Item Non-response of Different Question Types and Formats in Mixed-mode Surveys: A Case Study of a Public Broadcasting TV Station’s members

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Available at: https://works.bepress.com/louisa_ha/44/
Item Non-response of Different Question Types and Formats in Mixed-mode Surveys: A Case Study of a Public Broadcasting TV Station’s members

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Abstract
As the mixed-mode survey is increasingly used, this study examines the response quality in a mixed-mode telephone and Web survey across different types of questions. Survey data were collected by telephone and Web from 273 members of a U.S. public broadcasting TV station’s members who donated to the TV station. We compared the participation rates of the telephone survey and the Web survey and the gain in responses using mixed mode surveys; the overall item-completion rate, the effect of question format, order, and type on item non-response rates of telephone and Web modes; and assessed whether demographic characteristics of respondents predict item non-response in different survey modes. Although the response quality in Web surveys was superior to telephone surveys in most types of questions by contents and formats, demographic questions were the ones with highest item non-response in Web surveys, but not in telephone surveys. We found survey mode was the single most significant and strong predictor of survey completion rate while other demographic variables such as age and education of respondents were insignificant. Implications for survey researchers trying to use either Web or telephone surveys or mixed-mode surveys economically and importance of preferred contact information are discussed.

Key Words: Mixed-Mode Survey, Item Non-Response, Online Survey, Telephone Survey, Research Method

Introduction
Survey is one of the most commonly used research methods in mass communication research (Ha et al., 2015). The purpose of surveying is usually to collect a large quantity of data from a sample of respondents that are generalizable to the population (Wimmer & Dominick, 2011). However, the survey environment is becoming more and more unfavorable due to spams and other fraudulent practices with decreasing participation rates. To improve response rates, the use of mixed-mode surveys, or the data collection with a variety of survey methods, is increasingly necessary to reach the target population and minimize coverage errors (Dillman, Smyth & Christian, 2009). Faced with budget constraints, how to conduct a mixed-mode survey effectively and understand the impact of survey modes on response rates and response quality is of increasing importance to communication researchers. This study is an attempt to examine the impact of survey modes on participation and data quality in a mixed-mode survey.

Significance of Study
Scholars had suggested using mixed-mode surveys to collect data for decades. As early as 1964, Payne (1964) argued that different survey methods, such as the personal interview, the telephone interview, and the mail survey, are not necessarily seen as exclusive and alternative methods but can be used as a combination to reach different respondents and to satisfy

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different needs of respondents in different phases of data collection (e.g. pretests). Some major advantages of mixed-mode surveys are minimizing coverage errors, reaching certain subgroups, reducing data collection costs and improving response rates, etc. (Couper, 2011). While mixed-mode surveys can improve coverage of the target population, there are concerns about the response quality of different methods and how to make the data collected via different survey modes comparable (Dillman et al., 2009).

Researchers have provided different criteria of evaluating survey response quality, such as accuracy, credibility, comparability, accessibility, timeliness, and completeness (Biemer, 2010), together with low coverage errors and non-response errors. There are different aspects to consider for improving the response quality, such as appropriateness of survey mode choice, researchers’ control, and costs. Studies show that selecting an appropriate mode based on the population’s characteristics will minimize different types of errors as well as increasing the quality of collected data. Depending on the nature of different survey modes, researchers have more control in some survey modes than other modes although it is impossible to achieve 100% response rates in voluntary surveys (Wimmer & Dominick, 2011). In fact, many scholars (Dillman et al., 2009; Groves, 2011) state that participation rates in surveys are declining and surveys that strive for high response rates always experience high costs.

When probability sampling cannot access a particular portion of the population, coverage errors may occur. To minimize coverage errors in single-mode surveys, mixed-mode surveys are recommended (Dillman, Smyth & Christian, 2014). Mixed-mode surveys can reduce the coverage error caused by certain modes (such as landline phone coverage in telephone survey) and several modes can be used to contact hard-to-reach respondents in different groups (Vannieuwenhuyze, Loosveldt, & Molenberghs, 2010). Using single-mode surveys usually cannot cover the whole population of interest. For example, using a certain survey method may exclude some people automatically from the sampling frame, such as individuals who do not have access to the Internet in a Web survey or individuals who cannot write and read due to lack of education in a mail survey. Thus, matching a proper method with each group of people will help researchers to have higher coverage rates and lower coverage errors (Dillman et al., 2014).

