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COLLEGE STUDENT RESPONSES TO WEB AND PAPER SURVEYS: Does Mode Matter?+

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We examined the responses of 58,288 college students to 8 scales involving 53 items from the National Survey of Student Engagement (NSSE) to gauge whether individuals respond differently to surveys administered via the Web and paper. Multivariate regression analyses indicated that mode effects were generally small. However, students who completed the Web-based survey responded more favorably than paper on all 8 scales. These patterns generally held for both women and men, and younger and older students. Interestingly, the largest effect was found for a scale of items involving computing and information technology.

KEY WORDS: survey mode; student engagement; Web survey; NSSE.

INTRODUCTION

The dramatic surge in online computing over the past decade promises to have far-reaching social and educational consequences. Electronic technology, especially the Web, is no longer the province of the highly educated elite. In 2000, some 55 million Americans went online each day (Pew Internet and American Life, 2000). Various forms of computing and information technology are practically universal on college and university campuses. For instance, 86% of college students have gone online, as compared with 59% of the population overall (Jones, 2002). In 2000, 59% of all college courses were using electronic mail, up from 44% in 1998 and 20% in 1995 (Green, 2001). In addition, the

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percentage of college courses that rely on Web-based resources has increased almost fourfold, from 11% in 1995 to 43% in 2000 (Green, 2001).

In addition to becoming a widely used educational tool, the Web is gaining popularity as a vehicle to collect survey information. In part, this is due to the allure the Web holds as a cost-effective method to enhance response rates, especially among computer-savvy respondents such as college students, the vast majority of whom have Internet access either at home or through a college or university account. Moreover, some research suggests that individuals have different mode preferences (Groves and Kahn, 1979), and a mixed mode approach (offering the option of completing a paper survey or via the Web) might induce more people to respond than any single mode approach. Finally, Web technology has the ability to overcome some of the privacy protection barriers that make it difficult to contact potential respondents using traditional survey administration methods. For example, caller identification and other technology allow people to screen unwanted telephone interviews (Dillman, 2000). Taken together, these factors may well prompt increased use of the Web or mixed-mode survey approaches.

However, little is known about how people perceive and respond to Web-based surveys (Couper, 2000; Dillman, 2000). For example, do students respond differently to Web surveys than they do to traditional paper surveys? If so, are their responses to Web surveys more or less favorable than responses to paper surveys? It is important to know the answers to these and related questions. What may appear from survey results to be changing student behaviors or attitudes that suggest modifications in policies and practices might be a function of mode effects, not actual changes *per se* in the student experience.

The few research studies comparing Web vs. paper modes on student surveys report somewhat mixed findings. Several single-campus studies found few substantial differences between the responses of students who completed the same survey via the Web and paper (Layne, DeCristoforo, and McGinty, 1999; Olsen, Wygant, and Brown, 1999; Tomsic, Hendel, and Matross, 2000). Other research suggests that the particular survey administration mode shapes how people respond (Burr, Levin, and Becher, 2001; Dillman, 2000; Dillman, Sangster, Tarnai, and Rockwood, 1996; Schwarz, Hippler, and Noelle-Neumann, 1992; Turner et al., 1998). For example, Burr, Levin, and Becher report that customers of a federal government agency report more satisfaction with products and services when they respond via the Web instead of paper. Interestingly, computer-mediated surveys may yield more honest responses on items of a sensitive nature (Turner et al., 1998). Others have found that people respond more favorably to similar items when interviewed by telephone as compared with completing a paper survey (Dillman et al., 1996).

Dillman (2000) suggests that some normative and cognitive mechanisms might contribute to mode differences. Normative mechanisms include social

desirability (responding in socially acceptable ways), acquiescence (the tendency to agree rather than disagree), question order effects (answering later questions to attain consistency with answers to previous questions), and primacy or recency effects (selecting the first or last offered response). Cognitive mechanisms refer to whether or not survey respondents receive identical stimuli via different modes of administration. These include different visual and aural communication and neurological processing preferences, such as respondents being more disposed to answer in different ways depending on whether they or the interviewer is controlling the question flow (Jenkins and Dillman, 1997). These explanations are helpful for understanding what factors might influence mode differences. At the same time, the bulk of the research in this area is based on comparisons of telephone and paper survey approaches. The literature is nearly silent with regard to Web vs. paper differences, especially involving student respondents from multiple institutions.

