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ABSTRACT

The differences between Whites and African Americans in the United States with respect to computer access, which is the current prerequisite for Internet access and World Wide Web use, were studied. The question was whether observed race differences in access and use can be accounted for by differences in income and education, how access impacts use, and when race matters in the calculation of equal access. Whites are more likely than African Americans to have a computer in their homes (44.2% compared to 29.0%), but African Americans are more likely to state that they would like to acquire access to a computer. Whites are more likely to have used the Web (26% versus 22%). Increasing levels of household income corresponding to increased likelihood of owning a home computer, regardless of race. Increasing levels of education correspond to an increased likelihood of work computer access, regardless of race. People who owned a home computer and had access to a work computer were much more likely than others to have used the World Wide Web in the past 6 months. When students are considered, race almost always makes a difference. White students lacking a home computer, but not African American students, appear to find an alternative means of accessing the Internet. These results have certain implications for policy with regard to computer access. African American students need multiple points of computer access. To ensure the participation of African Americans in the information revolution, it is critical to improve the educational opportunities of African Americans. Results also indicate that if access is ensured, use will follow. (Contains 5 figures and 20 references.) (SLD)

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Bridging the Digital Divide: The Impact of Race on Computer Access and Internet Use

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This Working Paper is a longer version of the article, "Bridging the Racial Divide on the Internet," published in *Science*, April 17, 1998.

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Introduction

That portion of the Internet known as the World Wide Web has been riding an exponential growth curve since 1994 (Network Wizards 1998; Rutkowski 1998), coinciding with the introduction of NCSA's graphically-based software interface Mosaic for "browsing" the World Wide Web (Hoffman, Novak, and Chatterjee 1995). Currently, over 29 million hosts are connected to the Internet worldwide (Network Wizards 1998), and somewhere between 60 to 75 million adults (CyberAtlas 1998) in the United States alone have access to around 320 million unique pages of content (Lawrence and Giles 1998), globally distributed on arguably one of the most important communication innovations in history.

Enthusiasm for the anticipated social dividends of this "revolution in democratic communication" (Hoffman 1996) that will "harness the powerful forces of science and technology" (Clinton 1997a) for all members of our society appears boundless. The Internet is expected to do no less than virtually transform society. Nowhere is this confidence expressed more clearly than in President Clinton's aggressive objective to wire every classroom and library in the country by the year 2000 (NetDay 1998), followed by every home by the year 2007, so that "every 12-year-old can log onto the Internet" (Clinton 1997b).

Yet even as the Internet races ambitiously toward critical mass, some social scientists are beginning to examine carefully the policy implications of *current* demographic patterns of Internet access and usage (Hoffman, Kalsbeek, and Novak 1996; Hoffman, Novak, and Venkatesh 1997; Katz and Aspden 1996). For while Clinton's "Call to Action for American Education" (Clinton 1997a) may likely guarantee universal access for our nation's next generation, are the approximately 200 million Americans presently over the age of 16 equally likely to have access to the Internet? The findings thus far are both obvious and surprising, with important implications for social science research and public policy.

Key demographic variables like income and education drive the policy questions surrounding the Internet. These variables are important because they are the most likely to differentially impact the consequences of interactive electronic media for different segments in our society. Looming large is the concern that the Internet may not scale *economically* (Keller 1996), leading to what Lloyd Morrisett, the former president of the Markle Foundation, has called a "digital divide" between the information "haves" and "have-nots."

For example, although almost 70 percent of the schools in this country have at least one computer connected to the Internet, less than 15 percent of classrooms have Internet access (Harmon 1997). Not surprisingly, access is not distributed randomly, but correlated strongly with income and education (Coley, Cradler, and Engel 1997). Further, although numerous studies (see CyberAtlas 1998) suggest that the gender gap in Internet use appears to be closing over time, the perception persists that the gap for race is not decreasing (Abrams 1997).

The consequences to American society of this race gap in Internet use are expected to be severe (Beaupre and Brand-Williams 1997). Just as A.J. Liebling observed for the freedom of the press, the Internet may provide for equal opportunity and democratic communication, but only for those with access. The United States economy may also be at risk if a significant segment of our society, denied equal access to the Internet, lacks the technological skills to keep American firms competitive.