There are different situations where using one mode of surveys is not sufficient to cover all populations. One such example is the accessibility of contact information of the population of interest. If the target population of a survey cannot be reached by mail or they ignore the survey invitation by mail, researchers may also use telephone to reach the targets and persuade them to participate. A mixed-mode survey can also be applied to people with different contact information in a study. For example, a mixed-mode survey can be used to reach two types of people who only provide mailing address and people who only provide telephone number in the same target population. In this case, the mixed-mode survey would have the ability to cover all people in the target population without bias by contact information. Researchers could start with the more economic mode and then try to reach participants that are harder to reach through the more expensive mode. Furthermore, studies that have time limitations could choose the mode that leads to faster results; or they can also use both modes simultaneously. This study examines how response quality and item non-response can be improved by using a mixed-mode survey of telephone and Web.

**Literature Review**

For a long time, the participation rate has been considered as an indicator of survey quality (Dillman et al., 2014; Groves, Presser, & Dipko, 2004). Most researchers are concerned about participation rates because of non-response errors (Groves, Singer, & Corning, 2000). The response rate has a close relationship with the representativeness of the survey results. Elliot (1991) divided non-responses into three types: non-coverage, unit non-response, and item non-response. Non-coverage happens when the units in the sampling frame of the survey population are omitted accidentally or purposely. Unit non-response, also refers to non-participation, occurs when a sample unit cannot be reached due to reasons such as refusal. Item non-response is the situation that the sample unit participates in a study, but he/ she does not give
all required information needed to be collected for the study. For example, the sample unit refuses to answer certain questions. Non-coverage error can be improved by selecting appropriate survey mode or mixed modes in collecting data. The unit non-response and the item non-response are more difficult to be eliminated. In general, improving non-responses is a crucial issue during data collection because non-response errors caused by the large differences between respondents and non-respondents (Dillman, Smyth, & Christian, 2009).

The completeness of answers or item-response rate is also a dimension of data quality. Item non-response is the situation that parts of information are missing from an individual respondent’s survey (Fricker & Grabka, 2005). Item non-response is normally treated as missing data (Wagner, 2010). There are ways that help survey designers to encourage or even force respondents to answer questions to get better completeness of surveys and less missing data. For example, surveyors can implement a function that forces online respondents to choose an answer to proceed to the next question. Studies have shown that respondents are more likely to respond to the questions when a force function is implemented in online surveys (Dillman et al., 2009).

The study of item non-response has focused on two aspects: the reason why people skip certain questions and the characteristics of individuals who skip questions. Not all item non-response occurs because of the participants’ reluctance to answer or deliberate skipping of questions. For example, in an interviewer-administered survey, such as telephone survey, the respondents may give answers other than those given choices in closed-ended questions. Such incompleteness might be repaired if the interviewer has sufficient skills and fill in the appropriate answer for the respondents. Indeed, Vander Zouwen & Smit’s (2006) study found 41% of their telephone survey respondents did not provide adequate initial responses.

Regarding reasons to skip certain questions, previous studies show that sensitivity of the information (Shoemaker, Eichholz & Skewes, 2002), cognitive efforts, perceived possibility of confidential and private information violation (Fricker & Grabka, 2005) are related to item non-response. The sensitivity of information required by the question has a positive correlation with the refusals of questions. Also, the more cognitive efforts needed to answer a question, the more possible that respondents will give a “don’t know” answer (Shoemaker et al., 2002). A review study of a Web survey design shows that the display of Web survey, such as scroll design and screen design and length of a Web survey, may affect item non-response (Vicente & Reis, 2010).