To accurately use and interpret Web survey results, it is important for practical and theoretical reasons to determine if people respond in the same fashion to Web and other modes of survey administration. If it turns out that people answer similarly via the Web and other modes, researchers and the public will have reason to be confident about the validity of the results. However, if people answer differently because the Web mode shapes their responses, adjustments might be made to standardize responses across modes. In addition, new theories or analytical criteria may be needed to properly evaluate and interpret Web results (Dillman, 2000).

PURPOSE OF STUDY

The purpose of this study is to determine whether mode effects are associated with responses of undergraduate students to a national survey administered via a paper questionnaire and via the Web. Three questions guided this study:

1. Do responses of students who have the option of using either a paper or Web questionnaire differ from those who can only complete a survey on the Web?
2. Do students who use a paper or Web version of an instrument respond differently to questions about their college experiences?
3. Do any observed mode effects differ by certain student background characteristics, notably sex and age?

DATA SOURCE

The National Survey of Student Engagement (NSSE) annually collects data about the nature of the college experience from tens of thousands of first-year

and senior students at several hundred 4-year colleges and universities (Kuh, 2001). The project routinely uses both paper and Web survey modes. As such, NSSE data are a rich source of information for examining possible response differences between Web and paper administration modes.

The target sample included 151,910 students from 276 4-year colleges and universities that registered for the NSSE survey in 2000. Each institution provided student information in an electronic data file. The students were equally divided between first-year and senior students randomly sampled from student populations in each class. The participating colleges and universities generally mirrored the national profile with respect to institutional type (as defined by the 2000 Carnegie Classification), sector (public or private), region, and urbanicity (National Survey of Student Engagement, 2000). The NSSE survey was administered from March through June of 2000 in a mixed-mode format, that is, both traditional paper and Web-based modes were employed. The overall response rate was 42%. No incentives were provided by the NSSE for survey completion.

The results reported in this paper are based on 58,288 undergraduates (27,121 first-year students, 31,167 seniors) who provided information for all of the control variables used in our analyses. Of this group, 37,682 students completed the paper version (71% women, 29% men), and 20,606 completed the Web version (58% women, 42% men). At 223 institutions, each student was sent a paper survey, but had the option of completing it on the Web. In contrast, 53 other colleges and universities elected to use a Web-exclusive format, wherein all contact with students was electronic, and students completed the survey via the Web. Thus, there were two mutually exclusive scenarios for completion: (a) paper or Web option and (b) Web only. Among Web-completers, we analyzed the responses of 10,254 students from Web-only institutions and an additional 10,352 students who exercised the Web option.

INSTRUMENT

The NSSE survey instrument, *The College Student Report* (Kuh, 2000a), measures the degree to which students participate in effective educational practices (Kuh, 2001). Many of its 67 items have been employed in other collegiate surveys such as the *College Student Experiences Questionnaire* (CSEQ) and UCLA's *Student Information Form* (the CIRP survey of first-year students). *The College Student Report (*hereafter *The Report)* taps student experiences on several dimensions: (a) involvement in different types of in-class and out-of-class activities, (b) taking part in educationally enriching programs such as study abroad, internships, and senior capstone courses, (c) perceptions of collegiate contributions to educational, personal, and social development, (d) perceptions of the campus environment, such as institutional emphases and quality of relationships on campus, and (e) satisfaction with their overall institutional experi-

ence. In addition, students give background information, such as their sex, age, race/ethnicity, enrollment status, living arrangements, and major field.

Like all college student surveys, the NSSE instrument solicits self-reported information. *The Report* was designed to satisfy five general criteria that promote valid self-reports (Kuh, 2000b): (a) respondents possess the information asked of them, (b) the items are phrased clearly to avoid confusion (Laing, Swayer, and Noble, 1989), (c) the questions ask about recent experiences (Converse and Presser, 1989), (d) the respondents believe the items warrant thoughtful answers (Pace, 1985), and (e) responding honestly does not threaten, embarrass, or compromise privacy (Bradburn and Sudman, 1988). Kuh et al. (2001) provide details about the psychometric properties of *The Report*.