Given these concerns, we set out to systematically investigate the differences between whites and African Americans in the United States with respect to computer access, which is the current prerequisite for Internet access, and Web use. We wished to examine whether observed race differences in access and use can be accounted for by differences in income and education, how access impacts use, and when race matters in the calculus of equal access. We believe our results may be used as a window through which policymakers might view the job of ensuring access to the Internet for the next generation.

Our analysis is based on primary data from the Spring 1997 CommerceNet/Nielsen Internet Demographic Study (IDS), conducted in December 1996/January 1997 (Nielsen Media Research 1997). This nationally projectable survey of Internet use among Americans was the first to collect data on race and ethnicity. The IDS is based upon

an unrestricted random digit dial sampling frame, and used a computer assisted telephone interviewing system to obtain 5,813 respondents. Weighted, these 5,813 respondents represent and allow projection to the total population of 199.9 million individuals in the United States aged 16 and over.

African Americans and Whites Differ Significantly in PC Access and Web Use

Figure 1 presents overall differences between whites and African Americans on computer access and general Web use. In all figures, asterisks indicate statistically significant differences¹ between whites and African Americans, according to a series of χ^2 tests. We can see that whites are significantly more likely than African-Americans to have a home computer in their household (44.2% vs. 29.0%). Whites are also more likely to have access to a personal computer at work (38.5% vs. 33.8%), but this difference is not statistically significant (p=.087).

While whites are more likely to currently have PC access, African-Americans are more likely to state they would like to *acquire* access: nearly twice as many African-Americans as whites (27.2% vs. 16.7%) stated they planned to purchase a home computer in the next six months. African-Americans were also more interested in purchasing a set-top box for Internet television access (14.9% vs. 11.7%) but this difference was not significant (p=.104).

In terms of Internet access, whites are more likely to have ever used the Web (26% vs. 22%), and the gap between whites and African-Americans becomes proportionally larger the more recently the respondent stated they had last used the Web. When we consider respondents using the Web in the past week, 12.9% of whites vs. only 5.8% of African-Americans used the Web. As of January 1997, this translates into 5.2 million (+/- 1.2 million) African-Americans and 40.8 million whites (+/- 2.1 million) who have ever used the Web, and 1.4 million (+/- .5 million) African-Americans and 20.3 million (+/- 1.6 million) whites who used the Web in the past week.

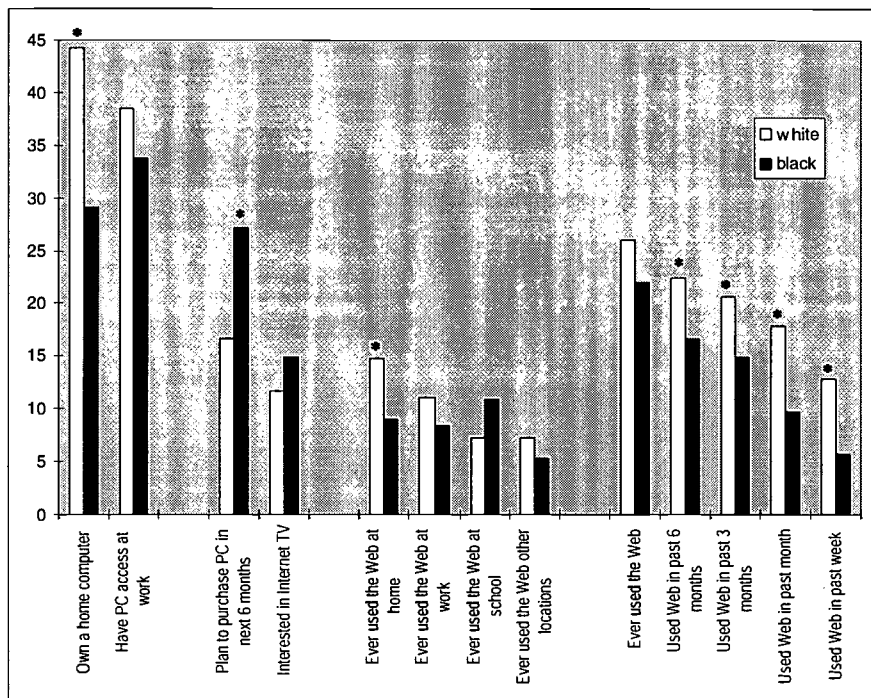


Figure 1

¹ Asterisk indicates p<.05. All significance tests were obtained using Research Triangle Institute's SUDAAN software and incorporate sampling weights. Sampling weights provided by Nielsen Media Research specified the probability of a respondent being selected into the sample. These sampling weights were adjusted for number of phones in the household and number of people aged 16 and older in the household, and were also adjusted for nonresponse by post-stratification adjustments to equate sample race, education, age, and gender distributions to Census data (Nielsen Media Research 1997)

Whites and African-Americans also differ in terms of *where* they have ever used the Web. Most notably, whites are significantly more likely (14.7% vs. 9%) to have ever used the Web at home. African-Americans are more likely to have ever used the Web at school, and whites are more likely to have ever used the Web at work and at other locations (such as friends' houses, libraries, etc.), but these differences were not statistically significant.

