

Second-Level Digital Divide: Differences in People's Online Skills*

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Abstract

Much of the existing literature on the digital divide – the differences between the haves and have nots regarding access to the Internet – limits its scope to a binary classification of technology use by only considering whether someone does or does not use the Internet. To remedy this shortcoming, in this paper I look at the differences in people's online skills. In order to measure people's online ability, I assigned search tasks to a random sample of Internet users from a suburban county. Findings suggest that people search for content in a myriad of ways and there is a large variance in whether people are able to find various types of content on the Web and how long they take to complete online tasks. Age is negatively associated with one's level of Internet skill, experience with the technology is positively related to online skill, and differences in gender do little to explain the variance in people's ability to find content online.

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Introduction: Inequalities in Internet Use

Much of the literature documenting the Internet's spread across the population has focused on the differences among those who have access to the Internet and those who do not, or the differences among those who use it and those who do not. Since the National Telecommunications Information Administration published its first report "Falling Through the Net: A Survey of the Have Nots in Rural and Urban America" in 1995, many analyses have been written on the inequalities of access to and use of the medium. Existing studies of differential Internet access and use document inequalities among various segments of the population (Bucy 2000) with particular attention to education (NTIA 2000) race (Hoffman 1999), gender (Bimber 2000), age (Loges and Jung 2001), income (Benton 1998) and rural residence (Strover 1999).

These studies have been essential in understanding inequalities in access to the Internet, or what has come to be known as the "digital divide". Here, I argue that as the medium spreads to a majority of the population (NTIA 2002) it is increasingly important to look at not only who uses the Internet, but also to distinguish among people's varying levels of online skills. Skill, in this context, is defined as *the ability to efficiently and effectively find information on the Web*. By exploring the differences in how people use the Web for information retrieval, we can discern if there is a "second-level digital divide" in the making as the Web spreads to the majority of the American population. To explore this question, I report findings from a project that explores people's ability to locate content online. Documenting differences in people's Web use skills allows us to distinguish between how different kinds of people are able to take advantage of the medium in varying ways.

Refining the current approach to the digital divide

While most reports identify differences among various segments of the population, over time studies emphasize the increasing diffusion of the medium among the population at large (Howard, Rainie and Jones 2001; Katz and Rice 2002; NTIA 2000; 2002; Pew Internet and American Life Project 2000). As more people start using the Web for communication and information retrieval, it becomes less useful to merely look at binary classifications of who is online when discussing questions of inequality in relation to the Internet (DiMaggio and Hargittai 2001).

Rather, we need to start looking at differences in how those who are online use the medium, that is, differences in people's online skills.

It is important to consider more than mere access to the network when studying the differential spread of the Internet across the population and inequalities in people's use of the medium. Given the increasing spread of the medium, it is important to expand the research agenda to allow analyses of the differences *among* Internet users. That is, how can we talk about the Internet's effect on political participation if a user does not possess the skills to find political information? Similarly, how can the Internet prove to be a useful link between government and citizens if people are unable to find official documents online?

Information about people's online skills tells us to what extent they are able to use the medium in ways of most interest to them and in ways that are most useful to their particular needs. The ability to find different types of information online allows people to use the medium to their maximum benefit. If users often give up in frustration and confusion then merely having access does not mean that a digital divide has been solved because a divide remains in their capacity for effective use of the Internet. As Kiesler et al. (2000) note, the computer – currently the basis of most users' Internet access in the United States – is still not an appliance with obvious directions when something does not seem to go as expected. By measuring users' Internet skills, we can bridge the gap in the literature between mere structural measures of access and descriptions of what people do online to account for what different people are *able* to do online.

Methods and Data

Sampling

The data presented in this paper are based on in-person observations and interviews with a random sample of 54 Internet users from the suburban towns and boroughs of a New Jersey county conducted during the summer and fall of 2001. Respondents were recruited through random sampling. Potential respondents were first sent a letter via postal mail explaining the project and requesting participation. They were also sent a brochure that presented more details about the study. People were also pointed to the study's Web site (www.webuse.org) for more information and

were given the option of calling/writing the researcher to schedule an appointment. A few days after the letters had been sent, the households were contacted by telephone.

