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The Digital Divide as a Continuation of Traditional Systems of Inequality

The digital divide is the gap between those that have access to vital information technology resources and those that do not have access to those resources. There are two primary ways in which the gap is enacted, through lack of technical skill and through a physical limitation on access to technology. The digital divide is caused by and reinforces traditional systems of inequality such as race, socioeconomic status and gender. People caught in the divide are disadvantaged in their access to social interaction, health and governmental information, general educational opportunities and access to some services such as healthcare and financial services.

Gaps in access to information technology resources are of interest in sociology because they are mechanisms through which one group in society is marginalized and disadvantaged over another. In a society where a person's access to community, friends and government resources were determined by one's technical skill, the technical skill would become a prized commodity and a predictor of social status. While this is not yet entirely true in American society, technical skill and access to technology are quickly becoming necessities of social functioning. Sociologists and researchers in other related fields have identified variations in both technology skill and access to technology. While

some variation is expected for older adults, many recent studies present data to suggest that this is a significant problem for children and young adults as well. Class inequality affects access to technology and consequently to the ability to develop technical skill. People that are most likely lack access to technology are those that are in a low socioeconomic status, aging adults and the disabled. There is also a gender gap in technology, but that is rapidly narrowing (Gui and Argentin 2011:964). Through misinterpretations of data and a degraded understanding of the severity of the digital divide problem it has been dismissed as an area of concern and allowed to continue with little or no attention toward a social solution. The more technology becomes seemingly ubiquitous for those that have access to it, the greater the gap becomes. Those who lack the knowledge or resources to access information technology fall further from those who find it to be a not only ubiquitous element but an integral component of their social functioning.

BACKGROUND

When discussing "information technology systems" in relation to the digital divide it is possible for the term to take on many meanings, but primarily it is meant to be analogous to the inclusive Internet. The inclusive Internet contains what is typically thought of as Internet resources such as web content but also the communication mechanisms that are supported by the Internet's infrastructure such as chat services, voice over Internet Protocol (VoIP), interactive text-messaging relays and on-demand

subscriber content. The factors that affect digital literacy have changed recently as the nature and dynamic of the Internet has changed.

Initial attempts to assess the digital divide were flawed, relying on simplistic predictors of access to information technology such as owning a computer (de Almeida et al. 2012:221). Such simplistic measures do not provide any insight into the capabilities of the individuals that own computers or account for people who have access to computers through other means such at public libraries. A related flat measurement that has been used more recently is the presence of a subscription to Internet access (United States Census Bureau 2010:125). While this is a good predictor of Internet use, it still lacks the dimension of assessing whether or not the subscriber has the skills to accomplish the tasks which they wish to attempt utilizing their connectivity. For a measurement of whether or not there is a gap in technology utilization there must be more comprehensive measures which account for computer usage, Internet access and considers the type of activities that a user engages in through the Internet medium.

In recent history the fields of computer science and information systems have been slowly moving away from being machine centered with an emphasis on the interaction between hardware and software. The areas of study have expanded to considering the interactions between humans and computers in an area of study referred to as HCI (Human-Computer Interaction). HCI is both a research and applied academic field. In research HCI is concerned with how humans choose to interact with information

resources[1] and the factors that are involved in structuring those interactions. In applied HCI the focus is on designing interfaces which are accessible to a wide group of people and that require minimal training or skill to use by designing information systems to be simple or utilize a method of interaction that the user will find to be intuitive based upon social training. A key principle of HCI is "user-centered design" (Vredenburg et al. 2002:473). While the name may have a connotation of being individualistic or based upon individual cognition or psychology it is strongly rooted in understanding cultural concepts and then applying them either directly, through symbol or by metaphor to a technological interface problem. When the transition from command-line interfaces[2] to a graphic system began a common metaphor that was used to make the interface understandable was the elimination of the file-path constructs in favor of the more familiar the concept of file folders (Sease 2008:11-12). In lieu of expanding information technology education, which includes mostly non-generalizable skills, to a larger population it may be possible to work towards a solution to the information technology literacy component of the digital divide by working closely with computer scientists who specialize in human-computer interaction to develop technology that is more natural and less intimidating.

