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Digital Divide Déjà Vu: Examining Second-level Digital Literacy

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Digital Divide Déjà Vu: Examining Second-level Digital Literacy

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Acknowledgment

During my adolescent years as a teenager, I was frequently taught that the present generation must surpass the generation before them in order to continue the family legacy. In lieu of those words, this body of work is a culmination of my grandmother's wisdom and a significant milestone as the first person to receive a Master of Science degree in my family.

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Abstract

Since the advent of the Internet, the diffusion of computers has narrowed the gap between the digital "have" and "have-nots," however researchers have identified a new disparity beyond computer accessibility as a result of the growing dependence of information on the Internet. This study will explore people's differences in online skills among users in the city of Rochester, N.Y. Based on a quota sample and a survey computer tasks are administered to evaluate internet skills. Findings suggest that there are significant differences in the amount of time it took to complete each task, while differences in education level, sex, age, and ethnicity in completing the tasks proved to be statistically insignificant.

Keywords: digital divide, internet, knowledge gap, online skills

Digital Divide Déjà Vu: Examining Second-level Digital Literacy

Described as the "great equalizer" by Howard Rheingold (1991), the Internet possesses the ability to extend beyond the physical and geographical limitation of tangible objects to permit people in inaccessible areas to converge onto a unified platform. By ensuring technological entry to individuals, regardless of societal barriers, individuals can access unlimited universal information and educational opportunities to reduce social exclusion. Similar to a network of communication channels, the Internet serves as the platform by bringing together people whose lives, interests, hobbies, and other affiliations would otherwise never have intersected.

Exchanging information by electronic means through the Internet has transformed traditional forms of entertainment, shopping, and communication, allowing individuals to freely curate content and disseminate ideas. Through the influence of the Internet, daily interactions are enhanced considerably through the use of computer-mediated technology. Consecutively, the use of mediated communication instills the feeling of interconnectedness by extending a network of individuals beyond one's physical location through an online community. The growing use of information and communication technology (ICT) in all areas of private, public, and economic life has caused a significant demand for the skills and ability to operate this technology in our home and work life (Selhofer & Husing, 2002). Initially it was understood; the Internet was democratic and would eliminate privilege, thus narrowing the gap between economic classes and stature. However, the Internet is not fully democratic due to lack of financial access by some individuals. As initially articulated, the "digital divide" referred to the gap between individuals at different socio-economic levels with regard to their opportunities to access information and communication technologies and their use of the Internet (OECD, 2001).

Society experienced the first wave of the digital divide as an unequal access and usage of information and communication technologies. The diffusion of computers into the American market has narrowed the existing gap between the digital "have" and "have-nots," however, researchers have identified a new disparity-- the second-level digital divide, which concerns the social imbalance of computer skills and its consequences. As the divide shifts from physical barriers in the first level of the digital divide (access to computer hardware) to newer technological barriers (i.e., high speed internet access) and online digital skills, the increase of information in society is unevenly acquired by members of the general public. The scope of the second-level digital divide phenomenon focuses on access to the information highway on a stabilized infrastructure, as well as the economic resources and usage capabilities required to use information and communication technologies.

Previous research addressed the deficiency in accessibility surrounding the increasing gap between highly educated groups, which utilize advanced technology, compared to lowly educated groups with limited accessibility known as the knowledge gap theory. People with higher socio-economic status tend to have a better ability to acquire information (Weng, 2000). Understandably, this emerges into a separation of two categories: a group consisting of highly educated people who are well informed, and those with low education who are less knowledgeable. This study will examine the phenomenon of the second-level digital divide by focusing on the levels of Internet usage among users in Rochester, New York. Computer skill, in this context, is defined as the ability to efficiently and effectively find information on the Web. To rectify the imbalance of past digital divide research, this study will explore people's digital skills when retrieving information online to understand people's usage access by the average time, frequency spent online, and completion of computer tasks. Demographic information will

also be collected to examine whether race, education, or sex are predictors of second-level digital divide.

Rationale

Digital divide studies have become a critical component in examining the gap among groups from diverse socio-economic backgrounds as previous research addresses the effects in society. The research conducted in this study is needed for the heuristic value to increase social, political, and cultural awareness. Inequality and social injustice issues have gained attention as computer behavior among various demographic categories predicts patterns in computer usage. The digital divide is one of the most important civil rights issues facing our modern economy today. Equally, as telecommunications continues to advance and coalesce with educational, social, financial, and employment opportunities, communities without digital skills will find themselves laggards among the digitally savvy. While the power of the Internet possesses the aptitude to equip its users with new computing skills, the groups which remain isolated from technology will be further segregated and marginalized in society.

The importance of the second-level digital divide from a scholarly perspective is significant because previous research explores the technological barriers to access, yet little research is devoted to the digital skill set of online users. Researchers argue that the resolution for the inequalities and improvement of life can be attributed to direct access to public resources as a basic right to narrow the gap in knowledge. In essence, the use of information and communication technologies has the potential to influence decision-making, disseminate information, and gather particulars pertinent to organizations and special interest groups to sway public opinion and policies. Parts of society that remain unaware of the policies affecting their livelihood risk their opportunities for personal enhancements and advancements.

Few studies have addressed Internet skills; instead, they have theorized the digital divide framework with several communication theories, including the diffusion of innovations, uses and gratifications, and the structuration theory. Additional research also revealed that typical studies in this field used survey questions to estimate their own digital skill set using survey questions. The self-reporting method of measuring people's perception of their online skills causes significant validity problems and does little to uncover actual digital skills. Contrary to previous studies, my research on the digital divide will focus on the retrieval of valuable information, necessary for practical application. Participants in this study will be asked to demonstrate their knowledge of online skills for employment opportunities, social reasons, and to use government related websites as a resource. The study's findings will fill in gaps in existing knowledge regarding the second-level digital divide and will prove to be useful in addressing this communication problem. Due to the limited scholarly knowledge of the second-level digital divide, the results of this study will explore digital online skills and its impact on socio-economic subgroups.