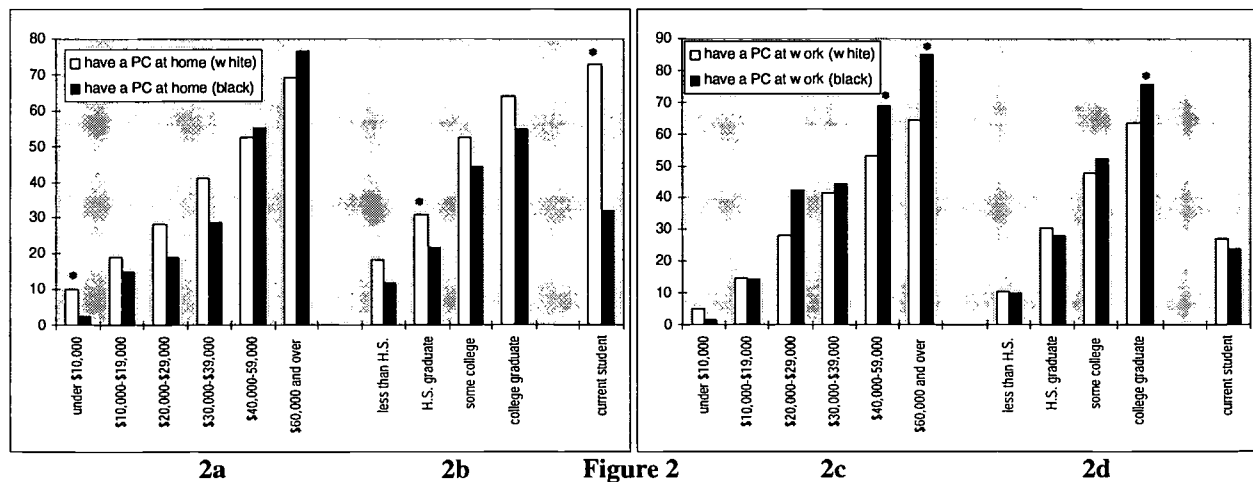
Explaining Race Differences in Computer Access

Because whites and African Americans differed significantly in their ownership of home computers, and because race differences on work computer access approached statistical significance, we fit a series of logistic regression models to examine whether these two general differences could be accounted for by income and education. Owing to small sample sizes in some cells (only a quarter or so of the general population uses the Internet), models combining income and education could not be estimated.

As students behave quite differently from the rest of the respondents with respect to computer access and Internet use, we treat them separately in a later section. Thus, students are excluded from the following series of analyses.

Income explains home computer ownership. Figure 2a shows that the significant overall difference in home computer ownership we found between whites and African Americans appears to vary when examined in the context of different household income levels. For household incomes under \$40,000, whites are more likely than African Americans to own a home computer, but for household incomes of \$40,000 or more, a greater proportion of African-Americans own a home computer. However, the apparent interaction between race and income in predicting home computer ownership was not significant ($p=.14$).

This permitted us to control for income levels. We found no significant difference between whites and African Americans with respect to home computer ownership ($p=.21$). Thus, statistical adjustment for household income effectively eliminates the observed differences between whites and African Americans in home computer access. Within the under \$10,000 income category, there is a significant difference between whites and African-Americans (10.1% vs. 2.8%). However, since neither the interaction of race and income, nor the test of race controlling for income were significant, this isolated result must be interpreted with caution. In sum, *household income explains home computer ownership: increasing levels of income correspond to an increased likelihood of owning a home computer, regardless of race.*



