

Literature Review: Non-Response Bias on Web-based Surveys

As Influenced by the Digital Divide and Participation Gap

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Research Questions

RQ1: Are there an appreciable number of students in this sample of American institutions of higher education whose have matriculated from environments in which they had little or no access to the Internet?

RQ2: If “yes” to RQ1, do those students exhibit a significant non-response (after controlling for confounding variables) to a Web-based survey advertised primarily through e-mail?

Literature Review: Non-Response Bias on Web-based Surveys
As Influenced by the Digital Divide and Participation Gap

This literature review links survey non-response bias with the concepts of the digital divide and the participation gap. This is accomplished by first discussing non-response bias, the potential impact of non-response bias on survey data, and possible causes. Many of these causes are linked to non-respondents' past experiences, society, and culture, factors that are also crucial in discussions of the digital divide. Finally, a critical study that links these ideas is discussed in some detail to provide preliminary empirical evidence supporting the central hypothesis of this dissertation and the importance of definitively answering my research questions.

First, non-response bias, a significant source of error in self-administered surveys, is introduced (Dillman, Eltinge, Groves, & Little, 2002; Dillman, 2007; Goyder, 1987). Some methods for correcting non-response bias (Bethlehem, 2002; Fuller, 1974; Lee, Rancourt, & Särndal, 2002; Mandell, 1974; Zanutto & Zaslavsky, 2002) are briefly discussed before a broader discussion of the impact of non-response bias. Causes of non-response bias, particularly those related to culture (Dillman, 2007; Goyder, 1987), are then presented. The section closes with studies specific to college students, noting their similarity to the general public in their response rates (Hutchinson, Tollefson, & Wigington, 1987; Sax, Gilmartin, & Bryant, 2003; Porter & Whitcomb, 2005).

Second, the concept of the digital divide is discussed. The discussion opens with definitions of the concept (Hargattai, 2002; Lynch, 2002; Mehra, Merkel, & Nishop, 2004; Miller, 2001) and some analyses of the concept (Stewart, Gil-Egui, & Pileggi, 2002; Stewart, Gil-Egui, Tian, & Pileggi, 2006), including some that specifically discuss it in terms of civic and economic inequality (Benkler, 2006; Carvin, 2000; Fink & Kenny, 2003). An overview of the most reliable statistics about the digital divide in the United States (U.S. Census,

2009b, 2009c; Horrigan, 2009; Pew Internet & American Life Project, 2009c) and on American college campuses (ECAR, 2009; EDUCAUSE, 2009; Junco & Mastrodicasa, 2007; Smith, Salaway, & Caruso, 2009) is presented to demonstrate the continuing importance of this idea. Finally, critiques of the digital divide concept (Gunkel, 2003; Hargittai, 2002; Selwyn, 2004; Warschauer, 2002; Young, 2001) are discussed as a lead into the closing discussion of the “participation gap,” an idea that seeks to address many of those critiques (Jenkins, 2006a, 2006b; Ito et al., 2008, 2010).

The chapter closes with a summary of the information presented in this chapter about non-response bias and the digital divide. The conclusion discusses in some detail a 2009 study by Millar, O’Neil, and Dillman that links these two ideas together. These researchers provide preliminary evidence that for Web-based surveys there is a connection between non-response bias and computer access and ownership, the central hypothesis this dissertation tests.

Non-Response Bias

In every voluntary survey, some persons may choose to not participate. These “non-respondents” may have chosen to not participate for many different reasons, some of which are related to survey design and others related more closely to cultural norms and expectations. When the non-respondents differ significantly from the survey population, the resulting errors in the survey data are said to be the result of “non-response bias” (Dillman, Eltinge, Groves, & Little, 2002; Dillman, 2007; Goyder, 1987). As an indication of the importance of understanding non-response bias, Dillman lists non-response error as one of the four primary sources of survey error (2007). Although there are statistical procedures that attempt to correct for non-response error, including weighting (Bethlehem, 2002; Fuller, 1974; Mandell, 1974) and imputation (Lee, Rancourt, & Särndal, 2002; Zanutto & Zaslavsky,

2002), these procedures are often complex and it often remains the better option to reduce non-response bias at the outset (Bethlehem, 2002).

