

A COMPARISON OF MAIL, FAX, AND WEB-BASED SURVEY METHODS

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ABSTRACT:

This study compared mail, fax, and web-based surveys in a university setting for response speed, response rate, and costs. The survey was distributed to 300 randomly chosen hospitality professors from the Council on Hotel, Restaurant, and Institutional Education (CHRIE) members listed in the organization's online directory as of April 2000. It was found that the fastest method was fax with an average of 4.0 days to respond followed by web surveys with 5.97 days to respond. The slowest method was mail surveys with 16.46 days to respond. The response rate was 26.27% for mail, 17.0% for fax, and 44.21% for web. An LSD type z-test shows significant differences between mail and e-mail/web and between fax and e-mail/web, but no significant difference between mail and fax.

INTRODUCTION

As the number of Internet users in the world doubles every year, reaching 100 million in 1998, researchers are using Internet tools such as e-mail and web-based surveys more often. According to Dillman (1999), the most significant advances in the survey methodology during the twentieth century were the introduction of random sampling in the 1940s and telephone interviewing in the 1970s. Researchers today are witnessing similar advances in the field of survey methodology with the introduction of technology-based surveys such as the Internet, voice recognition systems, and electronic fax surveys.

Not much research has been focusing on technology-based survey methodologies because they have only been introduced in the last decade. The analysis of past research on the use of the Internet as a survey methodology shows a wide variation in response rates and speed of response for Internet-based surveys (Sheehan & McMillan, 1999). Since the number of studies using these methodologies is limited and the populations and research topics they use are different, there is no clear idea of the effects of the Internet-based surveys. There are not many studies that compare fax methodology to other methodologies.

The purpose of this study is to compare mail, fax, and web-based surveys in a university setting for response speed, response rate, and costs.

REVIEW OF LITERATURE

Dillman's Total Design Method (TDM) (1978) brought a new perspective and method to mail and telephone surveys. TDM suggested a one size-fits-all approach in which the methods of implementing mail and telephone surveys remained the same for many different populations or conditions. Dillman (1999) claimed that this was the biggest shortcoming of TDM. The original TDM employed numerous interconnected procedures for conducting mail and telephone surveys that resulted high response rates. Social exchange was maximized for both the respondents and the researcher. The perceived rewards were increased while perceived costs were decreased for the respondents. TDM did not employ more than one method to collect survey data. Researchers eventually started to use mixed-mode surveys that employed telephone, mail, fax, and e-mail methods altogether or in different combinations. (Dillman & Tarnai, 1988; Beck, 1996; Dillman, 1999). Research on mixed-mode surveys has suggested that employing more than one method for collecting survey data is acceptable and usually yields a higher response rate. The main reason why one may want to use a mixed-mode method for surveys is that developing technologies may not be available to all members of a population, therefore, eliminating the chance for being selected. With the development of the Internet, the biggest concern is using e-mail or web-based surveys is that not all members of the population have access to e-mail and to the World Wide Web (Web) (Dillman, 1999).

Dillman (1999) claimed that the level of technology reached made it impossible for most populations to be reached by only one mode. Within each group, there are people who can be primarily reached by mail, telephone, fax, personal visit, or e-mail rather than several or all of the methods.

The major potential problem with using mixed-mode surveys for the same population is defined as the measurement differences between modes (de Leeuw, 1992; Schwarz, Hippler & Noelle-Neumann, 1992; Dillman, 1999). This difference may even result in different analytical conclusions and recommendations. Dillman (1999) suggested that there are four main reasons for differences between different modes: social desirability, acquiescence, question order effects, and primary/recency effects. This potential problem may be minimized by applying a unimodal design which focuses on writing and presenting questions in a way that assures receipt by respondents of a common

mental stimulus. Most research on mixed-mode surveys has focused on differences between mail and telephone, mail and personal interview, and telephone and personal interview. There is little research on the measurement differences between mail, fax, and internet-based surveys. Different from mixed-mode designs that employ telephone and mail methods only, the survey data obtained by using mail, fax and internet-based surveys may not be statistically different, provided that the surveys do not depend on the printing quality, complex graphs, and color.

