EFFECTS OF WEB PAGE DESIGN AND REWARD METHOD ON COLLEGE STUDENTS’ PARTICIPATION IN WEB-BASED SURVEYS

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The use of Web-based surveys is a new research methodology in higher education and as a surveying method it is still in the early stage of development. Compared to traditional methods, Web-based surveys have lower participation rates. Very few studies have examined effects of survey web page design on survey participation. The purpose of this study was to investigate how two types of survey Web page design (single-page and multiple-page design) and three reward methods (no-incentive, incentive, and lottery) effect college students’ participation in terms of response rate, time duration to complete a survey, and the number of answered items.

A survey instrument was designed in single-page and multiple-page format and delivered on the Web. Participants were undergraduate students in a Midwestern university. A sample frame of 6,000 undergraduates was randomly selected and randomly split into two groups based upon the single-page and multiple-page design. Participants in each design were then randomly assigned into three groups based on the reward method, no-incentive, online incentive, and lottery. All the perspective participants were send email invitations with a hotlink to the survey Websites. The study received 745 submitted surveys.

The research design utilized the Chi-Square test and two by three analysis of variance (ANOVA). In terms of submitted response rate, data analysis revealed no
statistically significant difference between single-page and multiple-page design, but found significant difference among the reward methods. Additionally, there was no significant relationship between survey design and reward method on response rate. The ANOVA analysis revealed that it took a significantly longer time to complete a multiple-page survey than a single-page survey. There was no interaction effect between survey page design and reward method on time duration to complete a survey. The study failed to identify any significant difference of number of answered items in the submitted surveys between the single-page and multiple-page design as well as among the three reward methods. There was no significant interaction between survey page design and reward method regarding the number of answered survey items.

Some additional findings concerning abandonment, drop outs, effect of follow-up reminders, and gender difference are presented. Limitations, conclusions, recommendations for future study are provided.

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Chapter 1: Introduction

Background of the Study

In order to gather institutional and individual information from remote and distributed subjects, surveys have been one of the most frequently used methods among the social science and educational research methods (Babbie, 1992). Before the Internet was widespread, paper-and-pencil surveys and telephone surveys were frequently applied methods. But these survey instruments for data collection are thought to be both costly and time consuming (Medlin & Whitten, 2001). With development and application of the Internet, survey researchers have found a new platform, the World Wide Web (WWW or the Web) to deliver surveys. Web-based surveys are usually conducted by sending e-mail invitations to the selected samples with a hotlink to the survey Web page. Given the popularity of Web applications at work, school, home, and even travel, Web-based surveys are applied to all kinds of inquiry such as research, government, and business. They have become a practical and helpful research method used by a growing population.

According to Medlin and Whitten (2001), researchers who use survey instruments to collect data usually seek to improve response rates, shorten the time required for data collection, and reduce the cost of data collection. The use of the Web-based surveying methodology offers possibilities for improvement in all three areas. Compared to traditional surveys, Web-based surveys have many advantages such as low cost, time-saving, possibility of large sample size, fast delivery, quick feedback, convenience, and so forth. The form of Web-based surveys streamlines the data collection process, formatting and entering responses directly into a database for analysis (Solomon, 2001).
These characteristics reduce time and cost for researchers and make contribution to research more quickly with which paper surveys can’t compete.

On the other hand, in terms of reliability, this Web format can be competitive to a traditional format. Mertler and Earley (2003) conducted a study to compare the overall internal reliability (internal consistency) and item analysis of the individual survey items between two forms of an identical survey: paper-and-pencil format and Web format. The two survey forms were used to survey a sample of 236 undergraduate students. The results revealed very similar patterns, indicating that the two modes of survey delivery were quite comparable. Medlin and Whitten (2001) compared the data consistency between internet and mail survey methodologies. Their study found that the reliabilities of the two formats were consistent and Internet surveys had a faster response time and lower cost than mail surveys.

Given the above appealing characteristics, Kaye and Johnson (1999) even predicted that “as an increasing number of people discover the Web and become frequent and competent users, the Web will become more representative of the general population and, therefore, survey results will be more reliable and generalizable” (p. 334). Web-based surveys are especially appealing to and favored by university faculty and students (Sax, Gilmartin, & Bryant, 2003). Survey research is a particular kind of research that frequently appears in the educational milieu (Tuckman, 1999). More and more researchers in education are starting to develop Web-based surveys and distribute them on the Internet. Web-based surveys are getting more and more attractive to researchers.

Web-based surveying is still in the early infancy stages. There is increased
research studying this new surveying medium by comparing its participation to that of
traditional surveying media. Medlin and Whitten (2001) compared response rates
between Internet and mail surveys methodologies as well as response times, and costs
related to the two formats of methodologies. Their study found that, although Internet
surveys had faster response time and lower cost than mail methodology, they had lower
participation (lower response rates and higher item nonresponses). In term of differences
of participation rates between traditional mail surveys and electronic surveys, Shannon
and Bradshaw (2002) conducted a study among a sample of 377 college faculty members.
Electronic surveys yielded a shorter response time and lower costs associated with
surveys, but lower participation rate and higher rate of no responses, than mail surveys.
Underwood, Kim, and Matier (2000) explored issues for the proliferation in use of
electronic survey methods in higher education, but in particular examined whether
response rates differed between surveys administrated by the traditional way (mailed
paper-pencil instrument) and electronic ways (e-mail and the World Wide Web). They
found that the response rate was substantially lower for the Web survey than for the mail
survey. Difference of response rates of Web versus paper surveys were also studied by
Matz (1999). Matz argued that research via the Internet was becoming more attractive for
many researchers. Matz’s study particularly examined sampling and format effects, and
response rates of Web surveys. The study found no sampling bias or format effects in
tests of the respondents’ demographics and the content of responses. Although responses
to Web surveys are gathered more quickly than traditional surveys, traditional survey
methods yielded higher response rates than Web surveys.
All the above-listed studies indicate that, compared to traditional surveys, Web-based surveys do have advantages, but Web-based surveys fail to reach the level of participation of traditional survey methodologies, in terms of response rates and item nonresponses. These issues have concerned researchers. Although item nonresponses haven’t concerned researchers as widely as response rates, it will be another dominant concern after the response rate issue is overcome because item nonresponses can cause missing data errors (Medlin & Whitten, 2001).

**Statement of Problem**

Although Web-based surveys are attractive, Web-based surveying is still in the early stages of development (Solomon, 2001). There are still challenges to this kind of survey delivery format. The current common concern about the Web-based delivery medium of surveys is participation rates (response rates and item response rates). According to Solomon (2001) and Shannon, Johnson, Searcy, and Lott (2002), the most important factors to participation rates of Web-based surveys are: the Internet coverage issue; issues related to the sound design of Web-based surveys, such as Web page design of Web-based surveys; and survey reward method with appropriate characteristics (i.e. rewarded participation with incentives, lottery, etc.).

The Internet coverage issue refers to the fact that a number of people do not have access, or choose not to use the Internet, or are not familiar with Internet browsers. However, it is undeniable that the Internet is becoming an massive global communication instrument, increasing from 16 million users in 1995, to 451.04 million users in December 2000, to 552.51 million users in December 2001, to over 580 million in May
2002 (“World Wide”, n.d.), and eventually to one-third of the world’s population predicated in 2007 (Stromquist, 2002). With the trends of development in the economy and technology, lack of Internet access, either by personal choice or by non-personal circumstance, will not be an issue in the foreseeable future (Solomon, 2001). With development of Hypertext Markup Language (HTML), Java Scripts, etc., which construct the Web pages, interfaces of Web pages are getting more and more user-friendly and less and less technologically-demanding. Lack of familiarity with Internet surfing will also be less and less of an issue. The Internet coverage issue will not be a concern in the near future due to the above mentioned trends.

Thus, the second and third concern, the sound design of survey Web pages and reward method with appropriate characteristics in particular may really determine survey participation and response rates, whether now or in the future since this kind of survey is delivered via Web pages over the Internet. This means that, with different Web survey design, some persons may visit the survey Web site, but they may quit from the Web site before they start or complete the survey due to personal preferences of the Web-based survey. This suggests that different types of Web page designs of a Web-based survey may attract or discourage people to participate in and complete the survey. Thus, the Web page design of a survey may critically affect participants’ decision to quit the survey or finish the survey. Even if participants submit the surveys, they may leave some items unanswered because of survey design. More specifically, as an example, a single-page design of a survey may make some people feel bored and burdened with scrolling down the screen, and just answer several items or even none and then submit or quit, while a
multiple-page design may attract people to keep going on to answer more items and complete the survey. On the other hand, appropriate survey reward methods, such as incentive rewards, or lottery enrollment for survey participation or completion, may be necessary for Web surveys in order to convince people to go to the survey Web site. No-incentive method (without any reward for participants), incentive method (rewards provided for participants), and lottery method (chances for participants to win a lottery) may have various effects in convincing people to visit and participate in the Web-based surveys.

Most of the current studies on Web-based surveys were conducted to investigate the advantages and disadvantages of Web-based surveys by comparing these to traditional survey modes, or to examine the potential difference in demographics. Effects of survey Web design on participation have been studied very little with the exception of Dillman, Tortora, Conradt, and Bowker (1998). Although there are some guidelines from survey professionals and designers in designing and implementing Web-based surveys, there is no research concerning the Web design which works to increase response rates and item responses to Web-based surveys. There is a need for research to investigate results and roles of Web design and technology in Web-based surveys in order to promote higher participation and response rates. Although, comparatively, effects of reward methods in Web-based surveys have been investigated more, they are not systematically examined together with survey Web design, in term of effects on survey participation such as response rates, number of answered items, and time duration to complete a survey. Studies on participation in Web-based surveys by systematically
investigating survey Web page designs and reward methods are still lacking, especially in the educational environment.

Carrying out a Web survey was thought to be an appropriate choice of instrument for a college population, based upon advantages such as its speed, ease of editing, asynchronicity, and lack of expense (Daley, McDermott, Brown, & Kittleson, 2003). How do college students react to the different Web page designs of an identical survey? How do different types of Web page design of identical surveys affect participation among different reward groups who participate in the Web-based surveys? These questions should be investigated in this technology-supported research area. Thus, related research is essential for the understanding of Web-based survey design and better application of this survey format into practical online research. This study seeks to investigate the effects of survey Web page design and reward methods on participation in the Web-based surveys.

Purpose of the Study

The purpose of this study was to examine the results of designing Web pages to facilitate administration of a Web-based survey and to provide information concerning participation in a Web-based survey based on the Web-page designs of the survey; particularly how Ohio University students participated in two identical surveys delivered by two differently designed Web pages. It investigated the effects of single-page design and multiple-page design of an identical survey on participation including response rates, number of responded items, and time duration to complete a survey by college students. One existing survey titled as “Internet Fluency” by Bunz and Sypher (2001) was chosen based on a focus group of undergraduate students who took EDCT 203 class (Application
of Computer Technology in Education) in spring of 2005 in College of education at Ohio University. This survey was delivered in single-page design and multiple-page design. In order to encourage and examine Web survey participation, three different survey reward methods were adopted: no-incentive, incentive, and lottery. Participants were first randomly split into either single-page design or multiple page design. Afterwards, participants in each design were randomly assigned, according to the three reward methods, into no-incentive group, incentive group, and lottery group. Thus, all the participants were randomly divided into six sub-groups in this study: single-page design with no-incentive, incentive, and lottery; multiple-page design with no-incentive, incentive, and lottery. Participants in the no-incentive group were not offered any reward. Participants in the incentive group were provided an online reward after participation. Lottery group had a chance to win a lottery as a reward for survey participation. All the three groups received an e-mail invitation with a hotlink to access the survey Web site. The study focused on whether participation in a survey which was alternatively designed in single-page format and multiple-page format were different across the reward methods and whether interaction exists between survey page design and reward method. Only the submitted surveys were studied on participation.

Research Questions

This study attempted to provide answers to the following research questions:

1. A: Is there significant difference of the submitted response rates between single-page and multiple-page design?
   B: Is there significant difference of the submitted response rates among the no-incentive, incentive, and lottery methods?
C: Is there is significant relationship between the survey Web page design and reward method in terms of the submitted response rates?

2. A: Is there significant difference between the single-page and multiple-page design on the time duration to complete a survey in the submitted surveys?
   B: Is there significant difference among the three reward methods on the time duration to complete a survey in the submitted surveys?
   C: Is there significant interaction effect between survey design and reward method on the time duration to complete a survey?

3. A: Is there significant difference between the two types of survey Web page design on the number of answered items in the submitted surveys?
   B: Is there significant difference among the three reward methods on the number of answered items in the submitted surveys?
   C: Is there significant interaction effect between survey design and reward method on the number of answered items in the submitted surveys?

Research Hypotheses

Based on the research questions of this study, four research hypotheses were derived and tested.

HO₁: A. There is no significant difference of the submitted response rates between single-page and multiple-page design.
      B. There is no significant difference of the submitted response rates among the no-incentive, incentive, and lottery methods.
C. There is no significant relationship between the survey Web page design and reward method in terms of the submitted response rates.

HO₂:  
A. There is no significant difference between the two types of survey Web page design on the time duration to complete a survey in the submitted surveys.
B. There is no significant difference among the three reward methods on the time duration to complete a survey in the submitted surveys.
C. There is no significant interaction effect between survey design and reward method on the time duration to complete a survey.

HO₃:  
A. There is no significant difference between the two types of survey Web page design on the number of answered items in the submitted surveys.
B. There is no significant difference among the three reward methods on the number of answered items in the submitted surveys.
C. There is no significant interaction effect between survey design and reward method on the number of answered items in the submitted surveys?

Significance of the Study

This study involved Web design technology in a Web-based surveying environment in regards to participation in Web surveys. Survey participation such as response rates and item response rates is fundamental to statistical power and validity of research. Design of Web-based surveys is like the design of a city. City design affects residents, while Web-based survey design may affect participants’ surveying interests and their responses. Hiskey and Troop (2002) claimed that Web-based researchers should
conduct Web-based survey with appropriate and optimized methods. Besides following the basic rules and principles in traditional surveying to create and edit Web-based survey questions, Web design of a Web-based survey is very critical for survey responses. Gaddis (1998), after a review of more than 100 Web-based surveys, found out that there were many types of designs in use, but some were effective while some not. He pointed out that, to be most effective, Web-based surveys should make design considerations applicable to an interactive environment and optimized Web survey design could turn out to motivate higher survey participation and response rates.

There is an increasing demand for research on how to attract participation and improve the overall response rates and item response rates in Web-based surveys with the help of survey Web design. The significance of this study was that it would contribute to the body of knowledge related to designing Web-based surveys in higher education. It could also reveal new trends in the application of the World Wide Web to academic research for achieving the goal of excellence set by the higher education institutions. It was hypothesized that conducting the study using different Web page design techniques might increase knowledge about whether the method was a viable option for collecting data from college students. Rather than reporting the quantitative results of the survey itself, this study reported on the effects of background logistical work (survey Web page design and reward method) on data collection such as response rates, number of answered items, and time duration to complete a survey. The results of this study may help Web-based researchers in higher-education settings to gain practical insight on how to design and implement their online surveys in a more appropriate way for the collection of data.
from college students and thus benefit their research. The study may also be able to provide information for future reference and research studies in this area.

**Delimitations**

It is recognized that universities, especially in America, Canada, and Western Europe, are environments where the Internet is highly facilitated. The focus of this study was limited to Ohio University. The study intended to involve the full-time and part-time undergraduate students on Athens campus at Ohio University who were enrolled in fall quarter of 2005-2006. The emphasis of this study was to investigate the effects of two types of Web page designs for a Web-based survey on participation of college students who were in three different groups by no-incentive, incentive and lottery method. Findings of this study concerned influence of survey Web page design and reward method on Web-based survey participation.

**Limitations**

While the scope of this study was focused on the Web-based surveying medium which is still in the initial stages of development, the available literature on Web-based surveys, especially effects of Web page design in Web-based surveys on participation (response rates, number of answered items, and time duration to complete a survey), was not productive. However, compared to the aspects of number of responded items and time duration to complete a survey, the overall response rates were more studied in the research literature. Therefore, this study referred to some research literatures which were focused on overall response rates. It also brought the broader electronic surveys into review and examined difference between Web formats and traditional formats.
Definitions of Terms

The following operational definitions will be used in this study:

Abandonment: The difference between the number of viewed/visited surveys and the number of the submitted surveys was called abandonment.

Drop outs: The difference between the number of the started surveys and the number of the submitted surveys was drop-outs. Drop outs were recorded and calculated only in multiple-page design.

Incentive Method: A participant would receive an online incentive after submitting a survey.

Item Responses: This referred to the number of answered items in a submitted Web-based survey.

Lottery Method: Participants would have a chance to enter a lottery after submitting a survey.

Multiple-page design: It displayed the survey items in separate screens/pages in order to make the screen scrolling into none or minimum: some pages had multiple items within common categories per screen and others had single item per screen. Each page in the multiple-page design had a bar-type indicator to indicate progress of survey participation. The Appendix A and Appendix B illustrate the two types of survey design respectively.

No-incentive Method: There were no any incentives provided for participation in the Web-based survey.
Response Rate: The general response rate was the proportion between the number of samples who submit online survey and the number of framed samples. In this study, it was also defined by distribution of counts of submitted responses.

Reward Methods: This referred to the methods of rewarding the survey participants or respondents in this study, including no-incentives, incentives, and lottery.

Started Surveys: They were the surveys that were answered at least one item and/or clicked the “Continue” button between survey pages. They included both the unsubmitted (only recorded in multiple-page design) and submitted surveys.

Single-page Design: The single-page design displayed all survey items in one screen/page. Participants had to scroll up and down to view the whole survey.

Survey Web page Design: A Web page is a Web document designed by using HTML, Java Scripts, or other codes. There is a large variety of Web pages depending on how the Web page designer uses HTML or other script languages to design the Web pages. In this study, Web page design included single-page design and multiple-page design.

Time Duration to Complete a Survey: The time duration to complete a survey was the time span from the time point when a participant accessed the survey to the time point when the participant submitted the survey by clicking the “Submit” button at the end of the survey.

Viewed/Visited Surveys: They were the surveys that were accessed by the potential participants who clicked the links in the email invitations or copying/pasting the link.
Web-based Survey: A Web-based survey is a kind of survey which is delivered via Web pages on the Internet.

Web Survey Participation: Survey participation in this study included the submitted response rate, number of answered items in a submitted survey, and the time duration to complete a survey.

World Wide Web: It is also called WWW or the Web. According to the definition on Webopedia (Webopedia, 2004), World Wide Web is “a way of accessing information over the medium of the Internet. It is an information-sharing model that is built on top of the Internet. The Web uses the HyperText Transport Protocol (HTTP) to transfer HTML, Java Scripts, or other code documents of the World Wide Web. This is the only one of the languages spoken over the Internet, to transmit data. Web services, which use HTTP to allow applications to communicate in order to exchange business logic, use the Web to share information. The Web also utilizes browsers, such as Internet Explorer or Netscape, to access Web documents called Web pages that are linked to each other via hyperlinks. Web documents also contain graphics, sounds, text and video” (Webopedia, 2004, para. 3). World Wide Web and the Internet are not synonymous. The Web is only one part of the Internet.
Chapter 2: Literature Review

Introduction to the Literature

Web-based surveys have been widely utilized by researchers in the past years. Researchers have started to investigate the unique issues which influence participation in Web-based surveys, and research in this area is increasing. This chapter provides an overview of general surveying methodologies and relevant literature on Web-based surveys. The literature review starts with an introduction to categories and applications of different surveying methodologies. It is followed by a review of the documented advantages and disadvantages of utilizing Web-based surveys. Concerns about participation of Web-based surveys were then explored. Thereafter, a review of literature on issues of Web design of online surveys is presented. Next, reward and survey conducting methods, such as contact mode, incentives, follow-up reminders, etc, in Web-based surveys are illustrated. Finally, a summary of the literature on survey Web page design and its effects on participation is generated.

General Surveying Methodologies

As part of a research program, surveys are usually designed to collect information from a subset of a population and conclude formal statistical inference about some larger population (Schonlau, Fricker, & Elliott, 2002). Surveys have been utilized through different eras, from mail-delivered surveys in 1960s, to telephone interviews in late 1970s and (Dillman, 1978), and to e-mail survey mode in the late 1980s and early 1990s (Dillman, 2000), then to the wide spread of Web-based surveys at present.

Both mail and phone surveying modes are very straightforward. In a mail survey,
a questionnaire is sent to individual participants by postal mail. After participants respond to the questionnaire, their responses are mailed back to researchers, usually in a postage-prepaid envelope.

Telephone surveying mode is a method by which a researcher asks participants questions over the phone. Responses through phone surveys are either taped or written down, or both, as agreed between researchers and participants. Although the phone survey is thought to be fast, reliable, and good at controlling the sample, it is expensive (Conklin, 1999).

According to Dillman (1978), both mail and telephone surveys had been considered a very poor substitute for the face-to-face interview method in the survey research for a long time. Mail and telephone surveys were seen problematic and deficient with lower participation. Objections to mail and phone surveys were myriad. In the late 1970s, mail and telephone surveys were found to be competitive with face-to-face interviews and have become an effective alternative type of survey methodology, alongside with face-to-face interview (Dillman, 1978).

Beginning in the late 1980s and early 1990s, prior to the widespread use of the Web, e-mail was found to be another method to conduct surveys. As with the Web today, e-mail was explored as a survey mode. E-mail surveys are usually sent to participants by email attachment or within e-mail message. E-mail surveys require respondents to answer survey questions first, then attach the answered surveys to the e-mail and return the e-mail. But it was often found that respondents had problems converting an attachment to their own computer programs and attaching the answered surveys to e-mail. With
popularity of the World Wide Web on the horizon, Web-based surveys are preferred by researchers and respondents, and e-mail surveying methods have started to erode (Shannon, Johnson, Searcy, & Lott, 2002).