HISTORY OF THE DIGITIAL DIVIDE

[1] Information resources and information systems include computers, mobile devices, kiosks, game consoles or any other hardware or software system which is used for storing, producing or retrieving digital information.

[2] Command-line Interfaces (CLIs) are basic ASCII text based computer interfaces in which the user enters symbolic commands using a keyboard with no graphical representations or visual cues.

The history of the Internet as it is known today is relatively short, emerging in late 1984. Prior to that time the Internet was operated and inhabited primarily by engineers. Websites did not exist; all information was retrieved through a limited set of early protocols which were normally used for transferring files between hosts. Each host was assigned a unique number, similar to a phone number, which was used in connecting to the host. In early 1985 Dr. Jonathan Postel was given the responsibility of coordinating the transition to a name-based domain system for Internet hosts, giving them memorable names instead of numbers (Postel 1984). This was an important transition because of the growing number of hosts which was quickly creating an early digital divide between engineers that had the mental skill to memorize a large list of numbers for accessing hosts they needed to access. If the Internet would have not transitioned to a name-based system for identifying hosts the Internet likely would have not gained popularity because it would have remained accessible only to users who had knowledge of the structure of the network itself. The name-based structure allows the Internet to have ubiquitous quality because the naming structures of the network resemble familiar structures in society.

SCOPE OF THE DIVIDE

The digital divide is composed of both a skill gap and a gap of physical access to information technology. Often the two gaps contribute to each other in a circular causation. Without access to technology it is difficult to develop technological skill, whereas it is redundant to have access to technology without first having the skill to

utilize it. Due to intuitive design and other affordances of modern technology there is some flexibility in this somewhat paradoxical configuration of circumstances. However, for many people the affordances of technology are not enough to overcome the social and cultural boundaries which make a lack of technical skill a problem that keeps them at the "without access" end of the spectrum of the digital divide (Fry 2004:307). Limitations on physical access to information technology are broader than just having or not having technical skill. Most of the limitations faced by those without access to information technology resources are financial or otherwise structural.

Information technology skill is often referred to as "information technology literacy" (Bawden 2008:20). Information technology literacy refers to a person's ability to effectively utilize computer and Internet technology (American Library Association 2012). While there is no universal standard for what constitutes information technology literacy, it is generally defined as skill "associated with an individual's use of computers, software applications, databases, and other technologies to achieve an academic, work-related or personal goal." (Leung and Lee 2012:118) In some societies the computer is a component of culture. Most members of a Western society will have had interaction with a computer at some point in their life. This does not ensure any level of technical skill or a continued access to technology, only the awareness of its presence and its impact. One of the most problematic assumptions in assessing the state of a user's abilities is that if the user is experiencing a sense of satisfaction with their Internet experience does not mean that they have developed the skills required to accomplish everything that they would like to do, or that they might be interested in doing if such skills existed. While a

user may be able to rehearse and recall certain skills such as how to post statuses on Facebook or find an item in a popular online retailer, those skills are not generalizable and do not add to the user's technical literacy to accomplish other tasks that may be important to them, such as performing research about symptoms of a medical condition or locating contact information for local government agencies that are not engaged in normal modes of social media interaction (Bawden 2001:235). Information technology literacy is not a simple determination of whether or not a user can perform a certain set of tasks; it is a comprehensive understanding and aptitude for how to navigate information technology systems (Bawden 2008:20-22).

The digital divide is an interdisciplinary problem, spanning the social sciences and more technical fields such as computer science and information systems. Historically sociology and information technology have shared common interests and overlapping realms of inquiry in the field of cognitive science. Cognitive science is an interdisciplinary field to which sociology is a vital contributing member. Through the study of social cognition and cognitive sociology the discipline of sociology addresses the function of group understanding. Group understanding encompasses the particular norms, values and expectations of a particular group in a shared meaning of interaction and experience (DiMaggio 1997:267). From a cognitive science perspective this shared meaning is related to how a group interprets and organizes information they are given, how the group approaches seeking information or how a particular group encodes information. The interpretations of a group determine how they interact with a situation or an object (Hollan, Hutchins, and Kirsh 2000:176). While there are a lot of aspects of

the digital divide that apply to multiple disciplines, each discipline has its own function within the problem. It is the duty of sociology to provide theories about the social forces that function to suppress access to information technology, to provide data that the technical disciplines can utilize to reduce the gap of information technology literacy and work with other social science disciplines to assess the constraints that limit physical access to technology.

