envision the infrastructure of education to include immersive experiences; informal opportunities; and greater continuity between home, school, and workforce, all of which are enhanced by ubiquitous, reliable high-speed networks (NSF, 2007). However, when schools are connection rich but equipment and management poor, children's experiences with technology at school are negatively impacted (Kozma, 2011).

In many schools, bandwidth capacity dictates the extent to which teachers are able to foster high-level information, communications, and technology "21st century" skills among their students. While 99% of public schools in the United States reported having Internet access, less than one-third of schools reported top tier broadband speeds (Brenchley, 2011); rural and high poverty schools reported 88–96% Internet penetration (U.S. Department of Education, 2010). Classroom connections were less frequent in all schools (National Center for Education Statistics, 2011) and even when classroom access was available, many building-level bandwidth capacity management policies impede the integration of the Internet into teaching and learning. In 2010, the FCC reported that many (over 80%) school connections were not meeting school officials' needs because the

connections were overloaded and poorly managed, leading to slow performance or restricted use (FCC, 2010c). For example, in a study done in Michigan, education officials reported having to develop and enforce bandwidth use policies that limited video streaming and other high-capacity uses; the Michigan finding was confirmed by the overwhelming majority of respondents to a nationwide survey of school officials who reported that their networks were too slow to support video streaming (FCC, 2010c). Broadband capacity influenced teachers' use of the Internet in their classrooms as much as their skills with technology integration (Mardis, 2009).

Many school administrators reported that they would like to scale up the use of digital learning objects, handheld devices, and information resources, but lacked the funds to do so (FCC, 2010c; Project Tomorrow, 2013). Reflecting the rapidly increasing adoption of multimedia digital resources within the classroom, 71% of district technology leaders in a nationally representative sample said they could not ensure that their future needs for classroom connectivity can be met. Eleven percent said that their current connectivity did not even address current district needs; in 2010, only 10% of these leaders identified that same issue as critical (Project Tomorrow, 2013). School officials understood the potential benefits of increased Internet connectivity. If students and teachers had the bandwidth that they needed, school administrators reported they would be able to better utilize online curriculum, offer online learning opportunities for student and teachers, and strengthen school-home linkages, in addition to supporting usage of multimedia in the classroom (Project Tomorrow, 2013).

As technology and Internet have gained presence in classrooms, instructional materials and activities have become digitally rich and the use of digital textbooks is rapidly gaining ground in education at all levels. A lack of adequate broadband access is complicated by information needs that occur beyond the school day or in the case of schooling that occurs in a virtual format (Moyle, 2010). The number of districts enrolling students in distance or online education classes has grown from 36% to 55% in 2010 (U.S. Department of Education, 2010); several million K-12 students (over 5%) participated in different types of digital learning programs (Watson, Murin, Vashaw, Gemin, & Rapp, 2012). In 2012, many states enacted legislation that ranged from planning some form of online education initiative in an unstated time frame to immediately implementing a comprehensive digital learning mandate. Eight states (Alabama, Arkansas, Florida, Maine, Michigan, New Hampshire, North Carolina, Virginia) currently have statewide implementation plans and/or established virtual schooling (Watson et al., 2012) and the move toward digital textbooks is a juggernaut (Fletcher, Schaffhauser, & Levin, 2012).

But even the FCC states that it lacks "comprehensive data regarding the actual or desired level of broadband service our nation's elementary and

secondary schools" (FCC, 2012, p. 59) need. Therefore, to date, little data have been gathered on the extent to which delivery of learning and subsequent knowledge creation has been constrained (Somekh, 2007). Less clear from current research are what the Internet connection to the actual end user in school is like and what type of instruction and learning it has the capacity to support. However, researchers and policymakers must acknowledge the pivotal role of broadband in contemporary elementary and secondary education in order to prepare students for work and life in the 21st century (Fox, Waters, Fletcher, & Levin, 2012).

8.2.3. The Information Search Process: A Framework for Digital Information Seeking

Adequate, reliable broadband is a key affordance of a digital learning environment and the activities it enables within this environment deserve exploration. Whether at home or at school, teacher-directed activities function as a learning bridge that connects home and school Internet activity (Peters, 2008). Investigations into children's Internet information seeking have a long history and can be roughly grouped into what Kuhlthau (2004) called stages of the Information Search Process (ISP). In order, the stages are: Initiation; Selection; Exploration; Formulation; Collection; and Closure.

8.2.3.1. Stage 1: Initiation During the first stage, initiation, the information seeker recognizes the need for new information to complete an assignment (Kuhlthau, 2004). Previous research has shown that children mainly use the Internet for schoolwork (Project Tomorrow, 2012). This task functions as a *de facto* "imposed query," that is, an information task generated by someone other than the information seeker (Gross, 1996, 2006). For children, these imposed queries take the form of homework assignments, research paper topics, and other teacher-driven information explorations. While self-generated questions may emerge from within the confines of an assignment, the nature of the assignment still drives students' information investigations (Gross, 1999; Project Tomorrow, 2012).

8.2.3.2. Stage 2: Selection In the second stage, selection, the individual begins to decide what topic will be investigated and how to proceed (Kuhlthau, 2004). Some information retrieval may occur at this point. Because children are predominantly seeking information in an imposed query environment, the selection phase is particularly meaningful in situations where students have the option of selecting a topic within the bounds of the assignment. Mardis (2008) found that children often sought help from librarians in selecting a topic for their assignments, particularly in the

instance of science projects assigned in middle school. Gross (2006) explained that the successful completion of this phase is essential for all subsequent information seeking activities. Topic selection is often a reflection of children's confidence in the subject domain (Hirsh, 2004). In this phase, children often begin a recursive process of Internet use in which they gauge the viability of potential topics by initial keyword searches of databases and the Web (Bilal, 2004; Shenton, 2007).

8.2.3.3. Stage 3: Exploration In the third stage, exploration, information on the topic is gathered and a new personal knowledge is created (Desjarlais, Willoughby, & Wood, 2008). Students endeavor to locate new information and situate it within their previous understanding of the topic (Kuhlthau, 2004). Early studies of children's information seeking in electronic environments focused mainly on their abilities to navigate conceptually organized browsing interfaces and drew conclusions about children's seeking based on their topic selections (Cool, 2004). As the Internet became more commonly used in information seeking, and the sophistication of information presentation developed accordingly, research turned to children's abilities to form search queries that reflected their questions. These early studies suggested that children tended to excel in information environments created for and by them and that when they were faced with less intuitive interfaces, tended to construct short searches that often lacked the flexibility and sophistication experienced searchers used to get results (Bilal, 2002, 2005; Nahl & Harada, 2004). Prior research has also suggested that successful completion of this phase depends on the extent to which children encounter problems they cannot resolve throughout their searches. That is, when children make the effort to master the search strategies they are taught and unexpected technical problems hinder search problems, children can become discouraged and either abandon the investigation or engage in satisficing seeking based on weak and incomplete search results (Selwyn, 2011; Shenton, 2007; Watson, 2004).