Web-based surveys are a type of online surveys delivered via Web sites. They reside in Web pages on the Internet. The survey respondents participate in a Web-based survey by either clicking an active hyperlink in an e-mail or on another Web site, or by copy-and-pasting, or typing the Web address directly into the address bar of the Internet browser. After participants finish the surveys, they submit their responses online instantly by clicking the “submit” button.

Regardless of the method, mail, telephone, e-mail, or Web-based surveys, the surveying should first be thought of as a process (Schonlau, Fricker, & Elliott, 2002). It is accepted as an important truth that the entire survey process is critical to achieving acceptable response rates and research success (Dillman, 1978; Dillman, 2000; Fowler, 1993). Both the Total (or Tailored) Design Method (TDM) by Dillman (1978, 2000) and Total Survey Design (TSD) by Fowler (1993) advise that essentially, a researcher should take a holistic approach to survey design by consciously considering all aspects of the survey process. In particular, Dillman emphasizes in TDM that the survey process is part of a social interaction between the researcher and the survey respondents and stresses the importance of communicating the survey to the respondents in an appropriate and friendly way. These perspectives in TDM imply that, as one component of the surveying process, design aspect in Web-based surveys in particular, is crucially involved with successful response rates. On the other hand, Fowler (1993) implies in TSD that when a
survey is designed and developed to meet the needs of a research study, recognition of constraints in the survey, caused by survey design for example, is also necessary.

With all surveying modes in general and the Web-based surveying mode in particular, the interaction between survey researchers and survey respondents are very important for collecting good-quality data (Schonlau, Fricker, & Elliott, 2002). Survey participation such as response rates and item responses are prominent in impacting data quality and research generalizability (Dillman, 1999; Couper, 2001; Smith, 1997), particularly in Web-based surveys where the Internet coverage issue is overcome. Many researchers (Daley et al., 2003; Schmidt, 1997; Smith, 1997; Schonlau, Fricker, & Elliott, 2002) claim that participation and response rates in particular are the one of most important considerations in planning and designing a survey.

What are the unique issues influencing participation in all surveys but in the Web-based surveying mode in particular? As stated by Dillman (1978, 2000) and Fowler (1993), the surveying process is holistic. The holistic perspective implies that any component of surveying process, such as survey design, survey delivery, participants contacting, and so forth, can affect survey participation and needs to be consciously considered.

Although it is predicted that the Web-based surveys will replace traditional surveying methods and will become the primary surveying medium (see Cleland, 1996), at least currently, survey researchers are still exploring the feasibility, desirability and utilisability of this unique surveying medium. The documentation is increasing concerning advantages, disadvantages, response rates, design issues, and reward and contact methods of Web-based surveys.
The Internet is profoundly changing the way we communicate with one another. Low-cost personal computers, the spread of the Internet, and widespread acceptance of online communications over the past decade have introduced new methods of conducting research surveys. One of the most recent new uses of the World Wide Web is as a survey platform. It is now possible to conduct an entire survey solely through the World Wide Web.

Whether Web-based surveys are feasible, desirable, and usable has generated greater discussion in the research area. Does a Web survey have more advantages, compared to traditional methods, or they are balanced? Or does a Web survey have too many constraints for use by researchers? It is worthwhile to take a review of documented advantages and disadvantages of Web-based surveys.

**Advantages**

Internet surveys have created opportunities previously unimagined. They can be used to explore and understand various social science phenomena, including not only Internet-specific phenomena, but also various other fields (Batinic, Reips, & Bosnjak, 2002; Reips, 2002). They have expanded the potential modes of data collection and enlarged the method range of conducting surveys. The many advantages of collecting survey data via the Internet have been well-documented. Although the Web-based surveys are still in their infancy (Schonlau, Fricker, & Elliott, 2002), they are believed to be faster, better, cheaper, and easier to conduct than more-traditional telephone or postal mail survey methods, and they are becoming increasing popular. Advantages presented in
this section are categorized as speed and cost, unique features, and potential representation of the general public.

**Speed and cost.** As noted, two major advantages of Web-based surveys are the speed with which completed questionnaires are returned and low cost of conducting the survey.

Davis (1997) states that an Internet-based survey can be designed and delivered “in the field” in a matter of hours, with immediate access to results, and e-mail or online advertising can reach tens to hundreds of thousands of potential respondents in an instant. Davis claims that the survey is a simple mouse click away. When Couper, Traugott and Lamias (2001) conducted an online study targeted at college students, they found that by the end to the first day, a total of 201 completed surveys were received, making up 30 percent of the total number of submitted surveys. By the third day, 50 percent of all submitted surveys had been returned. As agreed by Bandilla (2002), surveys can be conducted within short periods with an extremely high number of cases. A vast improvement in response speed over traditional mail surveys is widely reported (Tuten, Urban, & Bosnjak, 2002).

Internet surveys are inexpensive due to the elimination of postage, printing, and data entry and minimized use of laboratory space, time, and materials (Hertel, Naumann, Konradt, & Batinic, 2002; Saxon, Garratt, Gilroy, & Cairns, 2003; Tuten, Urban, & Bosnjak, 2002). The advantages of such a venture are obvious. In comparison to mail surveys, the financial expenditure of conducting Web-based assessment surveys on the Internet is much smaller (Bandilla, 2002). The cost of recruiting one participant via the Internet is little different from recruiting 100, 1000, or an even larger number of
participants (Funes, 2000). Funes also concludes that Internet surveys are generally 20 percent cheaper than traditional methods. Cleland (1996) reports, after online study, that online research costs about half that of traditional methods, and predicts that the Internet will replace telephone and mail surveys as the primary medium for conducting research.

Although Davis (1997) thinks that costs for an Internet-based survey should be structured around length and complexity, he also states that a fixed set-up charge can cover the required programming and administration of the Web survey, and there should be little cost differential for collecting data from samples of 100 and 100,000 respondents. Thus, total administration costs for an Internet survey are low. On the other hand, data acquisition (sometimes data analysis as well) run automatically, which can save a large amount of time on data entry, data coding, and data analysis. Anyone who has experience of coding questionnaire data can imagine how enthusiastically scholars have reacted to this new method (Hertel et al., 2002; Smith, 1997).

The Web-based surveys can provide advantages of speed, cost and efficiency. They don’t come free, but come at a price reduction.

*Unique features.* Because of its uniqueness, a Web-based survey has some advantages that traditional survey methods can’t realize. Couper (2001) lists some unique features of Web surveys: self-administered (no trained person to deliver questions, assist respondent, or influence answers), computerized (enabling randomization, interaction, and complex logic such as skips, edits, etc), distributed (respondent uses their own hardware and software at their end), and rich visual multimedia (abilities to add color, texture, etc, to background, include drawings, pictures, sound, and videos, and randomized presentation of all the above). It is claimed that these abilities vastly extend
the range of stimuli that can be use in surveys. Similarly, Daley et al. (2003) indicated that speed, asynchronous communication, and absence of intermediaries are very unique characteristics related to the advantage of electronic surveys, as well as lower costs, faster transmission time, and ease of editing in conducting electronic survey research.

The Internet provides ready access across geographic boundaries and time zones (Schmidt, 1997). People in the entire world can access and make response to an online survey at the same time. Web-based surveys have also provided convenience for participants, since they usually can be completed at a time of participants’ choosing, even at respondent’s leisure (Sax, Gilmartin, & Bryant, 2003) and under conditions that may be more conductive to thoughtful responses (Daley et al., 2003).

Interactivity is another unique feature in Web-based surveys. The interactive nature of Web-based surveys may be quite appealing to respondents. As stated by Davis (1997), as to overall effectiveness, Web surveys can hold the interest of respondents with both interactive features and visual appeal. Web surveys are often designed to provide feedback and summary statistics about an individual’s responses which serve as an incentive to participation (Dillman, 2000; Schmidt, 1997; Smith, 1997).

Since Web-based surveys are supported by the Hypertext Markup Language (HTML), an authoring language used to create Web pages, Java Scripts, or other forms, they are programmable. It is possible to have real time error checking and correction to increase the accuracy of the data collection process and streamline the data collection process, formatting and entering responses directly into a database for analysis (Solomon, 2001). The programmability of Web codes or languages makes it possible to facilitate adaptive testing, randomly assigning questionnaire items based on answers and
information participants provided earlier in the survey, and to offer interactive exercises, online interviews, and virtual role-playing (Hertel et al., 2002; Solomon, 2001), although the computerized adaptive tests are still controversial. Along with the enhanced user interface and more interactive features, Web-based surveys and the formatting capabilities of HTML offer the possibility of multimedia surveys containing audio and video allowing the creation of an attractive Web page that may improve response rates.

In addition, the answer behaviors of participants in a Web survey can be explored unobtrusively by measuring decision times and observing answer correcting online. Bosnjak and Tuten (2001) and Hertel et al. (2002) advocate that a Web-based survey can capture data about a respondent’s answering process and claim the Web survey has substantial advantage in comparison to traditional surveys. Some patterns of response behaviors online could be identified such as answer correction. Such information provides additional insight into the reliability of data, in addition to responses to survey questions. The use of programming methods such as Java scripts (a language can add interactivity and function to a Web site), java applets (a small program could be included in Web pages), and log files (the files that list actions that have occurred) can trace the response process (Kieley, 1996).

Potential representation of the general public. Although the percentage of Internet users is not overwhelmingly larger than nonusers, it is undeniable that the Internet has become a massive global communication instrument. The Internet coverage issue, the fact that a number of people do not have access, or choose not to use the Internet, or are not familiar with Internet browser, will not be a concern in the near future (Solomon, 2001).
Particularly, there are specific populations where Internet access is extremely high and the Internet coverage is likely to be less of a concern. As Aoki and Elasmár (2000) argued, “…the Web will present advantages over traditional modes of data collection if it is used for specific populations that are known to be Internet savvy” (p. 3). College students and university faculty within the USA, Canada, and Western Europe, federal government employees, workers in many companies and corporations, and members of some professional organizations are examples of such population (Dillman, 2000). It is well documented that, especially when directed at a college population, a Web-based survey is a highly feasible, desirable, and utilizable way to collect and analyze data (Daley et al., 2003). Web-based questionnaires are methodologically and financially appealing to researchers who study and work with college student populations, not only because of its convenience and lower processing fees, but also because the Internet use among college students continues to grow exponentially and remains popular (Sax, Gilmartin, & Bryant, 2003).

According to Couper (2000), one assumption, based on the fast proceeding adoption of the Web, is that eventual level of Web adoption will exceed that of any other technology before, such as the telephone. “Much of the optimism regarding the potential of Web surveys is based on the predicted trajectory of future penetration, extrapolating from the tremendous growth in WWW use seen in recent years” (Couper, 2000, p. 469-470). As Smith (1997) claims, it is well recognized that the Web population will better represent the average public as technology becomes increasingly adopted and decreased in price and availability.
Web-based surveys do offer advantages for researchers, such as speed, low cost, efficiency, uniqueness, and potentiality. It is unquestionable that the Web will play an enormous role in the future of survey research. Existing reports on Web-based surveys indicate that data quality (missing data, errors, and item nonresponse) is comparable or better than that of traditional mail surveys, and reliabilities show no difference to paper-and-pencil surveys (see Miller et al., 2002; Pealer, Pigg & Weiler, 2001; Stanton, 1998). These results indicate that Web-based surveys have great potential for becoming a mainstream data collection method in the future.

Disadvantages

While benefits of Web-based surveys are well documented, some methodological disadvantages are also presented. Disadvantages to this kind of venture are identified by such categories as the Internet coverage issue, technological issues, difficulty attracting and retaining respondents, and uncontrolled samples.

The Internet coverage issue. The Internet coverage issue here is the fact that a number of people do not have access, choose not to use the Internet, or are not familiar with Internet browsers. It is often suggested as the major challenge for Web-based survey methodology.

Bandilla (2002) claims that the benefits of Internet-based surveys are often exaggerated. He states that “According to estimates of August 2001, there are about 513 million Internet users worldwide: the USA and Canada alone account for 180 million, whereas in Europe 154 million people are online. These numbers prove that the Internet cannot be considered a fringe phenomenon. Even if at present, the majority of the population does not have access to the Internet, we must ask ourselves whether it is
already (really) viable to use the opportunities of the Net for acquiring sociological data—i.e., by conducting surveys via the Internet” (Bandilla, 2002, p. 1). This statement indicates that the population of Web users is not yet representative of the general public, and the Internet coverage is currently still a concern.

A well-known continuous WWW survey conducted by the Graphics, Visualization, and Usability (GVU) Center at the Georgia Institute of Technology from 1994 to 1998 came to display a very homogeneous picture regarding Internet users’ demographic characteristics of age, education, income, and sex (Bandilla, 2002; Tuten, Urban, & Bosnjak, 2002). This survey is reported to identify Internet user demographics, behaviors, and attitudes towards technology and commercial activity on the Internet. Anybody who had access to the Internet and the usual browser software could take part in these surveys. In the course of time the survey results showed that the average age distribution of Internet users is 35 years old; 70% are males and 30% female; 56% Web users hold college or advanced degree; 83% users are in the US; the average income of Web users is above 60,000 US dollars. On the whole, therefore, a dominance of the younger, educated, male and wealthy Web user groups was apparent in all surveys.

These findings are also agreed by Hertel et al. (2002) in that, although number of Internet users is growing rapidly, they are still not representative in sex, age, education, occupation, geographical, or cultural background of the main population. Most of them are educated, wealthy, young males living in America, Canada, Europe, Japan and Australia.

On the other hand, while the World Wide Web has been adopted as a primary tool for conducting research in the social science area, especially in market research, it is not
widely accepted yet for scientific communities in the short term (Tuten, Urban, & Bosnjak, 2002). Daley et al. (2003) even asserted that this situation makes generalizability impossible in the Web-based surveys.

Uncontrolled samples. Web-based surveys have difficulties in controlling their samples due to their online distributed nature. Hertel et al. (2002) states the following:

Compared to traditional tests, the possible advantages of Web-based surveys also imply higher risks. The broader range of potential participants that are contacted worldwide via Internet reduces researchers’ control of the subject sample. Although there are means to address certain subject groups (e.g., by specific advertisement and/or passwords via e-mail), Internet samples are often more heterogeneous (in geographical location, cultural background, etc.) than traditional questionnaire samples. (p. 118)

It is well realized that when a Web-based survey is available to an unframed large group of unknown potential respondents, the individual responses may be countable, but the response rate can’t be calculated (Bertot & McClure, 1996; Bosnjak & Batnic, 2002; Couper, 2000), as opposed to those directed at a particular framed sample of individuals. The World Wide Web is a very public place. When the sample is self-selected by individuals, which means that they know the survey address through links, search engines, or friends and choose to go directly to respond the survey, it is difficult to compare nonrespondents to respondents to ascertain key differences between the groups or to control the quality of the sample of respondents participating in the survey (Kaye & Johnson, 1999; Tuten, Urban, & Bosnjak, 2002). At the same time, data integrity presents a potential problem caused by the unwanted participation (intruders) that may stumble
upon the survey and distort the results (Solomon, 2001). A Web survey may be found and responded to by people who are not among those intended by the researcher, since one only has to click their mouse pointer on the submit button to respond to a Web-based survey once it is filled out, unless steps are taken to limit access to a survey. It is also quite possible for respondents to submit multiple copies of their responses either mistakenly or purposely (Stanton, 1998; Tuten, Urban, & Bosnjak, 2002). Thus, “the use of HTML forms for surveying poses a unique set of issues and challenges that need to be addressed to ensure valid data” (Solomon, 2001, Concerns with Web-based Surveying section, para. 1).

This may be avoided by employing password protection of a survey site, but security and confidentiality concerns may discourage participation so that this makes it more difficult to obtain the right participants (Smith, 1997). It is worthwhile to investigate as to what extent this method makes it harder to recruit right participants, especially when privacy, or even anonymity, is an issue (Smith, 1997). Consequently, most Web-based survey results are reported by the total usable responses (Smith, 1997; Stanton, 1998) or have partially relied upon an online group of participants (Bosnjak & Tuten, 2001).

**Difficulty in attracting and retaining potential participants.** Aside from the above major challenges, Web researchers may face difficulties attracting and retaining potential participants to a survey Web site. Accessing participants is a key concern in Web-based surveys (Madge & O’Connor, 2003; Tuten, Urban, & Bosnjak, 2002). Even if a frame population could be successfully identified for a Web survey, low response rate or item
nonresponse may still be a threat. If some people included in the sample are not willing or not able to complete the survey, concerns of response rates arise (Couper, 2000).

Intercept-based approaches, such as pop-up surveys and banner-advertised surveys, are often applied to recruit participation in Web-based surveys. Comley (1999) found that average response rate in pop-up surveys is 24%, while McLaughlin (2000) concluded that average response rate is 15% after reviewing data from CyberDialogue. It is well noted that click-through rates to banner ads are often very disappointing. Briggs and Hollis (1997) also indicated that responses rates aided by banner advertisement are very low. Cheyne and Ritter (2001) conducted a Web survey and attracted respondents by advertising in newsgroups (0.13% response rates based on hits), placing banner ads on Web sites (3%), and including it in three Internet search engines. They also found that high hitting rates did not generate high response rate in the above three approaches. Tuten, Bosnjak, and Bandilla (1999) found that click-through rates in banner-advertised Web surveys ranged from 0.13% (13 responses per thousand exposures) to 0.44%.

The only exception to this case is that Davis (1997) found that it has been successful to use banners located on frequently visited sites and the use of incentives in attracting and retaining respondents. But, cost for a researcher has been increased by such techniques.

“Another major challenge for all Web researchers is that it is hard to keep a respondent’s attention when another surprise is just a keystroke away” (Schonland & Williams, 1996, p. 86). This means that Web-based surveys have high drop-out rates. Respondents tend to lose interest after 25-30 questions and then quit the survey (Krasilovsky, 1996). Tuten, Urban, and Bosnjak (2002) conclude that Web survey
respondents are indecisive; even if they must be invited to a Web survey through sales promotion, banner advertisement, and incentives, they will only stay for several questions before dropping out. This phenomenon may give the survey either no response at all (such as in single-page design) or only a limited number of items answered (such as in multiple-page design), depending how the survey Web page is designed.

Dillman, Tortora, Conradt, and Bowker (1998) have proposed several principles to guide Web survey design to retain respondents, such as including a welcome screen, presenting questions in a traditional format, and providing specific instructions for computer actions necessary in answering each question. There is a lack of evidence as to the effectiveness of such principles. On the other hand, high drop-out rates may also be due to system or technical problems. Smith (1997) pointed out that servers and/or computer crashes very possibly frustrated and prevented survey continuation and completion. Technical troubles may arise when browsers are not equal in terms of their capacity to view Web pages, which may cause surveys to have a different appearance from respondent to respondent (Dillman, 2000), or may result in complications that prevent some individuals from even accessing the survey (Smith, 1997). In addition, slow page-loading also works as an impetus to high drop-out rates (Dillman et al., 1998).

Technological issues. Technological savvy is always an issue in the Web-based surveys. Even though the Internet coverage may be less of an issue for groups in universities, experience and comfort with Internet-based tools such as Web browsers is another serious potential source of bias both in response rates and the way people respond to the survey (Dillman, Tortora, & Bowker, 2001; Kaye & Johnson, 1999).
Web-based surveys also create challenges for researchers, such as incompatible networks or software, technologically cumbersome programs that made research design a lengthier process, multiple submissions, lack of computer skills, and concerns about response rates for this method versus more traditional methods (Daley et al., 2003; Dillman, 1998; Schimidt, 1997).

Although many of the problems mentioned in the section of uncontrolled sample (e.g., multiple submission) can be solved via careful programming and/or data cleaning by hindsight, not all the researchers are good at computer programming and thus delivering Web-based surveys become a very complicated task for them (Aoki & Elasmar, 2000; Stanton, 1998; Tuten, Urban, & Bosnjak, 2002). Involvement of computer tech-staff accordingly increases the survey expense. Sax, Gilmartin, and Bryant (2003) conducted a national survey of first-year college students to examine response rates across four modes of survey administration: paper-only, paper with Web option, Web-only with incentive, and Web-only without incentive. Based on their online administration procedures and experiences, they found that, although Internet-based surveys may be less expensive in the long run, the initial development costs can be quite steep. When the online response rate is very low, the investment can’t be justified.

Another major disadvantage of Internet-based survey methods has been the lack of anonymity (Daley et al., 2003). Concerns of privacy and safety of network surveys may affect survey participation (Chou, Chang, & Jiang, 2000). How to solve this problem technologically online is another issue in Web experimental study.
Section Summary

Internet surveys have been both hyped for their capabilities and criticized for their limitations. This section discussed advantages and disadvantages of Web-based surveys, with comparison to traditional methods. The advantages are presented as speediness, low cost, efficiency, uniqueness, and potentiality, while the disadvantages are listed as coverage of the Internet, uncontrolled samples, low response rates, and technical issues. Advantages and limitations of administering a survey on the Web are specifically addressed by Reips (2000) and Mertler (2002a, 2002b).

Nevertheless, Internet-based surveys do have advantages over more-traditional methods. Just as issues were raised about mail and telephone surveys when they were first introduced, many researchers and practitioners are trying to determine the best way to conduct Internet surveys to collect valid data (Schonlau, Fricker, & Elliott, 2002). There are no standard guidelines to direct what constitutes an appropriate Web-based survey setting and how researchers conduct online surveys. In particular, research in systematically examining effects of Web design of Internet surveys and rewards methods on participation are lacking.

Participation in Web-based Surveys

The Web survey participation includes the overall response rates, number of responded items, and time duration of completion. Because most existing Web-based studies focus on overall response rates and very little information about number of responded items and completion time are provided, this part of the review will highlight a picture of response rates in particular. Response rate is critical as to how representative the research data is and whether the research results can truly be generalized to other
subpopulations or the entire population. This review discusses surveys that primarily or exclusively used the Web as the response mode as well as those combined with traditional survey methods.