Literature Review

Historical Overview

Influenced by the idea of many independent networks conjoined within a framework, the Internet evolved into a powerful conduit of communications for governments, companies, and individuals. The advent of the Internet changed nearly every aspect of social, cultural, economic, and political life because it transformed the level of human interaction. The 1980s and 1990s offered tremendous opportunities in electronic commerce and education through the advancement of computer technology and the accelerated growth of personal computers. Since the mid-1990s the Internet has had a significant impact on culture with the rise of instant

communication via email, instant messaging, Voice over Internet Protocol, discussion forums, and online shopping sites. Transmitted at higher speeds, the Internet continued to grow as the years progressed and greater amounts of information were disseminated. Soon, the Internet sparked enough interest to be used as a form of amusement in the increasing development of online communities. In the late 1990s, the traffic on the Internet was estimated to have grown by 100% per year, while the mean annual growth in the number of Internet users was thought to be between 20 and 50% (Coffman, 1998). However, concerns regarding the penetration of the Internet technology and the ease of access to computers created the notion of a divide. Initially, the digital divide has been defined as the lack of access to information and communication technologies by segments of the community due to linguistic, economic, educational, social, and geographic reasons (Aquili & Moghaddam, 2008). Consisting of gaps in computer access and usage among various demographic categories such as age, gender, and ethnicity, the use of information and communication technologies created the division of the haves and have-nots (Mason & Hacker, 2003).

Existing research on the digital divide has mostly focused on the categorization of physical access. An indication of a dual divide between those with and without access to technology has cast specific diverse groups in an unfavorable light. For example, in the United States (Walton, 1999) African-Americans are routinely portrayed as being on the vulnerable side of the divide, when in actuality, Internet access among African-Americans and other multicultural groups fluctuates by income-while divisions between Blacks and Whites fades as income increases (Katz & Rice, 2002). As of 2011, Zickuhr and Smith (2012) stated Internet use remains strongly correlated with age, education, and household income which are the strongest positive predictors of Internet use among any of the demographic differences. Ironically, the gap

that is the closest to disappearing is between Whites and minorities with Internet usage in August 2011 remaining at 80% among Whites and 71% among Blacks (Pew Research Internet Project, 2012). Neither race nor gender is the sole contributor in the digital story. In previous Internet usage studies in 2000, Katz and Rice (2002) found that racial and ethnic divides dissolved once awareness was achieved. Social dimensions such as age, gender, ethnicity, and income have become influential determinants in shaping emerging patterns and barriers to technological disparity. Discussions have focused on the negative effects on social exclusion as a consequence of varying access to the global network for community groups, genders, and minorities. Modarres (2011) challenges the racial differences as a factor in the Internet disparities through her observations in *Beyond the Digital Divide*. She highlights the activities of Internet usage among low-income individuals as "the most likely users of online classes and that minority groups were likely to use online services, such as searching for classified ads, taking courses, and accessing government reports indicated a desire to use the internet" (Modarres, 2011, p. 4). According to the researcher, Modarres constructed a narrative that minorities were aware of the value of the new technology, yet, it was access and the disproportionate use of the Internet which hindered the full engagement of the underrepresented community to develop the digital online skills.

Communication research has analyzed the socio-economic impact of having access to information. The digital divide phenomenon has been embedded in the earlier knowledge gap theory of the 1970s. In relation to the digital divide, the theory predicts that people with higher socio-economic status (SES) acquire information than groups with lower socioeconomic status (Weng, 2000). According to the theory, P.J. Tichenor (1970) discovered that mass communication may actually expand the knowledge gap among members of varying social status

(Tichenor et al., 1970). Zeng (2011) argued with the increasing information disseminated to the society by mass media, people with different socio-economic status received the media knowledge at different levels. As a result, people with higher socio-economic status will be quicker to receive information as compared to those of lower socio-economic status. Understandably, the knowledge gap emerges into a separation of two categories: a group consisting of highly educated people who are well informed, and those with low education who are less knowledgeable.

Second-level Digital Divide: Beyond Access

Over the past two decades, existing literature on digital divide has largely focused on the important role of first-level digital divide (Wang, 2009). By definition, the digital divide has been more broadly defined into two categories: the first digital divide level identifies the gap in Internet access between the information rich and the information poor. The second degree includes the social imbalance created by differences in acquired computer skills (IST, 2009). The second-level digital divide includes not only the access divide, but the imbalance of Internet usage, threatening the vision of a democratic space in which everyone has an equal opportunity for participation (Peters, 2001). Due to the continued use of the Internet and its growth, second-level divide raises the concern of varying differences in acquired computer skills for online users (IST, 2009). Further studies of how people use the Internet in public access places have been investigated that look at searches performed on various retrieval systems and focus on a spectrum of web behaviors (i.e., length of time spent, rate of speed, number of queries in the data set). Wang, Hawk, and Tenopir (2000) performed observational research by generating video and audio data about participant's search techniques to gain a better understanding for the general population using the Internet.