Considerable effort was made to make the structure and format of the Web survey match the paper survey. However, there were some minor inevitable differences in graphic and visual appearances. At the same time, the items and response options were identical in terms of wording and placement. Further, the number of response options was kept small enough to fit on a single page on any computer screen. Examples of the Web and paper surveys are available at *http://www.collegereport.org/NSSEDemo.htm* and *http://www.indiana.edu/~nsse/acrobat/tcsr-2000.pdf*, respectively.

VARIABLE SPECIFICATION

We tested for mode effects on eight scales of student engagement involving 53 survey items. Table 1 summarizes scales used in this article and provides descriptive statistics for each scale by mode of administration. In addition, the appendix lists the specific items contributing to each scale. All scales but *computing and information technology* stem from established scales described and used elsewhere (Kuh et al., 2001). *Active and collaborative learning, student-faculty interaction*, *general education gains*, *personal-social gains*, and *computing and information technology* were created by summing individual items contributing to each scale. As *academic challenge* and *supportive campus environment* each contained items with different response sets, we created *Z* scores for each item and then summed all *Z* scores. *Enriching educational experiences* also contained items with different response sets, including six dichotomous items on whether students had done/plan to engage in learning opportunities outside the classroom; we equalized the minimum and maximum for each contributing item and then summed all items.[1] Mode of completion was initially constructed as three dummy-coded variables: (a) Web-only or not, (b) Web option or not, and (c) paper or not. Later, Web only and Web option were collapsed, yielding a mode variable equal to 1 if Web, 0 if paper. To more accurately estimate possible mode effects, we controlled for a number of potentially confounding variables at both the student and institutional levels.

TABLE 1. Means, Standard Deviations, and Descriptions of Student Engagement Scales

			Web			Paper			Web vs. Paper
Scale	Description	Metric	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean Difference[a]
Academic challenge	Nature and amount of academic work performed	Sum of 10 *Z*-scored items	.44	5.25	20,576	−.16	5.32	35,814	.60***
Active and collaborative learning	Frequency of class participation and collaborative learning	Sum of 7 items	16.73	3.40	20,594	16.37	3.32	36,749	.36***
Enriching educational experiences	Participation in learning opportunities outside the classroom	Sum of 10 items	4.98	1.90	10,828[b]	4.53	1.86	18,825[b]	.44***
Student-faculty interaction	Frequency of student interactions with faculty	Sum of 6 items	12.49	3.43	20,594	12.16	3.17	37,167	.34***
Supportive campus climate	Degree to which the institution is perceived to be supportive	Sum of 6 *Z*-scored items	.41	4.12	20,574	−.17	4.21	37,075	.57***
General education gains	Self-reported gains in writing, speaking, and thinking critically	Sum of 4 items	12.23	2.66	20,593	12.26	2.61	37,335	−.03
Personal and social gains	Self-reported gains related to personal and community issues	Sum of 7 items	18.75	4.67	20,575	18.23	4.83	37,054	.52***
Computing and information technology	Degree to which use computing and information technology	Sum of 3 items	8.44	2.05	20,588	7.58	2.17	37,391	.86***

[a] *t* test.
[b] A large proportion of first-year students responded as "undecided" to one or more of six items that contributed to this scale.
***$p < .001$ (2-tailed test).

Student-Level Controls

- Class (1 = senior, 0 = first-year)
- Enrollment Status (1 = less than 2 courses, 2 = 2 courses, 3 = 3 to 4 courses, 4 = full-time)
- Residence
  - —On campus (1 = living in residence hall or Greek housing, 0 = living off campus)
- Sex (1 = female, 0 = male)
- Age
- Race/Ethnicity (dummy-coded)
  - —African American/Black, Asian/Pacific Islander, Latino/a, White, Native American, or other
- Major Field (dummy-coded)[2]
  - —Humanities (humanities, cultural studies, foreign languages/literature, liberal/general studies, and/or visual and performing arts)
  - —Math and sciences (biological/life sciences, computer and information sciences, engineering, mathematics, and/or physical sciences)
  - —Pre-professional (agriculture, business, communication, education, health-related fields, and/or parks/recreation/sports management)
  - —Social sciences (social sciences, multi/interdisciplinary studies, and/or public administration)
  - —Multiple Fields