This section of this literature review has opened with a definition of non-response bias and will move through a brief discussion of the impact of non-response bias before closing with discussion of some of the causes of non-response bias, particularly those related to college students. Additionally, two complications in this literature review must be noted. First, this section will only concern itself with “unit non-response,” the situation in which a potential respondent has not answered any questions; neither this literature review nor this study will address “item non-response” wherein respondents selectively answer and skip survey questions. Second, there is a tremendous body of literature in the general survey methodology field and the more narrow topics of survey response rates and non-response bias; this literature review will primarily be limited to the literature that discusses self-administered surveys, particularly those administered via the World Wide Web.

Impact of Non-Response Bias

At its most basic level, non-response bias has the potential to affect survey data by skewing the results of statistical inferences and estimates drawn from the collected data (Dillman, Eltinge, Groves, & Little, 2002). Much of the discussion of non-response bias remains rooted in statistical analysis and computation (Groves, 2006; Groves & Peytcheva, 2008). Importantly, Goyder (1987) broadens the discussion beyond its statistical impact to focus on non-response bias as a threat to the reliability of the field of survey research itself: “The title of this book [The Silent Minority] alludes to the danger that the social science built upon the results of survey research remains deaf to the nonrespondent minority who, unlike most minorities, deliberately remains silent” (p. 6). Researchers in higher education have taken these concerns to heart and conducted studies specific to surveys of college and

university students (Hutchinson, Tollefson, & Wigington, 1987; Porter & Whitcomb, 2005; Sax, Gilmartin, & Bryant, 2003).

Causes of Non-Response Bias

To explain survey response and non-response, Dillman (2007) presents extensive evidence in favor of social exchange theory, a theory that seeks to understand survey participation in terms of rewards, costs, and trust. Although it employs similar language, this theory is based largely in psychology and sociology, not economics. These ideas are often rooted in and influenced by participants' culture, quantified through demographic and background characteristics such as race, ethnicity, and gender; this is seen most clearly in the regression models employed by Goyder to explore survey non-response (1987).

In their review of previous survey methodology literature describing factors that influence survey participation, Groves, Cialdini, & Couper (1992) describe five sets of characteristics: societal-level factors, attributes of the survey design, characteristics of the sample person (the most widely researched area), attributes of the interviewer, and respondent-interviewer interaction. The last two factors are diminished or non-existent in the context of self-administered Web-based surveys but the first three remain prominent. Notable among the specific factors explored by survey methodologists are culture (Johnson, O'Rourke, Burris, & Owens, 2002) and socio-economic status (Goyder, Warriner, & Miller, 2002).

Given the immense breadth of this literature, it may be helpful to focus directly on a few notable studies of college students responses to surveys. In their 1987 study of non-response bias of college freshmen to a mail survey, Hutchinson, Tollefson, and Wigington conducted a follow-up telephone interview to determine if there was significant non-response bias in their study. Males and "low achievers" exhibited a lower response rate but this did not seem to produce a non-response bias as mean scores were not affected. Sax, Gilmartin,

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and Bryant (2003) expanded beyond just paper surveys to explore nonresponse bias in both paper and Web-based surveys of college students using the Your First College Year survey, a large national survey of first-year students. In exploring these two modes of survey administration, they found results that were complex and difficult to describe and explain. Sax, Gilmartin, and Bryant close their paper with a warning that “an online survey is a methodological alternative to a paper questionnaire, but not necessarily a more fruitful one” (pp. 425-426).

Porter and Whitcomb’s 2005 article *Non-Response in Student Surveys: The Role of Demographics, Engagement and Personality* is among the most informative pieces examining non-response among college students. Their summary of response patterns found in previous research indicates that “survey response is greatest for females, Whites, more affluent individuals, and those having higher levels of academic preparation, academic achievement, and engagement” (p. 136). By comparing the results of four different surveys administered, Porter and Whitcomb found empirical evidence supporting the previous research and discovered that student personality also plays a strong role in predicting survey response and non-response.