**Participation in the Web-mode Surveys**

Studies on the use of the Web primarily or exclusively as a survey mode vary widely. Most the studies examined participation by calculating overall response rates which include partial completes. It means that as long as an individual submits the survey, the submission is counted as one response, no matter how many items are not answered or answered.

Dillman et al. (1998) conducted a Web–based survey among the preselected purchasers of computer products. The study used two types of designs for the survey: one using a relatively plain Web design (no any decoration on the Web page), while the other using a relatively fancy design (some colors, graphics, etc. presented on the page). The overall response rate in the study was 38.5%.

Crawford, Couper, and Lamias (2001) conducted an online survey with an e-mail notification among University of Michigan students. Response rate, excluding partial completes, was 24 percent. Although the authors attributed the lower than expected response rates to competing activities, such as holidays and finals during the time of survey administration, there is no evidence that show these attributions equally affect participation rates of traditional surveys. Unfortunately, this study failed to provide details about number of nonresponded items, even though it computed response rate by excluding partial completes.
Schonlau, Fricker, and Elliott (2001) introduced two Web surveys which have very low response rates. The first one, titled as “Work/Life Balance Survey,” was targeted at office staff via the Web in early 2000. The second was directed at a random sample of college-bound high school youths and college students in 2001. The first survey consisted of slightly more than 80 questions about quality-of-life programs. Respondents in two geographically separate offices were initially contacted through an e-mail that contained a link to the survey Web site. The response rate arrived at 44 percent ultimately. The second survey contacted the sample by mail first to ask them to participate in a Web survey and used incentives and several follow-ups, one of which was a follow-up mailing including a mail survey. The overall response rate was close to 21 percent, of which Web responses was only 8 percent. These two studies only provided pictures of overall responses rates, but did not offer any accounts of item nonresponses and time duration of completion.

Cook, Heath, and Thompson (2000) conducted a meta-analysis of response rates in Web-based surveys. A total of 68 surveys in 49 studies were analyzed. A multiple regression was applied to predict response rates with some predictors. The mean response rate for the 68 surveys was 39.6%. The results indicated that Web response rate is lower than the average paper survey response rate.

Jones and Pitt (1999) sampled staff at 10 universities whose staff directories were available on the Web. They compared three surveying methods: contact and response by e-mail; contact by e-mail and response via the Web; and contact and response by postal mail. The overall Web response rate was only 19 percent, while the e-mail response rate
was 34 percent and the mail was 72 percent. Comparatively, the Web surveying in this study had the lowest response rate (19%).

Although the above studies showed that Web-based surveys have lower overall response rates than traditional mail method, the following research reported with the opposite findings. Schonlau, Fricker, and Elliott (2001) demonstrated four Web surveys separately in 1997, 1998, 1999, and 2000, which were conducted by the U.S. Census Bureau’s Computer Assisted Survey Research Office. The response rates are respectively 68%, 27%, 75%, and 89%. Although these surveys (except 1998) generated high response rates, their sample size were relatively small. The biggest sample size was 194 (the survey in 1999), the smallest one was 48 (1998), the other two are separately 50 (1997) and 73 (2000). Thus, it is hard to tell if the response rate results are reliable or not.

Couper (2001) conducted an experiment in which 7,000 students at University of Michigan were randomized to receive a survey about drug and alcohol use. A mail survey was sent to 3,500 potential respondents and the other 3,500 students were notified of an equivalent Web-based survey. Respondents in both groups received an incentive consisting of a $10 gift certificate. The Web-based survey achieved an almost 62 percent response rate, while the mail survey had a response rate of slightly less than 41 percent.

Cobanoglu, Warde, and Morco (2001) had even more successful results in employing Web surveying methodology. They conducted a study comparing mail, fax, and Web-based survey methods. Although the fax method was found the fastest, the Web was found to have the highest response rate (44.2%). Fax and mail were 17 percent and 26 percent, respectively.
In addition, there are a number of Web-based studies (for example, the study by Kaye & Johnson, 1999) that use convenience samples. Participants are often recruited through advertisements of some type. However, participation rates in these studies can not be calculated or are meaningless to investigate survey participation, due to unframed samples and no account of missing data (non-responded items). Although some studies mentioned in the section of Web survey disadvantages calculated the response rates by using the rates between link clicks and hits of submit-button, the response rates were found very disappointing, and ranged from .13% to .44%.

On the other hand, e-mail surveys may give us references and knowledge about response rates of Internet-based surveys, given that there is currently not much information on response rates of Web surveys. Several researchers (Couper, Blair, & Triplett, 1999; Schaefer & Dillman, 1998; Sheehan, 2001) have summarized the recent studies that compared response rates from e-mail studies to those from mail surveys of the same population. For all but one study, the e-mail surveys failed to reach the response rate levels of the mail surveys.

In all, although the above findings about response rates are inconsistent, Web research in most cases failed to reach the mail survey in terms of response rate. In addition, item responses and time duration of survey completion are very barely studied.

*Participation in the Mixed-Mode Surveys*

This section reviews research which utilized various methods of Web and traditional survey methods inclusively. These surveys provided their participants with options of the Web, mail, e-mail, or phone response mode.
Sax, Gilmartin, and Bryant (2003) conducted a national survey of first-year college students to examine participation across four modes of survey administration: paper-only, paper combined with Web survey option, Web-only with incentive, and Web-only without incentive. The nation-wide student samples were randomly assigned into one of four survey administration groups. The results indicated that paper-only administration yielded higher response rate (22%) than either Web-only with incentive (17.1%) or without incentive (19.8%). But, the paper format combined with Web survey option has the highest response rate, which was 24%. The total response rate in the study was 21.5%. Although the authors did not address in depth why Web-only option turned out much lower response percentages, the study gave a very clear picture of comparison of response rates between mail mode, Web mode, and mail with Web option mode. Especially, the study pointed out that the progress indicator employed on the computer screen probably resulted in drop-out effects when the survey was long. This statement implies that Web design considerations may influence response rates of Web-based surveys.

The study of Quigley, Riemer, Cruzen, and Rosen (2000) was conducted with three arms, two of which were mail-with-Web-option (the Web address was provided with the mail survey) and the Web-with-mail-option (a paper survey sent under request), the third was mail only. In the first study arm, the final response was 42 percent; among those who responded, 23 percent responded via the Web and 77 percent by mail. In the second arm, the overall response rate was 37%; among those who responded, 27 percent responded via the Web and 73 percent by mail; the final response rate was significantly boosted up to 37 percent after a mail survey was included with the third follow-up. The
mail-only study arm had an overall response rate of 40 percent. This study provides evidence that mail surveys generate higher response rates than the Web surveys.

Both Sedivi Gaul (2001) and Griffin, Fischer, and Morgan (2001) documented two US Census Bureau surveys: the American Community Survey and the Library Media Center Survey. Both of the studies allowed respondents to choose a Web or mail response mode. The response result of the American Community Survey (targeting at US households) conducted in 2000 showed that, with a sample size of 9,596, 95 percent of respondents chose to respond by mail, while only 5% responded via Web option. The Library Media Center Survey (targeting at librarians) was conducted twice, separately in 1998 and 1999. The 1998 survey (sample size 924) results showed that 95% librarian respondents answered by mail, while only 5% respondents responded via Web. The 1999 survey (sample size was 13,440) results identified that 81% librarian respondents answered by mail, while 19% respondents chose Web. Although the overall response rates increased from 38% to 63% across 1998 and 1999, the Web response rates were still low.

Bertot and McClure (1996) conducted a national survey for the National Commission on Libraries and Information Science (NCLIS) of public library involvement with the Internet. Each respondent could choose to complete their survey by paper-and-pencil or to answer the questions on a Web site. While most individuals used the paper-and-pencil format, many stated that they chose paper-and-pencil when they could not access the Web site. The reaction confirms the suggestion by Smith (1997) and Dillman et al. (1998) that technology can create response difficulties and then can ultimately affect drop-out effects and response rates. Findings in this study also
unintentionally answered a question from Schonlau, Fricker, and Elliott (2001): why some survey respondents choose traditional mail option instead of Web, even though they were also highly experienced Internet users.

Matz (1999) conducted a study to compare response rates of traditional paper and online methodologies. The study was administrated to academic librarians in North Carolina, which employing traditional mail, Web-based with e-mail notification, and Web-based with mail notification. Traditional mail survey was found with highest response rate, 43 percent; the Web-based survey with e-mail notification had 33 percent response rate; the Web-based survey with mail notification were 23 percent.

However, the results are mixed for some other studies. Zhang (2000) conducted a survey of researchers who were scheduled to have their papers published in library science journals. The respondents were initially contacted via e-mail, could respond via the Web or request a mail survey. In the third of three follow-ups, a paper survey was also sent by postal mail. The total sample size was 201. Ultimately, the total response rate was realized at 78 percent, of which 80 percent was via the Web while 20 percent by mail. Schleyer and Forrest (2000) conducted a 22-question survey about clinical practices among dentists. Its final response was 74% and among those who responded, 84% of respondents chose to respond via the Web.

Although studies that provide respondents with options to choose either a Web or postal mail response mode are not many, these studies are very important. On one hand, mail is an appropriate alternative mode when the fraction of respondents who can answer via the Web may not be sufficiently large. On the other hand, these studies may be able to motivate survey researchers to examine the reason of difference of response rates.
However, regarding response rates among the above studies, the Web mode fails to reach traditional modes. Tuten, Urban, and Bosnjak (2002) believe that “related to the issue of (lower) response rates in Web-based surveys, though, is the idea of mode preference on the part of respondents. In other words, response to Web-based surveys may be affected by preference for other modes of response, particularly in multi-mode studies” (p. 20).

Some other explanations are documented to account for the difference of response rates between Web and traditional mail modes. Couper (2000) listed three main reasons. One is that the previously tried and tested motivating tools, monetary incentives for example, used in mail surveys can not be implemented in the same way in Web surveys, and functional equivalents are yet to be developed and tested. There is at present little research literature on what works and what does not, in terms of increasing response rates to Web surveys. Many of techniques developed and tested over time to increase response rates in mail surveys (Dillman, 1978, 2000) may not work the same way in fully electronic Web surveys. The second possible reason for lower response rates could be that technical difficulties interacting with an Internet survey may discourage some from starting or completing the survey, such as low modem speed, unreliable connections, low-end browsers, incompatible browsers and hardware platforms, and varying levels of familiarity with the Web. The third explanation may be privacy and/or confidentiality concerns.

Section Summary

Studies on the use of the Web as a response mode vary widely. Review of past Web studies on participation with a focus on response rates uncovers inconsistent
findings. But most of the research on Web-based data collection indicates that Web response rates are lower than its traditional counterpart. However, very few studies addressed time duration of completion and issues of item nonresponses which may cause missing data errors.

Although some explanations for the difference in response rates between the Web and traditional mail method are provided, association between survey Web page design and participation are not addressed. A Web survey is loaded on the Internet and delivered as Web pages. Design considerations may be more important. Daley et al. (2003) state that design of a Web-based survey may influence participation rates. Dillman (2000) also suggested that Web survey response rate could be produced around 70% consistently for general public populations if careful attention is paid to design. Although the review of the published research uncovered overestimation of typical response rates, one of the reasons may be that most of the reviewed studies did not take design into full considerations when conducting Web-based studies.

How can Web surveys take advantages of design uniqueness to increase participation? The experimental examinations on association between survey Web design and participation is still lacking, with the only exception of Dillman et al. (1998). As our knowledge of how to design and implement Internet survey increases, all of these issues may well be temporary factors that are eventually resolved.

*Design Considerations of Web-based Surveys*

Several studies (Couper, 2000; Couper, Traugott, & Lamias, 1999; Crawford, Couper, & Lamias, 2000; Dillman et al., 1998, 1999; Dommeyer & Moriarity, 2000; Schonlau, Fricker, & Elliott, 2001; Smith, 1995) have started to pay attention to survey
Web design issues and suggest design as a solution to low participation concerns in Web surveys. Currently, the number of Web experiments on design issues regarding survey participation is very limited. Comparatively, considerations and guidelines on Web-based survey design and implementation are a growing body of documentation.

Experiments on Web Survey Design

The very first study on the effects of survey Web design is a comparison of the influence of plain (no any decoration on the Web pages) versus fancy design (some colors, graphics, etc., presented on the pages) on participation for Web surveys, which was conducted by Dillman et al. (1998).

Dillman et al. (1998) compared the effect of an elaborate or fancy versus plain format for a Web-based survey. The sample was drawn from a list of computer buyers who were then contacted by telephone and invited to participate in the Web survey. Participants were randomly assigned to a condition of plain or fancy format. The authors found that a “plain” survey resulted in a higher response rate (41 percent) while a “fancy” survey was associated with a lower response rate (36 percent), which is 5 percent lower than the “plain” survey. Further more, the plain group had higher completion rate (93.1%) than the fancy group (82.1%). Based on their findings, the researchers specifically point out that while fancy formats may entertain respondents, such formats also require more time in transmission and processing by browsers. When Web pages load slower and systems may crash, an individual participant may ultimately be discouraged from responding to a survey or to drop out, which directly affects response rates and causes missing data (in multiple-page designed surveys). The authors also indicate that while Web surveys utilizing the latest programming advances may be more
attractive and entertaining in order to acquire and retain respondents, the end result may be fewer usable responses.

This study has greatly broadened researchers’ knowledge of Web-based surveys. However, it neglects another type of Web page design which is between “plain” and “fancy”. This middle-type design (e.g., images appropriately and sparingly used on the screen) may have effect on participation rates. Research is needed to examine it. The following two studies have provided some degree of examination.

Daley et al. (2003) conducted a study to address risk-taking behaviors among college students by employing 2 established survey instruments. They found that the split-frame design for the instruction page, which would keep the instructions on the side of the page at all times, was successful in raising response rates and reducing probabilities of missing data; a solution in particular to the problem of administrating two independent survey instruments. They found in their two pilot tests that an external hyperlink linking the two instruments’ Web sites made navigation confusing for participants; adoption of a split-frame design for the instruction page was the solution to the problem. After their first pilot test, some changes were made, such as addition of background images and clip arts reflecting behaviors in the survey, changes of font style and color, and addition of digital photos of the initial investigators made the Web pages more attractive for college students. The response rates increased from seventy-five percent (75%) to ninety-seven percent (97%) from first pilot to the second. The authors suggest that it is essential to identify attractive images to enhance face validity of the survey and promote interests in the survey among college students. They also indicate that instructional technology (IT) personnel could have been helpful in designing and
operationalizing the Web pages and refinement of survey Web page design could foster higher participation and response rates.

Couper, Traugott and Lamias (2001) conducted a number of Web experiments of an existing survey among 1,602 students at the University of Michigan in order to examine the effects of three Web design features (progress indicator version and no progress indicator version, multiple items within common categories per screen and single item per screen, radio button and entry box). Eight different versions of the instrument were created reflecting $2 \times 2 \times 2$ experimental designs. The versions were randomly assigned to the 1,602 subjects in the sample. The results indicated that, as expected, the response rate in progress indicator version is higher than that in non progress indicator version. This indicated that a progress indicator reduces drop outs. In terms of the mean time to complete, the progress-indicated survey (22.7 minutes) is significantly higher than no progress-indicated version (19.8 minutes). The entry box produced more missing data (nonresponded items), but better response quality when answered, compared to the radio button. Unfortunately, the authors failed to compare the participation in the later two sections. However, Sax, Gilmartin, and Bryant (2003) found that progress indicator resulted in drop-out effects when the survey was long.

The above two studies by Daley et al. (2003) and Couper, Traugott and Lamias (2001) showed agreement with each other in terms of images. Both of them reported that if images in the Web survey are appropriately and sparingly used, they do help increase participation rates. Their reports indicated some inconsistency with the findings of Dillman et al. (1998). Nevertheless, both Daley et al. and Couper, Traugott and Lamias directed at a subpopulation of college students, while participants in the study of Dillman
et al. are purchasers of computer products. Whether the nature of population leads to different image preferences is unknown yet. On the other hand, studies of Daley et al. and Couper, Traugott, and Lamias were conducted five and three years respectively after Dillman et al. Internet speed at the time of Daley et al. and Couper, Traugott and Lamias is much faster than the time Dillman et al. conducted the study.

Web-based surveys have provided a variety of ways to construct response scales. They may look similar to those in paper-pencil studies, while they may also appear and function quite differently (Birnbaum, 2000). The following three studies present a picture of effects of response scale format on survey participation.

Reips (2002) conducted experiments on the WWW to investigate whether response scale characteristics of survey Web pages, such as a button scale, pop-up menu in close state, and pop-up menu in opened state, affect data collection on the Internet. The results were found that format characteristics of response scale in a Web survey don’t influence the answering behavior of Web participants.

What’s very interesting is that Couper, Tourangeau, and Conrad (2004) also conducted a similar study to examine effects of the three above different common response formats used in Web surveys. They found strong evidence that visible response options are endorsed more frequently, which suggested that visibility may be a more powerful effect on reducing missing data than primacy in Web surveys. The authors suggested that scrolling drop boxes (some but not all of the options are visible) should be avoided unless when the respondents must search a long list of response options (e.g., state or country of residence, make and model of car). The study results indicate that the response format used in Web surveys does affect the choices made by respondents.
Couper, Traugott, and Lamias (2001) did an experiment on the size of the entry box (radio button, short box and long box) with a sample size of 1,602 of University of Michigan students. The results of effect of entry format on item-missing data and invalid responses showed that radio button has 0% invalid responses, while the short entry box has 11.3% and the long entry box has 20.7%. However, as to effect of entry format on completion of task as requested, radio button has 50.9% completion rate, short entry box has 76.1%, and long entry box has 67.4%.

Among the above three studies, Reips (2002) found that design of response scale format in a Web-based survey has no influence on answer choice, while Couper, Tourangeau, and Conrad (2004) reported that it did affect respondents’ answers. Couper, Traugott, and Lamias (2001), from the perspective of response rates, indicated that different designs of response formats are associated with different overall response rates and item missing data. Although not all the above three studies were targeted at the effect of design on participation rates, all three studies provided evidence for the holistic approach to survey design suggested by Dillman (1978, 2000) and Fowler (1993) and proved the importance of consciously considering all contents or aspects of survey design.

In terms of the effect of multiple-page design or single-page design in a Web-based survey, some researchers did intended or unintended studies. These studies were not focused on response rates but the response behaviors. In the studies of Couper, Traugott and Lamias (2001) which is introduced in the above section, effect of multiple items within common categories per screen and single item per screen were also investigated. Multiple-item screens did not yield significantly different response from
single-item screens. Reips (2002) inadvertently found that a practical implication for single-page and multiple-page design of online surveys can lead to different answers. Fuchs (2001) provided some preliminary evidence that when multiple questions are placed on the same screen or all the survey items are on one single screen, respondents frame their response to one question in the context of the other questions, and some respondents appear to read ahead before answering the first question on the screen. Also, Fuchs (2001) identified some evidence that using a few screens for short surveys minimized respondents’ abandonment or drop-outs, whereas using a single screen and forcing the respondent to scroll down in long surveys increased abandonment.

It can be summarized that both Fuchs (2001) and Reips (2002) found that the multiple-page design has different effects on response behaviors than single-page design, while Couper, Traugott and Lamias (2001) found no difference between the two designs. Although the findings are quite inconsistent, these studies have broadened survey researchers’ attention to different design aspects and may influence researchers’ interest. Unfortunately, these studies failed to compare effects of page design on participation rates between the two different designs.

*Web Survey Design Guidelines*

Besides the cognitive text principles of paper-and-pencil surveys which are assumed to be applicable in Web-based surveys (Gräf, 2002; Reips, 2002; Mead & Drasgow, 1993), there are numerous unique design considerations in this survey mode. Design of a Web-based survey is a suggested factor that may affects response rates, although most studies focus on responses. On the Web, unlike on paper, the appearance of a survey can vary from respondent to respondent because of different browser settings,
user preferences, variations in hardware, and so on. Design may be much more important for Web surveys, not only because there are more tools available to the designer (color, sound, images, animation, etc.), but also because of variation in how these may be seen by respondents (Couper, 2000). Although Web experiments investigating effects of Web survey design on participation are very few, considerations and guidelines on how to appropriately design a Web-based survey are increasingly offered.

Regarding graphics in a Web-based survey, it is well recognized that, because of their large size, they can significantly slow the downloading of a Web page. This situation is even worse for users who are likely to connect to the Internet using a modem, as compared to those who use broadband, DSL (digital subscriber line), or some other high-speed connection. Slow downloads are likely to frustrate some respondents and thereby decrease response rates (Dillman, 2000; Dillman et al., 1998; Smith, 1997). It is then suggested to use graphics sparingly, or alternatively to provide the respondent with a choice of survey either with or without graphics (Schonlau, Fricker, & Elliott, 2002).

Gräf (2002) states that users “prefer seeing the information they need on the screen” (p. 61), they do not like screen scrolling, and therefore scrolling must be reduced to a minimum. He also believes that frame technology in particular must be avoided. Anything that requires extra effort on the part of the respondent diverts concentration from answering the question. He claims that changing from one question to another should be facilitated via the implementation of hyperlink and there should be a minimum of switching from keyboard entries to mouse entries. The level of maneuvering is recommended to be kept simplest on the whole.
Although there is no evidence to examine Gräf’s design suggestions so far, Schonlau, Fricker, and Elliott (2001) also agree with Gräf by stating that Web surveys should “list only one, or very few, questions per screen. Respondents do not have to scroll down to get to the new question. Excessive scrolling can become a burden to respondents and lengthy Web pages can give the impression that the survey is too long to complete, both of which have the potential to negatively impact response rates” (p. 42). With widespread high-speed connections, penalty of graphics on participation rates may decrease significantly as overall transmission speeds increase. New research is needed to investigate this aspect.