8.2.3.4. Stage 4: Formulation and Stage 5: Collection During the formulation stage, the information seeker starts to evaluate the information that has been gathered. Formulation is considered to be the most important stage of the process because it is in this stage that the information seeker formulates a personalized construction of the topic from the general information gathered in the exploration phase (Kuhlthau, 2004). During the fifth stage, collection, the information seeker has a focused topic and can proceed with a greater sense of ownership over the information seeking process and a clearer sense of desired outcome (Kuhlthau, 2004).

The main instantiation of these phases is the ability to identify relevant search results. Shenton (2007) traced the change in published literature of

relevance assessment discussed as a generic skill, to one situated in the child's prior knowledge of the topic, confidence in the information seeking process, trust of the information source, and other personally constructed ideas toward the information seeking process. Underlying this change, Shenton contended, was researchers' growing familiarity with the complexity of children's processes and willingness to propose more sophisticated conceptions of children's information seeking. In short, he posited that researchers tended to report results in the areas they were examining and did not often note results that did not fit within the frames of their studies, especially when those results took the shape of search failures. While Shenton noted that search failure has been documented by a handful of researchers (e.g., Cool, 2004 and, more recently, Bilal & Sarangthem, 2009) but that exploring the causes of those failures had not been a focus of research.

8.2.3.5. Stage 6: Closure In the sixth and final stage, search closure, the individual has completed the information search. Now the information seeker will summarize and report on the information that was found through the process. The information seeker will experience a sense of relief and, depending on the fruits of their search, either satisfaction or disappointment (Kuhlthau, 2004). This phase is one in which the most current research relating to children's learning in an online environment is important. While not necessarily always considered part of information seeking, children's use of social media as a means by which to communicate what he/she has learned as a result of schoolwork functions as an expression of closure. In 2012, Project Tomorrow reported results of its nationwide survey of school-aged children. Among their findings was a strong preference for using Internet-mediated tools for schoolwork, but especially for communication and assessment of learning:

- 1 in 10 students in grades 6–12 have sent out a Tweet about an academic topic that interests them;
- 15 percent have informally tutored other students online or found an expert to help them with their own questions;
- 18 percent have taken an online assessment to evaluate their own self-knowledge;
- One-fifth have used a mobile app to organize their schoolwork;
- 1 in 4 have used a video that they found online to help with homework;
- 30 percent of middle school students and 46 percent of high school students have used Facebook as an impromptu collaboration tool for classroom projects; and
- Almost half of the high school students have sought out information online to help them better understand a topic that is being studied in class (p. 4).

Robust connectivity allows children to personalize their approaches to learning (Nesbit & Winne, 2008); and the potential to blur the distinction between home and school learning (Project Tomorrow, 2012). Inadequate or unreliable access can distract from the ISP and contribute to frustration and a lack of persistence that may be credited to poor task definition, weak search strategy, or any number of other failures that describe the downside of children's information experiences. Positive Internet experiences, on the other hand, lead children to a sense of success and accomplishment that results in a willingness to be self-directed, independent learners (Selwyn, 2011; Warschauer & Matuchniak, 2010) who understand the relationship between schooling and the rest of their life experiences (Somekh, 2007).

8.3. Methods

In this section, the systematic approach used to select the literature for the synthesis and to analyze the results is described. The researchers chose to focus on peer-reviewed articles available through leading periodical databases to mimic a primary information gathering strategy used commonly by academic researchers (Ge, 2010; Head, 2008; Niu et al., 2010).

8.3.1. Data Collection

To collect data, the researchers first defined the target sample, developed a search strategy, and gathered the initial sample.

8.3.1.1. Definition of the target sample The first step of collecting the data was to clearly define the criteria for inclusion in the study.

Publication date. The first criterion of selecting the study sample was publication date. This criterion was framed by dates that frame the growth of the Internet. As Crandall and Jackson (2001) pointed out, "The obvious candidate for the sudden acceleration in economic growth after 1994 is the Internet" (p. 8). One indication of the phenomenal impact of network connectivity was in 1990, the first World Wide Web server was deployed in Geneva, Switzerland (Berners-Lee, 1996). In 1989, 12 years after Apple introduced the first personal computer in 1977, only 12% of American households possessed any type of home computer (Crandall & Jackson, 2001); by 1994, this figure quickly jumped to over 40% three years after the Internet began connecting users.

Inclusion characteristics. After determining the sampling frame using the databases as boundaries, criteria for study inclusion in a systematic review required that the study participants be located in the United States, and be comprised of participants between the ages of 5–18 years. No restriction was placed on methods used or any other aspect of the study participants. As a truly exploratory search, and in order to fully expose the hypothesis to scrutiny, the sample selection process was broadly derived. Clear inclusion criteria were established at the outset in order to demonstrate reliability and avoid the bias that can occur with selectively sampled studies (Littell, Corcoran, & Pillai, 2008).

8.3.1.2. Search strategy With the sample criteria clearly defined, the next step was to define the search strategy. Definition of the search strategy was a two-step process: (1) identify the relevant databases that index research literature; and, (2) identify relevant articles.

Target databases. Based on this background, we devised the sites for the literature search. Eleven databases that contained full-text, peer-reviewed research articles published between the years 1991 through 2011 were considered, based upon the Joint Information Systems Committee's (JISC) Academic Database Assessment Tool (ADAT). ADAT was used to determine suitability based on the journals included, extent of full-text peer-reviewed journal content, and availability through the Florida State University (FSU) Library system. FSU academic librarians were also consulted on database choice to ensure the widest possible coverage of the subject. The 11 database names and their publishers are listed in Table 8.1.

Table 8.1: Target database names and publishers used in this study.

Database name	Publisher
ACM Digital Library	Association for Computing Machinery
EBSCOHost	EBSCO
Emerald Library E-journals	MCB Publications
Gale Databases	Gale Cengage
Google Scholar	Google
IngentaConnect	PublishingTechnology
OmniFile Full Text Mega Edition	Wilson
ProQuest	ProQuest
SAGE Journals	SAGE Publications
ScienceDirect	Elsevier
Web of Knowledge	Thomson Reuters

Query formation. We purposefully chose very broad search terms to enable the database search to gather a rich selection of articles about children's information seeking in the United States. The terms were broadened to include youth and teens in order to collect studies that may not specifically refer to ages in the metadata.

The query used in each database, "child* OR youth OR teen*" AND "seek* W1 information" retrieved far more results than were relevant. Reasons for this include lack of effective search engine interfaces to adequately and consistently refine and filter the results; lack of comprehensive metadata, particularly with older or foreign articles, that did not adequately identify basic elements of the journal's study sample; and, library collection discontinuities that indicated possession of the full text of the article when the article was not actually available. Two databases were eliminated from the preliminary list: Google Scholar and Emerald were removed because they each yielded an extremely large number of results without providing effective features to filter results to meet the inclusion criteria.

8.3.1.3. Sample collection Given the wide range of terms used to refer to the key concepts of broadband, youth, and information seeking, the researchers intentionally kept the search terms very broad and manually reviewed the search results to determine which studies included broadband in their designs and/or results. Each researcher independently reviewed the results.

Using the FSU databases, the researchers' query yielded a combined total of 3290 articles from nine databases. This group of articles was refined to a final sample of 15 articles using the process illustrated in Figure 8.1. The list of articles included in the final sample is shown in Appendix 8.A.