MAIL, FAX, AND WEB-BASED SURVEYS

Table I shows the specifications of mail, fax, and web-based surveys. The coverage for mail surveys compared to fax and web-based surveys is significantly higher because members of all populations have some kind of address while not every population member has a fax machine and/or e-mail/web access. Non-deliverable surveys in mail and fax methods are relatively less than web-based surveys because people change their e-mail addresses and the Internet Service Providers (ISP) much more frequently than their postal addresses (Zatz, 2000). With a postal address change, a forwarding address may be valid for 12 months. Once an e-mail is changed, there is usually no way to forward e-mail messages that were sent to an old e-mail address. Research has shown that inclusion of cash and non-cash incentives can increase response rates significantly (Shank, Darr, & Werner, 1990; Hare, Price, Flynn, & King, 1998; Dillman, 1999). Cash and non-cash incentives can be easily included into mail surveys, but it is impossible to include tangible incentives into fax and web-based surveys. Dickson and Maclachlan (1996) suggested that coupons might be included with fax surveys as an incentive. The same idea can be implemented into the web-based surveys. Pre-addressed, pre-stamped envelopes can be included with mail surveys while a toll free 800 return fax number can be provided for fax respondents to pay for the return costs. In web-based surveys, there is no variable cost to the respondent although there are considerable fixed costs when establishing and maintaining Internet and e-mail access. Color, quality image and complex graphs can be used in mail and web-based surveys. Audio, video and animated graphics can be included in web-based surveys (Bachmann, Elfrink, Vazzana, 2000). Mail surveys are easy to construct but copying, labeling, folding, stuffing envelopes, and preparing the return envelopes (with stamps or business reply) takes considerably labor and financial resources. Fax surveys, if conducted with a modem capable computer and mail merge program such as Microsoft Word, can be prepared in minutes and the transmission of faxes can be even done

automatically. If an electronic fax machine such as efax.com is used for returns, the paper consumption becomes zero since the faxes sent to the efax number comes to the researcher as an email attachment (Efax.com, 2000). The variable cost for transmitting the survey depends on the long distance carrier and ranges from five cents to twenty-five cents per minute. With web-based surveys, the initial setup takes time but the transmission of thousands of surveys can literally be done in minutes. Respondents usually complete and transmit the answers immediately while they have the e-mail open on their computer and can easily retrieve it. In addition, web-based surveys are coded automatically as respondents enter their answers while mail and fax surveys have to be coded manually.

A review of the literature suggests that a majority of survey methodology researchers focus on the differences between mail and e-mail surveys (Sheehan & McMillan, 1999). However, there is little research that compared mail, fax, and internet-based surveys.

METHODOLOGY

A technologically advanced population was chosen in order to better explore the effectiveness issues. The survey was distributed to 300 randomly chosen hospitality professors from the CHRIE listed in the online directory on April 2000. The sample of 300 professors was randomly selected from the 653 entries that remained after removing 153 entries that did not include an e-mail address. One hundred professors were randomly assigned to each of the three distribution method groups: mail, fax, and web.

In order to encourage response, the survey topic covered an interesting topic to them: hospitality education. A cover letter was personally addressed to each professor introducing the survey. Each professor received the same introduction with specific instructions on how to respond using the appropriate method.

Detailed records of each procedural step were kept in order to facilitate analysis including the time involved in developing each type of survey, the dates the messages were sent, the postmarked return dates, method each respondent used to respond, and time required to code the responses. Costs were also recorded.

Many of the manual steps for the mail group were saved in word processing files and re-used for the fax and web-based surveys. The common cover letter for the survey was modified for each group by changing the response-option addresses and the basic instructions on how to return the survey. For the mail group, personalized cover letters were printed on university letterhead using Microsoft Word (1997) folded with a printed survey and business reply

envelope. The faxed version included a personalized cover letter with a university letterhead logo embedded into the software and a survey. Microsoft Word (1997) with Microsoft Fax (1995) and Microsoft Exchange (1995) were used to mail merge and to fax the surveys. The name, address, and fax numbers were automatically inserted into the letter and faxed by the computer. Microsoft Exchange (1997) provides a detailed record of the transmissions such as time faxed and the reason for a fax not going through. The software was programmed to repeat the fax three times should a problem occur before or during the transmission such as busy signal, line cuts, etc. Transmission records were kept for further analysis.