Studies on skipped questions mainly focus on the amount of missing items and the pattern of information missing (Tomaskovic-Devey, Leiter & Thompson, 1995), such as demographic and income information. Some item non-response studies examined the distribution pattern of blank answers among the survey. Certain sensitive questions, such as income, have a high item non-response rate (Giles & Feild, 1978). In a mail survey study, researchers found that people who have incomplete answers are less educated people (Burton, Turrell, & Oldenburg, 2004). They attributed it to the layout of questions which involved “linked items, logical skips, and optional elements” (p. 345), these people’s unwillingness to reveal personal information and their inability to understand the questions. People’s attitudes may change from time to time. Bell’s (1984) study confirmed the effects of age on item non-response and pointed out that the seniors might be less likely to answer surveys on telephone because of their doubt of the caller. But a more recent study by Elliott et al. (2005) found that old people aged from 65 to 74 have the highest item response rates. Hence how age affects item non-response is not conclusive at this point.

Additionally, there are other practical reasons why people miss certain questions. For example, the interview might be interrupted and did not continue later (Roth, Montaquila & Chapman, 2006). In Tripllett, Blair, Hamilton and Kang’s (1996) study, they found that converted refusers, who initially refused to participate but then were persuaded, have greater proportion of items of non-response than initial cooperators. Community ties are also mentioned as a reason that people may or may not participate in a survey (Abraham, Maitland, & Bianchi, 2006). Therefore, people’s attachment with the community may affect people’s willingness to participate in a survey.
The question formats may affect how people answer those questions (Dillman, Smyth, & Christian, 2009). For example, some constructs are measured better when they are asked in an open-ended format while others are better asked in a closed-ended format. The open-ended questions give respondents the flexibility to answer the questions with freedom. However, the wording of questions, the way questions are asked, and the visual design of the question could still influence answers (Dillman, Smyth, & Christian, 2009).

**Response Rates and Item Non-Response in Mixed-Mode Surveys**

In most studies on survey modes, researchers used two or more survey modes to reach the same population to compare the response in each mode. However, there is not any published study known to the authors of this paper on the impact of survey modes on response quality in a situation where there are two subsets of the target population with different access information available. In reality, such situations may be more common than situations where researchers have access to contact information in all modes for different subsets of the target population because usually the target population opts in their contact information. People usually provide only one, or a preferred contact, when they are given the choice.

With the technological developments, the world has witnessed the increasing adoption of mixed-mode surveys among researchers, and those developments have facilitated conducting various modes of a survey. Researchers who intend to use a mixed-mode survey always begin with the mode that has lower costs and then move to the one that costs more. Many organizations follow this strategy and try to lower all expenses that are related to their research. In addition, the mixed-mode survey helps researchers to collect data and responses more quickly. Indeed, many organizations applied mixed-mode surveys when conducting a longitudinal study and asking respondents to choose the most convenient mode (Dillman, Smyth, & Christian, 2009).

As the use of a mixed-mode survey has become popular, some scholars consider it as the norm of conducting a survey (Biemer & Lyberg, 2003). Technological development has helped surveyors to integrate the mixed-mode methodology in their research; technologies not only helped researchers in the data collection phase, but also in many ways such as the design of the survey and the analysis of the data collected through mixed-modes (Dillman et al., 2014). In addition, survey researchers have been eagerly trying to minimize survey errors such as coverage, sampling, and non-response errors. For example, researchers can reduce coverage error when one mode cannot cover the intended population. Thus, the choice of another mode could improve coverage and help survey researchers reach those who were not reached in the first mode (Dillman et al., 2009).

In general, researchers believe that telephone surveys can generate better participation rates than Web surveys (Essig & Winter, 2009). With the increased popularity of the Internet, surveys can be conveniently done online. Especially now that large portions of societies are relying on computers and even smartphones for communication and information, Web surveys are increasingly a common means of collecting data.

There are many advantages of online surveys that may improve the data quality, such as the completeness of surveys. For example, as a self-paced survey, Web survey could increase the likelihood of completing the survey. Without the pressure of an interviewer waiting for an answer, one can take their time and in addition, can be more thoughtful about their answers. Therefore, online surveys will yield more honest answers and more reliable results and also alleviate the problem of biased answers. Unlike in face-to-face interviews, online surveys allow respondents the privacy of answering sensitive questions openly without risk of being embarrassed or feeling ashamed if their answer is less than socially desirable (Chang & Krosnick, 2009).