As Figure 8.1 illustrates, in the systematic review process, the researchers narrowed the total number of search results ($n = 3290$) by discarding obviously irrelevant articles ($n = 3054$). Articles were deemed irrelevant if they did not pertain to any aspect of information seeking; if they did not include any aspect of youth; and if they focused on a site outside of the United States. The researchers then examined the titles and abstracts from the resulting group of articles ($n = 236$) and identified more articles to exclude, leaving 199 full-text, peer-reviewed articles that were available at FSU. Of this group, 46 articles included the use of computer mediation in the study of children, youth, or teens seeking information.

This group was then reviewed to determine whether broadband was considered in the study design or the study results. Broadband was considered broadly, taking into account mentions of high Internet connection speed, "ubiquity," "connectivity," or other expressions of high speed or capacity. Once the researchers excluded articles that did not consider broadband in any way, the sample size was reduced to 15 articles. The Appendix lists the

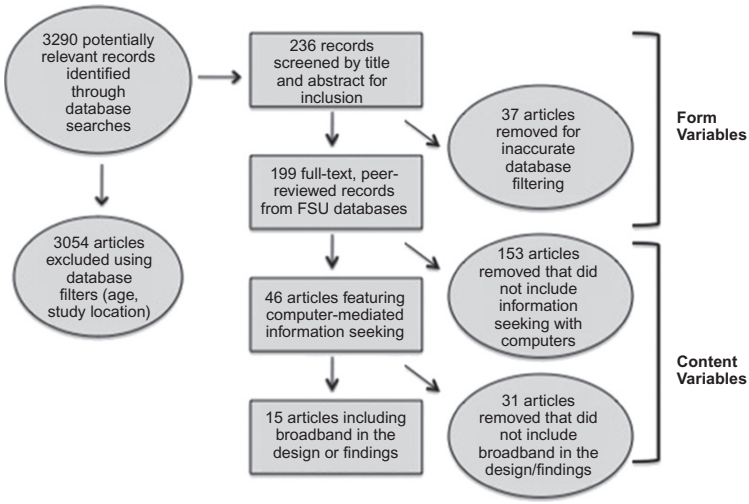

Figure 8.1: Systematic review steps using integrative content analysis. *Form variables*: Design attributes including study location, age of sample, full-text availability, and peer-reviewed articles. *Content variables*: Computer-mediated information seeking: presence of broadband. *Source*: Adapted from Shoemaker and Reese (1996).

full citations and assigned article numbers (A1–A15) for the 15 articles eligible for further analysis.

8.3.2. Data Analysis

The researchers conducted content analysis on the 15 articles that included children's computer-related information seeking to determine the presence and to determine the change of this presence over time.

8.3.2.1. Content analysis Content analysis is "the systematic, objective, quantitative analysis of message characteristics" (Neuendorf, 2002, p. 1). The purpose of content analysis was to determine the nature of broadband's consideration in the study, the type of information seeking activity being described by the study, and the difference between study settings and participants. The unit of analysis was a single, peer-reviewed, full-text article.

Broadband in design and/or use. The researchers were interested in studies in that reflected broadband as an explicit element of study design and/or

broadband as an explicitly stated element of a finding or conclusion. Broadband may have been discussed in the design or findings on a study in the following ways:

- Quality of access resulting from descriptions of ubiquitous, effective, fast, slow, speedy Internet connectivity associated with computer use by children/youth/teens seeking information;
- Quantity of features that work singularly effectively with high-speed Internet connectivity such as multimedia, interactive applications, and presences of a network.
- Type of access resulting from description of technology including bandwidth, latency, and fiber optic networks.

Importance of broadband. After the researchers determined how broadband was included in the study, they sought to determine how important of a consideration broadband was to the study. Importance was classified into three levels and defined as Table 8.2 describes.

Research method. The researchers also noted the research methods used in each study. The method names were taken from study authors' descriptions of the research methods employed in the study.

Classification into Kuhlthau's ISP stages. Once researchers identified reports that included broadband in design or findings, the reports were classified into one of Kuhlthau's ISP stages: Initiation; Selection; Exploration; Formulation; Collection; and Closure. These six stages are described in detail in Section 8.2. The ISP is a useful framework for

Table 8.2: Broadband levels and definitions used in data analysis.

Level	Design	Findings
Low	Broadband was mentioned as a data point to be collected	Broadband is mentioned in passing in results report
Medium	Broadband was mentioned as a data point with explanation as to why it was important to the study	Broadband is discussed as a result but did not have a significant bearing on results interpretation
High	Broadband was mentioned as a data point and with substantial explanation about its importance to the study	Broadband is discussed as a result and had a significant bearing on results interpretation

designing, framing, and analyzing the investigation of information seeking behavior in complex tasks and has been validated in a number of contexts in the last 20 years (Kuhlthau, Heinström, & Todd, 2008).

Description of sites, locales, number of participants, participant gender, and participant SES. The content analysis concluded with an examination of the study settings. That is, researchers noted: study site (e.g., elementary school, middle school, high school, public library, home); locale (urban, suburban, rural); SES (high poverty, low poverty, both); and gender (male, female).

8.3.2.2. Frequency analysis The publication dates of research reports used in the content analysis were frequency analyzed to determine change over time. Then, journal titles were visually inspected for frequency of publication years as well as the names of authors.

8.4. Results

This section presents the results of the content analysis and frequency analysis procedures.

8.4.1. Content Analysis Phase 1

All subsequent analyses were performed on the final group of 15 articles. The first phase of content analysis, summarized in Table 8.3, captured the role of broadband in study design or study findings as well as the data collection methods, query types, and ISP stages.

8.4.1.1. Broadband in study design and results The researchers analyzed the content each of the 15 eligible studies to determine whether broadband was included in the study design or the study results or findings. Table 8.3 illustrates the number of studies that included broadband in study design, in study results, or in both study design and results. As the table demonstrates, the majority of the eligible studies ($n = 9$ or 60%) included broadband in both the study design and the study findings. Only one study included broadband in design but did not also report it in findings. The remaining five studies reported broadband as part of a study finding.

Importance of broadband. Once the researchers established broadband's role in each of the content analyzed methods, the researchers sought to

Table 8.3: Broadband articles by study method, broadband inclusion type, broadband importance, query type, and ISP stage.

Article number	Design	Finding	Importance	Method(s)	Query type	ISP stage
A1	Yes	Yes	High	Survey Interview	Unimposed	1–5
A2	Yes	Yes	High	Systematic review	N/A	N/A
A3	Yes	Yes	High	Systematic review	N/A	N/A
A4	Yes	No	Low	Interview	Imposed/ Unimposed	2,4,5
A5	Yes	Yes	Medium	Survey	Unimposed	5,6
A6	Yes	Yes	High	Observation	N/A	N/A
A7	No	Yes	High	Observation Interview	Imposed	3–5
A8	Yes	Yes	Low	Observation Interview	Unimposed	1,4,6
A9	No	Yes	High	Survey Content analysis	Unimposed	2–5
A10	Yes	Yes	High	Interview	Unimposed	6
A11	No	Yes	Medium	Observation Interview Content analysis	Unimposed	1–5
A12	No	Yes	Medium	Survey Interview	Unimposed	6
A13	Yes	Yes	High	Survey	Imposed/ Unimposed	4,5
A14	No	Yes	Low	Observation Interview	Imposed/ Unimposed	4,5
A15	Yes	Yes	High	Survey	Unimposed	4,6

determine the extent to which broadband played a role. As described in Table 8.3, the presence of broadband was classified into three levels: low, medium, and high. For the nine articles that included broadband in both study findings and study results, seven had a high presence of broadband, one had a medium presence of broadband, and one had a low presence of broadband. The one article in which broadband was included in study design but not in study results reflected a low presence of broadband. The

remaining five articles included broadband only in the results reporting and of those articles, two had a high presence of broadband, two had a medium presence of broadband, and one had a low presence of broadband.