Institution-Level Controls

- 2000 Carnegie Classification (dummy-coded)
  - —Doctoral Extensive, Doctoral Intensive, Master's Institutions, Baccalaureate General, Baccalaureate Liberal Arts, or Specialized Institutions
- 1997–1998 Undergraduate enrollment from the Integrated Postsecondary Education Data System (IPEDS)
- Admissions Selectivity (1 to 6, with 1 being noncompetitive, and 6 being most competitive, from *Barron's Profiles of American Colleges*, 23rd Edition)
  - —Selectivity was unavailable for 13 institutions. However, using the criteria detailed in *Barron's*, we estimated selectivity for these institutions.
- Sector (1 = private, 0 = public)
- 1997–1998 Urbanicity from IPEDS (dummy coded)
  - —Large urban (large city or urban fringe of large city)
  - —Mid-urban (mid-city or urban fringe of mid-size city)
  - —Nonurban (Large town, small town, or rural)
- For *computing and information technology* only: 1997–1998 Academic sup-

port expenditures per student from IPEDS (library expenses, museums, galleries, audio/video services, academic computing, academic administration, personnel development, and course/curriculum development)

ANALYTIC STRATEGY

First, we predicted which students elected the Web option with a multivariate logistic regression. Although Web option is ultimately a student's decision, institutional characteristics might well mediate such use, chief among them the nature, quality, and availability of computing and information technology on campus. Overall, nearly 22% of eligible respondents selected the Web option. The following variables were statistically significant ($p < .001$) and were found to increase the odds of selecting the Web option by at least 25% over their range: living on campus, being younger, male, White or Latino/a instead of African American, majoring in math and science fields or having multiple major fields, and attending a more selective institution or one that invests more in academic support.

Given that the instrument itself was identical in Web-only and Web-option scenarios, any observed response differences should be due to selection processes at the student or institutional level. For example, Web-only responses are initially shaped by an institutional decision to administer exclusively via the Web. At the same time, this decision does not neutralize student agency. That is, students vary in their enthusiasm for using computing technology, and this could influence whether a particular student completes the Web-only survey at all. And accessibility to the Web may not be ubiquitous, at least not yet for all students. For example, some have argued that computing and information technology may be less accessible to students of color compared with White students (Malveaux, 2000), although Kuh and Hu (2001) found otherwise. Likewise, although the Web option is ultimately a student's decision, it is filtered through institutional characteristics, such as the availability and quality of on-campus computers and electronic mail.

If selection processes are accounted for by control variables, any response differences between these two administration types should disappear. Indeed, after controlling for student and institutional variables, the Web-only and Web-option responses on seven of the eight scales did not exhibit substantive differences (see Kuh et al., 2001 for an item-by-item comparison for all items on *The Report*). Thus, in subsequent analysis, we collapsed the two types of Web responses into a single Web mode so that paper and Web could be compared. We discuss the one scale that exhibited a difference between Web only and Web option later in this article.

We used ordinary least squares (OLS) to examine whether the two survey modes (paper or Web) affected average responses to each scale. To examine

whether these patterns are generalizable to different subpopulations of college students, we created multiplicative interaction terms involving (a) sex and mode, and (b) age and mode.

We considered, but ultimately rejected, using hierarchical models to analyze these data. First, hierarchical models cannot be used because there are no paper respondents at Web-only institutions; thus, there is no variance on the mode variable. Second, where only effect magnitudes are of interest and intraclass correlations are small, analysis with OLS regression and hierarchical linear modeling yields very similar conclusions (Ethington, 1997). Indeed, the intraclass correlations for scales used in this article are small for institutions that offered the Web option; seven of eight scales had less than 13% of their variance between institutions (available from the authors on request). These intraclass correlations are somewhat lower, but generally consistent with those reported by other higher education researchers in multiple institution studies (Ethington, 1997; Pascarella and Terenzini, 1991).