Most early definitions of digital literacy focused only on the user's ability to find information or conduct simple interpersonal tasks. In the early 1990s digital literacy was gauged based solely on a person's ability to effectively use the Internet to find information and communicate with others, typically by e-mail (Bawden 2008:20). Recent interpretations based on Web 2.0 ideology for an Internet society place expectations on a user's ability to not only retrieve information from the Internet, but also to be an active citizen who contributes to the community of the Internet. This new component of digital literacy is referred to as "digital production." Based on the criteria of Web 2.0 the user must be able to not only find information and exchange information with others via a monolithic mechanism such as e-mail or forum information, but also be able to become a producer of Internet content (Schradie 2009:145-146). While on the surface it may not seem to be a critical skill for an Internet user to be able to produce their own content and provide contribute it to the medium, it is a representative characteristic that is presently only of theoretical relevance, but will be of applied relevance in future reviews of the digital divide. Digital production is a growing trend of the social Internet. This trend is converting existing mechanisms for social expression and for manifesting a political

voice into a digital expression that is visible to a wider community. The suffering of the individual or the community is no longer restricted to their immediate physical or social vicinity. As long as a person has the skills and access to become a digital producer there is a medium for expression.

Physical access restrictions to information technology are a fundamental problem of the digital divide. While it is possible for a person to potentially work through a problem if they have access to technology but no technical skill, without access to information technology at all it is impossible for such resources to be utilized. While this may seem a trivial observation, it is one that is often overlooked when children are given computer and Internet training in public education (Hohlfeld et al. 2008:1649). The key inhibitor to accessing information technology is financial. Information technology is expensive to acquire and to maintain and as such may represent a large financial burden to a family with low income (DiMaggio et al. 2004:359). Some of the financial burden has been mitigated through public libraries, but depending upon public libraries and other public buildings to have Internet access also highlights another problem, the digital divide created by physical location. Rural locations are often under-served by their libraries and the physical distance to a public library may make it inaccessible to the population it is designed to serve (Wilson, Wallin, and Reiser 2003:134). Another problem for individuals living in rural locations is that those locations are often the last to be considered by commercial Internet providers for new mediums of access or for maintenance of existing mediums, limiting the available options for Internet access (Parker 2000:281-282).

Overall the digital divide affects anyone that does not have optimal access to technical skill and at least minimal physical access to information technology. The digital divide's impact is not only in access to information, but also in access to community and a social forum.

CURRENT LITERATURE

The interdisciplinary nature of the digital divide problem provides for a large amount of literature on the subject with a wide variety of perspectives. The sociological perspectives on the digital divide are heavily weighted toward the impact of existing systems of inequality on the gap in technology use. Sociologists who study the digital divide are concerned with differences in levels of access to Internet resources by race, socioeconomic class, gender, age and education level (DiMaggio et al. 2004:361). Technical disciplines, such as computer science and informatics, are concerned with applied aspects of the systems themselves such as accessible interfaces and intuitive design (Shneiderman 2000:85-86). Due to the various organizations and governmental entities that are involved in the structure and function of the Internet there is interest from public policy and organizational science perspectives. However, those fields are more interested in how the organizations involved are advocating for further accessibility to Internet resources for those that have been excluded than in the exclusion itself (Dijk and Hacker 2003:322). Due to the wide reaching impact of the Internet and the value placed

on being an Internet citizen there is literature and research available from most major academic fields.

Early research into the social factors of information technology literacy focused on the binary of "users" and "non-users," essentially dividing people with any technical skill, demonstrated by their use of it, with those that had no experience with computer technology at all. This method was ineffective as it provided a skewed image of what it meant to be literate in information technology, which changed drastically as technology became more accessible and the construct of non-user disappeared almost entirely. Modern research focuses on different levels of information technology literacy which can be classified by quantitative measures or coded and then categorized by qualitative measures (de Almeida et al. 2012:221). Inside the different levels of information technology literacy it is also important to consider the quality of technological skill which each user possesses. Dijk and Hacker define this quality in a spectrum of skill qualities ranging from instrumental, through informational and to strategic skills (2003:319). This range of skills defines the differences between a user that has the capability to perform basic functions and understand some of the underlying concepts of the information system (instrumental), being able to utilize the information system to access information based on a rehearsed retrieval mechanism (informational) and having the skill and competency to design and implement a new task utilizing unfamiliar techniques (strategic). New research into digital literacy seeks to understand not only if the user *can* perform a task, but attempts to analyze the patterns in the types of tasks that users actually implement each day that they utilize information technology resources (Dijk and

Hacker 2003:319-320). Academic understanding of the impact of digital literacy on the digital divide has progressed a considerable amount over the short history of research into the problem.