To further illustrate how the researchers discerned broadband presence, Table 8.4 includes example quotes from the eligible articles that reflect each level. Each quote is appended with the article number and article page number.

8.4.1.2. Study method Next, the researchers examined each of the studies to determine the methods used in data collection. As Table 8.3 indicates, the majority ($n = 9$) of the eligible studies used two or more data collection methods. Study A13 used three data collection methods. The remaining six studies employed a single data collection method.

The most common data methods were interview ($n = 7$), survey ($n = 6$), and observation ($n = 5$). For both data collection and data analysis methods, published research was the basis for systematic review ($n = 2$) and participant-provided artifacts informed content analyses ($n = 2$).

8.4.1.3. Query type The researchers also reviewed the content of the eligible articles to determine the types of queries that guided the tasks under study. The majority ($n = 8$) of the eligible studies were based on activities in which children were defining their own search tasks in unimposed queries while only two studies looked at children working on an imposed query. Three of the studies described situations in which children were using the Internet in tasks driven by both imposed and unimposed queries. The remaining two studies (A2 and A3), both systematic reviews, were not focused on a particular type of query. While each systematic review synthesized prior research that reflected both kinds of queries, the researchers determined that a secondary assignment of query was not meaningful for this study.

8.4.1.4. ISP stage The final task the researchers conducted during the content analysis phase of the data analysis was to note the stages of the ISP (Kuhlthau, 2004) were reflected by the activities reported in the eligible articles. These stages are Stage 1: Initiation; Stage 2: Selection; Stage 3: Exploration; Stage 4: Formulation; Stage 5: Collection; and Stage 6: Closure. Each stage is detailed in Section 8.2 of this research report.

Stage 4: Formulation ($n = 9$) and Stage 5: Collection ($n = 8$) were most often included in the eligible studies. Stage 6: Closure was reflected in five of the studies. Stage 2: Selection and Stage 3: Exploration were reflected in four studies while Stage 1: Initiation was included in three studies: A1, A6, and A13.

Table 8.4: Example quotes of levels indicating broadband inclusion in design or results.

Level	Design	Results
Low	*The group discussion guide was broad, including the following sections … Self-reported challenges encountered when using the Internet*. (A10, p. 243, e3)	*A lack of Internet experience, however, often led to quick abandonment of the Internet as an information source*. (A15, p. 415)
Medium	*In addition, participants were asked (1) the speed of their Internet connection, (2) if the line they use to connect to the Internet is ever needed for phone use, and (3) the extent to which parental rules restricted their weekday leisure time allocation* (A4, p. 637)	*For example, if the average participant reported spending 46 min online, she or he might spend 36 of those minutes IMing, 30 min downloading music from a favorite website, and, during this activity, visit a chat room for 5 min (all the while ostensibly conducting research for her social studies homework)*. (A4, p. 641)
High	*Respondents were asked to complete a pencil-and-paper survey to describe their access, frequency of use and comfort levels regarding general Internet use*. (A1, p. 54)	*Although T-1 lines connected the school's computers, sometimes the system was overloaded; graphics frequently took a long time to load. Slow connect times quickly tried students' patience, especially when they had only 45 minutes to use the school's library during their regularly scheduled library visits; waiting for the computer to load limited the amount of research students could accomplish. In some cases, slow connections caused students to abort their search or to shy away from Internet sites that could have contained useful information because they did not want to wait for them to load*. (A11, pp. 1270–1271)

8.4.1.5. Study participants In the second phase of the content analysis, the researchers examined each of the eligible studies to characterize their participants. Table 8.5 summarizes the study locales and sites as well as the participants' numbers and characteristics. Studies A2 and A3 are systematic reviews and this did not have participants, locations, or sites to record.

Number of participants. As Table 8.5 shows, the eligible studies included a wide range of participants, from 4 to 2416 children. Studies A2 and A3 are systematic reviews and this did not have participants. Study A5 was a case study that described the activities of children within an educational program at a homeless shelter and did not provide the number of participants.

Locale. The majority of the studies took place in suburban settings ($n = 5$), and as many took place in urban locales ($n = 5$). Only one study was conducted in a rural location. Three studies did not report a location.

Site. Public schools ($n = 5$) were popular study sites as were health centers and agencies ($n = 3$). Home was the site on two studies while a homeless shelter and a public library provided the sites of the two remaining studies.

Age. With the exception of study A15 that reported an age group as "Under 13," all studies that reported age ($n = 11$) included specific ages. The lowest age specifically reported was nine years old and five studies included eighteen-year-old participants. The majority of the studies included participants between 13 and 17 years old.

Gender. All of the studies that reported participant gender ($n = 11$) included both male and female participants. Two studies did not report gender.

SES. Seven studies specifically reported SES and five of those studies mentioned including both high and low SES participants. Two studies' participants were described as having high SES.

8.4.2. Relationship Analysis Results

The researchers visually inspected the publication dates and journal titles for frequency. Table 8.6 depicts the results by article number for frequencies of authors, publications years (Year), and journal title.

Table 8.5: Eligible studies' number of participants (*N*), locale, site, age, gender, and SES.

Article number	Study *N*	Study locale	Study site	Participant age	Participant gender	Participant SES
A1	319	Urban	Health center	13–18	Male Female	High Low
A2	N/A	N/A	N/A	N/A	N/A	N/A
A3	N/A	N/A	N/A	N/A	N/A	N/A
A4	157	Suburban	Public school	11–18	Male Female	High Low
A5	261	Suburban	Public school	12–13	Male Female	High
A6	Not reported	Urban	Homeless shelter	13–18	Male Female	Not reported
A7	10	Suburban	Public school	10–12	Male Female	Not reported
A8	7	Not reported	Home	15–17	Male Female	Not reported
A9	255	Suburban	Home	13–15	Not reported	High
A10	4	Not reported	Health agency	14–16	Male Female	Not reported
A11	16	Suburban	Public school	14–18	Not reported	High Low
A12	2416	Urban	Public school	9–12	Male Female	High Low
A13	405	Rural	Health agency	13–18	Male Female	Not reported
A14	11	Urban	Public library	Under 13 13–17	Male Female	Not reported
A15	1501	Not reported	Home	10–17	Male Female	High Low

Table 8.6: Broadband articles by author, publication year, and journal title.