In addressing the issues of access, it is essential to consider scholarly findings which simultaneously address disparities in both access to technology and use. Warschauer (2002) presented an unconventional approach by challenging the first-level digital divide, suggesting that in addition to the physical sides of access, other elements such as content, language, literacy, education, and institutional structures must also be taken into consideration when measuring the level of information and communication technology use in a community. Rainie (2013) presented the latest findings from a digital divide study noting that 28% of respondents cited usability as a reason why Americans do not use the Internet due to difficulty and frustration, 19% suggested that they are not computer owners due to the expense of owning a computer, 10% noted a lack of availability and access, while 34% were not interested in learning the technology. Further computer adoption issues reveal that two-thirds (63%) of the respondents admitted the need for personal assistance if the Internet was available for immediate use. Communities lacking training programs, technological support, and additional resources that are essential to improve their familiarity and knowledge of digital literacy, will fail to progress thus attributing to the gap. Hargittai (2002b) explains the importance of understanding digital skillsets by exploring the differences in how people use the Internet for information retrieval, to identify the second-level digital divide as the Internet spreads to the majority of the population. Investigating differences in digital literacy allows researchers to distinguish how people are taking advantage of the medium, the Internet, in numerous ways.

Second-level digital divide research has provided the foreground for different types of digital literacy as seen in the study conducted by Wang (2009) where scholars explored Taiwanese digital skills to find information and apply ICTs in living and social aspects. As RDEC (2008) reiterated, the study examined people's digital skills in rural areas based on the

category and the scope of borrowers' usage on software and Internet. Once the study discovered the meaning of digital skills in the country, researchers manipulated indicators using various dimensions.

As in the case of the pervasive use of the Internet as a new medium, the same information seeking behavior can be connected to the older medium of card cataloguing. In the broader context, the level of skill used to search effectively has been ignored as society has expanded on the fixation of technological devices rather than the skillsets. While traditional media enable active mental processing, digital media require users to interact with interfaces. A minimum level of active engagement with the medium is required using both computer software and hardware to accomplish an online task. To explore digital literacy, the following section will elaborate the range of skills that will be evaluated during the computer experiment of individual online behavior that measures online skill.

Research Questions

As initially articulated, few studies have addressed Internet skills and even fewer have measured online skills to explore the second-level digital divide. Past research has used self-reporting data to measure people's perception of their online skills to evaluate digital literacy; however, the use of surveys neglects software interaction related to computer graphics, operating systems, and the web interface along with the linguistics and human engagement (Kaptelinin, 2012). The most significant aspect of ICT within the second-level digital divide is not the widespread availability of the hardware, but relatively people's ability to use the Internet to engage in meaningful social practices. As a result, the intended study will seek to look beyond accessibility and explore the difference of digital skills among users.

In order to conduct a credible investigation of online skill measurement, it is necessary to note the digital divide research achievements of van Dijk and van Deursen (2009a; 2010) which have constructed four types of Internet skills: operational, formal, information, and strategic. For this study I will adapt a sequence of four skill types, to measure Internet use:

- *Operational skills* are instrumental in executing the ability to work with hardware and software equipment.
- *Formal skills* relate to the hypermedia structure of the Internet which requires the skills of navigation and orientation.
- *Information skills* are formal and substantial, used to search, select, and process information.
- *Strategic skills* can be defined as the ability to use both computer and network resources with the intention of using the Internet to achieve a particular goal.

A combination of four skills is needed to successfully acquire and maintain a level of digital literacy. Van Dijk and van Deursen (20091; 2010) provide a conceptual definition for each Internet skill (see Figure 1).

Conceptual definition for Internet skills (van Deursen & Van Dijk, 2009; 2010)	
Medium-related Internet skills	
Operational Internet skills	*Operating an Internet browser, meaning:* Opening websites by entering the URL in the browser's location bar; Navigating forward and backward between pages using the browser buttons; Saving files on the hard disk; Opening various common file formats (e.g., PDFs); Bookmarking websites; Changing the browser's preferences. *Operating Internet-based search engines, meaning:* Entering keywords in the proper field; Executing the search operation; Opening search results in the search result lists. *Operating Internet-based form, meanings:* Using the different types of fields and buttons; Submitting a form.
Formal Internet Skills	*Navigating on the Internet, meaning:* Using hyperlinks (e.g., menu links, textual links, image links) in different menu and website layouts. *Maintaining a sense of location while navigating on the Internet, meaning:* Not becoming disoriented when navigating within a website; Not becoming disoriented when navigating between websites; Not becoming disoriented when opening and browsing through search results.
Content-related Internet skills	
Information Internet Skills	*Locating required information by doing the following:* Choosing a website or a search system to seek information; Defining search options or queries; Selecting information (on Web sites or in search results); Evaluating information sources.
Strategic Internet skills	*Taking advantage of the Internet by doing the following:* Developing an orientation toward a particular goal; Taking the right action to reach this goal; Making the right decision to reach this goal; Gaining the benefits resulting from this goal.

Figure 1: Conceptual definitions for Internet skills (van Deursen & van Dijk, 2009; 2010).

Since little information about skill access in digital divide research is known, the following research questions will be examined:

RQ1: Is there a difference in the amount of time it takes to complete the operational, formal, information, and strategic tasks?

RQ2: What differences are there by the sex of the respondent and the speed at which they were able to complete the tasks?

RQ3: What differences are there in education level of the respondent in completing the tasks?

RQ4: What differences are there in ethnicity of the respondent and the speed at which they were able to perform the operational, formal, information, and strategic tasks?

RQ5: What differences are there in age of the respondent and the speed at which they were able to perform the operational, formal, information, and strategic tasks?

The paper will further operationalize the variables and justify the research question for the study.