Although OLS regressions will likely produce biased standard errors for these data, the statistical power ensured by the large sample size makes typical statistical tests of significance less instructive (Cohen, 1988). For this reason, we computed effect sizes to judge whether the magnitudes of the coefficients were large enough to warrant attention. The effect sizes were calculated by dividing the unstandardized coefficient by the standard deviation of the item for paper-mode respondents (Greenwald, Hedges, and Laine, 1996; Light and Pillemer, 1982; Pascarella, Flowers, and Whitt, 2001).

RESULTS

Means for each scale are presented separately for both Web and paper modes in Table 1. As shown in the rightmost column, Web responses yielded significantly ($p < .001$) greater means than paper for all scales except *general education gains*. Yet these mean differences are raw, that is, they do not control for potential respondent and institutional differences associated with the survey mode. In contrast, Table 2 shows the results from regressing each scale on mode of completion and all control variables. We coded mode = 1 if by Web and mode = 0 if by paper. By using paper as the referent category, we do not intend to suggest that the paper mode yields more valid responses, only that it remains the more commonly used mode. The second column in Table 2 displays positive and statistically significant ($p < .001$) unstandardized coefficients for all eight scales, suggesting that students who completed the survey online tended to report more favorable responses than those who completed via paper.[3] In no instance did responses to a scale favor paper over Web.

While average responses to all eight scales favor the Web mode, the effect sizes are modest, generally .15 or less (Table 2, third column). The exception is

TABLE 2. OLS Regressions of Engagement Scales on Mode of Administration and Selected Student and Institutional Controls[a,b]

	Web vs. Paper			
Scale	Unstandardized Coefficient[c]	Effect Size[d]	Adjusted R^2	Net R^2 Change[e]
Academic challenge	.330***(.048)	.062	.090	.001
Active and collaborative learning	.498***(.029)	.150	.136	.004
Enriching educational experiences	.079***(.022)	.042	.185	.0003
Student-faculty interaction	.238***(.029)	.075	.129	.001
Supportive campus climate	.224***(.038)	.053	.073	.001
General education gains	.164***(.024)	.063	.080	.001
Personal and social gains	.642***(.044)	.133	.054	.004
Computing and information technology	.593***(.019)	.274	.117	.014

[a]*Student-level controls* include class, enrollment status, residence, sex, age, race/ethnicity, and major field; *Institution-level controls* include Carnegie Classification, undergraduate enrollment, *Barron's* admissions selectivity, sector, urbanicity, and for *computing and information technology* only, academic support expenditures.
[b]*N*s for Web range from 10,828–20,594; *N*s for paper range from 18,825–37,391.
[c]Standard errors in parentheses.
[d]*y*-standardized coefficient.
[e]Difference in adjusted R^2 between the model containing mode and controls and the model containing only controls.
***$p < .001$ (two-tailed).

computing and information technology, which shows a .27 standard deviation increase if one responded via the Web instead of paper.[4] This scale is noteworthy for another reason: it is the only scale wherein Web-option and Web-only respondents differed in their responses after all controls were included, although both were more favorable than paper. Indeed, the effect size for Web only (.34) was larger than that for Web option vs. paper (.22; not shown here in tabular format). We find little evidence for interactions by sex or age in multivariate analyses on any of these eight scales. That is, these patterns hold for both women and men, and younger and older students.

In addition to computing effect sizes, we also considered the impact of mode relative to controls in the models, and the net improvement in variance explained by mode. To gauge the strength of the mode variable relative to controls, we compared the standardized coefficients for mode with those of each of the controls. Interestingly, mode showed larger effects on *computing and information technology* and *active and collaborative learning* than for several variables purported to shape student engagement, such as residence, age, race, and undergraduate enrollment. Only student's class wielded a stronger effect than mode

for *computing and information technology*; only class, enrollment status, and sector shaped *active and collaborative learning* more than mode. The mode coefficient was considerably weaker against controls for each of the other six scales. Finally, we examined the net improvement in variance explained (R^2) by introducing mode into the regression models after all controls were already introduced (Table 2, rightmost column). In other words, we examined the improvement in adjusted R^2 between the model containing mode and controls, and the model containing only controls. Only one scale yielded a net improvement in R^2 larger than .01: *computing and information technology* (.014 or 1.4%).