For the web-based survey, an e-mail message was sent to the professors along with a cover letter and the website address (URL). The respondents were informed that they could request a paper copy of the survey should they have problem with accessing the survey online. A unique website address was created for each respondent with the help of a common gateway interface protocol (CGI). Thus, the responses were tracked and the possibility eliminated of a response from a non-sample source. The Internet

protocol numbers (IP) were obtained along with the time and date the survey was completed by the respondent. Responses were checked for multiple entries by the same person, and if found, the extra ones were deleted. The invitation e-mails were sent by Microsoft Word (1997) and Outlook Express 5 (1999).

The mail and fax surveys and the e-mail invitations were sent on the same day. Of the original 300 surveys, only six surveys came back as undelivered. One mail survey was returned as wrong address, all of the fax surveys went through successfully, and five of the e-mail invitations were returned as undeliverable (See Table III).

FINDINGS

Response Speed: The fastest method was fax with an average of 4.0 days to respond followed by web surveys with 5.97 days to respond (see Table III). The slowest method, as expected, was mail surveys with 16.46 days to respond. The overall average response speed was 8.84 days. Figure I shows the response patterns for mail, fax and web surveys.

Table I: Comparison of mail, fax, and web-based surveys

Factor	Mail	Fax	Web-based
Coverage	High	Low	Low
Speed	Low	High	High
Return Cost	Preadressed/Prestamped envelope	800 return fax number	No cost to the respondent
Incentives	Cash/Non-cash incentives can be included	Coupons may be included	Coupons may be included
Wrong addresses	Low	Low	High
Labor needed	High	Medium	Low
Expertise to construct	Low	Medium	High
Variable Cost/each survey*	About \$1.00	About \$ 0.50	No cost

*: These are estimated costs for a 4-page survey that has a population in the U.S.

Table II: Comparison of mail, fax and email/web based methods.

	Mail	Fax	Email/Web-based (I)	TOTAL
Sample Size	100	100	100	300
Number not deliverable	1	0	5	6
Percent not deliverable ¹	1%	0%	5%	2%
Effective sample size ²	99	100	95	294
Surveys returned	26	17	42	85
Raw Response Rate ³	26.0%	17%	42.0%	28.3%
Adjusted Response Rate ⁴	26.27%	17.0%	44.21%	28.91%
Days to respond	16.46	4.0	5.97	8.84
Response Quality (completed the whole survey)	21	13	36	70
Response Quality (percent)	80.7%	76.4%	81.4%	82.3%

Notes:

1: Number not deliverable/ Sample size

2: Sample size-Number not deliverable

3: Surveys returned/Sample size

4: Surveys returned /Effective Sample Size

Although the average response speed of the fax method was fastest (4.0 days), the pattern shows that the web surveys came back very quickly in the first days (see Table III). This could be due to people not reading their e-mail for several days.

Response Rate: The response rate was 26.27% for mail, 17.0% for fax, and 44.21% for web. Using the arc sine square root transformation ANOVA (Kempthorne, 1952) there was a significant difference among the response rates for the two methods (Chi square = 9.336, df = 2, P = .0094). An LSD type z-test shows significant differences between mail and e-mail/web and between fax and e-mail/web, but no significant difference between mail and fax. In terms of response quality, that is the completeness of the survey, there is also a significant difference among mail, fax and web methods (Chi square=6.398, df=2, P= .0408).

Costs: Table IV shows the fixed and variable costs for mail, fax and web surveys. Fixed costs included designing the survey and cover letters which do not change based on the number of surveys being printed, faxed or e-mailed. Variable costs included printing, organizing, and sending the surveys. The web method cost the least, \$107.50 while the fax method cost \$119.50 and mail method cost \$260.50. It is clear that there is a significant difference between mail and fax/web methods. The same difference does not exist between fax and web methods. However, the variable cost for the web method is \$0.00 while it is \$ 0.52 for fax method. So, the web method would be significantly cheaper than mail and fax methods when the number of subjects is more than 200.