Digital Divide

To effectively use any information and communication technology (ICT), one must have access to it. In the context of the Internet, the unequal access experienced by persons has historically been framed as the digital divide, a dichotomy between those who physically have access to the Internet and those who do not (Birdsall, 2000; Lynch, 2002). First coined by U.S. Assistant Secretary of Commerce for Telecommunications and Information Larry Irving (Miller, 2001), this divide has found its widest use as a lens through which public policy has been debated and shaped both in the United States (National Telecommunications and Information Administration, 1995, 2000) and abroad (International Telecommunication

Union and United Nations Conference on Trade and Development, 2007; Stewart, Gil-Egui, Tian, & Pileggi, 2006). Hence this literature review will be restricted to a subset of the digital divide literature as this study is not concerned with international, national, or regional telecommunications policy. This section will begin with a brief overview of the concept of the digital divide, proceed with descriptions of the prevalence of the digital divide in the United States and American colleges and universities, and close with a summary of the criticisms of the usefulness of the digital divide as a concept.

Overview

The term “digital divide” was first used by U.S. Assistant Secretary of Commerce for Telecommunications and Information Larry Irving in the influential *Falling Through the Net* series of reports analyzing U.S. Census data detailing Americans’ access to and ownership of ICTs and ICT infrastructures (Miller, 2001). The first African American appointed to head the National Telecommunications and Information Agency (NTIA), Irving wrote in the fourth *Falling Through the Net* report that “the Digital Divide [is] the concept that the society should not be separated into information haves and information have-nots” (National Telecommunications and Information Administration, 2000, ¶1). Stewart, Gil-Egui, and Pileggi (2002) analyzed those NTIA documents and noted that the definitions and concepts used were closely related to technology and the economic marketplace. In that context, the digital divide was often presented as a “workforce deficit.” Further analysis (Stewart, Gil-Egui, Tian, & Pileggi, 2006) of state-produced documents showed a convergence towards market-based issues in both America and the European Union.

Some academics have continued to use definitions of the digital divide that are not deeply rooted in economics, similar to Lynch’s (2002) characterization that “the early approach to a definition [was that] the digital divide separated those who have access to the Internet from those who do not” (¶4). In introducing their study of marginalized members of

society and their use of computers and the Internet, Mehra, Merkel, and Nishop (2004), Information Science faculty in American research universities, described the digital divide as “the troubling gap between those who use computers and the Internet and those who do not” (p. 782). Other scholars offer broader conceptions of the digital divide, such as Hargattai’s (2002) characterization of the digital divide as “inequalities in access to the Internet” (¶2) and her expansion of the divide to explicitly encompass both use and access; this and other broader conceptions of the digital divide will be explored in detail later in this literature review.

The digital divide has attracted significant attention by being positioned as an issue of civic and economic inequality. Fink and Kenny (2003), associated with but not representing the World Bank, wrote that the digital divide was “leaving the developing world behind, with potentially cataclysmic consequences in terms of development prospects” (p. 1). Andy Carvin, Senior Associate at The Benton Foundation, described the digital divide as “one of the most important civil rights issues facing our modern information economy” (2000, ¶5). More recently, Yochai Benkler (2006) wrote in his ambitious and influential discussion of the nature of networked power and its affordances, *The Wealth of Networks*, that the digital divide tempers his enthusiasm for the Internet as a democratizing technology.

Prevalence in United States

Although this study focuses on American college and university students, it is one of the central premises of this study that neither American colleges and universities nor their students exist in a vacuum. They are affected not only by their histories but also their surroundings. It is particularly important for readers of this study to have some understanding of the computer ownership and Internet access enjoyed in the households from which students matriculate to colleges and universities. The data presented here come

primarily from two reliable sources of large-scale longitudinal data: The United States Census's Current Population Survey (CPS) and the Pew Internet & American Life Project.