Education explains access to a work computer. Figure 2d shows a varying pattern of race differences in access to a computer at work for different education levels. There is no difference at the lowest education level, a slight tendency for whites to have greater access than African Americans at the high school level, while college educated African Americans are significantly more likely than whites to have computer access at work. However, the interaction is not significant ($p=.28$). Additionally, after controlling for education, race differences in work computer access disappear ($p=.33$). Thus, as with household income explaining home computer ownership, *education explains access to a computer at work: increasing levels of education correspond to an increased likelihood of work computer access, regardless of race.*

When Race Matters

Education does not explain race differences in home computer ownership. Race differences in home computer ownership are consistent across different levels of education. Figure 2b shows that within each and every education level, whites are more likely to own a home computer than African-Americans. The difference is significant for high school graduates, but there is not a significant interaction between race and education in predicting home computer ownership ($p=.97$). The general pattern is that higher education levels correspond to higher probabilities of owning a home computer.

However, after statistically adjusting for education, the differences between whites and African Americans in home computer ownership persist ($p=.002$). That is, while income explains race differences in home computer ownership, *whites are still more likely to own a home computer than African Americans at each and every education level, despite controlling for differences in education.*

Income does not explain race differences in access to a work computer. We saw from Figure 1 that whites were more likely than African Americans to have computer access at work, although the difference only approached statistical significance. Figure 2c displays computer access at work according to income levels. Remarkably, the pattern reverses so that within income groups above \$20,000, African Americans are more likely than whites to have access to a computer at work. At household income levels exceeding \$40,000, these differences are significant. Overall, this interaction approaches significance ($p=.07$).

In contrast to home computer ownership, adjusting for income did not eliminate the differences between whites and African Americans with respect to computer access at work ($p=.0009$). The opposite occurs: African Americans are *more* likely than whites to have access to a computer at work after taking income into account.

However, we observed that African Americans in the upper two income groups in our sample were more likely to have completed a college degree than whites, and so we statistically adjusted for education. Yet, even after adjusting for education in addition to income, African-Americans are still more likely than whites to have computer access at work. Further analysis revealed that African-Americans in the upper two income groups were also younger and more likely to be working in computer-related occupations than whites; additional statistical adjustment for age and computer-related occupation, in addition to income and education, eliminated the differences in work computer access between whites and African-Americans.

Note that although age and occupation account for race differences in work computer access at varying income levels, this is still a case where race matters. In our sample, compared to whites in the over \$40,000 income categories, African Americans were more educated, younger, and more likely to be working in computer-related occupations. This all translates into a greater access to computers at work.

Thus, race matters to the extent that societal biases have either 1) required African Americans to obtain higher education levels in order to achieve the same income as whites, or 2) resulted in older African Americans not being able to achieve high incomes.

How Computer Access Impacts Web Use

We have identified race differences in home computer *ownership*, work computer *access*, and Internet *use* (as measured by overall Web use, Web use in specific locations, and recency of Web use). We showed when differences in computer ownership and access could be explained by *income* and *education*. Now, we examine how home computer ownership and work computer access relate to Web use, along with the corresponding role that income and education play in influencing these relationships.

Comparatively small sample sizes for African-Americans necessitated combining whites and African Americans for analysis. Figure 3 presents the details². The vertical axis shows the percentage of respondents in a particular group (for example, individuals whose household income exceeds \$60,000 and have both home and work computer access), that have used the Web use in the past six months. The four lines represent individuals who have a) both home and work computer access, b) only home access, c) only work access, and d) no computer access at home or work (although they may have access at other locations). Results are reported for each level of household income and respondent's education, again eliminating current students, who are shown at the far right of Figure 3 as a separate category.

The top-line findings are obvious. Across all income and education groups, and for current students, we find that *individuals who own a home computer and have access to a computer at work are much more likely than any other group to have used the Web in the past 6 months*. Owning a home computer by itself is somewhat more likely to translate into Web use in the past six months than only having access to a computer at work. Not surprisingly, except for current students (who may have access at school), those who have *no* computer at home or access at work have almost no chance of having used the Web in the past 6 months.