The eligible adult (i.e. Internet user adult over 18) with the next nearest birthday was selected in order to randomly sample from within households. If this randomly selected person from the household was not willing to participate then the household was coded as a refusal even if another member of the household would have been willing to take part in the study. Such strict measures of random selection assure that the participants of the study represent a truly random sample of the Internet user population. People who were identified as Web users were invited to participate in the study. Web users are defined as people who go online at least once every month for more than using email. This is a low threshold for including people in the study; it is used to maximize variance in experience.

Respondents were offered \$40 for their participation, which they received after the observation session. Respondents were asked to come to the research site on the university campus and were offered assistance with transportation if they could not provide their own (one respondent took advantage of this option and was reimbursed for bus fair). The study's response rate was 64 percent.

Studying how people find information online

Researchers in the library and information science community have conducted analyses on how people locate content online, but their projects limit their scope to people in particular academic communities (e.g. graduate students in information science programs (Wang, Hawk and Tenopir 2000) or at best college students in general (Cothey 2002)) making their findings impossible to generalize to the broader Internet user population (see Jansen and Pooch 2001 for a review of the literature on Web searches). Moreover, these studies focus on the technicalities of searches – such as the number of search terms used in a search query – instead of exploring the demographic variables that contribute to differences in how people find information online.

Information about subjects' usual Internet use and history as well as data on their demographic background were collected via surveys. People's ability to locate

content on the Web was measured by giving respondents tasks to perform online.

Here, I analyze the results of the following five tasks. People were asked to find:

1. Information about local cultural events in the area such as art shows, musical performances, theatre shows or movies
2. Music they could listen to online
3. A Web site comparing different presidential candidates' thoughts on abortion
4. Tax forms
5. Art by kids

These tasks were chosen to explore people's ability to find information on the Web in different topical domains. They explore whether users can find locally relevant content, whether they can take advantage of the multimedia nature of the Web, whether they can use the Web for political purposes, for government information, and for a random task such as finding children's art online. The last task proved to be useful in that it was new to all users and thus was able to control for people's previous experiences with any given task.

Respondents were given the choice of using a PC or a Mac so they could use the platform with which they are familiar. The three most popular browsing software applications were all available on both machines; Internet Explorer, Netscape Communicator, and America Online to allow respondents to replicate their usual online experience. The computers connected to the Internet on a T1/T3 university network line. Additionally, a program called Don't Panic (Panicware 2001) was used to erase the browser and URL history on each browser program so that each respondent started out with a clean slate and was not influenced by previous users' actions. The search sessions were recorded with the Hypercam screen capture program (or SnapZPro for the Mac) that generated audio-visual files of the entire search sessions. The whole screen was captured with every action – e.g. click of the mouse, scrolling – and every verbal comment the respondent made during the search. These files were then analyzed to measure whether people successfully completed a task and how much time (in seconds) they spent on each task. This is the outcome of interest in this study: *Skill is operationalized as success and time to completion of a task*.

The researcher sat behind to the left of the respondent and refrained from influencing the respondents' strategies (e.g. never suggested any particular online actions, did not answer questions about spelling or whether a certain click would be useful). Respondents were encouraged to look for the information until they found it. No one was cut off from pursuing a search. In some cases when respondents looked frustrated or agitated they were given the option of moving on. However, when a subject simply stated that he or she was unable to perform a certain task, that person was encouraged to try several times nonetheless. When the subject suggested multiple times that they would not be able to complete a search, they were read the next task. (Hargittai (in press) describes the study methodology in detail.)

The sample

Respondents range in age from 18-81 (see Table 1 for details). Half of the sample is male. Fifty-five percent of the respondents work full time and an additional 15 percent work part-time. Their occupations range from real-estate agents, environmental policy analysts, blue-collar workers to office assistants, teachers, service employees and medical professionals in addition to students, unemployed and retired persons. (See the Appendix for a complete list of participants' demographic characteristics including their occupations.)

Eighty-nine percent of the respondents are White, there are four African Americans and one Asian American respondent, one person chose the "other" category for race; there is one Hispanic participant. Eleven percent live without another adult in the household, 45 percent live with a spouse, the rest live with roommates or others (parents in most cases). Eighty-two percent of the respondents have children. Of these 28 people, 53.5 percent (15 people) have children currently living with them.