Several researchers (Couper, Tourangeau, Conrad, & Crawford, 2004; Couper, Traugott, & Lamias, 2001; Kenyon, Couper, & Tourangeau, 2001) with a focus on effect of visual design on data indicated that increasing addition of “humanizing cues” (e.g., images relevant or irrelevant to survey tasks) often maintain interest and reduce drop-outs, but may also affect the answers provided. This is consistent with suggestions from experimental research in human-computer interaction, that is, adding modest humanizing cues affects user’s performance on, and reaction to, the computer (Schaik & Ling, 2003). The addition of “humanizing cues” may help to increase social desirability effects, although the nature of self-administration of Web surveys may decrease it (Hancock & Flowers, 2003). It must be aware that the interplay between words and images, design and layout may affect answers, though the Web offers enormous potential for survey measurement such as visual content, randomization, self-administration, and interactivity.

Web surveying is assumed to be a friendly communication between researcher and respondents. The user-friendly design of the Web-based surveying instruments may
be extremely important in obtaining friendly response rates and results (Gaddis, 1998). Smith (1995) identified several instances of changes of unintentional physical layout of a Web survey which produce a difference in responses. User-friendly design for online surveys is highly recommended by research literature.

In the Web surveys, forcing answers is sometimes utilized to press respondents to answer a previous question or complete a previous section before they move to the subsequent questions. Respondents may become annoyed and give an arbitrary or deliberately false answer in order to proceed to the next screen or stop taking the survey altogether, which negatively impact response rates and response errors (Schonlau, Fricker, & Elliott, 2002). Forcing answers may help the researchers decrease missing data, but this advantage can not be justified with the possibility of increased unit nonresponse and/or decreased response rates (survey abandonment). Whether forcing answers is a friendly design in a Web-based survey or not is still awaiting examination.

Although the World Wide Web provides an enormous number of imaginative possibilities for constructing online questionnaires, it may, at the same time, present risks of making survey errors (Dillman, 2000). It implies that, the more complex and innovative a design, the more likely it is to be too complex for some participants to access the site. If a Web site has a level of technical sophistication that makes it difficult to gain entry to the survey, to download it, to complete it, or to submit results, the likelihood increases that participants will not become involved in the study. “Knowing that this lack of user friendliness was a possibility, creation of a relatively simple and technically uncomplicated design that was compatible with various operating systems
was essential” (Daley et al., 2003, p. 119). Flexible technical support should be available anytime during the participants answer surveys on the Web.

It is worth noting here that if the Web survey researchers and/or designers put considerable effort into carefully designing and extensively testing these instruments to make them as friendly as possible, the surveys can result in higher participation and response rates (Dillman, 2000; Couper, 2001). The Company Organization Survey and the Industrial Research and Development Survey instruments for the Web from the US Census Bureau (Nichols & Sedivi, 1998) involuntarily support the above suggestion. These two Web surveys were written completely in HTML and JavaScript. The program was designed to perform real-time branching and editing, opening in its own browser window with “help” information and edit capabilities built in. Respondents could partially complete the survey, close the application, and then return later to continue the survey. The instruments had a menu bar on the right side of the screen that permitted immediate access to any section in the survey, so respondents could choose to work through the instrument sequentially or jump around in any order they preferred. The response rates for the 1997 Industrial Research and Development Survey and the 1999 Company Organization Survey were 68 percent (68%) and 75 percent (75%), respectively. Although this study is not an intended experiment on effects of Web survey design, the user-friendly design characteristics embedded in the Web survey might contribute to the high response rates in some degree.

On another perspective, the context of a survey’s intended goal and audience should be taken into consideration when evaluating the appropriateness of a particular design. As Couper (2000) illuminated, “The design of a Web poll intended primarily as
entertainment might be quite different than one designed for scientific purposes. Similarly, the design of a survey on a Web site targeted at teenagers would likely have different design requirements than one aimed at older persons” (p. 476). Couper suggests that it is premature to use the notion of a one-size-fits-all approach in Web survey design. “The range of design options, the visual features, and the required respondent actions all differ. We have much to learn about what design knowledge and practice translates across media and what does not. There is much work to be done to determine optimal designs for different groups of respondents and types of surveys” (Couper, 2000, p. 476).

Suggestions for Web survey design are increasingly being documented. Criteria for Internet survey design are presented by several individuals (Andrew, Nonnecke, & Preece, 2003; Kaye & Johnson, 1999). Some important principles and guidelines were provided, both in general and in detail, on the design and implementation of user-friendly Web-based surveys (Dilliman et al., 1999; Schonlau, Fricker, & Elliott, 2002). The three criteria and eleven principles for designing respondent-friendly Web surveys provided by Dilliman et al. are listed in Table 2.1 and Table 2.2.
Table 2.1

The Respondent-friendly Criteria in Designing Web Surveys

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria 1</td>
<td>Respondent-friendly design will take into account the inability of some respondents to receive and respond to Web questionnaires with advanced programming features that cannot be received or easily responded to because of equipment, browser, and/or transmission limitations.</td>
</tr>
<tr>
<td>Criteria 2</td>
<td>Respondent-friendly design must take into account both the logic of how computers operate and the logic of how people expect questionnaires to operate.</td>
</tr>
<tr>
<td>Criteria 3</td>
<td>Web questionnaires should take into account the likelihood of their use in mixed-mode survey situations.</td>
</tr>
</tbody>
</table>

Table 2.2

*The Respondent-friendly Principles in Designing Web Surveys*

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>1: Introduce the Web questionnaires with a welcome screen that is motivational, emphasizes the ease of responding, and instructs respondents on the action needed for proceeding to the next page.</td>
</tr>
<tr>
<td>2: Begin the Web questionnaires with a question that is fully visible on the first screen of the questionnaire, and will be easily comprehended and answered by all respondents.</td>
</tr>
<tr>
<td>3: Present each question in a conventional format similar to that normally used on paper questionnaires.</td>
</tr>
<tr>
<td>4: Limit line length to decrease the likelihood of a long line of prose being allowed to extend across the screen of the respondent’s browser.</td>
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<tr>
<td>5: Provide specific instructions on how to take each necessary computer action for responding to the questionnaire.</td>
</tr>
<tr>
<td>6: Provide computer operation instructions as part of each question where the action is to be taken, not in a separate section prior to the beginning of the questionnaire.</td>
</tr>
<tr>
<td>7: Don’t require respondents to provide an answer to each question before being allowed to answer any subsequent ones.</td>
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<td>11:</td>
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Section Summary

Besides Dillman et al. (1998), there are a few empirical researches to date on the effect of various design decisions on participation in a Web survey. Not all of them focused on response rates and their findings are not consistent. None of them have studied effect of screen-scrolling necessary single-page design and none-or-minimum screen-scrolling multiple-page design on survey response rate. Suggestions and guidelines on Web survey design are already documented in literature. Most researchers recommended the none-or-minimum screen-scrolling design for Web surveys. There is gap between the recommendation and real-life experiments. On the other hand, since the Web continues to develop and new tech-possibilities occur, what Web survey technology can create and what some respondents can easily access and answer may present a gap (Dillman et al., 1998). Research is needed to determine scientific standards on designing and implementing Web-based surveys.

Contact and Reward Methods in Web-based Surveys

Studies on the use of the Web as a response mode vary widely in terms of how respondents are contacted, reminded, and motivated with rewards. Whether different contact methods and incentive techniques have effects on participation in Web surveys is another aspect which needs attentions.

Contact Methods

How survey participants are contacted is an important aspect in the whole surveying process. Sills and Song (2002) believe that the e-mail invitation plays a disproportionately important role in eliciting responses to a Web survey. Unlike mail
invitation, the respondents with e-mail invitations have the opportunity or access to review the content, length, and design and make a decision to participate in or not. Solomon (2001) indicated the following:

E-mail offers one option for distributing Web-based surveys. Combining an e-mail invitation letter as a means of contacting sampled people with the use of an HTML form for data collection provides an especially effective and efficient approach to Web-based surveys. Modern e-mail packages automatically convert universal resources location (URLs) or Web addresses in the text of an e-mail into active hyperlinks. Placing the URL of the survey form in a cover letter e-mail allows the respondent to click their mouse on the URL to display the survey forms and subsequently fill it out”. (Introduction)

Madge and O’Connor (2003) believed that one reason resulting in that online surveys often have lower response rates than traditional surveys is that online users are intolerant of unsolicited communications and invitations to participate in research (increasingly considered “spamming”). Taylor (2000) also warns that unsolicited invitations for participation may seem like spamming and result in lower participation. The above statements imply that inappropriate contact modes may irritate survey sampled respondents and discourage them from participating in the survey.

After a Web survey is in the field for a certain time, follow-up contact may be needed to remind the nonrespondents to participate in the survey. When emphasizing the effectiveness of follow-up notices sent by e-mail to survey nonrespondents, Kittleson (1997) asserted that follow-up reminders would approximately double the response rate for electronic surveys. Cook, Heath, and Thompson (2000) conducted a meta-analysis of
factors influencing response rates in Internet-based surveys. They found that three distribution factors (follow-up e-mail contact with nonrespondents, personalized contacts, and precontact: contacting sampled people prior to sending out the survey) were highly associated with higher response rates. They also found that when the number of reminder notices reached a certain large level such as eight or more, response rates may not be appreciably affected, in fact that a slight decrease among those receiving the largest number of reminders has been observed.

Sax, Gilmartin and Bryant (2003), after their study, reported that although e-mail reminders are much easier to distribute than are postcard reminders, ease of distribution doesn’t guarantee effectiveness, nor do multiple e-mail reminders always appeal to students. Unfortunately, they fail to identify beyond what range multiple e-mail reminders lose appeals.

Review of literature on contact methods in particular generates mixed findings. Although e-mail invitation is believed an appropriate contact mode, unsolicited invitations may result in lower participation. E-mail follow-ups are reported as an effective way to increase response rates. But beyond a certain range, response rates may not be appreciably affected. It seems that contact method can influence response rates, depending how appropriate it is.

Incentives and Lottery

In order to attract survey sampled subjects, incentives are often techniques suggested to increase survey participation. It is also reported that the use of incentives on the Web have been successful in maximizing completion rates for surveys, along with prescreening, personalization, and reminders (Davis, 1997).
After their study, Dillman et al. (1998) addressed the effectiveness of techniques for increasing response rates to Web-based surveys by including an incentive technique, even though their study can not draw conclusion about the effectiveness of incentive technique because the variable was not part of the study’s experimental design (all respondents received incentives). Daley et al. (2003) did not use incentives in their study either. But, they suggested that incentives may need to be developed in order to recruit and encourage participation because as the uniqueness of online surveys begins to erode, interests and rates of participation may decline.

After surveying librarians by using Web-based and print-based questionnaire concerning the use of Web-based questionnaire for survey research, Bertot and McClure (1996) found mixed results both in favor for and in opposition to further Web-based survey research. They recommended that inducement or rewards are appropriate for Web responses.

Recommendations of incentives to Web surveys are growing. Porter and Whitcomb (2003) found that the use of incentives (especially the lottery) is one popular method for increasing response rates in student surveys after conducting a short Web survey to ask institutional researchers about their use of lottery incentives by.

However, the findings of experimental studies are uncertain. Based on their online administration experience conducting a national survey among first-year college students, Sax, Gilmartin and Bryant (2003) pointed out that, although they applied incentives in their online study, the results demonstrated that the Web survey without incentives had even higher response rate (19.8%) than those with incentives (17.1%). Unfortunately, their study did not address this incentive issue in detail.
Prepaid monetary incentives consistently exert the largest positive effect on response rates in mail surveys (Porter & Whitcomb, 2003). Although it is impossible to include prepaid monetary or material incentives with an e-mail notice for a Web-based survey when researchers move from paper to electronic format (Couper, 2000), Bosnjak and Tuten (2003) made prepaid monetary incentives possible in a Web survey, with the help of new Web-based services which can transfer money to people online. The authors tested if this really has the same positive effect on response rates as shown in traditional mail surveys. They conducted an experiment in the context of a Web-based survey among members of a professional association in Virginia. The results indicate that prepaid incentives in Web surveys seem to have no advantages concerning the willingness to participate, actual completion rates, and the share of incomplete response patterns when compared with postpaid incentives. The authors reported that postpaid incentives show no advantages over no-incentives. Finally, compared to no incentives, prize drawings increase completion rates and also reduce various incomplete participation patterns.

Cook, Heath, and Thompson (2000) conducted a meta-analysis of 49 studies and found one particularly interesting result. The use of incentives in Web surveys actually seemed to be associated with more homogeneous and lower response rates. It is uncertain if this result of incentive use can be generalized to Web-based survey as a whole because the factors (such as populations, the way of implementing incentives, and so forth) in the limited 49 studies included in the meta-analysis are not consistent. Groce-Niehoff (2002) conducted an experimental study on the effect of a lottery among Ohio State University students and found that there was no statistically significant difference in response rates between the control group and the experiment group.
The recipients of prepaid incentives may feel obligated to respond to the survey and then prepaid incentives are believed to increase the survey response rates. The lottery incentives may be not working like the prepaid incentives due to the too-diffused benefits. Porter and Whitcomb (2003) conducted a controlled Web experiment to test the effect of lottery incentives by using a prospective college applicant Web survey. The overall response rate was 15.2% among 9,305 high school student sample. There were no significant differences between the control group and the experiment group. This study provided empirical evidence for the use of postpaid incentives in general and lottery incentives in particular. This result may not be generalized to college students because the studied population is still not a college student population, but prospective college applicants (seniors in high school). These two populations may have different price sensitivities and ideas of research participation.

Negative findings of particular interest are also indicated by an experimental study by Tuen, Bosnjak, and Bandilla (1999). They found that the share of unit nonresponse (complete miss of a survey unit) is significantly higher when the chance to win a prize is offered as opposed to cases where the motivation to contribute to scientific research (intrinsic motivator) is addressed.

Many authors (Briggs & Hollis, 1997; Cheyne and Ritter, 2001; Tuten, Bosnjak, & Bandilla, 1999) note that intrinsic appeals in banner ads generated higher click-through rates to a Web survey than incentives (like prizes) in an extrinsic appeal banner ad, even though the overall response rates are still low.

The results are mixed in Frick, Baechtinger and Reips (1999). They conducted an experiment on the effect of incentives on responses. They concluded that the chance to
win prizes in a lottery resulted in lower drop-out rates than in those conditions where no prize drawing was offered as an incentive.

Bosnjak and Batnic (2002) conducted a preliminary online study with an open-ended response format to elicit motives for participation in online surveys. Twenty-five participants responded to the survey published within the CompuServe online service in one of the Internet-related discussion forums. Material incentives were found as top motivators, followed by other three intrinsic motivators (curiosity, self-knowledge, and contribution to research). The results also indicated that scientific online surveys are more accepted than those for business purposes.

The technique of incentives is hypothesized as a means to increase response rates. The extensive survey research literature on postpaid and lottery incentives indicates they have little or no impact on Web survey response rates (Bosnjak & Tuten, 2003; Cook, Heath, & Thompson, 2000; Groce-Niehoff, 2002; Porter & Whitcomb, 2003; Sax, Gilmartin & Bryant, 2003; Tuen, Bosnjak, & Bandilla, 1999). The findings of non-significant differences are mixed by two other studies which found incentives did help with increasing response rates. As stated by Smith (1997), inducement and incentives for Internet research participation relative to traditional motivators deserve further scrutiny and systematic review.

Section Summary

Review on contact methods illustrates mixed findings for e-mail invitations and follow-up reminders, as well as for the use of incentive techniques. Further experiments are needed to examine the effects of reward methods and e-mail contact methods.
A growing stream of literature is developing to assess the effectiveness of Web-based surveys as a data collection method. Strengths and limitations of using the Web to conduct research surveys have been reviewed in the first part of this chapter. Web-based surveys do have advantages over more-traditional survey methods. It is unquestionable that the Web will play an enormous role in the future of survey research. However, the Web also offers risks and challenges for researchers.

Web-based surveys have lower participation rates than their traditional mail counterparts in most cases of research, although the findings about response rates are mixed and they may be due to population effects. Such studies do not address effects of survey Web page design on response rates and item nonresponse issues. Rather, most of them tend to compare Web and paper surveys in terms of response rates, ways of answering survey items, and the demographic characteristics of respondents (Sax, Gilmartin, & Bryant, 2003). As such, Web-based surveys are still less understood in terms of how to improve participation from the perspective of survey Web page design, particularly such as single-page or multiple-page design. More research is needed.

Review of literature uncovered a growing suggestion that page design of the Web survey instrument plays an important role in this electronic self-administrated format. Although there are no standard guidelines for Web survey design yet, most researchers consistently recommended the none-or-minimum screen-scrolling multiple-page design, instead of screen-scrolling necessary single-page design, for Web-based surveys. However, to date, little empirical work about the effect of optimal design of single-page or multiple-page on participation has been fielded and published. How the survey Web
page particularly in single-page or multiple-page design affects participation has little explanation.

It is important to note that design may interact with reward methods (such as incentives or lottery), the type of Web survey being conducted and the population at which the survey is targeted. Many articles cited previously indicated that Web page design and reward techniques (e.g., incentives) may improve participation in Web-based surveys. These tools (variables) have not been systematically investigated, but only in dichotomy. In order to determine practical guides for the design and implementation of Web-based surveys, these tools should be systematically examined. With this in mind, the goal of this study was to systematically explore whether or not factors such as single-page vs. multiple-page design by no-incentive, incentive, and lottery reward affected college students’ participation of response rates, item responses, and time duration to complete a survey in a Web-based survey.
Chapter 3: Methodology

Research Design

In spite of greater application of the World Wide Web as a tool in research, systematic studies on the effect of single-page vs. multiple-page design and reward methods on participation by college students are still lacking. The research questions were proposed as below:

1. A: Is there significant difference of the submitted response rates between single-page and multiple-page design?
   B: Is there significant difference of the submitted response rates among the no-incentive, incentive, and lottery methods?
   C: Is there is significant relationship between the survey Web page design and reward method in terms of the submitted response rates?

2. A: Is there significant difference between the single-page and multiple-page design on the time duration to complete a survey in the submitted surveys?
   B: Is there significant difference among the three reward methods on the time duration to complete a survey in the submitted surveys?
   C: Is there significant interaction effect between survey design and reward method on the time duration to complete a survey?

3. A: Is there significant difference between the two types of survey Web page design on the number of answered items in the submitted surveys?
   B: Is there significant difference among the three reward methods on the number of answered items in the submitted surveys?
C: Is there significant interaction effect between survey design and reward method on the number of answered items in the submitted surveys?

In order to examine the effect of Web page design in Web-based surveys on participation, two experimental conditions of design for a single survey were implemented. One condition was a single-page design format (see Appendix A) with screen-scrolling necessary, while the other was a multiple-page design format (see Appendix B) with none-or-minimum screen scrolling. An identical survey was delivered separately by these two different Web page designs. In order to get a helpful observation of participation in the surveys, three reward methods (no-incentives, incentive, and lottery) were implemented to convince sampled subjects to visit the Web pages and participate in the survey.

Participants were first randomly split into either single-page design or multiple page design. Afterwards, participants in each design were randomly assigned, according to the three reward methods, into no-incentive group, incentive group, and lottery group. Participants were randomly divided into six sub-groups in this study: single-page design with no-incentive, inventive, and lottery; multiple-page design with no-incentive, incentive, and lottery. Participants in the no-incentive group participated in the Web-based survey, but no rewards were offered. Participants in the incentive group were provided an online reward after submitting the survey. The online incentive reward was a simple but very interesting game (see http://www.funny-games.biz/home-run.html). The game was free online. After the participants clicked the “Submit” button, a link would be provided on a new screen. By clicking the link, the participants would be able to play the
game. However, the email invitation sent to the incentive groups didn’t reveal what kind of incentive it would be, but only motioned an online reward ready for them once the participants submitted the surveys. Participants in the lottery group would have a chance to win one of the five lottery prizes, which were five Flash Memory Devices (USB drives with 512 Megabytes). The email invitation described the above lottery information. The lottery participants were asked to enter their e-mail addresses at the end of the survey for lottery contact purpose. The five lottery winners were randomly drawn from the list of recorded e-mail address of respondents in the lottery group. The lottery winners were notified by the e-mail addresses they provided when completed the survey. All the six groups received an e-mail invitation with a hotlink to access the survey Web site (see Appendix C to Appendix H).

The study focused on whether participation in a survey which was alternatively designed in single-page format and multiple-page format were different across the reward methods and whether interaction exists between survey page design and reward method. Only the submitted surveys were studied on participation.

**Operational Definitions of the Variables**

Based on the research hypotheses, there were two independent variables and three dependent variables:

**Independent Variables**

1. **Web page design of a Web-based survey.** This independent variable had two levels: single-page design vs. multiple-page design. The contents of questionnaires in the two Web surveys are exactly identical, but they are delivered in two different types of Web page designs.
2. Reward method of a Web-based survey. This independent variable had three groups: no incentives, incentives, and lottery. They are used to investigate whether or not they are helpful to increase participation in a Web-based survey.

**Dependent Variables**

1. Response rates. Response rate was measured by distribution of counts of responses. They were counted only by the submitted surveys.

2. Time duration to complete a survey. It was the time span from the time point when a participant accessed the survey by clicking the survey hotlink in the email invitation to the time point when the participant submitted the survey by clicking the “Submit” button at the end of the survey.

3. Number of answered items. This dependent variable was the number of answered items in a submitted Web-based survey by a potential participant.