Method

Research Design

Each subject was assigned a task to measure digital literacy: *operational, formal, information, and strategic*. To increase the size of the sample pool, rather than mandating each respondent to participate in all four tasks, participants performed one task which was randomly selected by the researcher in advance. The procedure to randomize the task was likely to increase participation since it reduced the required time to administer the test.

First, the researcher established that 30 participants would be used for the study. An Excel spreadsheet was created, numbering the first column one through 30; the second column was labeled "skill" which pre-determined the tasks by using a randomly drawn procedure, prior to the involvement of participants. The third column was labeled "participant names" in which the blank spaces were designated for the names of the respondents as they volunteered in the observation.

Each skill was assigned a numerical value between one and four per the following key: 1= operational, 2 = formal, 3 = information, and 4 = strategic. Using Random.org (http://www.random.org/sequences/), the researcher used the Random Sequence Generator to generate randomized sequences of integers. The randomness comes from atmospheric noise, which for many purposes is better than the pseudo-random number algorithms typically used in

computer programs (UsingRandom.org, 2013). Each computer task was assigned a number. After the generator chose the tasks at random, the researcher recorded the values under the second column using the numerical key above as a reference for each skill. For example: 4, 2, 1, 3 was drawn below which would determine the first four assignments to measure digital literacy, since each skill is associated with a numerical value in the key above and a *task*. Since the generator is preset to randomize the total number of skills/assignments at one time (four), the researcher randomized the numbers seven more times until each of the 30 participant slots were filled. Participants were assigned a specific performance task based on the skill number in the order they volunteered to determine which computer tasks to administer. A tally was used to monitor the number of participants to meet the quota sample aforementioned. Participants were given a consent form to understand the nature of the research and to voluntarily decide whether or not to participate (see Appendix A).

Subjects

A quota sampling strategy will be used to recruit participants from the City of Rochester Public Market on 280 N. Union St., Rochester NY 14609 and the Rochester Public Library to sample a pool of participants from the area. Participants will be recruited by the researcher at the community locations to ensure that the likelihood of respondents within the study yield a breadth of demographic information within the study. Though the sampling procedure and locations have limitations, quota sampling is likely to ensure that quotas by specific attributes will be filled. The study will explore selected elements of the digital divide and differences among three racial subgroups in the city of Rochester.

A selective quota sample of 10 participants from each race was included in the study: African American (AA), Caucasian (C), and Hispanic (H). Subjects were recruited by quota sampling using race and gender as the criteria for recruiting the respondents. The first 10

African-American participants (five males and five females) to consent to the study fulfilled the racial subgroup for AA. Correspondingly, the first 10 Caucasian participants (five males and five females) and the first 10 Hispanic subjects (five males and five females) to consent to the study filled the racial subgroups for C and H respectively. Each subgroup was divided evenly between males and females (i.e., 10 Caucasians will include five men and five females).This method allowed for a modest sample size with particular attention to the social construct of SES to assist with evenness across race, sex, and education to draw comparisons that will more likely be valid. The researcher guaranteed the confidentiality of the participants' information to ensure that it will not be distributed. Confidentiality was honored; however, anonymity could not be since the study required face-to-face interaction. The study offered participants a chance to enter a $50 Visa gift card drawing, following the completion of the survey and task in its entirety.

Instrumentation

Survey.

Similarly to van Dijk's (2010) method, participants will be evaluated on their Internet skills through an experiment of individual online behavior that measures Internet skills. Prior to the experiment, a self-administered survey was administered to participants consisting of a seven question paper-and-pencil survey (see Appendix B). The open-ended questions captured Internet use patterns and demographic data of the participant including race, sex, and level of education as independent variables of the study. Demographic factors were measured using the self-administered survey whereby respondents were asked to self-report data relating their ethnicity. Once the survey data was coded by the author and inputted into the SPSS software for further analysis, the original survey forms were destroyed along with any information linking the electronic data with the original survey.

HyperCam.

Participants were invited to a table set up at the Public Market and provided with the same hardware to perform the online tasks: a laptop and a mouse. This allowed the environment to be virtually new to every user in which all respondents can access online information. The three most popular browser applications will be available (i.e., Internet Explorer, Safari, and Mozilla Firefox) to allow participants to replicate their usual Internet usage patterns. The HyperCam (Hyperionics, 2013) software program will be used to record the observations and the completion times without interfering with the participant's session. The program captures screen actions and curser movements and exports them into audio-visual files (.avi). Following the user's completion of the tasks, each browser was configured to automatically erase the URL history and cookies when participants closed the browser to avoid influential factors that would affect user experience.

Performance tasks.

Past research has relied upon a leisure-related assignment to investigate Internet search capabilities as will my study. The performance test adapts van Dijk and van Deursen's (2009a; 2010) instrument to measure operational, formal, information, and strategic skills.

Direct observation of participants was noted by the researcher. Observations of the respondents' online usage patterns measured browsing behavior resulting in two measures of Internet skill: the percentage of the four tasks completed successfully (effectiveness) and the total time spent on the four tasks (efficiency). The conceptual definition for Internet skills by van Dijk and van Deursen (2009a; 2010) and the modified tasks to assess the digital literacy of participants as they search for information are clarified in the organizational table (see Table D1).

Recruitment script.

A recruitment script was used to obtain verbal consent from participants (see Appendix C). The language in the script provided the following to the potential participants: an introduction as the researcher, a brief overview of my study and its purpose, the length of the observation, instructions, and the process used to protect their confidentiality. In addition, participants were informed that their participation was voluntary and at any time they could refuse to answer questions that they did not wish to answer or withdraw their participation. As the investigator, participants were provided with the researcher's contact information to express concerns or questions about the research in the provided consent form (see Appendix A).