One of the most damaging factors in the digital divide with regard to digital literacy is the assumption that certain groups are excluded and are "immune" to the inequality. The use of terms such as "the net generation," "cyber kids" or "internet natives" describes a notion that all children have access to technology and are intrinsically skilled in its use (de Almeida et al. 2012:220). In reality children appear more comfortable with technology because they are willing to experiment and are curious about technology. There are many subtle levels of technological access and skill. Children suffer from an awareness of the functionality of technology, but without guidance into how to utilize it as an information resource they do not achieve information technology literacy (Gui and Argentin 2011:964; de Almeida et al. 2012:220-222). The perception that children have a higher degree of information technology competency has a negative effect when that perception is used to make policy decisions or when deciding on a level of technology integration in a classroom. Implementation of lesson plans that assume that a child has a certain level of technical competence merely because of their age or because of the capabilities of their peers can result in a child being excluded from a lesson or otherwise being left out of the educational experience (de Almeida et al. 2012:222). The recognition of a type of "digital diversity" will help alleviate this type of issue. Various studies that have been conducted found that children developed a number of distinct approaches and strategies to interacting with information technology and thus

even students that are generally technically literate may have different levels of understanding and capability for different tasks (Gui and Argentin 2011:973). Labeling and assuming any group is not impacted by the digital divide complicates the problem and furthers the divide.

Research in the area of human-computer interaction has shown that one method of overcoming the gap in digital skill in regards to new and emerging technologies is to allow for integration with the user's environment through the use of metaphors or other symbolic relationships that do not require specialized training or experience to use (Sease 2008). The inclusion of computers as social actors is one proposed, abstract method for achieving this type of seamless computing experience. The specifics of utilizing computers as social actors often involve technical constructions such as artificial intelligence and heuristic information processing. Some less complicated approaches involve giving computers a gendered first-person conception of self in dialectic or prompting situations. Much of the anthropomorphistic transformation will be conducted by the user once the computer has presented itself as a social actor (Nass, Steuer, and Tauber 1994:72). In essence, HCI seeks to utilize the existing knowledge that a user has about their environment and social interaction to design an interface system that will require little or no additional educational burden to use effectively.

The implementation of the computers as social actors system is not a viable solution for the problem of the digital literacy gap. Such a solution would be very costly, wasteful and would not be practical in all situations. The largest obstacle in implementing

such a solution is the need to replace all existing systems with social actor systems to adapt for the individuals who do not possess digital literacy skills. Another problem is that such technology has not been perfected and thus leads to organizational problems such as lost productivity due to failures of the system interpreting user input. Given the current state of technology it is simpler to educate a large number of users with adaptive systems that utilize existing hardware and software to teach users how to perform the tasks that are most beneficial to them (DiMaggio 1997:266). The computers as social actors approach illustrates one of the key reasons that computer scientists require input from sociologists. Computer scientists have developed many solutions that could potentially solve the digital literacy component of the digital divide, but getting the technology to everyone who needs it would be costly and logistically difficult to administrate from a policy standpoint. Computers as social actors is a good concept in theory and it may be the future of human-computer interactions, but it is not presently a viable solution for the gap in digital literacy and overlooks many of the other structural problems in society that have led to the greater digital divide.