On average, participants in this study are more educated than the general Internet user population as 26 percent have less than a college degree, a third hold a college degree and the remaining 40 percent has a graduate degree. This suggests that findings from the study will be conservative with respect to effects of different educational levels on people's ability to use the Internet effectively. The family income of respondents is greater than the national average although it is important to note that

Mercer County is one of the highest income counties in the country and thus despite the high median income, the sample is not out of the ordinary for the local population.¹ (See Table 1 for descriptive statistics of the family income distribution.) Respondents' differ in their political leaning with 20 percent identifying as conservative, 30 percent claiming to be middle of the road and half identifying as liberal.

Regarding Web use frequency and history, the group is diverse. Respondents were asked how much time they spend on the Web each week excluding email use, that is, time spent specifically for browsing information online. Participants' Web use ranges from just a few minutes a week to as much as 70 hours weekly (see Table 1 for details). About half of the respondents use the Web more than they use email, 18.5 percent use the two types of online services the same amount and the rest do more emailing than Web browsing.

The group is similarly diverse in its overall experience with the medium. Users were asked to note when they first started using the Internet. One person went online the year of the study with an additional 18.5 percent only having used it for two years or less. However, many – 39 percent – of the subjects had been users for 5-7 years. There are also several long-term users among the respondents with 18.5 percent having used the Internet for more than ten years (see Table 1 for details).

Table 1. Descriptive Statistics for Independent Variables

	Mean	St. dev.	Median	Minimum	Maximum
Age	43.06	16.37	41.5	18	81
Education ^a	N/A	N/A	College	Less than high school	Ph.D.
Family income ^a	N/A	N/A	\$80-89,000	\$17,500-19,000	>\$250,000
Number of years since first use of the Internet	6.24	3.54	6	0	16

¹ The average median per capita income in Mercer County, NJ in 2000 was almost \$40,000 (based on Census data). Here, I look at family income, which is likely to be considerably higher on average. Moreover, because this sample excludes inner-city Trenton, the poorest neighborhoods are not in the sample at all suggesting that these earnings are characteristic of the local population.

Number of hours browsing the Web weekly	8.55	10.76	5	8 minutes	70
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^a Education and Family income have no means as those variables were collected categorically.

Differences in people's ability to find content online

I measure people's online skills in two ways. First, the binary success/failure rate shows what portion of the respondents was able to complete a certain task. Second, the time to completion of each task is measured in seconds to show the gradual differences in how long people take to find information on the Web. The exact time spent on each task is recorded for every respondent so information is available both on when respondents successfully completed a task and when they decided to give up on a task.

There is some variance in people's success rate in performing tasks and large variance in the amount of time they take to complete the tasks. Half of respondents (27 people) were able to successfully complete all tasks and an additional 31.5 percent (17 people) succeeded in locating four of the five types of information sought (see Table 2 for details). However, the remaining ten people were only able to successfully complete 1-3 tasks. This is a considerable proportion given that people were encouraged to pursue tasks without any time constraint. Table 3 describes in detail what proportion of respondents was successful for each task with additional information on the amount of time people spent on each task.

Table 2. Number of Successfully Completed Tasks (N=54)

Number of Tasks Completed Successfully	Number of Respondents (% in parentheses)
1	1 (2)
2	3 (5.5)
3	6 (11)
4	17 (31.5)
5	27 (50)