**Identification of Population**

Since the World Wide Web is the required platform for Web-based survey delivery, Internet and computer access are essential for participation in a Web-based survey. It is recognized that in term of Internet and computer access, universities in America are a highly Internet facilitated environment. Ohio University is certainly one of them. Computers connected with Internet at Ohio University are available for student access in various places. There are 56 computer labs for students at Ohio University Athens campus, which covers all the departments with 1161 computers connected with
Internet (Campus computing labs, 2004). Every room in Ohio University residence halls has a computer with Internet access. Also, all buildings and some main outdoor areas at Ohio University Athens campus have wireless Internet access. Any student with a wireless laptop can get online on campus.

In addition, the subpopulation being studied (college students) is generally thought to be more computer literate than many other population segments (Daley et al., 2003). Internet and computer-based communication technology predominates in university settings. With the application of information technology in the curriculum at Ohio University and the increasing amount of time spent on the Web by students, the difficulties in Web exploring is becoming less and less of an issue.

The population of this study was part-time and full-time undergraduate students who were enrolled on Athens campus at Ohio University in fall quarter 2005-2006. College undergraduate students due to their large number are usually a heavily surveyed population in higher-education research. Studies on their participation in Web-based surveys are becoming very important. The most recent data from Ohio University demonstrated that the total number of students for the academic year (Winter 2004) was 18,857, among which 15,880 were undergraduates and 2,977 were graduate students. The number of undergraduate students is over five times than that of graduate students (Ohio University Institutional Research, 2004).

Sampling Plan

Given the previous description of the general target population, a MS Excel version list of names and email addresses of undergraduate students on Athens campus enrolled in fall 2005-2006 was requested from the Office of Institutional Research at
Ohio University after the study obtained permission from the Ohio University Institutional Review Board (IRB). The researcher utilized a random-sample strategy. Random samples are also called probability samples. By this strategy, the probability of an individual being selected can be determined. Probability sample from an organization maintaining lists of their members in some type allows for contacting potential survey respondents via e-mail (Schonlau, Fricker, & Elliott, 2002). This provides the capability to easily conduct a Web-based survey in particular.

The researcher utilized one of the random functions embedded in Microsoft Office Excel 2003 to randomly select the framed sample. The function randomly generated a number for each sample in the list and the randomly generated numbers were listed in a new column. Then the column of e-mail addresses, the column of names, and the column of randomly generated numbers were sorted together increasingly based upon the randomly generated numbers. The framed sample was selected from the beginning of the sorted list. Thereafter, the selected samples were randomly split to single-page or multiple-page design, half by half in each design. By employing the random function in MS Excel again, all the participants in the each design were randomly assigned into the three different incentive groups: the no-incentive group, the incentive group, and the lottery group. Accordingly, the study had six cells.

According to Lipsey (1990), the sample size is statistically determined by the desired statistical power, significance level, and the effect size. “Statistical power is defined as one minus the probability of a Type II error, and it is the probability that you will detect an effect that is really there” (Light, Singer, & Willett, 1990, p.191). Since there was no consensus about the power a study should routinely adopt, Light, Singer,
and Willett recommended at least moderate power, between .70 and .90 for study design. The typical desired power for most of the social studies is determined to be at least .80 (Murphy & Myors, 1998). This study used .86 as the statistical power. All the hypotheses were tested at the .05 level of significance. Regarding the effect size, there is a lack of research on the difference of effects of different Web page designs of a Web-based survey on survey participation. Based on this situation, this study assumed a medium effect size in order to strike a balance between the detection of small effects and large effects.

The sample size of this study was determined based on the three factors mentioned above and Cohen’s convention of statistical power (Cohen, 1987), as well as consulting with the software of SamplePower. Thus, a total sample size in two by three ANOVA was estimated at 360 and each cell size was expected at 60. At the same time, based on the reviewed studies, the approximate response rate in a Web-based survey has been decreased since the late 1990s. In order to reach a sufficiently large sample size with the reviewed Web response rate in mind, the randomly selected framed sample was 6,000.

Instrumentation

Since a Web-based survey is delivered on a Web page and this study focuses on the effects of two types of Web page designs of a Web-based survey on survey participation, the instruments in this study included two parts: a survey questionnaire itself and two experimental conditions of Web page designs for the survey. The researcher chose an existing questionnaire and developed two types of Web page designs
(single-page design and multiple-page design) that attempted to cover all the considerations and attempted to give answers to the research questions.

Selection of the Survey Instrument

First of all, an existing survey relevant to computer, e-mail, and the Web and Internet was chosen by the researcher via library search, based on its topic and its internal consistency. The questionnaire scale is titled as “Internet Fluency”. It was developed and verified by Bunz and Sypher (2001). The purpose of the scale is to access university students’ perceptions and use of the computer, e-mail and the World Wide Web and the Internet. The original survey includes 77 items. It is mainly consisted of 69 items in five-point Likert scales, as well as 8 demographic and open-ended questions.

The Internet Fluency scale was developed throughout three major steps, pilot study 1, pilot study 2, and study 3. The two pilot studies through convenience samples generated very high overall internal reliability, $\alpha = .92$ and $\alpha = .96$ respectively. Bunz and Sypher (2001) reported that alpha coefficients of all subscales showed high internal subscale reliability and results from the principal-components factor analysis and correlations showed strong validity for the total scale. After the two pilot studies, the scale items were modified and expanded to a larger variety and different difficult levels. Thus, a third study was conducted to test the Internet Fluency scale from a more varied population. The overall internal reliability for the entire fluency scale in the third study was high ($\alpha = .89$), even though it was lower than the pilot studies, but still high enough. Correlations between the subscales and the total scales were high at the .85 level ($p < .01$), which showed strong validity for the total scale. The present study adopted the scale items which Bunz and Sypher developed for their third study.
The nature of the instrument might affect the response rate, number of answered items, and time duration to complete a Web survey. Since all the participants received the same questionnaire and all the participants were randomly selected and also randomly split into six groups, what would make difference in survey participation would be the design and reward method, not the questionnaire instrument.

Two Experimental Conditions of Designs

After the survey was selected, two Web page design experiments were developed to deliver the survey. Based on the reviewed general suggestions and recommendations for Web survey design, both of the Web design experiments were presented in simple formats. The two conditions had the same background color. No audio or video design was added to either of the two conditions. Since the study was initiated to study difference of survey participation between the screen-scrolling necessary single-page design and the none-or-minimum screen-scrolling multiple-page design, the two design experiments were single-page design and multiple-page design.

The single-page design displayed all the questionnaire items on one single page/screen with screen-scrolling necessary. Survey participants had to scroll the screen up or down to see all the items in the survey. The multiple-page design displayed the survey items in separate screens/pages (some pages had multiple items within common categories per screen and others had a single item per screen) in order to make the screen scrolling into none or minimum. In the multiple-page design, participants can go back to view or change the previous questions by clicking “Back” button on the browsers menu bar and move forward by clicking “Continue” button at the bottom of each page. There were 17 pages in total. Meanwhile, the multiple-page design had a progress indicator
designed and implemented at the bottom of each screen to show survey progress information. Individuals were not able to conclude the exact number of questions left in the survey during participation (to minimize any negative effect caused by survey length) which concerned researchers (Couper, Traugott, & Lamias, 2001; Dillman et al., 1998; Schonlau, Fricker, and Elliott, 2001). If the participants quitted from surveying in either single-page or multiple-page design, they couldn’t pick up the survey where they left off and they had to start the survey from the beginning.

Based on suggestions from Gräf (2002), the both types of survey Web page designs were focused on a minimum standard for screen size (640 × 480) to allow respondents with smaller monitor to participate in the survey. According to suggestions from Schonlau, Fricker, and Elliott (2002), forcing answers were not adopted in either design.

The participants would see the introduction page at first once they accessed the survey Web sites. This page showed a brief surveying instruction, assured privacy/confidentiality concerns, and included the researcher’s contact information in case the participants needed it. After reading the general instruction pages, participants were asked to type their names underneath the consent form and clicked the “Agree” button, as an indication that they agreed to participate in the Web experiments and submitted their consent form online, to start the surveys. All the names which were typed into the text box were recorded into a database. By comparing the recorded names to the names in the framed sample, two follow-up reminders were sent to the participants who hadn’t responded yet.
All the Web survey participation was automatically written to a corresponding database in the Web server, which was created respectively for the single-page and multiple-page design across the no-incentive group, incentive group, and lottery group. The data were directly converted into Excel files. In addition, the Web server tracked the survey Web page visit, drop outs (limited to the multiple-page design), and the time points of accessing and submitting the survey to calculate the time duration to complete a survey. The information could be helpful to improve future survey instruments.

**Pilot Study**

After the instruments were determined and refined (some type errors were found in the survey), a pilot study was conducted to check survey items and ensure the instruments were clearly understood. A convenience sample of undergraduate students, who took the EDCT 203 courses (Application of Computer Technology in Education) in winter and spring quarter of 2004-2005 in College of Education at Ohio University, were recruited from EDCT 203 instructors with lists of names and e-mail addresses. The total sample size was 228. Each participant received an e-mail invitation with an active link to a survey Web site that was intended to be identical to the e-mail invitation used in the actual study.

**Procedures of the Pilot Study**

Since the subpopulation in this study was different from the subpopulation when the survey was previously fielded, appropriateness of the survey needed to be verified. First of all, the researcher e-mailed the URLs of the Web surveys to 10 graduate students and 3 faculty members in Instructional Technology program at Ohio University to collect as much information as possible to verify and determine the clarity and appropriateness
of questionnaire items. Some peer views were also sought for the clarity and appropriateness of the items from graduate students. With their feedback, one of the original definitions of 5-point Likert scales for item 6-10 and item 57-77 were modified (“once a month” was changed to “less than monthly”); the question of item 14 was refined from “which of the following have you done?” to “which of the following have you experienced?”. Based on the recruited suggestions, one additional piece was added to the pilot study to ask which college the participants were in. Thus the total items in the current scale were 78 (the original scale had 77 items).

An extensive test was done to ensure that the two types of survey Web page designs work with multiple Web browsers such as Internet Explore, Netscape, FireFox, and Mozilla on different platforms such as PC and Macintosh.

After the instruments were refined, the researcher started the step to field the pilot study. The convenience sample of 228 undergraduates was randomly split into the six groups by single-page design and multiple-page design and by the three reward methods: no-incentive, incentive, and lottery.

The e-mail invitation was sent to the samples to invite participation. The invitations also indicated that participation was voluntary. All the e-mail invitations were sent with a hotlink to the survey Web site. The e-mail invitations to the incentive and lottery groups included information about online incentives (a free online game) and one lottery prize (a USB drive with 512 Megabytes), respectively.

The total submitted responses were 64 out of 228, which generated a response rate as 28 percent (28%). Among the 64 total responses, the single-page design received 33 responses covering 52 percent (52%) of the total responses, while the multiple-page
design had 31 responses achieving 48 percent (48%) of the total response. Across the reward groups, the no-incentive group with 17 responses had 26 percent (26%) of the total responses, the incentive group with 28 was 44 percent (44%) of the total response, and the lottery group with 19 was 30 percent (30%) of the total. A summary of data across design and reward method was displayed in Table 3.1.

Table 3.1

*A Summary of Submitted Responses in the Pilot Study*

<table>
<thead>
<tr>
<th>Reward Group</th>
<th>No-incentives</th>
<th>Incentives</th>
<th>Lottery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-page</td>
<td>8</td>
<td>15</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td>Multiple-page</td>
<td>9</td>
<td>13</td>
<td>9</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>28</td>
<td>19</td>
<td>64</td>
</tr>
</tbody>
</table>
The mean time duration to complete a survey design was 428.70 seconds (7.15 minutes) in the single-page and 719.97 seconds (12.00 minutes) in the multiple-page design. Among the three reward groups, the no-incentive group had 755.59 seconds (12.59 minutes) of mean time duration to complete a survey, the incentive group had 563.68 seconds (9.39 minutes), and the lottery group had 412.53 seconds (6.88 minutes). A summary of mean time across design and reward method was displayed in Table 3.2.

Table 3.2

*A Summary of Time Duration to Complete a Survey in the Pilot Study*

<table>
<thead>
<tr>
<th>Reward Group</th>
<th>No-incentive</th>
<th>Incentive</th>
<th>Lottery</th>
<th>Total Mean in Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>8.02</td>
<td>7.40</td>
<td>6.07</td>
<td>7.15</td>
</tr>
<tr>
<td>Single-page</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple-page</td>
<td>16.66</td>
<td>11.70</td>
<td>7.78</td>
<td>12.00</td>
</tr>
<tr>
<td>Total Mean in Reward</td>
<td>12.59</td>
<td>9.39</td>
<td>6.88</td>
<td></td>
</tr>
<tr>
<td>Total Mean</td>
<td>9.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The Mean time was calculated by minute
In terms of number of answered survey items, the mean number of answered items in single-page design was 74.7, while the multiple-page design had 73.2. The no-incentive group had mean number of answered items of 72.6, the incentive group had 73.7, and the lottery group had 75.7. The data across design and reward method were displayed in Table 3.3

Table 3.3

A Summary of Number of Answered Items in the Pilot Study

<table>
<thead>
<tr>
<th>Reward Group</th>
<th>No-incentive</th>
<th>Incentive</th>
<th>Lottery</th>
<th>Total Mean in Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-page</td>
<td>76.5</td>
<td>72.4</td>
<td>76.7</td>
<td>74.7</td>
</tr>
<tr>
<td>Multiple-page</td>
<td>69.1</td>
<td>75.2</td>
<td>74.6</td>
<td>73.2</td>
</tr>
<tr>
<td>Total Mean in Reward</td>
<td>72.6</td>
<td>73.7</td>
<td>75.7</td>
<td></td>
</tr>
<tr>
<td>Total Mean</td>
<td>74.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reliability Results

In this study the questionnaire was used as a tool investigate effects of survey Web page designs on survey participation measured by response rates, number of answered items, and time to complete the survey. The data of the survey itself were not the focus in this study. Although the selected survey questionnaire was fielded in the past and its reliability was already proven high, the nature of different subpopulation may affect its reliability in a new study. After pilot data were collected, a Cronbach (α) reliability was used for item analysis. With exclusion of 5 demographic items and 4 non-five-point-likert questions, the Cronbach (α) reliability was computed as .86 based on the data of the pilot study. This result is very similar to the former study by the instrument authors. A few items on this scale scored poorly, however, it was decided to keep these items due to the fact that the general reliability was high and this study didn’t use the data of survey itself, but focused on survey participation (response rate, time duration to complete a survey, and number of answered items). The pilot study reliability analysis result was displayed in Appendix I.

Statistical Results

Because of the insufficient data for ANOVA, only two preliminary single Chi-Square (χ²) Tests were run on the distribution of submitted response by the two variables, design and reward method, to assess the functionality of the statistical procedure.

A single Chi-Square (χ²) test was run to investigate if there was significant difference of distribution of submitted responses between the single-page and multiple-page design. The statistic results indicated that there was no significant difference between the single-page design and the multiple-page design, χ² (1, N = 64) = .063, p >
Another single Chi-Square test was run to investigate if there was significant difference of distribution of submitted responses across the three reward groups. The results indicated that there was no significant difference across the no-incentive, incentive, and lottery group, $\chi^2 (2, N = 64) = 3.219, p > .05$. Utilizing the Chi-Square criterion, it was determined that counts of responses were not proportionally distributed between the two designs and among the three reward groups.

Data Collection Procedures

After the study obtained permission from the Ohio University Institutional Review Board (IRB), the researcher requested an MS Excel-formatted list of names and email addresses of undergraduate students who were enrolled on Athens campus in fall 2005-2006 from the Ohio University Office of Institutional Research. The samples in expected size were randomly selected from the requested list. After the subjects were selected, they were randomly split into single-page and multiple-page design, half by half. The potential participants were then randomly assigned to three different reward groups according to the three reward methods: no-incentives, incentives, and lottery.

The data collection was conducted over a one-month period starting from the October 4, 2005 to November 4, 2005. The first e-mail invitation with a hotlink to the survey Web site was sent, on October 4, 2005, to the potential participants in the six groups requesting them to participate in the Web-based survey. A follow-up reminder was sent on October 12, 2005 to the participants who had not responded yet. A second follow-up reminder was sent on October 25, 2005 to encourage those participants who hadn’t responded yet. The data collection was ended on November 4, 2005.
Data Analysis Procedures

This study focused on investigating the effect of Web page designs (single-page and multiple-page) and reward method (no-incentives, incentives, and lottery) of a Web-based survey on participation. Based upon data collection, descriptive statistics for all independent and dependent variables were computed and illustrated.

All the data analysis procedures were implemented by using the Statistical Package for Social Science (SPSS) program in the 13.0 version. The main effects of both of the independent variables (Web page design and reward method) were examined and analyzed as well as the interaction between the two of them. The significance level of $\alpha = .05$ was applied to test all the hypotheses in this study.

In order to determine whether or not differences between two types of Web page designs and among different reward groups, as well as the interaction effects, existed on Web survey participation regarding response rates, number of answered items, and time duration to complete a survey, the following null hypotheses were proposed:

HO1:  A. There is no significant difference of the submitted response rates between single-page and multiple-page design.

B. There is no significant difference of the submitted response rates among the no-incentive, incentive, and lottery methods.

C. There is no significant relationship between the survey Web page design and reward method in terms of the submitted response rates.

HO2:  A. There is no significant difference between the two types of survey Web page design on the time duration to complete a survey in the submitted surveys.
B. There is no significant difference among the three reward methods on the time duration to complete a survey in the submitted surveys.

C. There is no significant interaction effect between survey design and reward method on the time duration to complete a survey

HO3: 

A. There is no significant difference between the two types of survey Web page design on the number of answered items in the submitted surveys.

B. There is no significant difference among the three reward methods on the number of answered items in the submitted surveys.

C. There is no significant interaction effect between survey design and reward method on the number of answered items in the submitted surveys?

*Analysis of Research Question One*

To answer the first research question, the submitted response in two different designs and three different reward groups were computed and described. Besides descriptive statistics, two single Chi-Square Tests were implemented to examine if there were significant differences of distributions of submitted responses between the single-page and multiple-page design and across the no-incentive, incentive, and lottery group. Some illustrative figures were also provided.

To determine if there was significant relationship on distribution of submitted response between the two-level design and the three-level reward method, a Chi-Square Test of Independence (Crosstabulation) was implemented. This statistical analysis was utilized to help make some important observations about the two categorical variables (Web design and reward method) on whether or not the counts of responses between
single-page design and multiple-page design were proportionately distributed across the three reward groups as determined by the reward methods.

Analysis of Research Questions Two and Three

In order to test these hypotheses, the study used two by three Factorial Analysis of Variance (2 × 3 ANOVA) to investigate the effect of two factors, Web page design (two groups) and reward methods (three groups), on time duration to complete a survey and number of answered items. Both of number of answered items and time to complete a survey served as the dependent variables for the analyses. Post hoc analysis was implemented to determine whether single-page design or multiple-page design significantly differed on a particular reward method. Besides this, the study examined if there was an interaction effect between survey Web page design and survey reward method on the above dependent variables (time duration of complete a survey and number of responded items). The study of the interaction between the independent variables would provide detailed and completed information of their effects on survey participation by college students. If the two independent variables were separated, they might sometimes have no effect on the dependent variables. But when studied together, they may have effects on the dependent variable.
Chapter 4: Findings

This study sought to provide information concerning the use of World Wide Web to deliver surveys. It particularly investigated the effects of survey Web page design and reward method on college students’ participation and examined the interaction between the two factors of Web page design and reward method.

The Statistical Package for Social Sciences (SPSS) for Windows (V. 13.0) was used to analyze the data of this study. Three types of research methods, Chi-square Goodness of fit Test, Chi-square Test of Independence (Crosstabulation), and two-way ANOVA were utilized to answer the four previously defined research questions.

The purpose of this chapter is to present the findings from the study. Included in this chapter are six sections: data collection procedure, presentation of survey participations, data screening and entry, reliability results, assumption testing results, and the results of the analysis for each research question and hypothesis. The sixth section is subdivided into four components according to the four specific research question and null hypothesis.

Data Collection Procedures

Participants in this study were full-time and part-time undergraduate students on the Athens campus of Ohio University who enrolled in fall quarter of 2005. An electronic list of names and email addresses of undergraduate students enrolled in fall 2005 was requested from the Office of Institutional Research. Based on the reviewed literature, the average response rate of a Web-based survey is fairly low. In order to get sufficiently large sample size, a sample frame of 6,000 undergraduate students was randomly selected from the requested list. All the 6,000 students were then randomly split into two groups,
3,000 students in each group, according to the single-page and multiple page survey design. Participants in each group of survey design were then randomly assigned to the non-incentive, incentive and lottery group. Thus, six subgroups were formed and each subgroup had 1,000 participants. All potential participants were sent with an e-mail invitation (see Appendix C-Appendix H). The e-mail invitations to the incentive and lottery groups also included information about online incentive or lottery, respectively. Once participants click the hotlink included in the email invitation, they were linked to the survey introduction page. They were instructed to read the general survey information and sign their name under the consent form and click the “submit” button to start the surveys.

The data collection was conducted over one-month period which started from October 4, 2005 to November 4, 2005. During the whole data collection period one e-mail invitation and two follow ups were sent. The e-mail invitation was sent on October 4, 2005. The potential participants who had not responded to the surveys yet were tracked based on the recorded signatures on the instruction page. The first follow-up was then sent on October 12, 2005. With the same working procedure the second follow-up was sent on October 25. The data collection was kept open until November 4, 2005.

Description of Participation

Descriptive statistics were utilized to calculate and gather participations of the students randomly selected in the study. Among the 6,000 selected potential participants, 904 participants clicked the links in the email invitations and viewed the surveys. There were 775 participants out of the 904 who started the survey, which means they clicked at least one survey item and/or clicked the “Continue” button between survey pages.
Among 775 participants 745 submitted the surveys. These resulted in a view rate of 15.07%, a start rate of 12.92%, and a submitted response rate of 12.42% out of the 6,000 framed samples. The difference between the number of viewed surveys (904) and the number of the submitted surveys (745) was called abandonment. The abandonment in the current study was 159. Thus, the abandonment rate was 17.59% (159/904). The difference between the number of the started surveys (775) and the number of the submitted surveys (745) was drop-outs. The study had 30 drop outs. This resulted in a drop-out rate of 3.87% (30/775).