Article	Author(s) (Year)	Journal title
A1	Borzekowski and Rickert (2001)	*Journal of Applied Developmental Psychology*
A2	Chan, Hue, Chou, and Tzeng (2001)	*Computers & Education*
A3	Dresang (2005)	*Library Trends*
A4	Gray, Klein, Noyce, Sesselberg, and Cantrill (2005)	*Journal of Adolescent Health*
A5	Gross (2004)	*Journal of Applied Developmental Psychology*
A6	Hendry et al. (2011)	*Children and Youth Services Review*
A7	Hirsh (1999)	*Journal of the American Society for Information Science*
A8	Jacobs (2006)	*Journal of Literacy Research*
A9	Marshall and Reday (2007)	*Young Consumers*
A10	O'Conner-Von (2009)	*Journal of Pediatric Oncology Nursing*
A11	Pickard (2008)	*Popular Narrative Media*
A12	Radford (2006)	*Library Trends*
A13	Rushing and Stephens (2011)	*The Journal of Primary Prevention*
A14	Slone (2003)	*Library & Information Science Research*
A15	Ybarra, Alexander, and Mitchell (2005)	*Journal of Adolescent Health*

As Table 8.6 shows, no author contributed to more than one of the publications in the analysis.

The publication dates reflected 2005 ($n = 3$) most frequently, followed 2006, 2001 ($n = 2$), and 2011 with two years. Finally 1991, 2003, and 2004 each had one publication per year.

The *Journal of Applied Developmental Psychology* and the *Journal of Adolescent Health* each published two of the publications in the analysis while *Computers & Education*; *Children and Youth Services Review*; *Journal of the American Society for Information Science*; *Journal of Literacy Research*; *Journal of Pediatric Oncology Nursing*; *Library & Information Science Research*; *Library Trends*; *Popular Narrative Media*; and *Young Consumers* represented only one publication per journal title.

8.5. Discussion

In this section, the results of the analyses in the context of each of the research questions are examined. The section concludes with some possible limitations and cautions to results interpretation.

RQ1. To what extent broadband emerged as a factor in the design and results of studies of children's information seeking?

Broadband is increasingly considered a cornerstone affordance of contemporary life and learning. Based on the number of studies first retrieved, the number of studies that had to be examined, and the subsequent analyses of method, no evidence suggests that academic researchers consistently consider broadband in study design or results. While there is a growing body of work that provide reasons for adoption and the new seeking that individuals adopt (Bennett, Stewart, & Atkinson, 2013), the ways in which broadband impacts imposed information seeking upon children in K-20 environments is not widely considered in scholarly studies.

As indicated in the literature, the lag between broadband availability and broadband adoption appears to parallel the study of broadband in research of children's information seeking. The results of this study showed that researchers considered broadband in only 15 studies over 20 years and that only four of those years had more than one broadband-inclusive study. Equally remarkable is that despite the fact that broadband began spreading into homes in 1991, no study considered broadband's role in children's information seeking until 1999. Only three journals produced any more than one study and no journal produced more than two broadband reflective research reports in 20 years. Health-related journals produced six studies, information studies journals provided five, and the remaining studies were published in communication- or education-related publications. Non-imposed information seeking comprised at least 11 of the studies. Queries were imposed in 5 of the 15 studies and three of these included mixed queries.

In spite of Internet availability mandate of national and state policy plans (FCC, 2010a) and the specific technology-enhanced educational mission, as outlined by NETP, the number of studies in which researchers examined broadband in any aspect of children's information seeking is minimal. With such scant research, it is simply not possible to determine the extent to which broadband's "always on" nature or the sluggishness of an insufficient connection affects children's decisions to remain engaged in an information seeking task or undertake any online information-related activities. While the U.S. Department of Education (2010) stressed that broadband connectivity was a crucial aspect of anytime, anywhere learning,

only 60% of the focused on computer-mediated information seeking by children examined this element. The fact that four of the five research reports examined in this study studies reported a broadband-related finding of high and two of medium importance suggests that broadband may emerge as an important element, even if not intentionally studied. These findings can be seen to mirror the FCC (2012) report's conclusion that broadband speed measurement is confusing and often misrepresented and may not always be considered or understood by consumers, researchers, and policymakers. Perhaps this "measurement confusion" (Carmichael, McClure, Mandel, & Mardis, 2012) is why so few authors of the research reports targeted for this study considered broadband as a factor in study design or findings.

Broadband policy clearly favors increasing adoption and nascent research has demonstrated that broadband has strong potential to enrich household activities and children's learning (Joshi et al., 2011). However, as more states increase the number and size of their digital learning initiatives, the inconclusive nature of this research does not support that communities, schools, and homes are prepared to offer the ubiquitous access necessary to use broadband to its potential. Equally unclear is whether researchers study the effects of the absence or presence of broadband factor with the intensity or frequency it deserves.

RQ2. Which information seeking emerged in studies that considered broadband?

In this study, we used the search "information seeking" as a proxy in order to capture activity that is distinguished from a broad span of information behavior for its often intentional and high stakes nature (Case, 2012). In spite of Peters' (2008) assertion that teacher-directed activities connect home and school Internet use, 12 of the 15 studies were driven by unimposed queries derived from activities based on the ISP Stage 1 of Initiation. Study A1 described the use of the Internet for personal health care information. Study A8 explored adolescents' use of digital text messaging to focus the initiation process while Study A11 described this type of iterative query construction as a disruptive, stating that teachers felt that sharing query ideas encouraged "'messing about' and 'getting no work done'" (p. 59) and wasting bandwidth on frivolous pursuits. Natural curiosity and personally developed search seeking will likely become more prominent as statewide digital learning initiatives increase students' need to seek information for a larger number of learning tasks. Project Tomorrow has indicated that teachers will face technical challenges but this seeking will likely pose some as well.

The ISP Stage 2 process of Selection was explored in four articles (A1, A4, A9, and A11). In spite of the Mardis (2008) finding that children often sought help from librarians for help with assignments, Study A11's findings indicated that students preferred to use social "trial and error" methods of search refinement instead of asking for help. Because teachers and librarians found this type of collaboration to be inefficient use of time and bandwidth, teachers and librarians advocated limiting student Internet access to curtail this information seeking. However, studies A1, A4, and A9 all indicated that when children had positive experiences while information seeking for health information, they became confident information seekers and were elevated to the position of family technology decision-maker due to their familiarity with Internet use. These findings extended the Rompaey, Roe, and Struys (2002) and Tripp (2011) studies of children's influence on home technology adoption, demonstrating uses beyond schoolwork completion to practical, everyday decision-making support. Home broadband offers the entire family greater opportunity to increase Internet use (Hsieh et al., 2008; Van der Heijden, 2004; Venkatesh & Brown, 2001).

ISP Stage 3, Exploration was characterized in studies A1, A7, A9, and A11. While previous research indicated that children may abandon searches if their search strategies are not successful or they encounter technical difficulties (Selwyn, 2011; Shenton, 2007; Watson, 2004), Pickard (2008) found that peer interaction was beneficial to students in overcoming this challenge (A11); A1's study of adolescents seeking health information found that users referred back to family, peers, and health care professionals when faced with questionable information (A1). However, Study A8 reinforced the need for increased media literacy skills in a digital environment that could deliver information in a quantity commensurate with broadband capacity, as youths of all ages struggled to accurately assess the authority of this information (A7). Risky online seeking and online safety concerns (Cranmer, 2006; Livingstone & Helsper, 2007) were mitigated by an increase in digital literacy skills and Study A8's findings extended this concern to the use of the Internet for schoolwork as well. In each of these studies, broadband access was a backdrop for skills and abilities for digital learning.