DISCUSSION

After controlling for student and institution characteristics, it appears that the responses of college students to paper surveys and Web surveys generally evince small distinctions. This conclusion is consistent with other single-campus studies in postsecondary settings (Layne et al., 1999; Olsen et al., 1999; Tomsic, et al., 2000). That said, our findings do not allow us to conclude that Web-based responses are essentially identical to those generated from paper. In particular, responses to Web were more favorable for all eight scales examined. Interestingly, *computing and information technology* yielded the largest effect favoring Web over paper. Several other recent studies also suggest that responses to Web surveys may be more favorable than for paper on computing-related items (Daly, Cross, and Thomson, 2001; Tomsic et al., 2000), although these studies do not appear to statistically control for possible confounding differences in respondent pools between modes. Although we find moderate effects for *computing and information technology* that favor the Web mode, selection processes inherent in completing the Web survey may have led to more favorable responses on this particular scale. Given that students were not randomly assigned to one mode or another, those who completed the Web survey after receiving an invitation via traditional mail (Web option) were likely among the most competent and frequent users of computing technologies, that is, actual engagement may shape mode choice instead of mode choice in itself shaping reported engagement. As reported earlier, Web-only respondents scored somewhat higher than Web-option respondents on *computing and information technology*. Perhaps there are factors associated with being a Web-only school that disproportionately prevents many of the least computer-savvy students from responding to the Web survey. In particular, students who seldom used their electronic mail accounts may have been unaware they were invited to participate. If many of the least engaged students on *computing and information technology* were effectively removed from the Web-only respondents, this group should outscore their Web-option and paper counterparts.

What does this mean for institutional researchers and others who wish to use

Web surveys? This study and others underscore the need to carefully evaluate issues of sampling, nonrespondent bias, and measurement error when interpreting the findings from Web and paper surveys. Couper (2000) cautions that we presently know very little about the nonresponse problem in Web surveys and must rely on electronic mail surveys to try to accurately account for potential respondent bias and differences in the characteristics of responders and nonresponders. This is a nontrivial problem inasmuch as response rates to Web surveys tend to be lower than for paper surveys, although response rates were similar for the data we analyzed here (40% for Web-only institutions vs. 43% for Web-option institutions). While college students are far less likely to be affected by the "digital divide" (National Telecommunications and Information Administration, 2000), it is nonetheless likely that many potential respondents may prefer to complete a paper survey rather than Web, which can dampen response rates as well as affect the responses of those who complete a survey on-line.

Further, it is possible that some of the same normative and cognitive factors that shape differences between other mixed-mode surveys (although they are mostly based on differences in paper vs. telephone results) may have produced the patterns we observe in this article (Dillman, 2000). For instance, the novelty aspect of the Web, since it is still a relatively new mode of survey administration, might invoke a more positive response if completing via the Web is perceived as socially desirable due to the growth of information technology and the Internet. In fact, a new set of mode considerations may be needed to properly evaluate Web vs. paper responses (Dillman, 2000). For example, during focus groups and cognitive testing of *The Report*, students suggested that the Web version was easier to complete than the paper version. We could speculate that this ease of use might lead to slightly more favorable responses. Clearly, additional research is needed in this area to confidently interpret, and perhaps ultimately obviate any differences in Web and paper responses.

Finally, it would be profitable to explore the meanings and implications of computer usage, such as whether extensive use of computers by college students may have positive or negative implications depending on the nature of the application, such as surfing the Web for pleasure, playing games, and developing personal Web pages as contrasted with seeking additional relevant sources for class papers and projects. In particular, to the extent that computing applications are substituted for face-to-face social interaction, they might be viewed as less positive outcomes (Gatz and Hirt, 2000; Kuh and Vesper, 2001). For instance, Gatz and Hirt suggest that electronic mail may not wield an academic or socially integrative role on-campus, but may instead signal a more passive and indirect form of communication. One exception to this more passive student voice via electronic mail often occurs if the content involves a confrontational message.

Further, their research suggests that many students consider electronic mail to be an impediment or distraction to completing coursework.