The completeness of a survey is one indicator of response quality (Hoonakker & Carayon, 2009). The more questions answered, the better the quality of a survey. There are not many studies done for item non-responses in both Web and telephone survey. Dillman et al. (2009) stated that the self-paced nature of Web survey makes it very susceptible to item non-response if no control function (such as force respondents finish questions) is used. In contrast, the nature of telephone survey may yield more positive results. An example is that respondents cannot read ahead or know in
advance what questions will be asked. In many surveys, a yes response yields another series of questions that respondents may not to answer. Respondents may choose “no” in order to avoid the following questions if they read in advance. Therefore, lack of the ability to scan and premeditate answers help to make telephone surveys accurate and sincere. A comparison study on data responses and data quality with individuals who have Internet access reported that telephone is still the most effective mode to reach both Internet users and non-Internet users (Frickeret al., 2005). The result shows that Web respondents are less likely to give a “don’t know” answer and have fewer item non-responses than telephone respondents, but they are more likely to satisfice by providing non-differentiated answers than telephone survey respondents. Hence data quality of Web survey is not always better than telephone surveys.

Pertaining to demographic characteristics and the item non-response rates, Wolfe et al. (2008) found that item response rates were not affected by demographic characteristics of the teachers such as gender and education level. Teclaw, Price, and Osatuke (2012) found that placing demographic information at the beginning of the questionnaire increases the response rate for demographic items without affecting non-demographic items response rate. Based on the different aspects of relationship between demographic information and item non-response rates, this study aims to explore how demographic characteristics of other group of people will affect item non-response rates.

Research Questions
Although past research has studied the participation rate to each survey mode and in mixed-mode surveys, only Olson, Smith & Wood (2012) compared the participation (cooperation) rate of each survey mode if the population indicate the mode preference and the survey reach them by their preferred mode. They found that preferred mode is significant in predicting participation rate and timeliness in response for Web mode controlling for respondent demographic factors. Such comparison is important because the participation rate is on the same level of playing field than comparing response rate of each mode, which may not be the preferred mode of the respondents. However, they did not examine the role of question formats such as open-ended and closed-ended formats in item-response rates for each survey mode. Also in a limited budget situation, how a mixed-mode survey can be conducted effectively to improve coverage has not been addressed in the literature. In addition, to what extent item non-response in demographic information may be affected by different survey mode has not been examined. Hence this study poses the following questions. The first two questions focus on overall participation rate and how much a telephone-Web mixed-mode survey can improve coverage of the population. The last two questions are on data quality regarding item non-responses for different specific questions types between telephone and Web survey.

**RQ1**: Which survey mode has better participation rate, the telephone survey for people with telephone numbers or the Web survey for people with e-mail addresses?

**RQ2**: To what extent does the mixed-mode survey help to enhance the overall participation rate than using telephone survey only or Web only if two different survey modes are used for two different subsets of a population (Telephone users who have access to email but may not want to be bothered by email and hence not give out e-mail addresses; and Internet users who provide e-mail addresses)?

**RQ3**: How does question format (closed-ended: matrix questions, multiple choice, and open-ended), order, and type affect item non-response rates in the telephone survey or the Web survey respectively?

**RQ4**: To what extent demographic characteristics of respondents predict item non-response in different survey modes?

Method of Study
This study is a case study of Public Broadcasting (PBS) TV station members in a midsize market in the Midwest United States. These members donated money to the TV station with their membership. We chose to study Web and telephone mixed-mode surveys because the two modes complement each other the most. Most large-scale national surveys (e.g., the Gallup Poll and the Pew Internet Surveys) employ telephone surveys to reach a broad spectrum of the population and PBS members tend to be older adults easily reached by phone. Web survey complements telephone surveys with visuals and other features to help guide respondents and is the lowest in cost regarding distribution and sending reminders. Telephone survey has the advantage of probing
and reaching respondents on the spot with interviewer support while Web survey can obtain responses easily in as self-paced format and record them directly on the computer.