Household income explains home computer ownership, but beyond that has little direct relationship to Web use for those with both home and work access. Income exerts a modest influence on Web use for those with *either* home

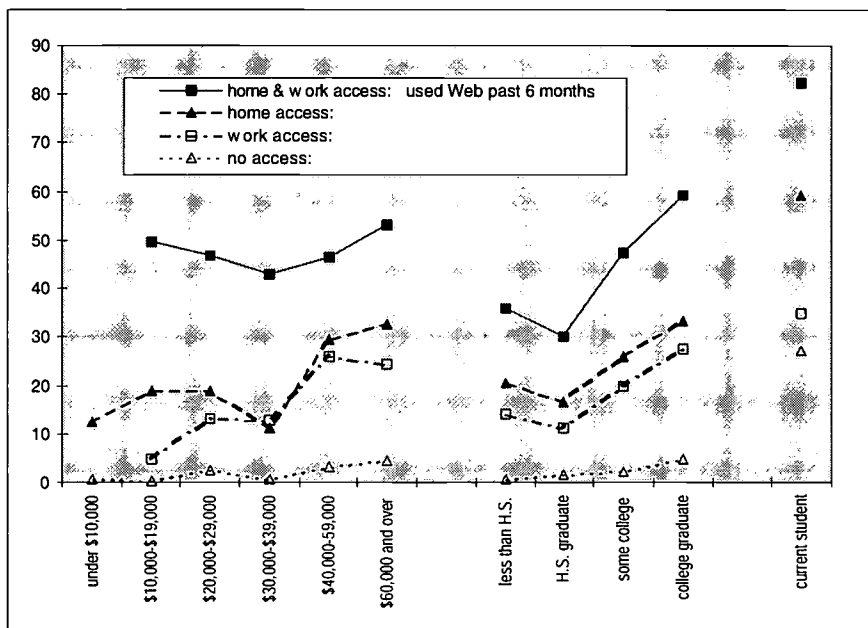


Figure 3

² Two points, home and work access with household income less than \$10,000, and work access only with household income less than \$10,000, were omitted from Figure 3, due to respective unweighted sample sizes of 11 and 13.

or work access, but only above household incomes of \$40,000. And regardless of income, those with no home or work computer access exhibit virtually no Web use. *Thus, income appears to exert its effect on computer access; it is computer access which in turn explains subsequent Web use.*

On the other hand, education explains computer access and also relates directly to Web use. The relationship is strongest for those with *both* home and work access: higher education translates into an increased likelihood to use the Web. Thus, *education not only affects computer access, but Web use, as well.*

Students are Special: Race Almost Always Matters

Figure 3 shows that current students are more likely than any income or educational group to have used the Web in the past six months. Students exhibit the highest levels of Web use at each access point because, even without home computer ownership or access at work, they presumably have access at school.

Figure 2b shows that the most dramatic difference between whites' and African Americans' home computer ownership occurs for current students (including both high school and college students). While 73% of white students own a home computer, only 32.9% of African American students own one. This difference persists when we statistically adjust for students' reported household income. Thus, in the case of students, household income does not explain race differences in home computer ownership. *This is the most disturbing case yet of when race matters.*

Figure 4 takes an in-depth look at race differences in students' Web use. In this figure, four sets of bars each compare three groups of white and African American students: a) all students, b) students who have a computer at home (*have home PC* in Figure 4), and c) students who do not have a computer at home (*no home PC* in Figure 4).

The first group of bars shows overall Web use in the past six months. White students are significantly more likely than African Americans to have used the Web in the past six months (58.9% vs. 31.1%). However, the gap disappears when we consider those students who have a computer at home - 66.7% of white and 63.8% of African-American students with a computer at home have used the Web in the past 6 months. The gap prevails when we consider those students who do not have a computer at home - 37.8% of whites compared to 15.9% of African-Americans have used the Web in the past six months. Thus, *white students lacking a home computer, but not African American students, appear to be finding some alternative means of accessing the Internet.*

The second group of bars in Figure 4 show an expected relationship in Web use at home. Overall, white students are significantly more likely than African-American students to have used the Web at home, but the difference in home Web use disappears if students have a computer at home. Students with no home computer, regardless of race, have almost never used the Web at home.

To explain why white students without home computers are more likely than African-American students without home computers to have used the Web in the past six months, we consider access at school. Our results show that white and African-American students appear to access the Web from school equally, regardless of whether they have a computer at home. These results parallel our findings for respondents accessing the Web from work. However, our data cannot be used to evaluate differences in school technology, which are likely to have an impact on the quality of access and use.