Table III: Response Days for Mail, Fax, and Web Surveys

	Response Days		
	Mail	Fax	Email/Web-based
1-7 days	-	13	25
8-14 days	8	4	11
15-21 days	16	-	5
22-28 days	2	-	1
Total	26	17	41

Figure I: Response patterns

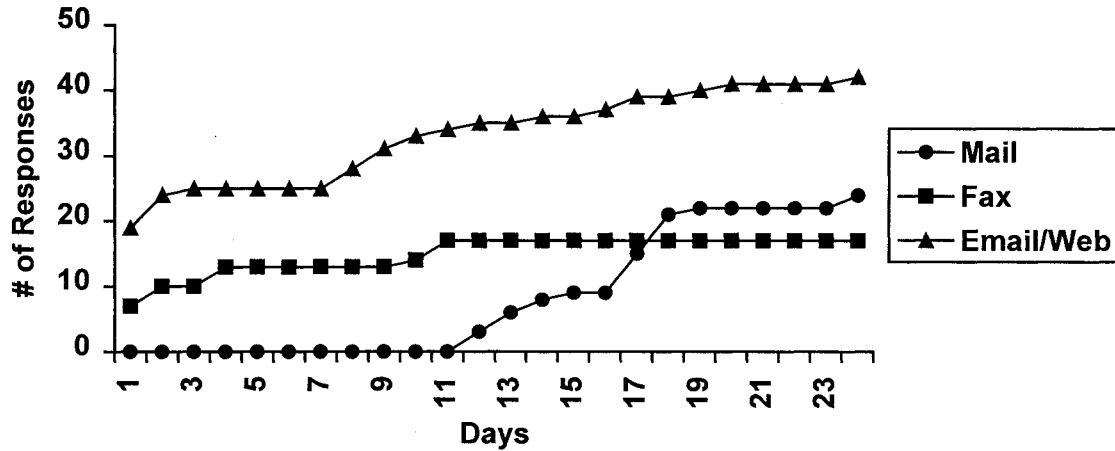


Table IV: Summary of costs

Method	Fixed Cost	Unit Cost	Quantity	Variable Cost	Total Cost
Mail	\$67.5	\$1.93	100	\$193.00	\$260.5
Fax	\$67.5	\$0.52	100	\$52.00	\$119.5
Web	\$107.5	\$0.00	100	\$0.00	\$107.5
Total	242.5	\$2.45	100	\$245.00	\$487.5

The cost summary table did not include coding costs. Coding for mail and fax surveys has to be done manually while web survey responses are automatically coded as they were answered by the respondent. When coding costs are taken into

consideration, web surveys appear to be the most cost efficient method compared to mail and fax methods.

Data Consistency: Table V shows the means for four factors identified in the study for mail, fax and web methods.

Table V: Means for four factors identified in the study for mail, fax, and web methods

Factor	Means			ANOVA Results	
	Mail	Fax	Web	F	P
1. Use of trade magazines and industry show	3.60	3.50	3.36	1.074	.346
2. Responsibility of hospitality faculty	3.73	.375	3.78	.075	.928
3. Applicability of hospitality research	3.21	3.36	3.48	1.767	.177
4. Peer-review process	2.55	2.27	2.43	.475	.623

N=85

None of the factors were significantly different from each other in each method. Analysis of Variance

revealed a p-value ranging from 0.177 to 0.928 for each factor.

CONCLUSIONS

The results indicate that web surveys have significant advantages over mail and fax surveys in terms of response rate and costs. Fax methods were fastest on the average (4.0 days) followed by the e-mail/web method (5.97 days). This could be due to people not reading their e-mail for several days. The findings of this study in terms of response rate between mail and Internet-based surveys were the same as those of Kiesler and Sproull (1986), Parker (1992), and Bachman, Elfrink, and Vazzana (2000). In addition, this study has shown that fax methodology did not yield significantly different response rate from mail methodology for educators. This may be due to educators not using fax as much as businessmen. Another factor might be that educators may not perceive fax messages as more important, convenient, and accessible while business people perceive them to be more important than mail and more convenient (Dickson & MacLachan, 1996).

Based on the findings of this study, it is recommended using e-mail/web-based surveys when surveying educators for three reasons; first, e-mail/web methodology yields a higher response rate at less cost and more rapidly than mail surveys. Second, the majority of educators have access to e-mail and in the United States. Finally, since e-mail/web surveys code the data automatically eliminating hand-coding, it saves the researcher time and resources. For those of the sample educators who do not have e-mail and web access, other methodologies such as mail and fax could be used as a means for mixed design. However, researchers need to measure any significant differences between different methodologies.

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