Measures

Survey Results

The sample of 30 participants included 11 African-Americans (36.7%), 15 Caucasians (50%), and four Hispanics (13.3%). Asian/Pacific Islanders and Native Americans categories were provided on the survey however 0 participants identified themselves within the two categories (see Table D2). Participants were 12 men (40%) and 18 women (60%); the average age of participants was 47.7 years (*SD* = 15.6) ranging from 24 to 83 years (see Tables D3 and D4).

Thirty participants completed the self-administered survey consisting of seven questions which resulted in 210 responses. Of the 30 participants, 27 (90%) completed the assigned computer task with a remainder of three participants (10%) who did not perform the task. The survey yielded results about the study's sample.

Table D5 reveals the sample survey included 30 participants in which the researcher received answers to the questions for all 30 volunteers, giving the researcher a validity percentage of 100%. The percentage of respondents that live in an urban community was 46.7%

(14 participants), suburban 46.7% (14 participants), and 6.7% from a rural community (two respondents). As shown from the data, participants from the suburban and urban communities were roughly equivalent to 50% (actual 46.7%) as the rural community was underrepresented in the study (6.7%). Education ranged from high school and some college (23.3%), 2-year degree (6.7%), 4-year degree and master's (20% each), and doctoral degrees (6.7%) respectively (see Table D6).

Table D7 reveals the frequency at which respondents access the Internet for a total of 30 valid observations with a value of zero in the missing row to indicate all values for the variables were existent. The highest Internet access category was 18 participants (60%) who selected several times a day compared to the lowest Internet access category of one participant (3.3%) who selected several times a week. Table D8 reveals the average amount for hours spent browsing as 11.52 (*SD* = 19.0) at 47 years old as revealed in Table D9 which reveals the average age of the participants. The data provided from the self-reported survey were a meaningful summary of statistics for the participants in the sample.

Computer Task Results

The frequency for the number of participants that completed the tasks in the four groups were roughly equivilent in number: eight participants (26.7%) completed operational skill, six participants in formal (20%), seven participants (23.3%) in information, and six participants (20%) in the strategic group (see Table D10). As previously mentioned, 27 respondents completed the assigned computer task which resulted in data missing for the remaining three participants (see Table 1). On average, all respondents took 197.8 seconds (3:28 minutes) to complete the tasks (see Table D11).

Table 1

Participant Completion of Assigned Computer Tasks

Tasks		Frequency	Percent	Valid Percent	Cumulative Percent
Valid:	Operational	8	26.7	29.6	29.6
	Formal	6	20.0	22.2	51.9
	Information	7	23.3	25.9	77.8
	Strategic	6	20.0	22.2	100.0
	Total	27	90.0	100.0	
Missing:	System	3	10.0		
Total		30	100.0		

Computer tasks were chosen to explore people's ability to find information on the Web in different topical domains (Hargittai, 2002a). As initially articulated, by adapting the experiment to the digital divide phenomenon, the researcher explored the research questions aforementioned.

RQ1: Is there a difference in the amount of time it takes to complete the operational, formal, information, and strategic tasks?

A one-way ANOVA was conducted to examine whether there were statistically significant differences among the four groups in relation to the amount of time for completion. The results revealed statistically significant differences among the computer tasks, $F(3, 23) = 5.36$, $p = .006$. Post-hoc Tukey tests revealed statistically significant differences between information group ($M = 360$, $SD = 69.8$), and the formal group ($M = 59.10$, $SD = 26.79$) of a .005 significant difference (see Tables D12, D13, and D14).

RQ2: What differences are there by the sex of the respondent and the speed at which they were able to complete the task?

An independent samples *t*-test was conducted to examine whether there was a significant difference between males ($M = 215.31$, $SD = 226.43$) and females ($M = 187.53$, $SD = 145.96$) in

relation to the speed of completion. The test revealed a statistically insignificant difference between males and females (t = .389, df = 25, p > .701; see Tables D15 and D16).

RQ3: What differences are there in education level of the respondent in completing the tasks?

A univariate test was used to examine differences between education levels among the respondents. The test revealed that there were no differences in education level = .706.

RQ4: What differences are there in ethnicity of the respondent and the speed at which they were able to perform the operational, formal, information, and strategic tests?

A univariate test was used to examine differences between the ethnicities of the respondents. The difference of ethnicity is .832. Results indicated that there is no interaction between the tasks and ethnicity because it is not statistically significant. The test revealed that there were no differences in ethnicity.

RQ5: What differences are there in age of the respondent and the speed at which they were able to perform the operational, formal, information, and strategic tests?

A scattered plot graph reveals that there is no correlation between age and tasks because age is flat but in between tasks, there is a difference. Regardless of age, participants performed similarly.

Discussion

The results of this study highlight how Internet use patterns reveal notable differences across subdivisions defined by demographic variances including age and socioeconomic status. Most notable are the preliminary results that suggest a large variance in the amount of time participants take to complete each task ranging from 17 seconds to 13.52 minutes. The initial outcome reveals that there is a significant relationship between time and tasks however it does

not indicate the specific tasks. Administering the ANOVA post hoc test provides greater insight revealing which tasks are significantly different from one another. In the means column, the task that is driving the significance is the information group, the lengthiest task to complete at 360.17 seconds, compared to the formal task with the least amount of time at 59.10 seconds. Strategic and operational are in between, showing similar results of no significant differences.