Table 3. Success Rate and Average Time to Successful Completion by Task

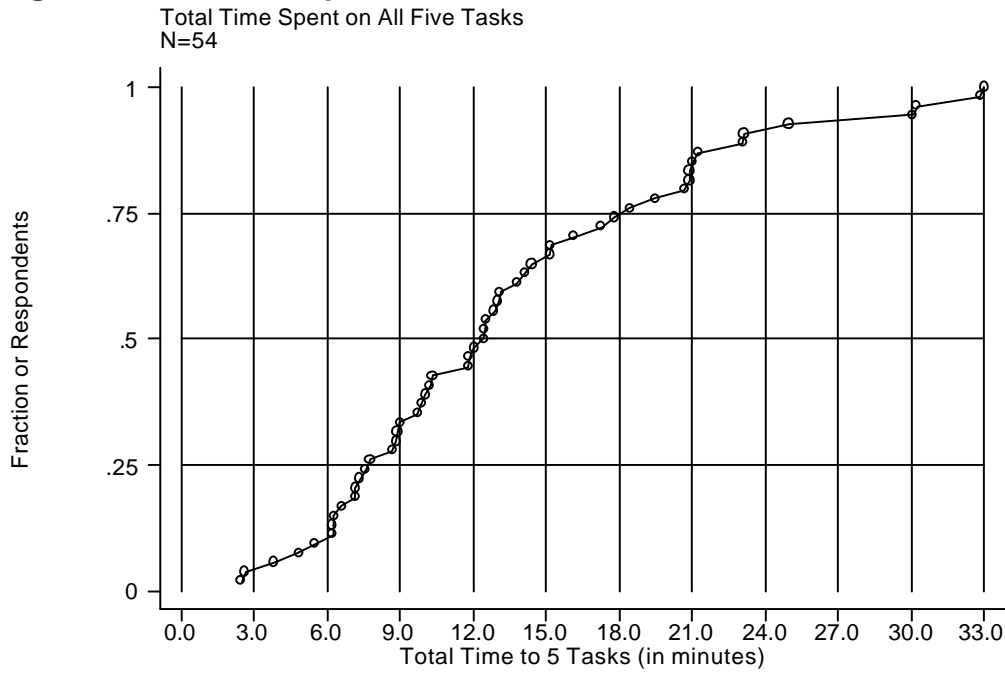
Task	Success Rate (%)	Mean (mins)	Standard Deviation	Minimum Time	Maximum Time (min)	N (success)
Music	94.44	1.55	1.67	5s	7.83	51
Local events	87.04	2.18	2.03	24s	9.78	47
Kids' art	85.19	2.09	1.67	11s	8.05	46
Tax forms	94.44	2.48	2.04	27s	8.75	51
Political info	61.11	3.79	3.10	27s	13.53	33

Note the low rate of successful completion (61 percent) for the task requesting respondents to find a Web site that compares different presidential candidates' positions on abortion. This finding has important implications when considering the potential effects of the Internet on political participation and its ability to inform citizens on political issues. A large percentage of users were unable to find a political comparison Web site even in a situation where they are not constrained by time and are not being distracted by other obligations and activities. This suggests that people have a very hard time finding political information that may be of use to them to further their understandings of candidates' views in a political campaign. Although there are numerous resources on the Web that showcase this type of information, the mere presence of such content will be of little use to advancing political participation if people are not capable of finding their way to such sites.

Overall, people spent anywhere from two and a half minutes to 33 minutes on the five tasks regardless of whether they were able to successfully complete them or not. See Figure 1 for the cumulative distribution function of the total time spent on all tasks where the y axis denotes the proportion of people still working on a task and the x axis shows the amount of total time spent on searching. There is a gradual increase in the amount of time people spent on all the tasks. Half of respondents were done in 12 minutes or less (so on average these people spent 2.4 or less minutes on each task),

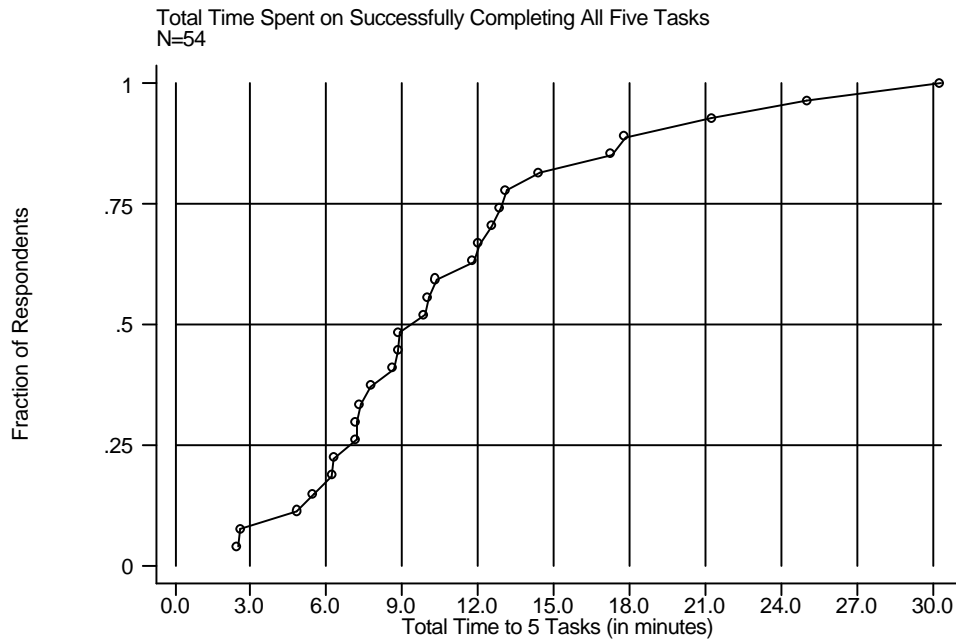
but the rest took longer, spending as much as 33 minutes on the tasks. Four respondents spent less than a total of five minutes on all tasks whereas four respondents spent more than 30 minutes on the five tasks.