LIMITATIONS

This study has several limitations. First, although our analysis controlled for a number of student and institutional characteristics, no direct measures of precollege characteristics, such as grade point average, ACT and SAT scores, or parental socioeconomic status, were included in the models. In addition, the results for *computing and information technology* might differ if a more direct measure of computing technology at particular campuses was available. That is, our findings might be due to a preponderance of Web respondents from highly "wired" campuses who are, in fact, more exposed to a greater array of computing and information technology. For example, Hu and Kuh (2001) found that undergraduates attending more wired campuses as determined by Yahoo's *America's Most Wired Colleges* surveys more frequently used computing and information technology than their counterparts at less wired campuses. While the academic support measure used here included computing support and was a significant predictor of whether students responded via the Web option, it likely does not fully capture the state of computing technology at particular campuses.[5] Second, the Web and paper versions of the survey had some differences in graphic and visual appearances, such as color, which might affect responses (Couper, 2000). Ideally, the two surveys appear identical to respondents in all respects, although this is difficult to implement in practice.

Third, the NSSE targets only first-year and senior students. Perhaps survey mode effects differ for other students. Notably, we did not observe differences in mode effects by sex or age of student. However, because this study examined college students, 89% of the respondents were less than 30 years old. Given the positively skewed distribution on age, we had limited ability to detect differences among the oldest college students. Further, because many college students are relatively computer savvy, the effects of mode may differ for noncollege populations.

A final limitation concerns the nature of the survey items themselves. Specifically, the response options for items consisted of relatively few choices, most often only four. Such constrained response possibilities may have dampened the magnitudes of observed effects. Also, the survey used in this study did not contain sensitive questions that posed potential embarrassment or risk. College student surveys that request such information as alcohol and illegal drug use may induce more socially desirable results or affect student responses in other ways that cannot be easily understood in the absence of other information.

CONCLUSION

Our findings suggest that mode effects for first-year and senior college students generally tend to be small. A notable exception involves items related to computing and information technology, which exhibit more favorable responses when answered via the Web. However, our data do not allow us to discern whether this is a true mode effect or whether those most engaged in computing and information technology are also those who gravitate toward the Web-based modes. Given the small effect sizes for most scales, this study should help allay concerns that data gathered via the Web may differ substantially from those collected from paper. On the other hand, our findings demonstrate the need for further research into possible mode differences involving the Web—both in terms of whether differences exist within the population-at-large and specific cognitive mechanisms to explain any observed differences.

APPENDIX: SURVEY ITEMS CONTRIBUTING TO STUDENT ENGAGEMENT SCALES

Academic Challenge (Cronbach's $\alpha = .72$)

—Number of hours in a typical week preparing for class (studying, reading, writing, rehearsing, and other activities related to your academic program) during the current school year

—Number of assigned textbooks, books, or book-length packs of course readings during the current school year

—Number of written papers or reports of 20 pages or more during the current school year

—Number of written papers of fewer than 20 pages during the current school year

—Extent to which coursework emphasized this school year: Analyzing the basic elements of an idea, experience, or theory such as examining a particular case or situation in depth and considering its components

—Extent to which coursework emphasized this school year: Synthesizing and organizing ideas, information, or experiences into new, more complex interpretations and relationships

—Extent to which coursework emphasized this school year: Making judgments about the value of information, arguments, or methods such as examining how others gathered and interpreted data and assessing the soundness of their conclusions

—Extent to which coursework emphasized this school year: Applying theories or concepts to practical problems or in new situations

—How often worked harder than you thought you could to meet an instructor's standards or expectations during the current school year?

—Extent to which your college emphasized this school year: Spending significant amounts of time studying and on academic work

Active and Collaborative Learning (Cronbach's $\alpha = .65$)

—How often asked questions in class or contributed to class discussions during the current school year?
—How often made a class presentation during the current school year?
—How often worked with other students on projects during class during the current school year?
—How often worked with classmates outside of class to prepare class assignments during the current school year?
—How often tutored or taught other students during the current school year?
—How often participated in a community-based project as part of a regular course during the current school year?
—How often discussed ideas from your reading or classes with others outside of class (students, family members, co-workers, etc.) during the current school year?