An interesting finding of this study is the extent to which time considerably affects the participant's ability to complete the task. Though users appear confident of basic web surfing skills, subjects assigned the information task to locate residential property were challenged with identifying houses within the predetermined parameters by the researcher. Unlike the three other tasks which require the initial use of a search engine or direct website, the information task specified the selection of five criteria to find properties including: the local area, school district, price range, number of bedrooms and bathrooms. Finding information in a closed environment for respondents proved to be difficult to navigate the various subcategories. Subjects often became disoriented between transitioning from the computer screen to the paper document which listed the five criteria that may have disrupted their attentiveness while focusing between the two mediums. Further observations reveal that users became slightly impatient when scrolling through multiple menu options to select the property features when advancing to the results page. Once more, unlike the other task groups, information users used additional time to review their selections to avoid identifying incorrect results. The most prevalent user behavior which prolonged the task time remained the filtering of a substantial volume of data to a finite search pool. The combination of the task directions, five criteria, and the thought process behind locating specific property increased the task completion time.

Minimal direction and oversight were given to subjects in the formal task group which significantly contributed to the shortest completion time. Respondents quickly identified which search engine they were comfortable with (i.e., Internet Explorer, Firefox, or Safari) and utilized the blank search box to type the search words "Italian restaurant." Users quickly and freely navigated the results page choosing the restaurant that was closest to the study's location. It should be worth noting that all users bypassed direction "2a. Identify the address where you are presently sitting" and proceeded directly to "2b. Locate an Italian Restaurant closest to your current location at the present moment." Since participants are familiar with the study's geographical location, they unconsciously missed the initial step. Knowing the current location allows users to circumvent the search for the Public Market address leading to shorter task completion times.

Limitations and Future Research

In the case of an empirical research study on the digital divide, it is important to recognize the limitations which were encountered during the sampling method and the survey as a data collection tool. Overall, the limitation that will accommodate the observation is that the study consisted of a non-random sample. Unlike a random sample, wherein each member of the population has an equal chance of being selected, the researcher utilized a quota sampling method to specifically discuss the respondents and data collected for exclusively Rochesterians. The limitation inhibits the extent of the researcher's findings and the generalization of the same study to other populations. Additionally, it opposes statistical inferences made from the sample to the general population because it is non-random. With nonprobability sampling, population determinants are selected on the basis of their obtainability (volunteer participants) or because of the researcher's personal judgment that they are representative. The consequence is that an

unknown portion of the population is excluded (those who did not volunteer). Because some members of the population have no chance of being sampled, the degree to which a quota sample actually represents an entire population is unknown. Non-probability sampling is particularly useful in exploring subgroups across race, sex, and level of education. The quota sample improves the representation of specific strata within the population to ensure that these groups are not over represented. The sampling method of ten participants from each racial group with each subgroup split evenly between males and females allowed the researcher to easily compare each group for the study. This method allows for a modest sample size with particular attention to SES to assist with evenness across race, sex, and education to draw comparisons that will more likely be valid.

Future research should include the usability of cellular devices and tablets as mobile technology ownership increases. Pew Research Internet Project (2014) reveals that as of January 2014, 90% of American adults have a cell phone, 58% of American adults have a smartphone, 32% of American adults own an e-reader, and 42% of American adults own a tablet computer. As newer technology platforms emerge, Internet users may experience the imbalance of resources, consequently leading to similar digital skill obstacles to locate information online. Research by Lenhart (2012) reveals that computer ownership among youth is substantially poorer among low education households where parents have a high school diploma or less. Her research explores the demographic differences among groups in their adoption, use, and experiences with technology and social media. While previous studies may have once categorized it as the digital divide, it appropriately highlights a variety of digital differences among youth groups as an emerging challenge.

Further research should include a random sample to generalize the findings to the larger user population. Even with these limitations, there is much to be learned from the data, and much future research on the digital divide to build on the earlier research. In particular, the data suggests that even as the gap in Internet access narrows, disparities in digital skill and individual gains due to SES may continue. As more disadvantaged communities gain access and increase their online skill set, the Internet and its developers must provide the means to create a basis of Internet knowledge for all to partake. Rainie (2013) illustrates that digital differences in the adoption and use of technology are closely associated with age, household income, educational attainment, and geographical locations as predictors of non-Internet use. Many believe that the Internet is equally accessible, however when compared to savvy users with economic affluence and familiarity, the Internet still has the potential to remain a place for the elite.

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Appendix A

Consent Form

R·I·T

Rochester Institute of Technology

2 Lomb Memorial Drive
Rochester, New York 14623-5604
(585) 475-6546

Dear Participant:

My name is Lisa Barber and I am a graduate student at Rochester Institute of Technology. I am conducting a study of how people locate information online using their computer skills. You are a part of the Rochester community whose information would be extremely valuable to me for the completion of my master's thesis in the Communication & Media Technology program.

Your participation in the study is completely voluntarily and you may refuse at any time to participate in the study. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with Rochester Institute of Technology or the researcher.

Participation in the study includes a brief survey of seven questions that will take you three minutes to complete. Following the survey, the participant will complete one online task that will take less than ten minutes on a computer provided to you where your online actions to locate information will be captured with a program called HyperCam.

There are no major risks caused by participating in this study nor right or wrong answers. The information will be gathered and kept confidential. Once the survey data has been input into a database, the original survey forms will be destroyed along with any information linking the electronic data with the original survey. Although the results of this study may be published, your name or information that could identify the participant will be included.

The benefits associated with this study will provide a greater level of understanding of digital literacy among online users in the Rochester community. Personal benefits may result in the discovery of individual online performance. Participants that are involved in this study will receive a coupon for a free ice cream following the completion of the survey and the online task in its entirety.