In this study, the local PBS station members usually provide either telephone number, mailing address or e-mail address to the station when they enter the membership in addition to their mailing address. Because not all three contact information is required, some members only have phone numbers, and some only have email addresses. But we may safely assume that the contact information that the member provides is the preferred contact method for the PBS station. If more than one contact is given, then it’s up to the researcher which method to reach the member. In this study, members of the population provided different ways of contact; some provided emails only while others provided phone numbers only and some provided both. Therefore, a mixed-mode survey (telephone and online) is deemed necessary to improve coverage without the high cost of mailing. The original purpose of the survey was to study PBS members’ reception of digital TV channels over the air and other TV and online video services. However, this study focuses on the methodological implications of using different modes for the same study on response rate and response quality.

A total of 3,309 members of the local PBS TV station were in the sampling frame. Among the membership roster, 2,073 had valid telephone numbers (which may or may not be landline phones). 236 had e-mail addresses, of which 214 have both telephone numbers and email addresses, the rest did not have either contact information. The researchers decided to use phone surveys for respondents with phone numbers only as we assumed telephone is their preferred contact mode and those with email addresses with Web survey assuming email is their preferred contact mode. The telephone interviewers came from a senior level media management college class who interviewed the members as part of their class project. They received basic training of phone interviewing skills and were instructed to enter the response in a Web survey form when they called the member. They were provided a script to read to the respondent on the phone. The questionnaire introduction and wording were modified slightly to adapt to the phone situation. But response format was identical for all the questions to allow for comparison between the phone and the Web survey format. Apart from cost concerns of hiring professional interviewers, the reason for not using professional telephone interviewers is that their status as college students may receive more rapport from the community. Most academic research studies will confront similar cost constraints and utilize students as interviewers. So this case study will provide settings easily replicable for other researchers. Using a membership list allowed the researchers to determine basic population information to compare the response rate and coverage error and other bias in the participants with the additional population data.

Results

The results show that Web survey (N=236, n=51) has better participation rate (21.6%) than telephone survey (N=2073, n=222, participation rate =10.7%) if we did not count the unreachable or invalid numbers and email addresses in this study. The combined response rate of using mixed-mode survey (N=2309, n=273, participation rate=11.82%) has been improved over using only telephone survey (participation rate=10.7%). But if the researchers only choose Web survey, which means e-mail as the mode of contact, they would lose the participation of the 267 respondents only available through telephone.

Because of the large sample size difference between telephone and Web survey, 51 telephone survey respondents were randomly selected from the 267 respondents to achieve equal sample size with Web survey respondents to compare the item response rate of each survey mode.

Effect of Question Format on Item Response Rate in Each Survey Mode

There were 17 item matrix question, nine multiple-choice questions, 13open-ended questions tested and 12 demographic questions tested. We examined the response quality on item response rate regarding question type (e.g., matrix question), question order, and content of questions. Table 1 compares the response rate of matrix closed-ended questions, multiple-choice closed-ended questions, and open-ended questions in telephone survey and web survey. An independent sample t-test was conducted to compare the response rate in different survey modes. The mean value of 1.0 indicates respondents answered all questions in
a format. The mean value of 0.45 indicates that 45% of the respondents have complete responses on those questions in that format. There was a significant difference in the item response rate of matrix questions for Web survey (M=.73, SD=.42) and telephone survey (M=.17, SD=.36), t (100) = -7.18, p < .05. There were also significant differences in the response rates of multiple choice closed-ended questions completed for Web survey (M=.86, SD=.22) and telephone survey (M=.68, SD=.34), t (100) = -3.17, p < .01 and open-ended questions completed for Web survey (M=.84, SD=.20) and telephone survey (M=.52, SD=.33), t (100) = -5.77, p < .001. In general, the item-response rates for all types of questions in the Web survey were higher than the telephone survey.