The single-page design in this study didn’t implement technology to record clicks in an unsubmitted survey, but recorded the clicks in a submitted survey. No drop outs were then calculated and studied in the single-page design. Thus, the number of the started surveys was the number of the submitted surveys due to lack of recording the clicks in the unsubmitted single-page surveys. The multiple-page design in the study recorded the participants who started the surveys by clicking the radio button of an item and continuing to the next page, but quitted without submission.

A general distribution of participations is displayed in Table 4.1. The general percentages in Table 4.1 were calculated from the total number of framed samples (n = 6,000). The dominance of survey participations (numbers of the viewed, started, and submitted surveys) by survey page design and reward method was illustrated by a bar chart (see Figure 4.1, 4.2 and 4.3).
Table 4.1

*General Distribution of Participations*

<table>
<thead>
<tr>
<th>Reward</th>
<th>Survey Design</th>
<th>Viewed</th>
<th>Started</th>
<th>Submitted</th>
<th>Submitted Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>Single-page N = 1000</td>
<td>96</td>
<td>77</td>
<td>77</td>
<td>7.7%</td>
</tr>
<tr>
<td></td>
<td>Multiple-page N = 1000</td>
<td>102</td>
<td>86</td>
<td>83</td>
<td>8.3%</td>
</tr>
<tr>
<td>Incentive</td>
<td>Single-page N = 1000</td>
<td>205</td>
<td>175</td>
<td>175</td>
<td>17.5%</td>
</tr>
<tr>
<td></td>
<td>Multiple-page N = 1000</td>
<td>216</td>
<td>196</td>
<td>179</td>
<td>17.9%</td>
</tr>
<tr>
<td>Lottery</td>
<td>Single-page N = 1000</td>
<td>137</td>
<td>115</td>
<td>115</td>
<td>11.5%</td>
</tr>
<tr>
<td></td>
<td>Multiple-page N = 1000</td>
<td>148</td>
<td>126</td>
<td>116</td>
<td>11.6%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>904</td>
<td>775</td>
<td>745</td>
<td>12.42%</td>
</tr>
<tr>
<td>General Percentage (%)</td>
<td></td>
<td>15.07%</td>
<td>12.92%</td>
<td>12.42%</td>
<td></td>
</tr>
</tbody>
</table>

Note: The general percentages were calculated from the total number of framed samples (n = 6,000). The submitted percentages were calculated from the total number of each cell (n = 1,000).
Figure 4.1: The View Surveys. A bar chart of dominance of the viewed surveys (n = 904) by survey page design and reward method.
Figure 4.2: The Started Surveys. A bar chart of dominance of the started surveys (n = 775) by survey page design and reward method.
Figure 4.3: The Submitted Surveys. A bar chart of dominance of the submitted surveys (n = 745) by survey page design and reward method.
Among the 3,000 participants who were randomly assigned into the single-page surveys, 438 participants out of 3,000 viewed the survey and 367 participants submitted the surveys. Thus, in the single-page designed survey a view rate was 14.60% (438/3,000) and a submitted response rate was 12.23% (367/3,000). The abandonment in the single-page design was 71 (438-367) and the abandonment rate was 16.21% (71/438).

The other 3,000 potential participants out of 6,000 were assigned into the multiple-page designed survey. 466 participants viewed the survey; 408 participants started the survey; and 378 participants submitted the surveys. Thus, a view rate in the multiple-page design was 15.53% (466/3,000), a start rate was 13.60% (408/3,000), and a submitted response rate was 12.60% (378/3,000). The abandonment was 88 (466-378) and abandonment rate was 18.88% (88/466). The drop outs in the multiple-page surveys were 30 (408-378) and the drop-out rate was 7.35% (30/408).

Participations in single-page and multiple-page survey were displayed in Table 4.2. All percentages are calculated from the total number of submitted responses (n = 745). A bar chart of dominance of the submitted response rates by single-page and multiple-page design was illustrated in Figure 4.4.
Table 4.2

Participations in Single-page and Multiple-page Surveys

<table>
<thead>
<tr>
<th>Survey Design</th>
<th>Viewed</th>
<th>Started</th>
<th>Submitted</th>
<th>Submitted Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-page</td>
<td>438</td>
<td>367</td>
<td>367</td>
<td>49.26%</td>
</tr>
<tr>
<td>Multiple-page</td>
<td>466</td>
<td>408</td>
<td>378</td>
<td>50.74%</td>
</tr>
<tr>
<td>Total</td>
<td>904</td>
<td>775</td>
<td>745</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Note: All percentages are calculated from the total number of submitted responses (n = 745).
Figure 4.4: Survey Participation by Design. A bar chart of dominance of survey participation by single-page and multiple-page design.
The no-incentive group consisted of 2,000 participants. A view rate in the no-incentive group was 9.90% (198/2,000), a start rate was 8.15% (163/2,000), and a submitted response rate was 8.00% (160/2,000). The abandonment was 38 (198-160) and the abandonment rate was 19.19% (38/198). The drop outs were 3 (163-160) and the drop-out rate was 1.84% (3/163).

Out of the 2,000 randomly selected potential participants in the incentive group, a view rate was 21.05% (421/2,000), a start rate was 18.55% (371/2,000), and a submitted response rate was 17.70% (354/2,000). The abandonments were 67 (421-354) and the abandonment rate was 15.91% (67/421). The drop outs were 17 (371-354) and the drop-out rate was 4.58% (17/371).

In the lottery group composed of 2,000 randomly selected potential participants, a view rate was generated as 14.25% (285/2,000), a start rate was 12.05% (241/2,000), and a submitted rate was 11.55% (231/2,000). The abandonments were 54 (285-231) and the abandonment rate was 18.95% (54/285). The drop outs were 10 (241-231) and the drop-out rate was 4.15% (10/241).

In terms of the three reward groups, participations were displayed in Table 4.3. All percentages were calculated from the total number of submitted responses of 745. Figure 4.5 illustrated dominance of the submitted response by the three reward groups in a bar chart.
Table 4.3

*Participations in the Three Reward Groups*

<table>
<thead>
<tr>
<th></th>
<th>Viewed</th>
<th>Started</th>
<th>Submitted</th>
<th>Submitted Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>198</td>
<td>163</td>
<td>160</td>
<td>21.48%</td>
</tr>
<tr>
<td>Incentive</td>
<td>421</td>
<td>371</td>
<td>354</td>
<td>47.52%</td>
</tr>
<tr>
<td>Lottery</td>
<td>285</td>
<td>241</td>
<td>231</td>
<td>31.00%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>904</td>
<td>775</td>
<td>745</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Note: All percentages are calculated from the total number of submitted responses (n = 745).
Figure 4.5: Survey Participation by Reward Method. A bar chart of percentage dominance of survey participation by the three reward groups.
Data Screening and Entry

The online databases for the surveys recorded the survey participation activities such as the time duration to complete a survey, the participants who viewed the surveys, started the surveys, or submitted the surveys, and the survey items which were answered or unanswered. Participants in the multiple-page design who answered some items but exited without submitting the surveys were also recorded. The “Continue” button between the multiple pages of a survey initiated the database to write down the response activities when participants clicked the button to move to the next page. Participants in the single-page design who answered some items but exited without submitting the surveys couldn’t be recorded into the database, unless participants clicked the “submit” button to finalize the surveying.

Since this study focused on the submitted survey responses, all the records in the original database needed to be examined for accuracy of data entry prior data analysis, particularly in the multiple-page surveys due to a function of recording clicks for both submitted and unsubmitted surveys. The way to identify the unsubmitted surveys was by the time duration to complete a survey. The time duration referred to the time span from the time point when a participant viewed the survey by clicking the survey hotlink to the time point when the participant submitted the survey by clicking the “Submit” button at the end of the survey. It was counted by second. If the time duration for a recorded survey was zero, the survey must be an unsubmitted multiple-page survey.

Altogether 30 records in the original databases were identified as unsubmitted surveys. All of them were from the multiple-page design, 3 in no-incentive group, 17
incentive group, and 10 in lottery group. They were all removed from the data which were used for the analyses targeted at submitted responses.

Additionally, there were 5 continuously submitted surveys that were recorded with zero item answered. Since the survey design didn’t implement forced-answer feature, participants in the multiple-page design could keep clicking the “Continue” button to the end of survey and press the “Submit” button to finalize surveying. Participants in the single-page survey could directly click the “Submit” button to end the survey. All the five records were from the incentive group and in multiple-page design. They were probably from a same participant because the time to access the survey for each record was very close to each other. The participant seemed very interested in the online incentive, a simple but funny game. The five empty records were also removed from the data. The statistical description of survey participations in the previous section was calculated after data screening.

Reliability Results

Cronbach’s coefficient alpha \((\alpha)\) was utilized to measure the internal consistency of the survey instrument in the actual study. Among the 78 items in the instrument, five items were qualitative demographic questions and four items were not five-point Likert scales. The measurement of the internal consistency excluded the above 9 items and targeted on the other 69 items. The survey data of rest 69 likert-scale items were converted into SPSS to run the item analysis. Reliability analysis yielded alpha coefficient of .91 (see Appendix J).

The comparison between pilot and actual study reliability including a breakdown of reliability results for two types of design and three reward groups was provided in
Appendix K. Item analysis revealed that the scale functioned similarly to the pilot data. The pilot study with 64 cases identified that among the 68 items were 64 positively correlated items and 4 moderately negatively correlated items (item 22, r = -.11; item 24, r = -.05; item 25, r = -.14, and item 64, r = -.04). It was decided that the four items remained for the actual study due to the fact that the general reliability in the pilot data was high and the study wouldn’t use the data of survey itself, but focused on survey participations. However, item analysis revealed that the four potentially fatal items in the pilot study were positively correlated in the actual study with 745 cases (item 22, r = .25; item 24, r = .39; item 25, r = .44, and item 64, r = .40). Comparisons of the four items’ reliability between pilot and actually study are provided in Appendix L. Only one flawed item (item 5, r = -.14) was found in the actual study.

Reliability results in this actual study (α = .91) was found a strong support to the original reliability results (α = .89) in the study conducted by the instrument’s authors, Bunz and Sypher (2001).

Assumption Testing Results

There are primarily assumptions that must be considered and met when using Chi-square test (both Chi-square Goodness-of-fit test and test of independence) and two-way ANOVA.

Assumption Testing for Chi-Square Tests

In general, assumptions for Chi-Square significance tests include (1) random sample data, (2) nominal data, (3) a sufficiently large cell size and sample size: most of the cells are large enough to have expected values close to or greater than 5; the total number of subjects should be at least 20 in order for the approximation to be adequate
because the formula for chi square yields a statistic that is only approximately a chi square distribution (Bradley, Bradley, McGrath, & Cutcomb, 1979); some assumption for minimum sample size is set at 50; (4) finite values: participants must be grouped in categories; (5) independence: each subject contributes data to only one cell. Therefore, the sum of all cell frequencies in the table must be the same as the number of subjects in the experiment. (6) whether or not the frequencies observed for the various values on the variables different from those expected based on some theory (such as the theory that the two nominal variables in a contingency table are independent or unrelated to each other) (Harris, 1998); (7) normal distribution of deviations (observed minus expected values): only for the deviations, not for the data as parametric tests are.

All the survey participants in the current study were randomly selected. The assumption of nominal data was satisfied by counts of responses for survey design and reward methods in the study. The sample size in the study was 745, which was beyond the sample size of larger than 50. Each cell size in the study was greatly larger than 5 with 77, 83, 175, 179, 115, and 116. All the selected samples were randomly split into single-page and multiple-page design. Participants in each design were then randomly assigned into no-incentive, incentive or lottery group. A participant in the study could only be in one reward group to answer only the single-page or multiple-page survey. They can not cross the reward groups or survey design types. This means that within the six cells of proportions each participant contributed data to only one cell. The nature of the research question 1 and 2 was to see whether or not the frequencies observed for the various values on the variables by design and reward method different from those expected. The two types of Chi-Square tests in the study had normal distribution from
deviation, which were displayed by tables in the section of hypothesis testing results (see Table 4.4 and Table 4.6). The assumptions for Chi-Square test are tenable in this study.

Assumption Testing for Two-Way ANOVA

Before utilizing a two-way Analysis of Variance (ANOVA) to test the hypotheses, assumptions for a two-way ANOVA were considered. There are primarily four assumptions that must be met when using two-way ANOVA: 1) independence of observations, 2) variables being measured on an interval or ratio scale, 3) normal distribution of observations, and 4) homogeneity of variance.

According to Stevens (2001), the assumption of independence of observations is usually satisfied by using a random sampling strategy. This study randomly selected the participants. The selected participants were randomly split into two types of survey design and then randomly assigned into the three different reward groups. The participants responded to the survey remotely and independently. Some dependency may exist due to responses coming from the same department or school. However, it is reasonable to assume that the independence of observation assumption is tenable.

When using two-way ANOVA for data analysis the scale of measurement for the dependent variable must be interval or ratio. The measures used on time duration to complete a survey (counted by second) and the number of answered items in a survey fall into ratio scale.

There are several methods of testing the normality assumption. This study chose to examine normality assumption non-graphically for each reward group and each type of survey design by using Shapiro-Wilks statistical test. Additionally, this was coupled with
the graphical test of histogram for normality for each of the distributions. When tested at alpha = .05 level, the Shapiro-Wilks tests were significant for the six cells with time duration to complete a survey and number of answered items as the dependent variables. This indicated that observations in all three reward groups and the two types of survey design deviated from normality. Stevens (2001) suggests that the two-way ANOVA is robust to the assumptions of normality if skewness is in the same direction for each cell or each of the distributions. In the current study, it was found that histogram for each reward group and each type of survey design skewed to the same direction when looking at the time duration to complete a survey and the number of answered items as the dependent variables (see Appendix M and N).

Likewise, Statsoft, Inc. (2005, part. 6: Assumptions and Effects of Violating Assumptions, n.p.) also confirms that overall the $F$ test (also called $F$ Distribution) is remarkably robust to deviations from normality. Statsoft, Inc. indicates that the skewed distribution usually does not have a sizable effect on the $F$ statistic. It is also stated that if the $n$ per cell is fairly large, then deviations from normality do not matter much at all because of the central limit theorem, according to which the sampling distribution of the mean approximates the normal distribution, regardless of the distribution of the variable in the population. The current study had fairly large sample size for each cell, 77, 83, 175, 179, 115, and 116, in the designed two-way ANOVA. It was concluded that there wouldn’t be any sizable effect on Type I error in this study even if the normality assumption was not quite satisfactory.

Both Brown (2003) and Stevens (2001) suggest that the two-way ANOVA is robust to violations of the assumption of homogeneity of variances. Brown even states
that a small violation of both the normality and homogeneity assumptions, or even a stronger violation of only one assumption, is usually not too detrimental as ANOVA is robust. It should be more cautious when there are simultaneous large violations of both homogeneity and normality. When this occurs, Brown suggests that a cautious response is to treat the $p$-values as less significant than they really are and adopt a stricter criterion for significance.

The Levene test, which tests the null hypothesis that the error variance of the dependent variable is equal across groups, was applied to check assumption of homogeneity of variance for each reward group and each type of survey design on the dependent variables of time duration to complete a survey and number of answered items. The Levene test was found not significant ($p = .07$) for both the three reward groups and two survey design when looking at the summated score for time duration to complete a survey as the dependent variable. Nor was it significant ($p = .12$) for the summated score for number of answered items as the dependent variable. Thus, the distributions in each cell were homogenous. Appendix O and Appendix P displayed the statistic of the Levene test for both the time duration to complete a survey and the number of answered items as the dependent variables. Therefore, the assumption of homogeneity of variance was found to be tenable.

**Hypothesis Testing Results**

The purpose of the study was to investigate college students’ participations in single-page survey and multiple-page survey across the no-incentive, incentive, and lottery group. The main statistical methods employed were Chi-square Goodness of Fit test, Chi-square test of independence, and two by three ANOVA. The following sections
were organized to identify each of the hypotheses in the study. Each hypothesis test is followed by the statistical analysis, the decision to reject or fail to reject the null hypothesis, and the necessary post hoc analyses.

**Hypothesis 1: Submitted Response Rates by Survey Web page Design and Reward Method**

\(H_{01A}\): There is no significant difference of submitted response rates between single-page and multiple-page surveys. The purpose of this hypothesis was to determine if there was significant difference of distributions of counts of submitted responses between single-page and multiple-page surveys. The null hypothesis stated that there would be equal distributions of counts of submitted responses between the two types of survey designs. The distribution of submitted responses is displayed in Table 4.4. A single Chi-square Goodness of Fit test was conducted. By utilizing the Chi-Square criterion, it was determined that the null hypothesis retained and there was no significant difference of submitted response rates between the single-page survey and the multiple-page survey, \(\chi^2 (1, N = 745) = .162, \rho > .05\).
Table 4.4

*Submitted Response Rate between Single-page and Multiple-page Design*

<table>
<thead>
<tr>
<th>Survey Design</th>
<th>Observed N</th>
<th>Expected N</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-page</td>
<td>367</td>
<td>372.5</td>
<td>-5.5</td>
</tr>
<tr>
<td>Multiple-page</td>
<td>378</td>
<td>372.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Total</td>
<td>745</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
H01B: There is no significant difference of responses rates among the three reward methods. The purpose of this hypothesis was to determine if there were significant differences of distributions of counts of submitted responses across the no-incentive, incentive, and lottery group. The null hypothesis stated that there would be equal distribution of responses across the three reward groups. Table 4.5 displayed the submitted response rates among the three groups. A single Chi-square Goodness of Fit test was conducted. By utilizing the chi-square criterion, it was determined that there was significant difference of submitted response rates among the no-incentive, incentive, and lottery group, $\chi^2 (2, N = 745) = 77.592, \rho < .001$. Therefore, the null hypothesis H01B was rejected.
Table 4.5

Submitted Response Rate among the No-incentive, Incentive and Lottery Group

<table>
<thead>
<tr>
<th>Reward Group</th>
<th>Observed N</th>
<th>Expected N</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>160</td>
<td>248.3</td>
<td>-88.3</td>
</tr>
<tr>
<td>Incentive</td>
<td>354</td>
<td>248.3</td>
<td>105.7</td>
</tr>
<tr>
<td>Lottery</td>
<td>231</td>
<td>248.3</td>
<td>-17.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>745</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
From Table 4.5 it was obvious that the incentive group had higher counts of responses than the no-incentive and lottery group, it was not allowed to conclude that the incentive groups statistically had the highest counts of responses than both of the other two groups. In order to test if the incentive group had higher responses than the other two groups, the researcher would have to conduct two more single Chi-square Goodness of Fit tests to compare the number of responses in the incentive group with the number of responses in no-incentive and lottery group. The distributions between the incentive and no-incentive group would be in Table 4.6. Since this $\chi^2$ test had only two categories, it has only 1 degree of freedom. A $\chi^2$ value of 73.22 far exceeded the critical Values at the .001 $\alpha$-level of 10.83, which permit the researcher to conclude that the incentive group had higher responses by a significantly higher proportions than the no-incentive group, $\chi^2 (1, N = 514) = 73.22, p < .001$. 
Table 4.6

Submitted Response Rate between the Incentive Group and the No-incentive Group

<table>
<thead>
<tr>
<th>Reward Method</th>
<th>Observed N</th>
<th>Expected N</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>160</td>
<td>257.0</td>
<td>-97.0</td>
</tr>
<tr>
<td>Incentive</td>
<td>354</td>
<td>257.0</td>
<td>97.0</td>
</tr>
<tr>
<td>Total</td>
<td>514</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The same procedure was adopted to compare responses between the incentive and lottery group. Table 4.7 displayed the counts of submitted responses between the two groups. It was found that the incentive group had higher responses by a significantly higher proportions than the lottery group, $\chi^2 (1, N = 585) = 25.86, \rho < .001$.

Table 4.7

*Submitted Response Rate between the Incentive Group and the Lottery Group*

<table>
<thead>
<tr>
<th>Reward Method</th>
<th>Observed N</th>
<th>Expected N</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lottery</td>
<td>231</td>
<td>292.5</td>
<td>-61.5</td>
</tr>
<tr>
<td>Incentive</td>
<td>354</td>
<td>292.5</td>
<td>61.5</td>
</tr>
<tr>
<td>Total</td>
<td>585</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In order to test whether or not differences existed between the no-incentive and lottery group, another single Chi-Square Goodness of Fit test was conducted. Distribution of responses between the two groups was displayed in Table 4.8. It was found that there was a significant difference between the two groups on submitted response rates. The lottery group had significantly higher submitted responses than the no-incentive group, $\chi^2(1, N = 391) = 12.893$, $\rho < .001$.

Table 4.8

*Submitted Response Rate between the No-incentive Group and Lottery Group*

<table>
<thead>
<tr>
<th>Reward Method</th>
<th>Observed N</th>
<th>Expected N</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>160</td>
<td>195.5</td>
<td>-35.5</td>
</tr>
<tr>
<td>Lottery</td>
<td>231</td>
<td>195.5</td>
<td>35.5</td>
</tr>
<tr>
<td>Total</td>
<td>391</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**H0_{1c}: There is no significant relationship between survey Web page design and reward method on the response rates.** The purpose of Null Hypothesis 1C was to determine if there was a significant relationship between the survey reward methods and survey Web page design regarding submitted response rate. The null hypothesis stated that there would be no relationship between the reward method and survey page design. A two by three Chi-square Test of Independence (Crosstabulation) was utilized to examine the hypothesis. The crosstabulation between the two variables is displayed in Table 4.9.