Figure 1. Total Time Spent on All Five Tasks



The large variance is not simply due to people searching endlessly without successful completion. Figure 2 shows the distribution of time spent on the five tasks for those 27 respondents who successfully completed all five tasks. Their times-to-completion range from 2.5 minutes to 30.3 minutes suggesting that the quickest respondent successful with all tasks was as much as twelve times quicker than the slowest fully successful respondent.

Figure 2. Total Time Spent on All Tasks for Those Successful with All Five Tasks



How can we explain these differences in people's ability to find content online? Here, I look at the relationship between online skills and age, gender, education, and experience with the technology. I consider both the mean number of successfully completed tasks by subgroups and the average amount of time (in minutes) spent on all five tasks. (Here I report time spent on all five tasks regardless of successful completion. The results are robust when only considering the total time of those who were successful with all five tasks.)

Age

There are clear generational differences in people's ability to use the Web. Table 4 shows the average number of successfully completed tasks by age broken down by decades. The 18 and 19 year olds were all successful with all five tasks whereas the people in their 70s and 80s averaged 3.33 successful tasks with people in their 60s also able to finish less than four tasks on average. The same table also presents information about the average time people spent on the five tasks broken down by age in decades. Again we see clear generational differences. People in their teens and people in their 20s are quicker than people in their 30s and 40s who are quicker than older respondents.

Table 4. Average Number of Successfully Completed Tasks and Time Spent on Tasks by Age

Age by Decade	Mean Number of Tasks	St.dev. of Tasks	Average Time on Tasks (min)	St.dev. of Time	Number of Observations
10s	5	0.00	6.7	3.96	3
20s	4.67	0.49	8.2	3.97	12
30s	4.17	1.33	15.7	6.11	6
40s	4.21	0.58	14.0	6.94	14
50s	4.13	1.13	19.1	8.44	8
60s	3.75	1.49	13.5	6.49	8
70s+	3.33	1.15	24.4	7.50	3

Gender

On average, women completed 4.19 tasks compared to men's 4.26 average success rate. The average total time spent on the five tasks for women was 14.6 minutes whereas for men it was 12.9 minutes. Neither of these differences is statistically significant, suggesting that there is no gender difference between whether people are able to find different types of content on the Web and how long they take to do so.

Education

Education has consistently been a predictor of people's access to the Internet (NTIA 1995; 1998; 1999; 2000) and is likely to affect people's level of Web use skill as well. Universities were the first ones to embrace the technology and thus those who attended college in the past decade would have had exposure to the medium during their schooling. Moreover, people with higher levels of education are likely to have had more exposure to computer technology in general, familiarity with which is an important first step in gaining access to the Internet. Moreover, higher educated people are more likely to possess the expertise needed to download and install additional software, a necessary prerequisite for the browsing of many Web sites.