Table 1. The response rate of different types of questions in different survey mode

<table>
<thead>
<tr>
<th>Survey mode</th>
<th>Question type</th>
<th>Telephone (n=52)</th>
<th>Web (n=52)</th>
<th>Total (n=102)</th>
<th>T</th>
<th>Df</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Matrix Closed-ended Questions</td>
<td>.17 (.36)</td>
<td>.73 (.42)</td>
<td>.45 (.48)</td>
<td>-7.18*</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Multiple Closed-ended Questions</td>
<td>.68 (.34)</td>
<td>.86 (.22)</td>
<td>.77 (.30)</td>
<td>-3.17**</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Open-ended Questions</td>
<td>.52 (.33)</td>
<td>.84 (.20)</td>
<td>.68 (.31)</td>
<td>-5.77***</td>
<td>100</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01, ***p<.001. (2 tailed)

Effect of Question Order on Item Response Rate in Each Survey Mode

There were a total of 41 questions in the questionnaire including demographic questions. The order effects were tested based on the content and the order of the questions with four subgroups of first 16 questions as set 1, first 17-23 questions as set 2, first 23-39 questions as set 3 and last 12 questions as set 4. Table 2 compares the response rate of questions in different orders on the questionnaire in the modes of telephone and web. An independent sample t-test was conducted to compare the response rate by order effects. The response rates in the first set of questions for Web survey (M=.96, SD=.21) and telephone survey (M=.66, SD=.36), t (100) = -5.07, p < .001, were significantly different. The response rates in the second set of questions for Web survey (M=.75, SD=.24) and telephone survey (M=.57, SD=.30), t (100) = -3.31, p < .01, are significantly different. The response rates in the third set of questions for Web survey (M=.73, SD=.42) and telephone survey (M=.17, SD=.36), t (100) = -7.18, p < .05, were significantly different. The response rates in the last set of questions (see Table 2) for Web survey (M=.67, SD=.31) and telephone survey (M=.41, SD=.38), t (100) = -3.72, p < .001, were still significantly different. The question order effect is apparent in both Web and telephone survey modes, declining from 66% to 41% in telephone mode and from 96% to 67% in the Web mode. In addition, telephone and Web survey shows different order effect toward the end of the questionnaire. The third (or second last) set of questions received lowest completion rate among all questions in telephone survey. But for Web survey, demographic questions (the last questions) have the least completion rate among the four question orders.

Table 2. The response rate of questions in order in different survey mode

<table>
<thead>
<tr>
<th>Survey mode</th>
<th>Question order</th>
<th>Telephone (n=51)</th>
<th>Web (n=51)</th>
<th>Total (n=102)</th>
<th>t</th>
<th>Df</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First set of questions</td>
<td>.66 (.36)</td>
<td>.96 (.21)</td>
<td>.81 (.33)</td>
<td>5.07*</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Second set of questions</td>
<td>.57 (.30)</td>
<td>.75 (.24)</td>
<td>.66 (.29)</td>
<td>3.31*</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Third set of questions (Matrix only)</td>
<td>.17 (.36)</td>
<td>.73 (.42)</td>
<td>.45 (.48)</td>
<td>7.18*</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Fourth set of questions (Demographic questions)</td>
<td>.41 (.38)</td>
<td>.67 (.31)</td>
<td>.54 (.37)</td>
<td>3.72*</td>
<td>10</td>
</tr>
</tbody>
</table>

*p<.05, **p<.01, ***p<.001. (2 tailed)
Effect of Question Content Type on Item Response Rate in Each Survey Mode

Questions were categorized regarding their contents, such as attitude questions, behavioral questions, factual questions and demographic questions. For example, questions such as “I will not spend money subscribing to pay TV services, when there is free over the air digital TV available,” are categorized as attitude questions. Behavior questions are questions like “How do you watch TV in your household?” An example of factual questions is “Who is your TV service provider?”

As shown in Table 3, there was a significant difference in response rates of attitude questions for Web survey (M = .74, SD = .40) and telephone survey (M = .22, SD = .33), t (100) = -7.09, p < .05. There were also significant differences in response rates of behavior questions for Web survey (M = .79, SD = .17) and telephone survey (M = .56, SD = .28), t (100) = -5.04, p < .001, as well as factual questions for Web survey (M = .90, SD = .20) and telephone survey (M = .63, SD = .37), t (100) = -4.56, p < .001.