Using the Chi-square criterion, a two by three Chi-square Test of Independence indicated that there was no significant association between survey reward method and survey Web page design in terms of distributions of counts of responses, \( \chi^2 (2, N = 745) = .112, \ p > .05 \). Therefore, it was concluded that the Null Hypothesis 2 was retained.
## Table 4.9

Submitted Response Rate and Percentages across Design and Reward Method

<table>
<thead>
<tr>
<th>Reward</th>
<th>Count</th>
<th>No-incentive</th>
<th>Incentive</th>
<th>Lottery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-page</td>
<td>Count</td>
<td>77</td>
<td>175</td>
<td>115</td>
<td>367</td>
</tr>
<tr>
<td></td>
<td>Expected Count</td>
<td>78.8</td>
<td>174.4</td>
<td>113.8</td>
<td>367.0</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>10.3%</td>
<td>23.5%</td>
<td>15.4%</td>
<td>49.3%</td>
</tr>
<tr>
<td>Multiple-page</td>
<td>Count</td>
<td>83</td>
<td>179</td>
<td>116</td>
<td>378</td>
</tr>
<tr>
<td></td>
<td>Expected Count</td>
<td>81.2</td>
<td>179.6</td>
<td>117.2</td>
<td>378.0</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>11.1%</td>
<td>24.0%</td>
<td>15.6%</td>
<td>50.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Count</td>
<td>160</td>
<td>354</td>
<td>231</td>
<td>745</td>
</tr>
<tr>
<td></td>
<td>Expected Count</td>
<td>160.0</td>
<td>354.0</td>
<td>231.0</td>
<td>745.0</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
<td>21.5%</td>
<td>47.5%</td>
<td>31.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Therefore, it was concluded that the Null Hypothesis 1A and 1C were retained, but the Null Hypothesis 1B was rejected. There was no significant difference of response rates between the single-page and multiple-page survey design. There was no significant relationship between survey design and reward method. However, there was significant difference of response rates between the no-incentive, incentive, and lottery groups. The incentive group had significantly higher counts of responses than both of the no-incentive and lottery group. It was also found that the lottery group had significantly higher response rate than the no-incentive group.

_Hypothesis 2: Difference of Time Duration to Complete a Survey by Survey Web Page Design and Reward Method._

Hypothesis Two was used to determine if there was a difference of time duration to complete a survey between the two types of survey page design, the single-page and multiple-page survey, and among the no-incentive, incentive, and lottery groups. The null hypothesis stated that there would be no difference between the two types of survey page design and among the three reward groups. It was also used to determine if an interaction effect existed between survey Web page design and reward method regarding the time duration to complete a survey. Additionally, hypothesis Three stated an interaction effect would not exist.

The means and standard deviations on the variable of time duration to complete a survey were different for single-page and multiple-page surveys and for all the three reward groups (see Table 4.10). The distribution provided a total mean score of 512.6550 seconds (8.54 minutes) across design types and reward groups. This indicated an overall mean time to complete a survey. The participants in the incentive group who responded
to the single-page surveys used least time with a mean of 457.72 seconds (7.63 minutes) to complete a survey, while respondents in the lottery group who answered the multiple-page surveys had the highest mean of 608.5948 seconds (10.14 minutes) to complete a survey. The multiple-page survey had higher mean time than the single-page survey.
Table 4.10

*Time Duration to Complete a Survey by Survey Design and Reward Method*

<table>
<thead>
<tr>
<th>Reward</th>
<th>Design</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Cases (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>Single-page</td>
<td>8.36</td>
<td>5.08</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>Multiple-page</td>
<td>8.87</td>
<td>9.80</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>8.62</td>
<td>7.87</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>Single-page</td>
<td>7.63</td>
<td>4.26</td>
<td>175</td>
</tr>
<tr>
<td>Incentive</td>
<td>Multiple-page</td>
<td>8.32</td>
<td>4.43</td>
<td>179</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7.98</td>
<td>4.35</td>
<td>354</td>
</tr>
<tr>
<td></td>
<td>Single-page</td>
<td>8.56</td>
<td>5.90</td>
<td>115</td>
</tr>
<tr>
<td>Lottery</td>
<td>Multiple-page</td>
<td>10.14</td>
<td>7.52</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>9.35</td>
<td>6.80</td>
<td>231</td>
</tr>
<tr>
<td></td>
<td>Single-page</td>
<td>8.07</td>
<td>5.00</td>
<td>367</td>
</tr>
<tr>
<td>Total</td>
<td>Multiple-page</td>
<td>9.00</td>
<td>6.93</td>
<td>378</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>8.54</td>
<td>6.07</td>
<td>745</td>
</tr>
</tbody>
</table>

Note: The mean time calculated by minutes
Result from the analysis of a 2 x 3 ANOVA with “time duration to complete a survey” as the dependent variable are presented in Table 4.11. The two-way ANOVA revealed that there was significant difference for the main effects of survey Web page design and the reward method, $F(1, 745) = 3.973, \rho < .05$, and $F(2, 745) = 3.628, \rho < .05$ respectively for the specified .05 significant level. The multiple-page design had significantly longer time to complete a survey than the single-page design. Tests of Between-subject effects also indicated that there was no significant interaction effect between design and reward on time duration to completes a survey, $F(2, 745) = .509, \rho > .05$ (see Figure 4.6).
Table 4.11

Two-Way ANOVA: Reward by Design on Time Duration to Complete a Survey

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reward</td>
<td>952852.250</td>
<td>2</td>
<td>476426.125</td>
<td>3.628</td>
<td>.027</td>
<td>.010</td>
</tr>
<tr>
<td>Design</td>
<td>521829.301</td>
<td>1</td>
<td>521829.301</td>
<td>3.973</td>
<td>.047</td>
<td>.005</td>
</tr>
<tr>
<td>Reward * Design</td>
<td>133735.486</td>
<td>2</td>
<td>66867.743</td>
<td>.509</td>
<td>.601</td>
<td>.001</td>
</tr>
<tr>
<td>Error</td>
<td>97052895.1</td>
<td>739</td>
<td>131330.034</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>294518118.00</td>
<td>745</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>98720806.30</td>
<td>744</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Significance at .05 level
Figure 4.6: The Interaction of Survey Design and Reward Method for Time Duration to Complete a Survey under the Two-way ANOVA Design.
The Post Hoc tests were conducted to determine where differences existed among the three reward groups on the time duration to complete a survey. Among the three reward groups, the lottery group had significantly longer time to complete a survey than the incentive group with a mean difference of 82.375 seconds (1.37 minutes), which was significant at $\rho < .05$ (see Table 4.12). However, there was no significant difference between the no-incentive group and incentive group with a mean difference of 38.433 seconds (0.64 minutes). Likewise, there was no significant difference between the no-incentive group and lottery group with a mean difference of 43.943 seconds (0.73 minutes).
### Table 4.12

*Comparisons of Time Duration to Complete a Survey among the Three Reward Groups*

<table>
<thead>
<tr>
<th>Reward (I)</th>
<th>Reward (J)</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>Incentive</td>
<td>38.433</td>
<td>34.540</td>
<td>.799</td>
</tr>
<tr>
<td>No-incentive</td>
<td>Lottery</td>
<td>-43.943</td>
<td>37.290</td>
<td>.717</td>
</tr>
<tr>
<td>Incentive</td>
<td>Lottery</td>
<td>-82.375(*)</td>
<td>30.652</td>
<td>.022</td>
</tr>
</tbody>
</table>
Therefore, it was concluded that there were significant differences of time duration to complete a survey between the two types of survey design and among the three reward groups and there was no significant interaction effect between design and reward method. Participants in the multiple-page design had significantly longer time to complete a survey than those in the single-page design. The lottery group had significantly longer time duration to complete a survey than the incentive group.

Hypothesis 3: Difference in Number of Answered Items by Survey Web Page Design and Reward Method.

Hypothesis Three was purposed to investigate if there was a difference of the number of answered items between the two types of Web-based survey designs, the single-page and multiple-page, and among the no-incentive, incentive, and lottery group. The hypothesis was also used to determine if an interaction effect existed between survey Web page design and reward method in terms of the number of answered survey items. The Null Hypothesis Three stated that there was no difference between the two types of survey Web page design and no difference among the reward groups. Additionally, it stated that no interaction effect existed.

The mean and standard deviations for the variable of “the number of answered items” for two types of survey design and all the reward groups are presented in Table 4.13. The mean and standard deviations for the variable of “the number of answered items” were very similar for single-page and multiple-page surveys and for all the reward groups. The distribution provides a total mean number of 77.08 across designs and reward groups. This demonstrates that survey participants responded to 77.08 items in the survey which totally had 78 items. The single-page survey participants in the incentive
group responded with the most items with a mean of 77.34, while the multiple-page survey participants in the lottery group had the lowest score of 76.81.

Table 4.13

*Number of Answered Items by Survey Design and Reward Methods*

<table>
<thead>
<tr>
<th>Reward</th>
<th>Design</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-incentive</td>
<td>Single-page</td>
<td>77.21</td>
<td>1.301</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>Multiple-page</td>
<td>77.07</td>
<td>1.512</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>77.14</td>
<td>1.412</td>
<td>160</td>
</tr>
<tr>
<td>Incentive</td>
<td>Single-page</td>
<td>77.34</td>
<td>1.445</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>Multiple-page</td>
<td>76.89</td>
<td>3.532</td>
<td>179</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>77.11</td>
<td>2.715</td>
<td>354</td>
</tr>
<tr>
<td>Lottery</td>
<td>Single-page</td>
<td>77.19</td>
<td>1.075</td>
<td>115</td>
</tr>
<tr>
<td></td>
<td>Multiple-page</td>
<td>76.81</td>
<td>2.621</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>77.00</td>
<td>2.011</td>
<td>231</td>
</tr>
<tr>
<td>Total</td>
<td>Single-page</td>
<td>77.26</td>
<td>1.307</td>
<td>367</td>
</tr>
<tr>
<td></td>
<td>Multiple-page</td>
<td>76.91</td>
<td>2.914</td>
<td>378</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>77.08</td>
<td>2.275</td>
<td>745</td>
</tr>
</tbody>
</table>
Results from the analysis of a 2 x 3 ANOVAS with “the number of answered items” as the dependent variable are presented in Table 4.14. The two-way ANOVA indicated that no statistically significant result for each of the main effects of survey design and reward method, $F (1, 745) = 3.320, p > .05$, and $F (2, 745) = .237, p > .05$ respectively for the specified .05 significant level. Tests of Between-subject effects also indicated that there was no significant interaction effect between design and reward on the dependent variable of “the number of answered items”, $F (2, 745) = .256, p > .05$. The interaction effect is illustrated in Figure 4.7.

Therefore, the Null Hypothesis Three was retained. It was concluded that there were no significant difference of the number of answered items between the two types of design and between the three reward groups. Additionally, there was no significant interaction effect between design and reward method.
Table 4.14

Two-Way ANOVA: Reward by Design on Number of Answered Items

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reward</td>
<td>2.45</td>
<td>2</td>
<td>1.23</td>
<td>.237</td>
<td>.789</td>
<td>.001</td>
</tr>
<tr>
<td>Design</td>
<td>17.17</td>
<td>1</td>
<td>17.17</td>
<td>3.320</td>
<td>.069</td>
<td>.004</td>
</tr>
<tr>
<td>Reward * Design</td>
<td>2.652</td>
<td>2</td>
<td>1.33</td>
<td>.256</td>
<td>.774</td>
<td>.001</td>
</tr>
<tr>
<td>Error</td>
<td>3821.952</td>
<td>739</td>
<td>5.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4430509.00</td>
<td>745</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>3850.84</td>
<td>744</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The mean difference is significant at the .05 level.
Figure 4.7. The Interaction of Survey Design and Reward Method for Number of Answered Items under the Two-way ANOVA Design.
Additional Findings

The current study had some additional findings about abandonment, drop-outs, effects of follow-up reminders, and gender difference. These findings are presented below:

Abandonment

Abandonment was the number difference between the recruited students who viewed the survey by using the survey links and those who submitted the survey. In the single-page survey 438 students viewed the survey and 367 participants submitted the surveys. The abandonment was 71. In the multiple-page survey 466 students viewed the survey and 378 participants submitted the surveys. The abandonment was 88. An additional single Chi-square Test indicated that the single-page design did not significantly differ from the multiple-page design regarding to abandonment.

Among the three reward groups, the no-incentive group had 38 abandonments with 198 viewed and 160 submitted, the incentive group had 67 abandonment with 421 viewed and 354 submitted, and the lottery group had 54 abandonment with 285 viewed and 231 submitted. The incentive group had significantly higher abandonment than both no-incentive group and lottery group.

Drop Outs

Drop-out was another one of additional findings. It is the number difference between the started surveys and the submitted surveys. In the current study the single-page design did not record the participants who started the survey but quitted without submitting. The multiple-page design recorded the drop-outs. There were 408 participants
who started the survey and 378 out of them submitted the survey in the multiple-page design. The drop-outs were 30.

Excluding the single-page design, the drop-outs in the multiple-page surveys among the three reward groups respectively were 3 in the no-incentive group, 17 in the incentive group, and 10 in the lottery group. The incentive group had significantly higher drop-outs than the no-incentive and lottery group. There was no difference between the no-incentive and lottery group.

*Effect of Follow-up Reminders*

During the whole data collection process the survey invitations were sent out three times. The first invitation was sent on October 4, 2005, which resulted in 244 submitted responses. Most of the responses were received in the second and third day after the invitation. No responses came up from the fifth day. One week after the first invitation, a follow up was delivered on October 12, 2005. The researcher received another 505 submitted responses. Two weeks later, the second follow up was sent on October 25, 2005, toward the end of the fall quarter at Ohio University. Only one response was received.

The effects of the first follow-up in the current study examined the assertion that follow-up email reminder to survey nonrespondents would approximately double the response rate for Web surveys (Kittleson, 1997). It also agreed that the follow-up email contacts are associated with higher response rates (Cook, Heath, & Thompson, 2000). The result of the second follow-up reminder could be able to attribute to the low response rate to school finals. This is also consistent with the reasoning from Crawford, Couper, and Lamias (2001) that if a follow-up reminder is sent out to college students during the
school final exam or holidays, a low response could be associated. The other reason for the lower than expected response rate of the second follow up could be that the time span between the first follow-up and the second follow-up was too long.

**Gender Difference**

This study also found gender difference on response rate. Based on the collected data about gender, there were 293 male participants and 452 female participants among the 745 submitted surveys. With a Single Chi-Square Goodness of Fit test, it was determined that the number of female participants was significantly higher than that of male participants.

It was revealed that there was no significant relationship between gender and survey page design on the submitted response rates, which means that the single-page and multiple-page design were proportionately preferred by male and female students. The female participants had higher response rate than males in either of the two types of design. The study also failed to identify any significant relationship between gender and survey reward method on the submitted response rates. In other words, the three reward methods were proportionately preferred by male and female participants.
Chapter 5: Summary, Limitation, Conclusion, and Recommendations

This chapter summarizes the previous four chapters. First, a summary of the study is presented including the purpose, problem and methodology of the study, and then is followed by the overall findings of the hypotheses. Limitations of the study are identified and are followed by conclusions and from analysis and findings. Finally, recommendations for application and future study are listed to conclude the chapter.

Summary of the Study

The present study was primarily designed to fill the literature gap on effects of Web page design in the Web-based surveys. The majority of studies in Web-based surveying literature were conducted to investigate the advantages and disadvantages of Web-based surveys by comparing to traditional survey methods, or to define the potential difference in demographics, in a descriptive or predictive manner. The main purpose of the present study was to investigate students’ participations in the Web-based surveys. The investigation covered the survey participation in three aspects: the submitted response rate, time duration to complete a survey, and number of responded items in a survey. Survey participations such as response rates and item responses are fundamental to statistical power and validity of research. Further, this study is the first attempt at systematically relating survey page design and survey reward method to college students’ participation in the Web-based surveys.

There were three research questions that were utilized to examine survey participations with the independent variables (survey page design and reward method). The first research question investigated the response rates for both survey Web page design and reward methods. It was analyzed by using the Chi-Square Goodness of Fit test
for the two types of page design (the single-page and multiple-page survey) and for the three reward methods (the no-incentive, incentive, and lottery method). This research question also examined if there was a significant relationship between the survey page design and reward methods in terms of response rates. A two-way Chi-Square Test of Independence (Crosstabulation) was implemented to conduct the analysis.

The second research question was designed to determine difference of time duration to complete a survey between the two types of survey Web page and among the three reward groups. It was also used to examine if an interaction effect existed between the above two independent variables regarding the time duration to complete a survey. A two levels (single-page and multiple-page) by three levels (no-incentive, incentive, and lottery) ANOVA was utilized to analyze the hypothesis.

The third research question was proposed to investigate difference of number of answered items between the two types of survey Web page design and the three reward methods. It was also used to examine if an interaction effect existed between the above two independent variables regarding number of answered items in a survey. Similar to the third research question, a two factors (single-page and multiple-page) by three factors (no-incentive, incentive, and lottery) ANOVA was utilized to analyze the hypothesis.

The sample in this present study was randomly selected from the undergraduate students on Athens campus at Ohio University who were enrolled in fall 2005. It was consisted of 6,000 undergraduates. Randomization was utilized to assign the select students into the six cells (two designs by three reward methods). First, the total sample was randomly split into a single-page group and a multiple-page group, 3,000 in each group. Then, the 3,000 potential participants in each survey design group were randomly
assigned into the three reward groups by no-incentive, incentive, and lottery method. Thus, six subgroups across design and reward method were formed with 1,000 in each.

Participants responded to the Internet Fluency survey that was developed by Bunz and Sypher (2001). This instrument was verified with high reliability by the authors and the pilot study. It measures student skills of using computer, email and the Web. Rather than reporting the quantitative results of the survey itself, the present study would report the effects of background logistical work (survey web page design and reward method) on data collection such as response rate, number of answered survey items and time duration to complete a survey.

**Summary of the Findings**

This study was conducted to examine the following null hypotheses.

**HO₁:**

A. There is no significant difference of the submitted response rates between single-page and multiple-page design.

B. There is no significant difference of the submitted response rates among the no-incentive, incentive, and lottery methods.

C. There is no significant relationship between the survey Web page design and reward method in terms of the submitted response rates.

**HO₂:**

A. There is no significant difference between the two types of survey Web page design on the time duration to complete a survey in the submitted surveys.

B. There is no significant difference among the three reward methods on the time duration to complete a survey in the submitted surveys.
C. There is no significant interaction effect between survey design and reward method on the time duration to complete a survey

HO3:  
A. There is no significant difference between the two types of survey Web page design on the number of answered items in the submitted surveys.

B. There is no significant difference among the three reward methods on the number of answered items in the submitted surveys.

C. There is no significant interaction effect between survey design and reward method on the number of answered items in the submitted surveys?

Among the 6,000 randomly selected samples, 904 participants viewed the survey, 775 participants started the survey, and 745 participants answered and submitted the survey. The overall submitted response rate was 12.4%. There were 367 submitted responses in the single-page survey and 378 in the multiple-page surveys. There were 160 submitted responses in the no-incentive group, 354 in the incentive group and 231 in the lottery group.

The descriptive result of overall submitted response rate (12.4%) presented above appears lower than the response rates of most of the reviewed studies with framed samples of college students (Cook, Heath, & Thompson, 2000; Couper, 2001; Couper, Traugott, & Lamias, 2001; Crawford, Couper, & Lamias, 2001; Daley et al., 2003; Jones & Pitt, 1999; Sax, Gilmartin, & Bryant, 2003; etc.). It was only a little higher than the response rate (8%) in a study targeted at college students which was reported by Schonlau, Fricker, and Elliott (2001). The response rate in the current study is much lower than all the reviewed studies with samples of non-college students (Cobanoglu,
Warde, & Morco, 2001; Dillman et al., 1998; Matz, 1999; Quigley, Riemer, Cruzén, & Rosen, 2000; Schleyer & Forrest, 2000; Zhang, 2000; etc.). Although this study has lower response than the study conducted by Kay and Johnson (1999), the 2000 American Community Survey and 1998 Library Media Center Survey documented by both Sedivi Gaul (2001) and Griffin, Fischer, and Morgan (2001), the above three studies used convenient samples, not framed sample as the current study recruited.

This study had less than one sixth of the participants who viewed the survey and less than one eighth participants who submitted the survey. Evidence was found supporting the prediction that interests and rates of participation may decline as the uniqueness of online surveys begins to erode (Daley et al., 2003). This study was also a supportive examination to statement that college students, a heavily surveyed group, were responding at lower rates than previous decades and overall non-responses had increased in recent years (Sax, Gilmartin, & Bryant, 2003).

**Hypothesis 1: Survey Design and Reward Method on Submitted Response Rate**

The hypothesis 1A attempted to determine if the distribution of submitted survey responses in the single-page design differed significantly from the distribution of responses in multiple-page design. The null hypothesis 1A stated that there would be no significant difference between the single-page design and multiple-page design. A single Chi-Square Goodness of Fit test was conducted to investigate the null hypothesis 1A. The results of this statistical analysis could be described as follow:

With regard to the dependent variable of submitted responses, the results indicated that the survey Web page design didn’t significantly affect the submitted response rates. The decision was to retain the null hypothesis for both the single-page
design and the multiple-page design. It appears that both the single-page and the multiple-page design were proportionately preferred by the participants. Descriptive statistics results showed that the observed number of submitted responses (367) in the single-page survey was very close to the observed number of submitted responses (378) in the multiple-page survey. The absolute residual values (5.5) between the observed number and the expected number in both types of surveys were exactly same. In other words, there was no difference between the single-page and multiple-page survey in terms of distribution of responses.