ISP Stages 4 and 5 were strongly captured in the many studies in which ubiquitous connectivity enabled, and in some instances, seemed almost to require personalization. Overwhelmingly, the ability to independently seek information in preferred modes appeared in several of the studies, especially those focused on seeking health-related information (A1, A2, A10, A13). Personalized health-related information seeking allowed youth to take advantage of interactive features that filtered out irrelevant information for them (A1, A13). Personalization demonstrates the user's query formulation in response to information problems,

adopting findings into a personally curated collection of perceived, credible resources. A13's focus on Native American teens provided a rich discussion of possible avenues for further research that begin to address Shenton's (2007) concerns that search failures are underreported, thus neglected in future studies (2007).

The ability to seek information independently and confidently, a foundation of digital literacy, was heavily impacted by youth and teen preference for interactive, bandwidth-intensive web resources and applications. For youth, "Internet sites must include and merge attention keeping qualities" (A1, p. 57). In fact, Study A15 reported that in comparison to other age groups, children 13 and under preferred websites that were light on text and had few graphics to download so that they could quickly decide whether to stay on the web page or view another site. A15 clearly showed how the act of information seeking is very much intertwined with the connectivity along which the query is transmitted and search resulted returned.

The research reports examined in the study also expanded the idea ISP Stages 4's Formulation and Stage 5's Collection. For example, A8's case study of instant messaging for homework suggested the constant background tasking functioned as a basic literacy skill. The need for simultaneous simulation and online social interaction was also reflected in a study of homeless youth (A6). The collaborative, social use of digital content and applications in information seeking, enabled by broadband, can be viewed as seeking enhanced by digital environments and offering stronger formulation and collection processes in achieving the user's desired outcomes, as described by Kuhlthau (2004).

The ISP Stage 6 Closure process also focuses on communication. Research reports examined in this study described the use of email and chat to obtain information from peers and friends as a form of search closure (A4, A5, A15). A finding of A3 noted that, contrary to current concern that youth may be isolating themselves with intensive Internet use, youth find greater connectivity in a social, online environment. The creative nature of networked learning also contributed to increased involvement in designing materials, and especially in a collaborative process (A2, A6, A11). In A10, study participants used online forums to communicate advice for cancer patients and families and this contributed to the work of the pediatric oncology nurse workforce (A10). These studies provided a rich complement to the findings Project Tomorrow's (2012) national survey of school-aged children in which the researchers reported that youth value the Internet as a means to enhance knowledge and skills beyond what was needed to complete homework (Livingstone & Helsper, 2010).

Jacobs' case study exemplifies the need to understand new seeking, especially youths as "text producers, distributors and consumers," so that they can be used and taught in the classroom. She also suggests that

understanding how these activities are culturally meaningful may help avoid the barriers posed for students with limited or no access (A8). Hendry et al.'s study of a computer drop-in center for homeless youth reinforces the need for engaging, stimulating settings that include interactive, visually appealing web resources; and that in learning how to use information technology and digital media provides a means to learn relationship skills and possibly helps to create a path out of homelessness (A6).

While they may be verifying information accuracy with other sources, there remains a concern about inaccurate information in this area (A10, A13). Gross's study of Internet use by depressive youths found that often, vulnerable youth would exhibit seeking activity called "solitary pretending" (A5). Other problematic behaviors include information overload (A11), and increased meetings with strangers (A15). But youths who seek health-related information like the private nature of Internet searches. Lacking the ability to use the Internet at home would likely deny most youths the opportunity to conduct this search, further diminishing youth perception of Internet value (Holmes, 2011; Livingstone & Helsper, 2007; Project Tomorrow, 2012).

RQ3. Which sites, locales, participant socioeconomic status (SES), and participant genders have researchers considered?

Availability of household broadband is a necessary, but not sufficient, condition for household broadband adoption. As many studies have indicated, broadband adoption, both in the United States and globally, is drawn largely on socioeconomic lines, primarily income (Connected Nation, 2011; OECD, 2013). Further, both the NETP (U.S. Department of Education, 2010) and Project Tomorrow's (2012) and (2013) reports, all broadband focused position papers and reports, reinforced the potential broadband had to improve the educational prospects for all students. In light of these contentions, few studies in the small sample fully described their participants or documented the role demographic differences may have played in study results. Seven of the 15 studies indicated a distinction between SES factors; of these seven, five study samples indicated a combination of SES factors. Study A1 presented two distinct SES groups of high school students, one group from an elite population for which the annual school tuition cost was nearly $21,000 and, another group of high school students who used public computers in a health center while they waited for free medical care (A1). The authors reported that most of the significant differences in Internet use between the two groups were drawn along "income lines" (A1, p. 56) and that ethnic and racial differences were not significant factors in Internet use. In A1, the researchers suggested that the low SES group experienced a "digital divide" (A1, p. 56) but did not

elaborate further on how increased or improved access might diminish this separation. On the other hand, in A4, researchers found that adolescents who sought information about health and medicine did not exhibit differences along SES lines — A4 participants' experience were focused on participation in a "common online experience" (A4 p. 1474) in which their differences were not apparent.

Five of the studies did not distinguish locale (i.e., urban, suburban, or rural). Two studies noted the inclusion of all locales but did not report results based on locale. Locale was noted in A1 as an element for further study, particularly between groups located in urban, suburban, and rural settings (A1). A15 reported demographic characteristics but the primary intent of the study was to examine relationships between health symptoms and use of the Internet, thus the technology was not the focal point and no relationship was reported, a practice repeated by several of the studies (A5, A9, A11).

Public schools and libraries were the sites for 6 of the 15 broadband studies, while health agencies hosted three studies. For the students described by A11, the study design was purposely heterogeneous by site type as well as locale. The A11 researchers reported SES indicators as well, in an attempt to gather information on "unique cases that could provide valuable insight into specific instances" (A11, p. 53). However, these demographic characteristics were not commented on in the findings. A11's researchers described the study site choice in great detail and indicated that the students used the location at times when supervision would be least present and this absent supervision seemed to break down barriers to learning in an online environment (A11). Building on A11's reports of personal, unaudited approaches to information seeking, A9's researchers drew strong correlations between home use of the Internet and youth competence in information seeking, just as Project Tomorrow (2013) reported.

A5, along with A15 and A9, presented studies in which gender and age appeared as strong factors the intensity of and the type of activity in Internet use (A1, A5, A9, A15). A9's researchers purposefully sought out male youths as participants but acknowledged this selection as a limitation due to upon prevailing data indicating stronger computer skills among young males (A9). In A15, the study sample was mostly male, but this study was focused on the relationship of all characteristics to symptoms of depression, but participant gender was not considered in relation to Internet use. Study A5 reported participant gender and age, and ethnicity. A5's researcher reported by gender and age, how youth spent their time on the Internet, distinguishing similar trends of use: boys played more games; girls used more social media and communication tools; and, activities trended similarly along different age groups. Interestingly, the A5 study

examined the use of an online avatar to transcend identity and assume different personae (A5). In A5, the researcher attempted to extend the challenge issued by Livingstone (2003) and further the research on details of Internet use by youths in order to "illuminate critical, subjective aspects of adolescent Internet use (e.g., motives) that may be difficult to capture" (A5, p. 646).