Here, respondents' level of education is broken down into three categories: less than a college degree, college degree and graduate degree. Table 5A shows the relationship of people's educational level and their online skills. Those with the lowest

level of education seem to do the best both in terms of number of tasks completed and amount of time to completion of tasks. However, because those currently in school are likely to have quite a bit of exposure to the technology, and because they would show up in an educational category that does not yet represent the degree they are currently seeking, in Table 5B, I present the relationship between education and online skill excluding those respondents who are currently in school (five college students and one graduate student were thus excluded from this table). Here, we see that those with a graduate degree do best both with successful completion of tasks and amount of time spent on tasks. In the last column of this table, I have included the average age of those in the three educational subcategories because we have seen earlier that age is significantly correlated with level of Web skill. Consistent with that finding, we find that the relationship of education to skill may be driven by the considerable differences in the average age of those who have no college degree (40) and those who do (48 for the college graduates and 47 for those with an advanced degree). However, since the average age is similar for these latter two categories, we can see that those with a graduate degree are considerably better at finding information online than those who did not obtain an advanced degree.

Table 5A. Average Number of Successfully Completed Tasks and Time Spent on Tasks by Education

Education	Mean Number of Tasks	St.dev. of Tasks	Average Time on Tasks (min)	St.dev. of Time	Number of Observations
No college degree	4.43	.94	10.4	5.13	14
College degree	3.78	1.21	18.4	8.44	18
Graduate degree	4.45	.67	12.0	6.42	22

Table 5B. Average Number of Successfully Completed Tasks by Education and Time Spent on Tasks Excluding Those Currently in School

Education	Mean Number of Tasks	St.dev. of Tasks	Average Time on Tasks (min)	St.dev. of Time	Number of Observations	Mean Age in Educational Subcategory
No college degree	4.125	1.13	12.9	3.89	8	40
College degree	3.78	1.21	18.4	8.44	18	48
Graduate degree	4.42	.68	12.3	6.45	21	47

Prior experience with the technology

The amount of prior experience people have with the Internet is likely to affect their online actions (Howard, Rainie and Jones 2001). People who spend more time online – whether at work or any other location – will likely acquire more knowledge about the Web and thus will have better online skills. Moreover, people who have been Internet users for longer are expected to be better at finding information online as they have more experiences to draw on. Moreover, these are people who were early adopters and thus tend to be more innovative suggesting more willingness to explore the new medium and familiarize themselves with it (Howard, Rainie and Jones 2001; Rogers 1995).

The data suggest that the amount of time people spend online does affect their efficiency in finding information on the Web but mostly for those who use it minimally. According to Table 6, those who browse the Web less than an hour each week are able to find less information and take considerably longer than those who spend either 1-7 hours online per week or those who spend even more time surfing the Web weekly.

Table 6. Average Number of Successfully Completed Tasks and Time Spent on Tasks by Time on Web Weekly

Education	Mean Number of Tasks	St.dev. of Tasks	Average Time on Tasks (min)	St.dev. of Time	Number of Observations
Less than 1 hour	3.20	1.78	18.9	8.37	5

1-<7 hours	4.22	.93	13.7	7.90	27
7 or more hours	4.45	.67	12.7	6.80	22

Table 7 sheds light on the importance of being a veteran versus a newcomer online. Those how who only recently started using the Internet – in the past two years – exhibit considerably lower online skills than those who have been online for longer. However, note again the age distribution among the subcategories. Late adopters are significantly older and so it may be a combination of people’s age and time since their first Internet use that is driving the differences in Web use skills.

Table 7. Average Number of Successfully Completed Tasks and Time Spent on Tasks by Number of Years Since First Internet Use

Number of Years Since First Use Net	Mean Number of Tasks	St.dev. of Tasks	Average Time on Tasks (min)	St.dev. of Time	Number of Observations	Mean Age in Subcategory
0-2 years	3.18	1.25	19.6	6.01	11	52
3-6 years	4.47	.61	14.3	7.67	19	41
7 or more years	4.50	.78	10.6	6.56	24	40

Conclusion

In general, young people (late teens and twenties) have a much easier time getting around online than their older counterparts (whether people in their 40s or 70s). Some of this is clearly based on comfort with the technology they are using and not necessarily based on elaborate techniques they have mastered specifically with respect to the Web. As the amount of time people have been Internet users also matters in how well people are able to navigate the content of the Web, it is possible that those who are currently less skilled will learn over time. However, in so far as people may be discouraged by the difficulties of finding information on the Web and thus may end up spending less time on it, lower level skills may persist over time.