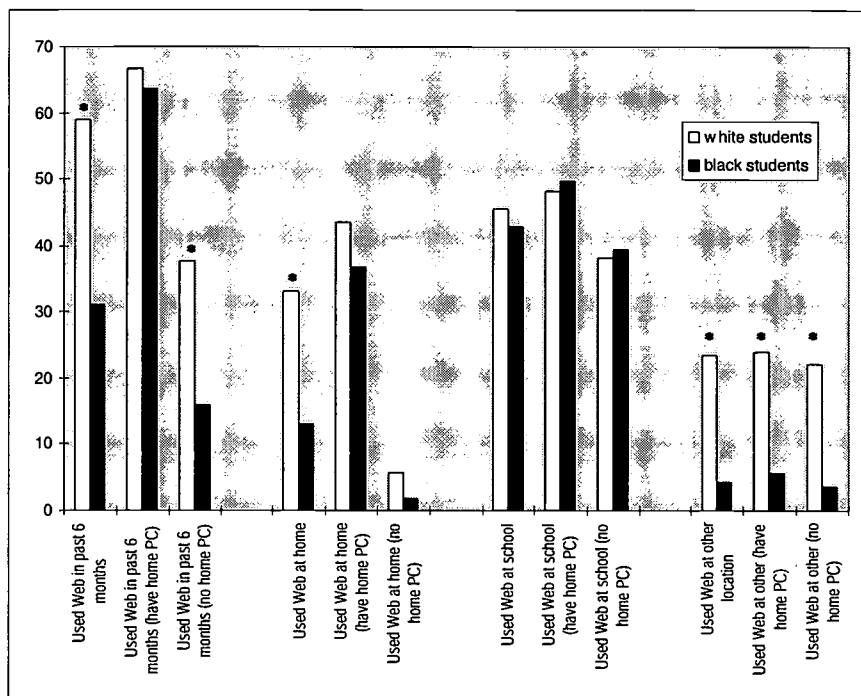


Figure 4

The rightmost set of bars in Figure 4 provides a potential explanation of race differences in Web use for students who do not have access to a computer at home.

It is strikingly apparent that white students are much more likely than African American students to have used the Web at locations other than home, school or work, regardless of whether there is a computer at home.

It is likely that white, but not African American students, are able to take advantage of non-traditional access locations including homes of friends and relatives with home computers, and libraries and community centers with Internet access. Our results suggest strongly that, *in terms of students' use of the Web, particularly when students do not have a home computer, race matters.*

Race Differences in Web Use May Diminish With Experience

Figure 5 shows overall differences between whites and African-Americans who have used the Web in the past six months. Demographically, the two groups are highly comparable; there are no statistically significant differences between white and African-American Web users on education, household income, gender, or the presence of children in the home. The only exception is that African-American Web users are much more likely to be ages 16-24 (43.3% vs. 25.1%).

In terms of general Web usage behavior, African-American Web users are more likely to be both newer and less frequent users of the Internet.

African-Americans are more likely than whites to solely rely on an online service, rather than an Internet service provider, as their only means of Internet access from home. And, African-American Web users are more likely to use the Web during office hours (between 6 a.m. and 6 p.m.).