Table 3. The response rate of questions in different content in different survey mode

<table>
<thead>
<tr>
<th>Question Content</th>
<th>Survey mode</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Telephone</td>
<td>Web</td>
<td>Total</td>
<td>t</td>
<td>df</td>
<td></td>
</tr>
<tr>
<td>(n=51)</td>
<td>(n=51)</td>
<td>(n=102)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Attitude</td>
<td>.22</td>
<td>.74</td>
<td>.47</td>
<td>-7.09*</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Questions</td>
<td>(.33)</td>
<td>(.40)</td>
<td>(.45)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Behavior</td>
<td>.56</td>
<td>.79</td>
<td>.67</td>
<td>-5.04**</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Questions</td>
<td>(.28)</td>
<td>(.17)</td>
<td>(.26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed Factual</td>
<td>.63</td>
<td>.90</td>
<td>.76</td>
<td>-4.56**</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Questions</td>
<td>(.37)</td>
<td>(.20)</td>
<td>(.33)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p < .001 (2 tailed)

To explain the item non-response rate of all questions, excluding demographic variables, we predict item non-response rate with demographic characteristics of respondents and survey mode with a hierarchical regression analysis. As shown in Table 4, Step 1 with survey mode and donation level was statistically significant F (2, 117) = 41.29; p < .001 and explained 41.4% of variance in the completeness of all questions. After entry of age at Step 2, not much improvement was seen and age was an insignificant variable. Step 3 adding education level of respondents in the model still did not change much. Among all predictors included, only survey mode is the sole and strong statistically significant predictor (β = .62, p < .001).

Table 4. Predictors of completeness of all questions

<table>
<thead>
<tr>
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***p < .001 (2 tailed)
Discussion

This study confirms that using a mixed-mode survey method helps to improve the overall response rates when different survey modes are used to reach the diverse subgroups of a population with varying contact information. Although the contact information of the two subsets are not exclusive, people who provided email addresses are considered to prefer to be contacted by email because an email address is provided as the additional information. Therefore, the higher response rate of a Web survey in this study provides corroborative evidence that a Web survey can work well for people who are comfortable using the Internet and computers. In this study, the Web survey has a better overall participation rate and an item response rate than the telephone survey when reaching people who provided e-mail addresses (e-mail as preferred contact).

Questionnaire design factors such as question format, question content and question order affect the completion rate in both the telephone and the Web survey but in different magnitudes. For example, the attitude question completion rate is much lower on the telephone than the Web survey. The gap in completion rate between telephone and Web surveys much narrowed in factual questions. The Web survey is most prone to order effect: The first set of questions in the Web survey ($M=.96$) have much higher completion than on the telephone ($M=.66$). Yet, the telephone survey completion rate is lowest in the second to last section of the telephone survey ($M=.17$) probably due to the complexity of the matrix questions for the section on the telephone when the questions are not as simple and straightforward as demographic questions.

For complex questions such as matrix questions, telephone surveys are more likely to yield an item non-response because these questions may cost respondents more cognitive efforts to understand and answer the question. Also, it is likely that people are unwilling to process a large amount of information and choices in a pressured environment with a phone interviewer (our interviewers were not instructed to push for an answer from the respondent if they said they did not want to answer the question).

In addition, the item response rate of demographic information is higher in the Web survey than in the telephone survey. The result echoes previous studies that people are more willing to divulge socially undesirable answers or sensitive information in Web surveys (Kays, Gathercoal & Buhrow, 2011; Tourangeau, & Yan, 2007). However, socially undesirable answers and demographic information are not the same. Compared with other questions in Web surveys, the demographic questions still have a lower item response rate in general. Respondents may think that the researcher may be able to identify them, as we know their email addresses, so they are more reluctant to provide demographic information. Respondents likely believe that their identities can be traced via their emails in Web surveys, so they are reluctant to provide the demographic information. Our study’s Web survey design allows them to skip these demographic questions. Web survey researchers need to be aware that this is a privacy concern of respondents. Although making the demographic questions mandatory in Web surveys may reduce the item non-response rate, respondents can also choose to terminate the survey if they don’t want to answer. Hence researchers need to consider the risk of doing so or perhaps live with the non-response in demographic information but obtain responses to other questions in the study as a compromise. As no other published survey method studies just focus on provision of demographic information, the results of this study should prompt interest of other survey method researchers to study more on this issue. Experiments may be conducted in the future on how much can be gained and lost through control function of demographic questions.