It is clear from the findings that there is great variance in people’s ability to locate content online. Merely offering people a network-connected machine will not ensure that they can use the medium to meet their needs because they may not be able

to maximally take advantage of the medium. Policy decisions that aim to reduce inequalities in access to and use of information technologies must take into consideration the necessary investment in training and support as well. Like education in general, it is not enough to give people a book, we also have to teach them how to read for them to gain any use from it. Similarly, it is not enough to wire all communities and declare that everyone now has equal access to the Internet. People may thus have technical access, but they may still continue to lack effective access in that they may not know how to extract information for their needs from the material available on the Web. Although providing Internet access may help alleviate some problems of the digital divide, a second-level digital divide remains when it comes to people's ability to effectively use the medium.

Appendix: Demographics of Respondents (abbreviation explanations on next page)

Occupation	Age	Sex	Education	Time on Web/week (in hours)	# of years using Net
Student	18	F	HS/GED	3	7
At home	18 ^a	F	HS/GED	10	5
Library office assistant/Student	19	F	SC	10	4
Accounting manager assistant/Student	20	F	SC	2	11
Sales data manager/Student	20	F	SC	4.5	7
Bank customer service representative/Student	21	F	SC	5	4
Computer lab tech support/Student	22	M	SC	70	7
Financial markets data manager	24 ^c	M	BA	30	5
Financial services sales representative	24	M	BA	21	6
Financial analyst	25	F	BA	1	11
Golf course groundskeeper	26	M	HS/GED	7.5	2
Hydrogeologist	26	F	BA	5	7
Non-profit administrator	26	F	MA	6	7
Graduate student (humanities)	27 ^a	M	PhD	10	11
Civil engineer	29	M	BA	17.5	6
US military pilot	33	M	MA	7	6
Non-profit computer programmer	34 ^b	M	MA	25	7
Local government GIS administrator	36	F	MA	15	6
Assembly worker (air conditioners)	39 ^a	M	<HS	0.13	1
Small company MIS director	39	M	HS/GED	7	6
At home	39	F	BA	.17	1
Self-employed real-estate agent	40	F	ASD	1.5	2
Medical equipment repair and installation	40	M	BA	10	11
At home	40	M	MA	4	9
Professor (mathematics)	40	M	PhD	8	9
Circulating nurse	41	F	ASD	9	8
Legal researcher for State	41	M	PRO	5	8
Unemployed	42	F	MA	21	8
Security officer	42	M	PRO	4	3
Personal/professional concierge (self-employed)	43	F	BA	8.5	2
Retail data administrator	44 ^a	F	BA	0.25	2
Self-employed consultant	44	F	MA	7	5
Environmental consultant	45	M	MA	3	5
School teacher	47	F	MA	3	10
Social work supervisor	48	F	MA	1	6
Sales accountant	50	M	BA	5	5
Professor (humanities)	50	F	PhD	0.5	13
Utility company budget analyst	52 ^c	M	BA	5	7
Retail customer service	52	F	MA	4	4
Management consultant (comp info systems)	52	M	MA	10	16
Technician manager	55	M	ASD	3.5	12
Business development	56	M	BA	3.5	4
Retired	57	F	MA	5	11
Development officer	60	M	PhD	7.5	8
Personal assistant to psychologist	62	F	ASD	18	7

Retired	62	M	MA	14	3
Retired	63	F	BA	3	2
Crisis counselor	64	F	BA	0.5	2
Real estate broker	66	M	BA	15	2
Pharmaceutical products customer support rep.	68	F	MA	1	2
Retired (was: scientific equipment marketer)	69	M	PhD	10	6
-	72	F	BA	10	13
Software programmer	72	M	BA	3.5	5
Store sales staff (formerly company tech staff)	81	M	BA	1	0

Labor Force Status: SCH = in school; HM = at home; FT = full time work; PT = part time work; L = looking; R = retired; JNW; with job not working; O = other

Education: <HS = less than high school; HS/GED = high school or equivalency exam; SC = some college; ASD = associates degree; BA/S = bachelor's degree (either arts or sciences); MA/S = Master's (either arts or sciences); PRO = professional degree; PhD = doctoral degree

^a African American

^b Asian American

^c Hispanic

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