Enriching Educational Experiences (Cronbach's $\alpha = .60$)

—Number of hours in a typical week participating in cocurricular activities (organizations, campus publications, student government, social fraternity or sorority, intercollegiate or intramural sports, etc.) during the current school year
—Done or plan to do a practicum, internship, field experience, co-op experience, or clinical assignment before you graduate
—Done or plan to do community service or volunteer work before you graduate
—Done or plan to do foreign language coursework before you graduate
—Done or plan to study abroad before you graduate
—Done or plan to do an independent study or self-designed major before you graduate
—Done or plan to do a culminating senior experience (comprehensive exam, capstone course, thesis, project, etc.) before you graduate
—How often had serious conversations during the current school year with students whose religious beliefs/political opinions/values were very different from yours?
—How often during the current school year had serious conversations with students of a different race or ethnicity than your own?
—Extent to which your college emphasized this school year: Contact among students from different economic, social, and racial or ethnic backgrounds

Student–Faculty Interaction (Cronbach's $\alpha = .75$)

—How often discussed grades or assignments with an instructor during the current school year?
—How often talked about career plans with a faculty member or advisor during the current school year?
—How often discussed ideas from your reading or classes with faculty members outside of class during the current school year?
—How often worked with faculty members on activities other than coursework (committees, orientation, student-life activities, etc.) during the current school year?
—How often received prompt feedback from faculty on your academic performance during the current school year?
—How often worked with a faculty member on a research project during the current school year?

Supportive Campus Environment (Cronbach's α = .79)

—Extent to which your college emphasized this school year: Providing the support you need to succeed academically

—Extent to which your college emphasized this school year: Helping you cope with your nonacademic responsibilities (work, family, etc.)

—Extent to which your college emphasized this school year: Providing the support you need to thrive socially

—In your experience this year, rate the typical quality of relationships among people at this college: With other students

—In your experience this year, rate the typical quality of relationships among people at this college: With faculty members

—In your experience this year, rate the typical quality of relationships among people at this college: With administrative personnel and offices

General Education Gains (Cronbach's α = .79)

Extent to which your college education contributed to your knowledge, skills and personal development in:

—Acquiring a broad general education

—Writing clearly and effectively

—Speaking clearly and effectively

—Thinking critically and analytically

Personal and Social Gains (Cronbach's α = .84)

Extent to which your college education contributed to your knowledge, skills and personal development in:

—Working effectively with others

—Voting in elections

—Learning effectively on your own

—Understanding yourself

—Understanding people of other racial and ethnic backgrounds

—Being honest and truthful

—Contributing to the welfare of your community

Computing and Information Technology (Cronbach's α = .57)

—How often used e-mail to communicate with an instructor or other students during the current school year?

—How often used an electronic medium (e-mail, list-serve, chat group, etc.) to discuss or complete an assignment during the current school year?

—Extent to which your college education contributed to your knowledge, skills, and personal development in: Using computing and information technology?

ENDNOTES

1. Coding "undecided" responses as missing for six items that asked whether students had done or planned to participate in activities resulted in a substantial loss of cases for this scale (Table 1), especially for first-year students. In supplementary analyses, we examined the 22,718 seniors separately for this scale and found the same patterns that we report here. Alternately, coding "undecided" responses as "no" before scale creation or using multinomial logit models with three outcomes (undecided, no, yes) on these six items did not alter our findings.

2. Using dummy variables instead for each of the 19 majors listed on the survey does not alter our findings.
3. In supplementary analyses including an additional 5,125 cases with missing data on one or more student-level controls, we performed mean substitutions and included dummy variables as indicators of substitution for each control in the regressions. This analysis produced the same patterns we report here.
4. This pattern holds for each of the three survey items contributing to the *computing and information technology* scale.
5. We further explored this possibility in supplementary analyses with data from *America's Most Wired Colleges 2000* (Yahoo Internet Life, 2001). Unfortunately, raw scores were publicly available only for the top scoring 300 colleges and universities who participated in the Yahoo survey. We added the wired measure as an additional control using only the 77 NSSE institutions with publicized wired scores. With the range on the wired variable restricted to only the highest scoring institutions, the coefficient for *computing and information technology* did not change appreciably after introduction of the wired variable. The implication for our analysis is not clear; we cannot judge whether we would find such stability in these mode effects across less-wired institutions.

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