Disabled individuals are among those that have the most difficulty in achieving access to information technology. The problems of individuals with disabilities are both in obtaining physical access to information technology as well as in achieving information technology literacy. The traditional keyboard and mouse interactions are difficult to use for many individuals with physical impairments and as devices are

becoming smaller so are their interaction gestures[3], which further disadvantages physically disabled individuals who may have difficulty with precision movement. While some physically disabled individuals are inhibited in access to technology due to their disability, some more common disabilities such as blindness and deafness are compensated for in newer technologies (Rhor 2012:1; Hayhoe 2011). However, there are usually economic boundaries involved in gaining access to such assistive technologies. The digital divide is especially problematic for disabled individuals because assistive technologies could potentially provide greater social access and allow them to overcome the limitations of their disability, including their stigmas through the use of computer mediated social interactions. Unfortunately, many publicly accessible information technology resources such as those found in public libraries do not have assistive technologies beyond basic screen-reading software and therefore do not provide a mechanism to allow people with disabilities to utilize information technology for self-improvement or general social engagement (Dobransky and Hargittai 2006:320). A challenge often faced by disabled individuals who do gain access to a computer and gain the skills to utilize assistive technologies is that content providers, such as website designers, often do not design with users with disabilities in mind and therefore assistive technologies may have difficulty in interpreting the content for the purpose of conveying the content to the user (Dobransky and Hargittai 2006:328). There are a lot of concerns around the digital divide for people with disabilities. Many of those concerns are outside

[3] An interaction gesture is any physical movement that is required for interacting with an information system such as moving an X,Y position device (mouse or joystick), making a keystroke on a keyboard or using a tactile "gesture" against a touch-sensitive surface.

of their control and as such represent sociological, political and structural problems within current systems of content production.

The digital divide is of sociological interest because of its inherent traits of inequality and social disenfranchisement. As alluded to earlier, economics and social class are large contributing factors to the digital divide. The earliest research into this particular problem found that a portion of the divide based on socioeconomic factors could be explained by education. Individuals with higher education have historically been linked to higher incomes and that trend continues with access to information technology due to both direct ability to afford equipment and access as well as the likelihood that the person has had some formal training in information technology (Talukdar and Gauri 2011:86). An unexpected aspect of the digital divide on economics is that the same social pressures that are used to de-prioritize technical skill for women is used to prioritize possession of or access to technology for low socioeconomic status families, thus encouraging them to acquire computers or to determine a means of accessing one. As a result of the decreased access to information technology training and guided explorations with an experienced Internet user the acquired technology is not utilized to its fullest potential by that particular group (Talukdar and Gauri 2011:89). No studies have been conducted to determine if the recreational use of information technology by people in low socioeconomic statuses has any impact on their overall level of information technology literacy. There is also an absence of information related to whether or not individuals who do invest in technology and Internet access become digital producers, an indicator of increased social engagement as a result of having access (Schradie 2009:558). The

current state of information about the digital divide presents economics as a major determiner of having access to information technology and education level as a determiner of overall level of information technology literacy.

For a time it was thought that gender was a contributing factor to the digital divide. While at one time there was evidence for this particular gap, that gap is now narrowing for general information technology literacy and it appears in present research as though physical access to technology is explained by geographic and economic factors (Cooper 2006:322). Much like the false labeling problems mentioned before, it is critical to not dismiss the category of gender as an important component of the digital divide simply because the gender gap is extremely narrow. Recent research indicates that women still experience more computer-related anxiety than men and overall women have lower levels of information technology achievement (Cooper 2006:320). Cultural standards regarding gender tend to discourage parents and teachers from exposing females to information technology at an early age, whereas skills with such technology would be considered important for males. Similar problems exist for females in information technology literacy as occur for women in science, technology, engineering and math academic fields. Primarily women are categorically excluded through social pressures which result in anxiety related to the topic (Seymour 2001:98-99). While research points to the decline of gender disparity as a problem in the digital divide, the qualitative measures of gender diversity in information technology utilization is less clear.

Beyond the economic disparity that is supported by the digital divide the problem of an absence of cultural citizenship is also a concern (Goode 2010:527). An individual who does not have access to the cultural components of the Internet are excluded from some forms of social interaction and denied certain professional development opportunities (Gui and Argentin 2011:964).