There were no research particularly investigating response rates between single-page and multiple-page designed Web surveys before this studies. The previously reviewed studies with survey Web page design into considerations (such as plain vs. fancy survey Web page, progress indicator vs. no progress indicator, multiple items within common categories per screen vs. single item per screen, radio button vs. entry box, etc.) found that responses rates were significantly different between different characteristics of Web survey design (see Dillman et al., 1998; Daley et al., 2003; Couper, Traugott, & Lamias, 2001; Reips, 200; Fuchs, 2001 etc). The results of this analysis appear to disagree with the findings of the above studies. Since this study investigated differences of response rates between the single-page survey with screen scrolling and multiple-page survey without scrolling, it was also considered as an examination of the statements of Gräf (2002) and Schonlau, Fricker, and Elliott (2001), which believed survey participants didn’t like screen scrolling and scrolling must be reduced to a minimum. The findings in the present study turned out not to support their suggestions.
The hypothesis 1B attempted to determine if there was significant difference of response rates across the no-incentive, incentive, and lottery group. The null hypothesis 1B stated that there would be no significant difference among the three reward groups. A single Chi-Square Goodness of Fit test with 2 degree of freedom was conducted to investigate the null hypothesis 1B. The results of this statistical analysis could be described as follow:

With regard to the dependent variable of submitted responses, the results indicated that the survey reward method did significantly affect the submitted response rates. The decision was to reject the null hypothesis for the no-incentive, incentive, and lottery group. In other words, differences did exist across the three reward groups in terms of distribution of responses. It appeared that the three reward methods were not proportionately preferred by the participants. Descriptive statistics results showed that the observed number of submitted responses in the incentive group (354) was much higher than the observed number respectively in the no-incentive (160) and lottery (231) group.

In order to directly test if the incentive method was preferred to the other two reward methods, another two tests were conducted to compare the observed number in the incentive group with the number of the no-incentive and lottery group. The results indicated that the incentive group had a significant higher observed number of responses than that of no-incentive group or lottery group.

Another single Chi-Square Goodness of Fit test was conducted to test difference between the no-incentive and lottery group. It was found that there was a significant difference between the two groups on distribution of response. The lottery group had
significantly higher responses than the no-incentive group. It implied that the lottery method was preferred to the no-incentive method by participants.

This study was supportive evidence to suggestions addressed by Bertot and McClure (1996), Dillman et al. (1998), and Daley et al. (2003) that a reward technique was effective to increase response rates of Web-based surveys. The above results also indicated a strong support to the two studies conducted by Sax, Gilmartin, and Bryant (2003) who implemented two reward methods (incentive and no incentive) and Porter and Whitcomb (2003) who implemented three reward methods (incentive, no incentive, and lottery) in that incentives were more effective to increase response rates than no incentives. Likewise, this study strongly agreed with Bosnjak and Tuten (2003) who found that lotteries increased response rates compared to no incentives.

Porter and Whitcomb (2003) also found that lotteries were even more effective than incentives to increase responses in Web-based surveys. This present study turned out in disagreement with Porter and Whitcomb. On the other hand, Bosnjak and Tuten (2003) found the incentives in the Web survey showed no advantages over no-incentives. The current study appeared to have a quite opposite result. Furthermore, the results of this study was also quite opposite to the findings indicated by Cook, Heath and Thompson (2000) that the use of incentives in Web survey actually seemed to be associated with lower response rates. It is in disagreement with Groce-Niehoff (2002) who found no significant difference in response rate between lottery group and no lottery group.

However, these studies revealed the incentives to the participants before they participated in the surveys. The currently study didn’t reveal the incentive to the
participants until they clicked the “Submit” button. If pre-revealed incentives and after-revealed incentives make difference in response rate is unknown yet.

This hypothesis attempted to determine if any significant association existed between survey page design and reward in terms of distribution of responses. The null hypothesis stated that there would be no significant association between survey page design and reward method.

A Chi-Square Test of Independence (Crosstabulation) was conducted to test the null hypothesis. The results indicated that there was no significant association between survey Web page design and reward methods regarding to distribution of responses. The decision was to retain the null hypothesis. It seemed that the distribution of counts of responses in the two categories of the single-page and multiple-page survey representing two different levels of the variable, survey Web page design, were the same for the distribution of responses in all three reward groups (no-incentive, incentive, and lottery) of the other variable, reward method. The results of this study among the sample of undergraduate students indicated that 77 (10.3%) no-incentive participants, 175 (23.5%) incentive participants and 115 (15.4%) lottery participants submitted the single-page surveys, while 83 (11.1%) no-incentive participants, 179 (24.0%) incentive participants and 116 (15.6%) lottery participants submitted the multiple-page surveys. The single-page and multiple-page surveys that were in no-incentive, incentive, and lottery group did not differ significantly with respect to distribution of submitted survey responses.

There was not previous research which studied survey page design and reward methods systematically. The results of this analysis appear an examination for researchers (Dillman et al., 1998) who made suggestions and recommendations of implementing
appropriate reward after they studied the effects of survey Web page design on participation.

In light of the results of the single Chi-Square Goodness of Fit tests, the following null hypothesis could be retained:

There would be no significant difference between the single-page and multiple-page survey in terms of the submitted survey response rates.

The following null hypothesis could be rejected:

There would be no significant difference among the three reward groups: no-incentive, incentive, and lottery group in terms of the submitted survey responses.

In light of the result of Chi-Square Test of Independence (Crosstabulation), the following null hypothesis should be retained:

There was no significant association between survey page design and reward in terms of response rates.

*Hypothesis 2: Time Duration between Survey Design and Reward Method*

This hypothesis attempted to determine if any significant difference of time duration to complete a survey by survey Web page design (single-page and multiple-page) and reward methods (no-incentive, incentive, and lottery). It was also used to determine if an interaction effect existed between survey Web page design and reward method. The null hypothesis stated that there would be no significant difference of time duration between survey page design and among the three reward methods. Additionally, the null hypothesis stated an interaction effect would no exist. A two by three ANOVA was implemented to examine the hypothesis. In the light of the ANOVA results, the conclusions were described as follow:
With regard to the dependent variable of time duration to complete a survey, the study found that there was significant difference between the single-page and multiple-page surveys. It indicated that survey Web page design did significantly affect the time duration to complete a survey. Participants had significantly longer time to complete the multiple-page surveys than participants to complete the single-page surveys. The mean time duration (by second) to complete a single-page survey was 484.38 seconds, while the mean time duration to complete a multiple-page survey was 540.10 seconds.

In the present study the multiple-page survey had a progress indicator bar at the bottom of each page. The Web browser viewing the multiple-page survey had to upload each page as well as the indicator bar. This could be a main reason that multiple-page survey had longer time duration than the single-page survey. Several researchers (Couper, Traugott, & Lamias, 2001; Dillman et al., 1998; Dillman et al., 2000; Fuchs, 2001; Sax, Gilmartin, & Bryant, 2003; Smith, 1997) examined and/or postulated that the mean time to complete a multiple-page survey or plain Web survey was significantly longer than that in the single-page or fancy design. The results of the current study provides further evidence that survey Web page design, in fact, has effect on the time duration to complete a Web survey.

The results also indicated that the time duration to complete a survey significantly differed among the no-incentive, incentive, and lottery group. Survey reward method did significantly affect the time duration to complete a survey. The differences existed between the lottery group and incentive group. Participants in the lottery group had significantly longer time duration to complete a survey than the incentive group did. The lottery group had 561.14 second mean time duration while the incentive group had
478.80 seconds. There were no significant differences between the no-incentive group and incentive group as well as between the no-incentive group and lottery group.

The results showed that there was no significant interaction effect between design and reward method with respect to time duration to complete a survey. This result indicated that the time duration to complete a survey that differed in two different types of survey Web page design didn’t significantly differ by survey reward method.

In light of the ANOVA results, the following null hypotheses could be rejected:

There was no significant difference of time duration to complete a survey between the single-page and multiple-page surveys.

There was no significant difference of time duration to complete a survey among the no-incentive, incentive, and lottery method.

However, the following null hypothesis should be retained:

There was no significant interaction effect between survey page design and reward method on answered-item number.

_Hypothesis 3: Number of Answered Items by Survey Design and Reward Method_

This hypothesis attempted to determine if any significant difference of number of answered items by survey Web page design (single-page and multiple-page) and reward methods (no-incentive, incentive, and lottery). It was also used to determine if an interaction effect existed between survey Web page design and reward method. The null hypothesis stated that there would be no significant difference of number of answered items between survey page design and among the three reward methods. Additionally, the null hypothesis stated an interaction effect would not exist. A two by three ANOVA was
implemented to examine the hypothesis. In the light of the ANOVA results, the conclusions were described as follow:

The current study found no difference of number of answered items between the single-page with screen scrolling and multiple-page design without screen scrolling. The mean numbers of answered items were very close between the two types of survey page design. The total number of items in the survey was 78. The screen-scrolling necessary single-page design had 77.26 answered items and the no-screen-scrolling multiple-page design had 76.91 answered items.

The results did not support the statement that screen scrolling could cause more unanswered items or missing data and it must be reduced to a minimum (Dillman et al., 1998; Graf, 2002; Schonlau, Fricker, & Elliott, 2001; Fuchs, 2001; Couper, Traugott, & Lamias, 2001, Sax, Gilmartin, & Bryant, 2003). Fuchs (2001) noted that using a multiple-page/screen design minimized the missing data. This study failed to prove his statement.

The current study found no difference of number of answered items among the no-incentive, incentive, and lottery groups. The mean numbers of answered items were very close to each other among the three reward methods. The no-incentive group had 77.14 answered items, the incentive group had 77.11 answered items, and the lottery group had 77 answered items. This meant that regardless of reward method, the survey items were responded by the student participants at the same level. No previous studies were found to study number of answered items between different survey reward methods.

In addition, the ANOVA results presented no significant interaction between survey Web page design and survey reward method with respect to the submitted response rates. This result indicated that survey Web page design didn’t significantly
influence the number of answered items by participants who were in no-incentive group as well as the answered-items number by participants in the incentive group and lottery group.

In light of the ANOVA results, the following null hypotheses should be retained:

There was no significant difference of number of answered items between the single-page and multiple-page surveys.

There was no significant difference of number of answered items among the no-incentive, incentive, and lottery method.

There was no significant interaction effect between survey page design and reward method on answered-item number.

With the unique potentials of Web surveys, it is hoped that the Web-based surveys could be favored by university faculty and students and increase participation (Sax, Gilmartin, & Bryant, 2003). Design considerations in Web surveys and appropriate reward methods offer possibilities to encourage participants to respond.

Limitations

Limitations of the study should be revisited when considering findings and conclusions.

1. The response rate was limited to the submitted response rate. The abandonment and drop-outs were not taken into statistical considerations even though they were presented as additional findings. Based on the features of Web based survey, participants could quit the survey without submission any time they intended, even they complete 99 items out of 100. In other words, some participants didn’t click the submit button but
answered a significant number of items, but they were not counted into the data for analysis. However, some participants submitted the survey but just answered a few items, but they were included into the final data.

2. The single-page design did not record participants who answered one or more items but exited without submitting the surveys, which were drop outs. This study was then not able to compare difference of drop-outs between single-page and multiple-page design. The additional findings about drop-outs were limited to the multiple-page survey by the three reward groups.

3. This study didn’t implement any control to avoid the overlapped survey submission. Some participants might come back to re-respond to the survey due to their interests in the online incentive of game, which was hard to search by doing Google. Five continuous records were found with zero items answered. They were suspected as attracted by the online incentives.

Conclusions

This study has increased the knowledge base regarding designing and delivering Web-based surveys to college students with concerns of participations such as response rate, number of answered items, and time duration to complete a survey.

Finding from the study failed to determine any significant difference of submitted response rates between the single-page and multiple-page design. It might be that the single-page survey participants were comfortable with mouse wheel. With technology development, the mouse with a wheel can help the computer users to navigate the screen
to the top or bottom very easily and it is not necessary to scroll a long screen up or down by using the mouse point to operate the scroll bar. Thus, a long-screen survey might not be a bother for participants nowadays. It would be interesting to investigate response rates between participants who use a mouse with a wheel built in and participants who use a mouse without wheel in a single-page survey. In this study, the multiple-page design had progress bar at the bottom of each page. Whether multiple-page design with and without progress bar would work same or not is another study area.

The online incentive method was feasible to increase response rate in the study. The lottery method worked better than no-incentive in terms of response rates. The reviewed studies revealed the incentives before the participants started the surveys, this study didn’t reveal the online incentive until the participants clicked the “Submit” button. Whether this way is more effective to recruit responses need further investigation. It would be also helpful to understand the reward method better if future study will examine the data quality between the different reward methods to see if the online incentive method may be at cost of authentic data even it has higher response rate.

In terms of time duration to complete a survey, there was significant difference between the single-page and multiple-page design. The multiple-page design had significantly longer time than the single-page design. It is very interesting that even though the multiple-page design took participants longer time to complete a survey, the response rate was similar to that in the single-page design. It would help understand this type of design if research will study data quality in the single-page and multiple-page design. In other words, participants in single-page design or multiple-page design might
choose to take the surveying without thinking each answer very carefully and at a cost of data quality.

This study revealed that there was significant difference among the three different reward methods in terms of time duration to complete a survey. The lottery group with a mean time of 561.14 seconds (9.35 minutes) had significantly longer time than the incentive group with 478.80 seconds (7.98 minutes). The lottery participants might think they couldn’t get the prize immediately anyway and they just took their time. Among the incentive group, it could be that they couldn’t wait to see the online incentive and speeded up their survey responding. The reason behind this result needs further studies. It would be worthwhile to investigate if there is significant difference of data quality among the reward methods.

In terms of answered-item numbers, there was no significant difference between the two types of survey page design and among the three reward methods. Findings also indicated that no significant interaction effect existed between design and reward method on answered-item number. Same though about data quality as mentioned above may also apply to this. Even though the two design, as well as the three reward methods, had similar number of missed items, whether the quality of answered items is same need exploration.

In addition, the current study had some additional findings about abandonment, drop outs, and effect of follow-up notice on response rate. It found that there was no significant difference between the single-page multiple-page designs regarding abandonment. The incentive group had significantly higher abandonment than both no-incentive group and lottery group. In terms of drop outs (limited to multiple-page
survey), the incentive group had significantly higher drop-outs than the no-incentive and lottery group. As to follow-up effects, the first follow-up reminder doubled the response rates for the Web survey. Female participants had significantly higher number than male participants among the submitted surveys. It would be interesting to explore whether or not female students may be more dedicated to web-based research than male students.

Further, technology does improve efficiency in such areas as: count of answered items, simultaneously record time duration to complete a survey, send survey invitation by group instead of one by one, and follow-up emails sent automatically based on the recorded signature (99% participants printed their name in the required box).

*Recommendations for Future Web-based Survey Design and Study*

1. Based on the previously reviewed literature about response rates of Web-based survey, this study had low response rate (12.42%). How to improve the response rate of a Web-based survey still need future exploration.

2. In this study both the single-page and multiple-page survey were designed with simple and user-friendly interface considerations from the research perspective. This study was the first attempt to examine difference of submitted response rate between single-page and multiple-page survey design. It could be that if a Web-based survey is designed as simple and user friendly as possible, it wouldn’t matter if the survey is in a single page or in multiple pages regarding to response rate. Furthermore, if the new technology, such as a wheel-built-in mouse, has been reducing the scrolling burden and making single-page and multiple-page proportionately preferred still needs investigation. Difference of response
rate between single-page and multiple-page design should be further investigated.

3. Currently, the online incentive method seems feasible to increase response rate. However, the study didn’t reveal the incentive to participants until they clicked the “Submit’ button. Future studies may choose to use this online incentive method to recruit responses from college students. Whether pre-revealed incentive method or pro-revealed methods works better need exploration.

4. Several researchers (Couper, Traugott, & Lamias, 2001; Dillman et al., 1998; Dillman et al., 2000; Fuchs, 2001; Sax, Gilmartin, & Bryant, 2003; Smith 1997) have noted that the multiple-page survey takes longer time for participants to complete. Although this study failed to identify difference of response rate between the single-page and multiple-page design, whether data quality is identical or not between single-page and multiple-page design needs exploration.

5. Difference of survey participation between Multiple-page design with and without progress indicator need future research.

6. The lottery group had significantly longer time than the incentive group in this study. The lottery participants might think they couldn’t get the prize immediately anyway and they just took their time. Among the incentive group, it could be that they couldn’t wait to see the online incentive and speeded up their survey responding. The reason behind this result needs further studies.
7. Further studies need to examine difference of the actual survey data between the incentive and lottery method to see if although the incentive method could speed up the survey completion, it could be at a cost of data quality.

8. In terms of number of responded items, the current study failed to identify difference between the two types of survey page design and among the three reward methods. A study to further explore significant difference of different Web survey design, not limited to single-page and multiple-page design, as well as reward methods should be conducted. It would be helpful to minimize the missing data and increase reliability and validity of a survey.

9. Based on the additional findings, a follow-up reminder should avoid the time period of finals for students. A shorter time span between two follow-up reminders may result additional responses.

10. The incentive group had significantly higher abandonment than the other two groups in this current study. The reason behind it needs to be examined.

11. A future study should implement the technology to record response behaviors in both of the single-page and multiple-page survey to investigate the significant difference of drop outs.
References


Appendices

(From Appendix A to Appendix P)
Appendix A

The Survey in Single-page Design

The single-page design is also available at

http://oak.cats.ohiou.edu/~ys285700/onepage/OnePage.htm
Appendix B

The Survey in Multiple-page Design

The multiple-page survey is also available at

http://oak.cats.ohiou.edu/~ys285700/multiplepage/IncentiveMultiPage1.htm
Dear Students,

You are invited to participate in an online survey conducted by Yanling Sun for dissertation research purpose. This survey instrument is about your perceptions and use of the computer, email, the World Wide Web and the Internet. It will take approximately 10 minutes of your time.

Please click the link below to access the survey website.
http://surveys.chimaeramultimedia.com/no_single

Your participation is very important to my study! Thank you very much for your time and support!

Sincerely
Yanling Sun

Ph.D student
Instructional Technology
Ohio University
Appendix D

Email to the No-incentive Group in Multiple--page Design

Dear Students,

You are invited to participate in an online survey conducted by Yanling Sun for dissertation research purpose. This survey instrument is about your perceptions and use of the computer, email, the World Wide Web and the Internet. It will take approximately 10 minutes of your time.

Please click the link below to access the survey website.
http://surveys.chimaeramultimedia.com/no_multiple

Your participation is very important to my study! Thank you very much for your time and support!

Sincerely
Yanling Sun

Ph.D student
Instructional Technology
Ohio University
Appendix E

Email to the Incentive Group in Single-page Design

Dear Students,

You are invited to participate in an online survey conducted by Yanling Sun for dissertation research purpose. This survey instrument is about your perceptions and use of the computer, email, the World Wide Web and the Internet. It will take approximately 10 minutes of your time.

After you complete the survey, you will get an online incentive reward. Please click the link below to access the survey website.
http://surveys.chimaeramultimedia.com/g2in.htm

Your participation is very important to my study! Thank you very much for your time and support!

Sincerely
Yanling Sun
Ph.D student
Instructional Technology
Ohio University
Appendix F

Email to the Incentive Group in Multiple-page Design

Dear Students,

You are invited to participate in an online survey conducted by Yanling Sun for dissertation research purpose. This survey instrument is about your perceptions and use of the computer, email, the World Wide Web and the Internet. It will take approximately 10 minutes of your time.

After you complete the survey, you will get an online incentive reward. Please click the link below to access the survey website.
http://surveys.chimaeramultimedia.com/g2in_m.htm

Your participation is very important to my study! Thank you very much for your time and support!

Sincerely
Yanling Sun
Ph.D student
Instructional Technology
Ohio University
Dear Students,

You are invited to participate in an online survey conducted by Yanling Sun for dissertation research purpose. This survey instrument is about your perceptions and use of the computer, email, the World Wide Web and the Internet. It will take approximately 10 minutes of your time.

After you complete the survey, you will have a chance to win a lottery, which is a Flash Memory (a USB storage medium of 512 Megabytes) with a value of $40.

Please click the link below to access the survey website.

http://surveys.chimaeramultimedia.com/g3lo.htm

Your participation is very important to my study! Thank you very much for your time and support!

Sincerely
Yanling Sun

Ph.D student
Instructional Technology
Ohio University
Email to the Lottery Group in Multiple-page Design

Dear Students,

You are invited to participate in an online survey conducted by Yanling Sun for dissertation research purpose. This survey instrument is about your perceptions and use of the computer, email, the World Wide Web and the Internet. It will take approximately 10 minutes of your time.

After you complete the survey, you will have a chance to win a lottery, which is a Flash Memory (a USB storage medium of 512 Megabytes) with a value of $40.

Please click the link below to access the survey website.

http://surveys.chimaeramultimedia.com/g3lo_m.htm

Your participation is very important to my study! Thank you very much for your time and support!

Sincerely
Yanling Sun

Ph.D student
Instructional Technology
Ohio University
## Appendix I

### Pilot Study Reliability Analysis Results

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Reliability Coefficients 69 items

N of Cases = 745

Cronbach’s Alpha = .909 Cronbach's Alpha Based on Standardized Items= .917
Appendix K

Comparisons of Reliability between Pilot and the Actual Study

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Normality Assumption
(Time Duration to Complete a Survey as the Dependent Variable)

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Histogram
For Reward = No-incentive

Histogram
For Design = Multiple-page

Histogram
For Reward = Incentive

Histogram
For Reward = Incentive
Appendix N

Normality Assumption
(Number of Answered Items as the Dependent Variable)

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Histogram
For Reward = No-incentive

Histogram
For Design = Multiple-page

Histogram
For Reward = Incentive

Histogram
For Reward = Incentive
Appendix O

*Homogeneity Test with Time Duration to Complete a Survey as the Dependent Variable*

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Significance level at .05
Appendix P

Homogeneity Test with Number of Answered Items as the Dependent Variable

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Significance level at .05