Each month, the U.S. Census Bureau conducts a survey of approximately 50,000 households representative of the entire U.S. population. A joint effort of the U.S. Census Bureau and the U.S. Bureau of Labor Statistics, the Current Population Survey (CPS) often includes supplemental questions focusing on specific topics (U.S. Census, 2009a). The Census asked respondents about computer ownership and Internet access in the CPS and other surveys conducted in 1997, 2000, 2001, 2003, and 2007 (U.S. Census, 2009b, 2009c). As expected, computer ownership and Internet access has increased each time: in 2003 (the last year in which this was asked), 61.8% of all respondents reported owning a computer and in 2007 61.7% reported having Internet access at home. However, there are significant disparities when the data are examined more closely. Specifically, those who do not have Internet access at home are disproportionately underemployed, less educated, and Black or Hispanic (U.S. Census, 2009c). Even when considering Internet access outside of the home, those same disparities still prevail (U.S. Census, 2009b).

The Pew Internet & American Life Project (Pew Internet Project) is a project of the Pew Research Center, a center hosting seven research projects funded by the Pew Charitable Trusts (Pew Internet & American Life Project, 2009a). Since its founding in 2000, the Pew Internet Project has regularly conducted research to monitor the online activities of Americans (Pew Internet & American Life Project, 2009b). The most recent surveys conducted by the Pew Internet Project yielded data very similar to that obtained by the U.S. Census: although most populations indicated increased access (76% of all respondents reported owning a computer and 63% reported having a broadband Internet connection at home), those who do not have Internet access at home are disproportionately older, poorer, less educated, and living in rural areas. In particular, African Americans continued to report

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below-average broadband adoption and access (Horrigan, 2009; Pew Internet & American Life Project, 2009c).

Prevalence in American College and Universities

The previous section makes it clear that although many Americans own computers and have access to the Internet at home, many do still do not. However, it is not entirely clear from those surveys if undergraduate college and university students have different levels of computer ownership and access. Authoritative sources that focus specifically on college student computer ownership and access are discussed below.

Each year, EDUCAUSE, the professional organization for information technology professionals in higher education, conducts several efforts that measure student IT usage and ownership. In 2009, EDUCAUSE collected data from the Chief Information Officers (CIOs) at 927 member organizations. These individuals – or their delegates – reported that between 80% and 90% of their students own their own computers, indicating that between 10% and 20% do not. All responding 4-year institutions reported providing high-speed Internet access in their residence halls but no data are available regarding (a) the number of students residing off-campus and (b) the availability of high-speed access off-campus (EDUCAUSE, 2009). It is unclear how these data were collected at each institution.

EDUCAUSE's research arm, the EDUCAUSE Center for Applied Research (ECAR), has conducted its own focused study of undergraduate students and information technology annually since 2004. In its most recent study, ECAR reports that 98.8% of the 30,616 students at 115 colleges and universities who participated in its survey (ECAR researchers also conducted focus groups) reported owning a computer (Smith, Salaway, & Caruso, 2009). In their 2007 Net Generation survey of 7,705 undergraduate students at seven institutions, Junco and Mastrodicasa reported results similar to ECAR's when 97.3% of their respondents indicated that they own a computer. Both of these surveys suffer from some significant

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limitations: (a) both surveys had very low response rates (10.4% for ECAR and 8.7% for the Net Generation survey) and (b) both surveys were administered online, a condition that this dissertation hypothesizes will result in significant non-response bias.

Criticism of the Digital Divide Dichotomy

Many researchers have criticized the usefulness and utility of the digital divide dichotomy. These criticisms have largely centered on the simplicity of the dichotomy. Some have suggested that the simplicity reduces the usefulness of the concept both as a methodological lens and a tool to shape policy (Gunkel, 2003; Warschauer, 2002) whereas others have suggested that it is actively harmful given its many limitations (Young, 2001). Some have suggested that enlarging the concept to embrace not only access but also use would make it more powerful and useful (Hargittai, 2002; Selwyn, 2004), explicitly recognizing the role that society and culture have played in shaping access.