Should you have any questions at any time about the study, please contact the researcher, Lisa Barber at lnbpro@rit.edu or at (585) 475-6546. If you have any additional questions please contact the Human Subjects Research Office at hmfsrs@rit.edu or (585) 313-8537

You will receive a copy of this letter for your records.

Sincerely,
Lisa Barber
Project Director

Appendix B

Internet Use Survey

We'd like to learn more about your background to understand you as an Internet user. For statistical purposes, please follow the directions and answer the seven questions below. Check one response for each item.

1 Which one term best describes the community you currently live in? (Please circle one)

Urban
Suburban
Rural

2 How often do you access the Internet? (Please circle one)

Once a month
Once a week
Several times a week
Every day
Several times a day

3 How many hours per week do you spend browsing the Internet? _____ (fill in the blank)

4 What year were you born? _____ (fill in the blank)

5 What is the highest level of education that you have completed? (Please circle one)

a. Less than High School
b. High School
c. Some College
d. 2-year College degree (Associates)
e. 4-year College degree (BA/BS)
f. Master's Degree
g. Doctoral Degree
h. Professional Degree (MD/JD)

6 What is your racial or ethnic identification? (Please circle one)

African American
Asian or Pacific Islander
Caucasian or White
Hispanic/Latino
Native American

7 Are you a: (Please circle one)

Male
Female

Thank you for your participation!

Appendix C

Recruitment Script

"Hello, my name is Lisa Barber and I am a graduate student at RIT. I am conducting a study of how Rochestarians locate information online using their computer skills. I have a brief survey that will take you three minutes to complete followed up by an online activity that will take less than ten minutes. It's entirely voluntary and you can skip any questions that you don't want to answer.

Would you like to participate in order to be considered for a $50 Visa gift card?

Great!

If you would like to participate in this research study, here's a quick survey and then we can get started here on my laptop with the online activity. Are you ready to begin?!"

{after survey and task is completed}

"Do you have any questions?

Thank you for your participation in this research study. If you have any questions later on you can reach me by email at lnbapt@rit.edu."

Appendix D
Tables

Table D1
Conceptual Definitions and Modified Tasks to Assess Participants Internet Skills

Skill	Definition	Task	Goal	Measurement
Operational	These are derived from concepts that indicate a set of basic skills in using Internet technology.	1. Go to the New York Department of Motor Vehicles website (www.dmv.ny.gov). Locate the "Enhanced Driver's License" document and complete the fields in the PDF.	Measure basic search and web skills	*How long it takes to complete the task Whether or not they correctly located info
Formal	These relate to the hypermedia structure of the Internet which requires the skills of navigation and orientation.	2. Imagine you just moved to Rochester. You would like to look up the physical address of the following: *a). Identify the address where you are presently sitting.* *b). Locate an Italian Restaurant closest to your current location at the present moment.*	The task involves an operational search process which allows the participant to research specific information online without getting disorientated when additional instructions are asked.	Two measurements: a). How long it took to complete the task b). How much of the task was completed
Information	These are derived from studies that adopt a staged approach in explaining the actions via which users try to fulfill their information needs.	3. Go to the Nothnagle real estate website to locate a house that has the following characteristics: *a). Area: Rochester* *b). School District: Rush-Henrietta* *c). Price: $150k-$200* *d). 3 bedrooms* *e). 2 bathrooms*	To find information in a closed environment on one specific website	How long it took to complete the task Whether or not they correctly located info
Strategic	i). The capacity to use the Internet as a means of reaching particular goals (digital literacy goal). ii). The general goal of improving one's position in society (social goal).	4. Imagine that you are the Marketing Director and your employer has not compensated your salary to your satisfaction based on your experience and education. Use a search engine to locate the average salary for your position through the Bureau of Labor Statistics website (www.bls.gov).	Participants need to define specific search queries and select proper resources relating to salary discrepancy. Example: Participants must identify other examples of people with greater or fewer qualifications to justify salary.	Two measurements: 1). How long it took to complete the task 2). How much of the task was completed

*The time to complete task will be noted after reviewing the recordings in HyperCam

Table D2

Frequency Distribution of Participants by Ethnicity

Ethnicity	Frequency	Percent	Valid Percent	Cumulative Percent
African-American	11	36.7	36.7	36.7
Caucasian or White	15	50.0	50.0	86.7
Hispanic/Latino	4	13.3	13.3	100.0
Total (Valid)	30	100.0	100.0	

Table D3

Frequency Distribution of Participants by Sex

Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Male	12	40.0	40.0	40.0
Female	18	60.0	60.0	100.0
Total (Valid)	30	100.0	100.0	

Table D4

Frequency Distribution of Participants by Age

Age	Frequency	Percent	Valid Percent	Cumulative Percent
24	1	3.3	3.3	3.3
26	2	6.7	6.7	10.0
27	1	3.3	3.3	13.3
28	2	6.7	6.7	20.0
32	1	3.3	3.3	23.3
36	1	3.3	3.3	26.7
38	1	3.3	3.3	30.0
39	1	3.3	3.3	33.3
40	1	3.3	3.3	36.7
43	2	6.7	6.7	43.3
46	2	6.7	6.7	50.0
49	1	3.3	3.3	53.3
50	1	3.3	3.3	56.7
52	1	3.3	3.3	60.0
55	1	3.3	3.3	63.3
56	2	6.7	6.7	70.0
59	3	10.0	10.0	80.0
60	1	3.3	3.3	83.3
62	1	3.3	3.3	86.7
66	1	3.3	3.3	90.0
68	1	3.3	3.3	93.3
76	1	3.3	3.3	96.7
83	1	3.3	3.3	100.0
Total (Valid)	30	100.0	100.0	