Moreover, this study aims to predict the completeness of questionnaires with demographic information. Our results found that survey mode, which is either the telephone survey or the Web survey for this study, is the sole strong predictor of completeness of overall questionnaire. Hence the choice of survey modes will significantly affect the quality of data obtained. In other words, people who fill out the Web survey are more likely to complete more questions.

Our study results indicate that when researchers choose a mixed-mode survey, they should expect some differences in item non-response and survey participation rates. Ideally, if they have all modes of contact information, then a sequential use of contact modes from low to high costs is the way to best maximize the
coverage, boost the participation with respondents’ preferred mode of contact, and use the budget efficiently. Also, researchers should carefully use matrix questions if they do a mixed-mode survey of the telephone and the Web because this study reveals that matrix questions are problematic in a telephone mode survey and should be avoided or changed to other formats for telephone surveys. When researchers have low budgets and have access to e-mail addresses of respondents, then a Web survey should be used as the first mode and followed up by telephone or other means to reach the respondents. The Web as a preferred contact in general has low coverage, compared to mail and other modes, but the quality of responses is important and should be a good complement to other modes of surveys.

**Implications for Conducting Mixed-mode Surveys with Small Budget**

Our findings suggest that the question formats in both the telephone and the Web surveys influence the item non-response rates in each mode. Further studies are encouraged to take careful consideration while constructing their questions for the method they use. For example, researchers should use more close-ended questions for online surveys and open-ended questions for telephone surveys to reach higher item-response rates. The study also shows that Web surveys can have higher participation rates than telephone surveys when the Web/e-mail is respondent’s preferred contact, contrary to previous studies. However, researchers might lose the response of some participants who can be only reached via telephone if they choose a single mode of Web surveys. Thus, the sample size needed for the study and available contact information might also be a critical factor for the researchers to select the appropriate research survey mode. The researchers of this study recommend that if the target population of the study is difficult to reach such as minorities, executives, or people who have other special qualifications, researchers should employ a mixed-mode survey to maximize the reach to those respondents.

The researchers also understand that without the standard seven call attempts of respondents and the lack of professional interviewing skills of the student interviewers may have caused a lower participation rate in the telephone survey in this case. Yet the labor and costs of repeated calls and professional interviewers might be prohibitive to most researchers without funding resources. Hence if telephone is not the only contact available and e-mail addresses are available, researchers may try a Web survey first before trying the more costly telephone survey. Another limitation of this study is that we use implicitly preferred mode rather than explicitly preferred mode in choosing the survey mode for the respondent. There may be a discrepancy between the two in the survey.

Finally, to examine whether the large amount of missing demographic information in the Web survey only applies to this study, we checked another Web survey on the same topic using the university population and found slightly less severe but similar results of a substantial proportion of missing demographic information (27-8% missing data for gender, education, income, and age). This missing information is across question formats, no matter whether it is open-ended, close-ended, in simple (male/female) or complex questions (intervals). The fear of respondents that researchers may be able to trace the respondents using their e-mail addresses could be a reason for the Web survey respondents’ unwillingness to provide demographic information. Placement of demographic questions at the end may also contribute to a larger proportion of non-response to them. We did not put the demographic questions at the beginning because many survey research texts such as Dillman et al. (2014) recommend putting sensitive and potentially objectionable questions such as demographic information near the end of the questionnaires. More research is needed on respondents’ perception of each data collection mode to improve participation in surveys and to weigh in the gain of putting demographic questions at the beginning and potential turnoff of respondents to other parts of the questions in the survey.

**References**