Participation Gap

In 2006, media scholar Henry Jenkins advanced the concept of the “participation gap” partially in response to the critiques of the digital divide dichotomy (2006a, 2006b). This idea goes beyond the digital divide and its focus on access by explicitly acknowledging that even those who have had access to technology have had different experiences with it and have thus gained different skills, predilections, and comfort levels with different technologies. Just as recommended by critics of the digital divide (Hargittai, 2002; Selwyn, 2004), the participation gap embodies a more nuanced idea embracing not just mere access but differing types of access.

Although the basic idea that social and cultural characteristics are related to technology use and comfort is not new (Hargittai, 2002; Mehra, Merkel, & Nishop 2004, Selwyn, 2004), significant amounts of work have recently been done by qualitative researchers, particularly those funded by the John D. and Catherine T. MacArthur

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Foundation's Digital Media and Learning Initiative. For example, small groups of researchers have described how American teens with computers and Internet access in their homes use tools such as Facebook and MySpace differently than teens who access the Internet from different locations such as school or the public library (boyd, 2008; Weber & Mitchell, 2008). More impressively, this initiative funded ethnographic work by over a dozen ethnographers who studied how hundreds of youths in America use technology to play, socialize, and learn (Ito et al., 2008; Ito et al., 2010). These researchers offer rich examples of the complex world in which today's youths live and how technology is woven into their lives, providing example after example of how mere access to technology is insufficient without "a supporting social and cultural world" (Ito et al., 2010, p. 17).

Conclusion

The preceding discussions illustrate that non-response bias in self-administered surveys is a significant potential source of survey error. The discussions also demonstrate that the digital divide and the participation gap are issues that still persist on many college campuses as many students do not own or use their own computers. These two ideas collide when college students are asked to participate in Web-based surveys. Millar, O'Neil, and Dillman's 2009 article *Are Mode Preferences Real?* illustrates this idea. Using a quasi-experimental design, they explored mode choice among respondents to a general population survey in Washington. Specifically, they explored demographic and attitudinal characteristics that correlated with respondents' likelihood to choose to use the Web over other response modes when completing a survey.

In late 2007 and early 2008, Millar, O'Neil, and Dillman (2009) conducted a survey of residents in two geographic areas in Washington. The sample was randomly selected and divided into six treatment groups of 300 households each. The mailings for each sample differed, placing a different emphasis on the availability of the Web option. One group was

told that the paper mode was preferred, one group was not told about the Web mode until late in the survey administration, one group was told that the choice was up to them completely, and the fourth group was not told of the paper mode until late in the survey administration (data from the other two groups were not reported). In the words of the authors, “this survey experiment was designed to see if we could contact respondents through mail but then ‘push’ them to fill out the questionnaire on the web” (p. 10).

Critical to this study was the inclusion of a question asking respondents how they would like to complete surveys (Web, mail, or telephone). The responses to this question allowed Millar, O’Neil, and Dillman (2009) to examine correlations not only between response mode preference and other variables but also actual response mode and other variables. Using Chi-square tests, Millar, O’Neil, and Dillman (2009) found several behavioural and demographic-like characteristics associated with respondents who preferred the Web: more frequent Internet use, less frequent need for assistance using the Internet, less fear of computer viruses, and less fear of online scams. Using multivariate logistic regression, Millar, O’Neil, and Dillman (2009) were able to further explore characteristics of respondents who preferred the Web mode. Respondents who were younger, more educated, earning higher incomes, and married were more likely to prefer the Web mode. Combining the Internet-use and demographic variables in more complex regression models yielded more complex but more powerful (i.e. higher variance explained) models.

Millar, O’Neil, and Dillman’s 2009 study provides empirical evidence that the argument to which I have been building – demographic and attitudinal characteristics may influence some college students to not respond to Web-based surveys – is plausible. These authors explored essentially the same demographic characteristics that the previously-discussed researchers, many of whom have performed qualitative work, have explored and linked to computer use. Although Millar, O’Neil, and Dillman (2009) did not (and could not,

given the design of their study) specifically explore non-response bias, they expect that non-response bias does occur on Web-only surveys: “[T]he use of a web survey could result in nonresponse bias if alternate modes of response are unavailable” (p. 23). I intend to explore that specific hypothesis.

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