Table D5

Frequency Distribution of Participants by Community Location

Community Location	Frequency	Percent	Valid Percent	Cumulative Percent
Urban	14	46.7	46.7	46.7
Suburban	14	46.7	46.7	93.3
Rural	2	6.7	6.7	100.0
Total (Valid)	30	100.0	100.0	

Table D6

Frequency Distribution of Participants by Education

Education Level	Frequency	Percent	Valid Percent	Cumulative Percent
High School	7	23.3	23.3	23.3
Some College	7	23.3	23.3	46.7
2-year College Degree (Associates)	2	6.7	6.7	53.3
4-year College Degree (BA/BS)	6	20.0	20.0	73.3
Master's Degree	6	20.0	20.0	93.3
Doctoral Degree	2	6.7	6.7	100.0
Total (Valid)	30	100.0	100.0	

Table D7

Frequency Distribution of Participant by Internet Access

Internet Access	Frequency	Percent	Valid Percent	Cumulative Percent
Never	2	6.7	6.7	6.7
Once a month	3	10.0	10.0	16.7
Once a week	2	6.7	6.7	23.3
Several times a week	1	3.3	3.3	26.7
Every day	4	13.3	13.3	40.0
Several times a day	18	60.0	60.0	100.0
Total (Valid)	30	100.0	100.0	

Table D8

Frequency Distribution for Hours Spent Browsing

Hours	Frequency	Percent	Valid Percent	Cumulative Percent
0	2	6.7	6.7	6.7
1	1	3.3	3.3	10.0
1	1	3.3	3.3	13.3
2	4	13.3	13.3	26.7
3	2	6.7	6.7	33.3
3	2	6.7	6.7	40.0
4	2	6.7	6.7	46.7
5	3	10.0	10.0	56.7
6	1	3.3	3.3	60.0
8	1	3.3	3.3	63.3
10	4	13.3	13.3	76.7
20	2	6.7	6.7	83.3
21	2	6.7	6.7	90.0
30	1	3.3	3.3	93.3
36	1	3.3	3.3	96.7
100	1	3.3	3.3	100.0
Total (Valid)	30	100.0	100.0	

Table D9

Descriptive Statistics: Hours and Age

	N							
	Valid	Missing	*M*	*Mdn*	Mode	*SD*	Minimum	Maximum
Hours Browsing	30	0	11.52	5.0	2[a]	19.077	0	100
Age	30	0	47.73	47.50	59	15.669	24	83

Note. [a] = multiple modes exist. The smallest value is shown.

Table D10

Frequency Distribution for Computer Tasks

Task	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Operational	8	26.7	29.6	29.6
Formal	6	20.0	22.2	51.9
Information	7	23.3	25.9	77.8
Strategic	6	20.0	22.2	100.0
Total	27	90.0	100.0	
Missing				
System	3	10.0		
Total	30	100.0	100.0	

Table D11

Descriptive Statistics: Time

	N							
	Valid	Missing	*M*	*Mdn*	Mode	*SD*	Minimum	Maximum
Time	27	3	197.8230	129.0000	76.20[a]	176.19895	17.12	811.20

Note. [a] = multiple modes exist. The smallest value is shown.

Table D12

Descriptives (Oneway Time by Tasks)

					95% Confidence Interval for Mean			
Time	*n*	*M*	*SD*	*SE*	Lower Bound	Upper Bound	Minimum	Maximum
Operational	8	139.0500	61.67359	21.80491	87.4896	190.6104	76.20	245.40
Formal	6	59.1033	26.79164	10.93764	30.9872	87.2194	17.12	87.00
Information	7	360.1714	69.84587	26.39926	295.5748	424.7681	252.60	439.80
Strategic	6	225.5000	288.27922	117.68950	-77.0305	528.0305	66.00	811.20
Total	27	197.8230	176.19895	33.90950	128.1210	267.5249	17.12	811.20

Table D13

ANOVA

Time	*SS*	*df*	*MS*	*F*	Sig.
Between Groups	332188.184	3	110729.395	5.362	.006
Within Groups	475009.595	23	20652.591		
Total	807197.778	26			

Table D14

Multiple Comparisons

Dependent Variable: Time

Tukey HSD

(I) Tasks	(J) Tasks	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Operational	Formal	79.94667	77.61232	.734	-134.8303	294.7236
	Information	-221.12143*	74.37704	.032	-426.9454	-15.2975
	Strategic	-86.45000	77.61232	.685	-301.2269	128.3269
Formal	Operational	-79.94667	77.61232	.734	-294.7236	134.8303
	Information	-301.06810*	79.95292	.005	-522.3222	-79.8140
	Strategic	166.39667	82.97106	.215	-396.0029	63.2095
Information	Operational	221.12143*	74.37704	.032	15.2975	426.9454
	Formal	301.06810*	79.95292	.005	79.8140	522.3222
	Strategic	134.67143	79.95292	.354	-86.5827	355.9255
Strategic	Operational	86.45000	77.61232	.685	-128.3269	301.2269
	Formal	166.39667	82.97106	.215	-63.2095	396.0029
	Information	-134.67143	79.95292	.354	-355.9255	86.5827

*. The mean difference is significant at the 0.05 level.

Table D15

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Time	Equal variances assumed	.116	.736	.389	25	.701	27.77671	71.39481	-119.26365	174.81706
	Equal variances not assumed			.348	13.484	.733	27.77671	79.87879	-144.16339	199.71680

Table D16

Time by Sex Report

	Time		
Sex	*M*	*n*	*SD*
Male	215.3120	10	226.43789
Female	187.5353	17	145.96079
Total	197.8230	27	176.19895