Overall, gender and age are most highly reported characteristics in this sample but relationships are often drawn to variables other than use of broadband technology. However, the studies that do focus on computer intensive information seeking make connections that support the NCES data linking the effects of home Internet use with student abilities in manipulating the digital environment (A5, A7, A9, and A15).

RQ4. How has the role of broadband changed over time in studies of children's information seeking?

Based on the results, there was not enough evidence to answer this question. Based on the evidence presented, in five of the studies, when children's learning seeking was the focus of a study, broadband deployment emerged as a facilitating condition, that is, as a high-level of Internet connection, even when broadband was not included in the study design. Based on the 15 research reports examined in this study, broadband's occurrence in study design or finding began in 1998 and did not increase over time, and no relationship can be discerned using the study's publication year.

8.6. Limitations

A few external factors influenced the data collection for this study. The researchers excluded research published in monographs, dissertations, and open access publications because we decided such a wide-ranging search would not represent an information gathering strategy common to academic researchers (Ge, 2010; Head, 2008; Niu et al., 2010). Because data were drawn from 11 different databases, searches had to be adjusted to suit the various search algorithms and indexing practices employed by different database publishers. Similarly, the researchers had no way of knowing if all possible articles in the database that met the search criteria were retrieved due to possible human or machine generated metadata generation inconsistencies. It should also be noted that periodical databases are dynamic and while data were collected from each database individually in separate single retrieval sessions, subsequent efforts to replicate the article counts described in Figure 8.1 may not be possible. Despite these cautions, a number of measures were taken to ensure that the data

collection and analysis adhered to high standards, was valid, and could be considered reliable.

8.6.1. Validity

The intent of this study was to identify the research contained in the scholarly journal databases available at a prominent academic institution's library. While abundant data about the deployment of broadband are being published through a variety of outlets, our aim was to describe the possible gap in the literature for research that reflected the impact of broadband on children's information seeking. To accommodate term variants common in developing research areas, the retrieved studies were coded using an open and axial method. The study team created a preliminary codebook and then revised it as the articles were analyzed. Further, inter-rater reliability was addressed and minimized by the researchers conducting searches using the agreed upon search string to compare use of the database search interface. By taking these steps, researchers minimized bias and agreed upon the descriptive presentation of results. While descriptive statistics were generated about the study designs, the only conclusions drawn are that the studies are inconsistent in implementation of characteristics that are known to be important to the study of children's use of technology and information seeking in general. Factors like SES, gender, and detailed variable measurements of the technology observed were not always included in the study design or in the findings, thus it is important not to overstate the results based on the number of studies included in the review but to gather characteristics that are emerging in scholarly research.

8.6.2. Reliability

Reliability of this study is based upon setting clear inclusion criteria and insuring that results can be discerned upon replication. The researchers simultaneously conducted searches to ensure consistent use of the different search interfaces of each database. Further, with a relatively unstudied topic like the influence of broadband on children's information seeking, the likelihood that the results of searches conducted today would yield greater numbers in the future cannot be predicted. Agreement rate with systematic reviews is the clearest technique to assure reliability and the authors worked together, reviewing all the included articles to minimize inconsistencies. In gathering data from each study, a table of terms was compiled to view the language being used to indicate the presence of broadband in the study; these terms were discussed several times by the authors to reduce discrepancies.

8.7. Conclusion: A Failure to Connect?

The intent of this study was to examine the corpus of 20 years of academic research conducted about children's information seeking in relation to the role of broadband in schoolwork. In light of the recognition that the Internet is an essential affordance of modern society and instrumental for learning, the United States has undertaken an array of initiatives to encourage organizational leaders and citizens of the importance of adopting and making meaningful use of broadband Internet that is "always on." Quite simply, broadband is an unquestionable high-level national imperative that requires swift and decisive action to ensure that citizens in the United States can compete and are educated to thrive in a global society infused with robust connectivity that enables commerce, scientific pursuit, lifelong learning, civic engagement, and social exchange.

Policy initiatives have established the basis for high-speed connectivity to homes and schools that is present, but not always adequate. Continued adoption and demand for connection improvement and stability are frustrated by a layer of community members, many of whom are parents, who do not believe that broadband is a valuable home utility for their families. In the last two decades, schools have progressed to nearly complete adoption of broadband, thus allowing children primary and complementary sites for access, but school connections are often inadequate in bandwidth and quantity for the kind of multimedia-rich learning that fuels virtual coursework, digital textbooks, distributed collaborations, and other activities of 21st century learners. Without adequate broadband, children are unable to truly integrate the available technology in their lives (Kozma, 2011).

However, in the same way that the current national infrastructure for broadband tends to be sparse, so too is the research literature about the relationship between broadband and children's efforts to use computers ($n = 46$), especially broadband Internet ($n = 15$), to gather information. In the few occurrences of published research, broadband appeared to have at least a minimal role in children's use of the Internet to seek information for school, especially in the question formation and refinement stages of the Kuhlthau's (2004) Information Search Process.

8.7.1. Implications for Research

At this point in the research report, the reader may be confused or perhaps feel a bit betrayed by the less than overwhelming findings and concise discussion presented here. However, rather than abandon the study as a failure to connect broadband to children's information seeking, the researchers carefully considered every aspect of the results and subsequent discussion

and found them revealing of the immanent need to consider broadband in the research designs and in the analyses of research results. They came to this conclusion after reflecting on their own research process to ensure that it was appropriately motivated and properly conducted and, therefore, solid enough to issue meaningful implications for research and policy. This reflection yielded the following implications for further research:

8.7.1.1. "Failed" studies yield important results A "failed" study is one in which the conclusions are not clear or the study did not go as planned, that is, "pear-shaped" (Cameron, 2007). Encountering failed studies in scholarly publications is rare. All too often, as Boman and Jevne (2000) noted:

> [B]y the time the research is presented or written-up, all the perils and pitfalls of the research experience have been omitted or smoothed out in a tidy report outlining what went right rather than what went wrong in the research endeavor. (p. 547)

Certainly the small number of studies eligible for our systematic review gave the researchers pause. The researchers are aware that "personal investment in research might blinker researchers from issues in study design" (Cameron, 2007, p. 74) and they carefully reviewed the procedures and motives. Ultimately, they chose to present this research in line with the sentiments of experienced education researchers Shenton (2004) and Lee, Croninger, and Smith (1997) who stated:

> [I]t is unusual to discuss misgivings about data and findings in a journal venue, which is typically the place where authors make arguments that engender confidence in their study's results and in the appropriateness of the data used to generate their findings. We suggest, however, that being candid about difficulties during the conduct of a study, and about … misgivings about the data, may be useful to other researchers. (p. 113)

With this conviction, we further investigated the supporting and explanatory literature for the method and found that the term "empty review" has been used to describe a meta-analytic study in which there are few or no eligible results (Cooper, 1984; Lang, Edwards, & Fleiszer, 2007; Schlosser & Sigafoos, 2009; Yaffee, Montgomery, Hopewell, & Shepard, 2012). Cooper (2010) suggested that, while systematic review may be premature with a body of literature that is young or undeveloped, for a more established body of literature, a systematic review may provide appraisal of the literature and tripe directions for research questions. Even when few or no conclusions may be drawn from the review results, a dearth of results may

indicate unrealized research potential or need. Especially in the instance of a disruptive, dynamic technology like broadband, empty systematic reviews may allow researchers to identify gaps in the knowledge related to the effects of a new technology on a particular user group. Certainly in the case of this study, one conclusion is that despite its identification as a key affordance, the role of broadband in children's information seeking is the subject of little research.