Social interaction through enacting some form of cultural citizenship is considered important to the development of both the society and the individual, but an absence of Internet citizenship can result in a reduced citizenship experience in more traditional forms of citizenship, such as participation in democracy and organized government (Goode 2010:529). An emerging concept called "E-Government" refers to the conducting of civic interactions and participation in governmental processes using Internet resources (Belanger and Carter 2009:132). In 2009 with the inauguration of the first term of Barak Obama's presidency in the United States the phrase "transparent government" became a positive objective which was encouraged through an Open Government Directive which effectively became policy on December 8, 2009. This directive encouraged components of the federal government to adopt a system of changes that would allow the public to be more involved through the use of Internet-enabled social media as well as through the websites of various governmental departments (Luna-Reyes et al. 2012:84-85). While an open government is beneficial to democracy and advancing citizen awareness, the implementation of such a directive through blogs and other forms of social media limits who can have access to the information to those who have the connectivity and skills to access the information electronically. Implementing

such a directive in a manner other than digital would be costly, and as such most likely prohibitive of the process itself. E-Government allows the government to provide more information to its citizens and allows for more citizen input and as such can result in more productive civic interactions.

Computer mediated communication is a communication form that utilizes information technology for forming communities. Older adults who did not have the advantage of computer technology being easily accessible either physically or in the level of skill required to use such technology are a group that is often excluded due to a lack of skill. Older adults who have high levels of Internet skill utilize computer-mediated communication (CMC) to seek social support. Individuals who have low levels of Internet do not take part in such activities and report feeling less socially connected and have a more negative interpretation of their quality of life (Wright 2000:110). This particular example of the benefits of increased social interaction over Internet technologies is particularly narrow, but is symbolic of the type of life improvements that are possible when a person has access to information technology and the skills that comprise information technology literacy.

Current research on the digital divide covers a large breadth of academic disciplines and encompasses many areas of practical concern. The digital divide hinders certain social groups that are already disadvantaged, further reinforcing social structures designed to favor the hegemon. In the absence of such structures and categorical limitations the Internet would provide a socially unifying experience that could alleviate

some of the effects of social inequality, even if it is not possible to completely remove the inequality. At the present time the digital divide continues the existing inequalities based on income, social status, geographic location, ability and age.

CONCLUSION

Economic, age and ability factors are the primary determiners of whether or not a person will be able to achieve a state of digital literacy. Economic and location factors are major contributing factors to a person having physical access to information technology. Improvements in publicly available Internet access and the expansion of awareness of such access would aid somewhat in easing the digital divide, but for many there will be little motivation to utilize such opportunities because the ubiquity of the Internet has superseded any discourse about its practical value.

References

American Library Association. 2012. “Introduction to Information Literacy.” Association of College and Research Libraries. Retrieved November 8, 2012 (http://www.ala.org/acrl/issues/infolit/overview/intro).

Bawden, David. 2001. “Information and digital literacies: a review of concepts.” *Journal of Documentation* 57(3):218–259.

Bawden, David 2008. “Origins and Concepts of Digital Literacy.” Pp. 17-31 in *Digital Literacies: Concepts, Policies and Practices*, edited by Colin Lankshear and Michele Knobel. Peter Lang Publishing.

Belanger, France and Lemuria Carter. 2009. “The Impact Of The Digital Divide On E-Government Use.” *Communications of the ACM* 52(4):132-135.

Cooper, J. 2006. “The digital divide: the special case of gender.” *Journal of Computer Assisted Learning* 22(5):320-334.

de Almeida, Ana N., Nuno de Almeida Alves, Ana Delicado, and Tiago Carvalho. 2012. “Children and Digital Diversity: From 'Unguided Rookies' to 'Self-reliant Cybernauts'.” *Childhood* 19:219.

Dijk, Jan v. and Kenneth Hacker. 2003. “The Digital Divide as a Complex and Dynamic Phenomenon.” *The Information Society: An International Journal* 19(4):315-326.

DiMaggio, Paul. 1997. “Culture and Cognition.” *Annual Review of Sociology* 23:263-287.

DiMaggio, Paul, Eszter Hargittai, Coral Celeste, and Steven Shafer 2004. “Digital Inequality: From Unequal Access to Differentiated Use.” Pp. 355-400 in *Social inequality*. New York City, New York: Russell Sage Foundation.

Dobransky, Kerry and Eszter Hargittai. 2006. “The Disability Divide in Internet Access and Use.” *Information, Communication & Society* 9(3):313-334.

Fry, Jenny. 2004. “The Cultural Shaping of ICTs within Academic Fields: Corpus-based Linguistics as a Case Study.” *Literary and Linguistic Computing* 19(3):303-319.