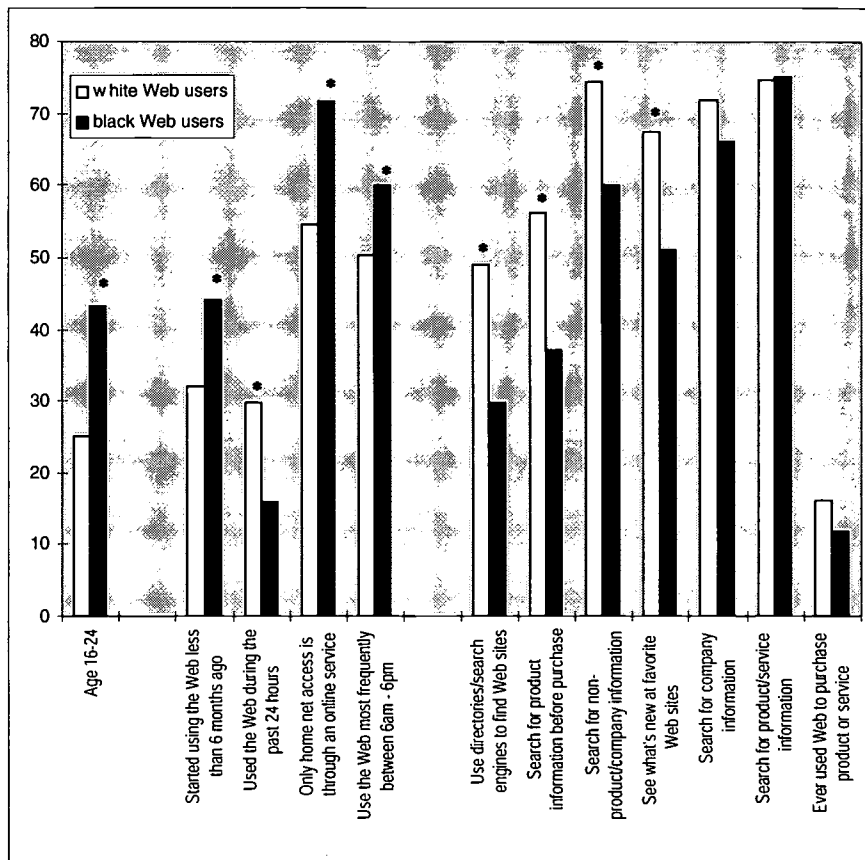


Figure 5

Race differences in search and purchase-related skills and behaviors have implications for the commercial development of the Internet. Whites are more likely than African-Americans to search for Web sites using directories and search engines; to see what's new at their favorite Web site; and to search for non-commercial information. However, these differences may diminish as African Americans gain more experience online.

Although whites and African Americans were equally likely to search the Web for information about products in general, whites are significantly more likely to search for product information before purchase, more likely to have purchased online, and more likely to search for company information. However, the latter two differences were not statistically significant.

Policy Points

There are more African Americans online than you think. Our statistically derived estimate of the number of African-Americans Web users is considerably larger than the current popular estimate of one million that is frequently reported in the popular press (Interactive Marketing News 1997).

Over 5 million African Americans have ever used the Web in the United States as of January 1997. Among those who have used the Web in the past week, 1.4 million were African-Americans. This means that African Americans are already online in impressive numbers, and that continued efforts to develop online content targeted to African Americans, commercial or otherwise, are likely to be met with success.

Not surprisingly, African Americans are among the newest Web users and currently among the least frequent. We expect that the few observed race differences in online search and purchase behavior will disappear as African Americans "catch up" to whites in terms of time spent online.

African American students need multiple points of access. Overall, current students enjoy the highest levels of Web use compared to any other income or educational group. This is regardless of access location. However, current students also display disquieting race differences that cannot be accounted for by demographics. White students are more likely than African Americans to own a home computer, *and this difference cannot be explained by household income.*

Overall, white students are more likely than African Americans students to use the Web. But given a home computer, this race difference in Web use goes away. *The important difference is among students who lack a home computer: here, whites are more likely to use the Web than African Americans.* This may be due in part to the fact that white students, regardless of whether they have a home computer, are much more likely than their African American counterparts to use the Web at places other than home, work or school. This suggests the importance of not only creating access points for African Americans in libraries, community centers, and other non-traditional places where individuals may access the Internet, but also encouraging use at these locations.

Education is what counts. Income certainly matters, but only to a point. Household income explains race differences in home computer ownership. In terms of overall access and use, higher household income positively affects access to a computer, but has little direct effect on Web use, except for those with *either* home or work access at the higher income brackets.

The situation is different with education. Overall, increasing levels of education positively influence both computer access *and* Web use. However, whites are still more likely than African Americans to own a home computer after controlling for educational differences. Education does explain race differences in work computer access, although African Americans in the upper income brackets - more educated, younger, and more likely to be working in computer-related occupations in our sample - are more likely than whites to have computer access at work after taking income into account. This suggests the presence of a powerful bias that could restrict Internet use to a narrow segment of African Americans.

The policy implication is obvious: *to ensure the participation of all Americans in the information revolution, it is critical to improve the educational opportunities for African Americans.*

Ensure access and use will follow. Access to a personal computer, whether at home, work, school or somewhere else, is important because it is currently the dominant mechanism by which individuals gain access to the Internet. Whites are more likely to have ever used the Web than African Americans, especially at home, and this usage gap increases the more recently the individual used the Web.

We have shown that access translates into usage. Overall, individuals who own a home computer *and* have access to a computer at work are much more likely than others to use the Web. Whites are more likely than African Americans to have access to a computer at home and work, while African Americans are more likely to *want* access. This may help to explain the recent commercial success of computers priced below one thousand dollars. It also suggests that programs that encourage home computer ownership (see, for example, Roberts 1997) and the adoption of inexpensive devices that enable Internet access over the television should be aggressively pursued, especially for African Americans.

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