Empty systematic reviews may also help researchers to see creative methodological applications or important unstudied variables. In addition to connection speed, details such as device type, broadband technology in use, applications used, hardware employed, and state of the data network providing connectivity all affect ubiquity and user experience in information seeking. Even when broadband was discussed in the small number of results in this study, those discussions were not in depth enough to plumb these additional factors. Therefore, another conclusion that can be drawn from this study is that the absence of research concerning invisible or less obvious structural influences on children's information seeking in digital environments is a warrant for further study.

8.7.1.2. Broadband research is imperative and challenging The importance of broadband to American life, established by numerous policy directives, two decades of reports, federal and nongovernmental agency missions, and a mounting body of scholarly research, is hardly up for debate. Likewise undeniable is the need to prepare children to function in an information rich, hyper-connected world in which children in many peer nations have access to broadband for learning and communication and gain a level of digital literacy that surpasses that of children in the United States. While the need for more research may be self-evident, conducting more research on the impact of broadband in children's learning and getting a clearer idea of the interplay between technology, connectivity, and educational attainment is far from simple.

Just as the research about information seeking would benefit from a specific consideration of broadband in study design and results analysis, so too would research benefit from considering the nature of children's access, not just what happens with the access they have. As the NTIA (2012) pointed out in a recent report:

> Until recently, research on broadband availability has typically taken a binary approach, i.e., whether it is or is not available … [C]onsumers, businesses, and institutional users have a variety of broadband requirements, and faster speeds are among the most important … others require significantly higher speeds to access a more advanced set of applications,

> including real-time video streaming and video conferencing, distance learning, and telemedicine. This variation in user needs underscores the importance of evaluating broadband availability across multiple speed tiers, not just the baseline speed level. (p. 16)

Castells (2000) exhorts in his acclaimed treatise on networked society that technology, especially for younger generations, is an "augmentation of the body and mind." However, to date, published research in peer-reviewed journals has not extensively explored the role of broadband as a key facilitator. This paucity of research may indicate that researchers are disconnected from fundamental questions that will allow a greater understanding of information seeking. Broadband's role is a subtly complex one that goes beyond a simple conception of a have/have not digital *divide*; rather, a more accurate descriptive term is *disconnect*, because there are multiple points at which an individual must disconnect from obstacles to promised benefits (Warschauer, 2003). This study not only issues a call for more research, but also for more kinds of research that take into account a greater number of factors that affect the role of broadband in learning.

Slone (2003) pointed out, "[P]eople who do not understand the Internet often cannot truly access it" (p. 415). If researchers fail to connect broadband to children's information needs, then policymakers will fail to connect the economic impact of depriving the United States' children access to the information access they require.

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APPENDIX 8.A: Eligible Articles by Article Number, APA Reference, and Database Source

Article number	APA reference	Database
A1	Borzekowski, D. L. G., & Rickert, V. I. (2001). Adolescents, the Internet, and health: Issues of access and content. *Journal of Applied Developmental Psychology*, *22*(1), 49–59. doi:10.1016/S0193-3973(00)00065-4	ScienceDirect
A2	Chan, T.-W., Hue, C.-W., Chou, C.-Y., & Tzeng, O. J. L. (2001). Four spaces of network learning models. *Computers & Education*, *37*(2), 141–161. doi:10.1016/S0360-1315(01)00044-6	ScienceDirect
A3	Dresang, E. (2005). The information-seeking behavior of youth in the digital environment. *Library Trends*, *54*(2), 178–196.	Web of Knowledge
A4	Gray, N. J., Klein, J. D., Noyce, P. R., Sesselberg, T. S., & Cantrill, J. A. (2005). The Internet: A window on adolescent health literacy. *Journal of Adolescent Health*, *37*(3), 243. e241–243, e247. doi:10.1016/j.jadohealth.2004.08.023	ScienceDirect
A5	Gross, E. F. (2004). Adolescent Internet use: What we expect, what teens report. *Journal of Applied Developmental Psychology*, *25*(6), 633–649. doi:10.1016/j.appdev.2004.09.005	ScienceDirect
A6	Hendry, D. G., Woelfer, J. P., Harper, R., Bauer, T., Fitzer, B., & Champagne, M. (2011). How to integrate digital media into a drop-in for homeless young people for deepening relationships between youth and adults. *Children and Youth Services Review*, *33*(5), 774–782. doi:10.1016/j.childyouth.2010.11.024	ScienceDirect
A7	Hirsh, S. G. (1999). Children's relevance criteria and information seeking on electronic resources. *Journal of the American Society for Information Science*, *50*(14), 1265–1283. doi:10.1002/(sici)1097-4571(1999)50:14 < 1265:: aid-asi2 > 3.3.co;2-5	Web of Knowledge

Appendix 8.A: (*Continued*)

Article number	APA reference	Database
A8	Jacobs, G. E. (2006). Fast times and digital literacy: Participation roles and portfolio construction within instant messaging. *Journal of Literacy Research*, *38*(2), 171–196. doi:10.1207/s15548430jlr3802_3	SageJournals
A9	Marshall, R., & Reday, A. P. (2007). Internet-enabled youth and power in family decisions. *Young Consumers: Insight and Ideas for Responsible Marketers*, *8*(3), 177–183. doi:10.1108/17473610710780927	IngentaConnect
A10	O'Conner-Von, S. (2009). Coping with cancer: A web-based educational program for early and middle adolescents. *Journal of Pediatric Oncology Nursing*, *26*(4), 230–241. doi:10.1177/1043454209334417	SageJournals
A11	Pickard, A. J. (2008). Rich pictures: Researching the role of peer interaction for pupils using the internet. *Popular Narrative Media*, *1*, 169–181.	Gale
A12	Radford, M. L. (2006). The critical incident technique and the qualitative evaluation of the connecting libraries and schools project. *Library Trends*, *55*(1), 46–64. doi:10.1353/lib.2006.0051	Web of Knowledge
A13	Rushing, S., & Stephens, D. (2011). Use of media technologies by Native American teens and young adults in the Pacific Northwest: Exploring their utility for designing culturally appropriate technology-based health interventions. *The Journal of Primary Prevention*, *32*(3–4), 135–145. doi:10.1007/s10935-011-0242-z	IngentaConnect
A14	Slone, D. J. (2003). Internet search approaches: The influence of age, search goals, and experience. *Library & Information Science Research*, *25*, 403–418. doi:10.1016/S0740-8188(03)00051-3	ScienceDirect

Appendix 8.A: (*Continued*)

Article number	APA reference	Database
A15	Ybarra, M. L., Alexander, C., & Mitchell, K. J. (2005). Depressive symptomatology, youth Internet use, and online interactions: A national survey. *Journal of Adolescent Health*, *36*(1), 9–18. doi:10.1016/j.jadohealth.2003.10.012	ScienceDirect