Goode, Luke. 2010. “Cultural citizenship online: the Internet and digital culture.” *Citizenship Studies* 14(5):527–542.

Gui, Marco and Gianluca Argentin. 2011. "Digital skills of internet natives: Different forms of digital literacy in a random sample of northern Italian high school students." *New Media & Society* 13:963-981.

Hayhoe, Simon. 2011. "Using an iPad as an assistive device to improve technical literacy." Trial usage with an Emirati student. Retrieved November 11, 2012 (http://shct.hct.ac.ae/events/edtechpd2012/articles/Using-an-iPad-as-an-assistive-device.pdf).

Hohlfeld, Tina N., Albert D. Ritzhaupt, Ann E. Barron, and Kate Kemker. 2008. "Examining the digital divide in K-12 public schools: Four-year trends for supporting ICT literacy in Florida." *Computers & Education* 51(4):1648-1663.

Hollan, James, Edwin Hutchins, and David Kirsh. 2000. "Distributed cognition: toward a new foundation for human-computer interaction research." *ACM Transactions on Computer-Human Interaction* 7(2):174-196.

Jackson, Linda A., Alexander v. Eye, Gretchen Barbatsis, Frank Biocca, Hiram E. Fitzgerald, and Yong Zhao. 2004. "The Impact of Internet Use on the Other Side of The Digital Divide." *Communications of the ACM* 47(7):43-47.

LaRose, Robert, Jennifer L. Gregg, Sharon Strover, Joseph Straubhaar, and Serena Carpenter. 2007. "Closing the rural broadband gap: Promoting adoption of the Internet in rural America." *Telecommunications Policy* 31:359–373.

Leung, Louis and Paul S. Lee. 2012. "The influences of information literacy, internet addiction and parenting styles on internet risks." *New Media & Society* 14:117-137.

Luna-Reyes, Luis F., Soon A. Chun, Teresa M. Harrison, Santiago Guerrero, G. B. Burke, Meghan Cook, Anthony Cresswell, Natalie Helbig, Jana Hrdinova, and Theresa Pardo. 2012. "Open government and e-government: Democratic challenges from a public value perspective." *Information Polity: The International Journal of Government & Democracy in the Information Age* 17(2):83-97.

Nass, Clifford, Jonathan Steuer, and Ellen R. Tauber. 1994. "Computers are Social Actors." *Human Factors in Computing Systems* 72-78.

Parker, Edwin B. 2000. "Closing the digital divide in rural America." *Telecommunications Policy* 29:281-290.

Postel, Jonathan B. 1984. “Domain Name System Implementation Schedule.” in *RFC 897, Request for Comments Series,* edited by Jonathan B. Postel.

Rhor, Monica. 2012. “With iPads in hand, blind students find independence.” *Houston Chronicle,* July 16.

Schradie, Jen. 2009. “The digital production gap: The digital divide and Web 2.0 collide.” *Poetics* 39:145–168.

Sease, Robin. 2008. “Metaphor's Role in the Information Behavior of Humans Interacting with Computers.” *Information Technology & Libraries* 27(4):9-16.

Seymour, Elaine. 2001. “Tracking the processes of change in US undergraduate education in science, mathematics, engineering, and technology.” *Science Education* 86(1):75-105.

Shneiderman, Ben. 2000. “Universal usability.” *Communications of the ACM* 43(5):84-91.

Talukdar, Debabrata and Dinesh K. Gauri. 2011. “Home Internet Access and Usage in the USA: Trends in the Socio-Economic Digital Divide.” *Communications of the Association for Information Systems* 28(7):85-98.

United States Census Bureau. 2010. “Current Population Survey.” United States Census Bureau. Retrieved November 22, 2012 (https://www.census.gov/apsd/techdoc/cps/cpsoct10.pdf).

Vredenburg, Karel, Ji-Ye Mao, Paul W. Smith, and Tom Carey. 2002. “A survey of user-centered design practice.” *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* 471-478.

Wilson, Kenneth R., Jennifer S. Wallin, and Christa Reiser. 2003. “Social Stratification and the Digital Divide.” *Social Science Computer Review* 21(2):133-143.

Wright, Kevin. 2000. “Computer-mediated social support, older adults, and coping.” *Journal of Communication* 50(3):100-118.