Use of web-based surveys in social science and education research:

Practical and methodological considerations

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The World Wide Web (WWW) is an increasingly popular space for the solicitation of participants, the distribution of survey materials and the collection of survey data. Web-based surveys have a number of advantages and disadvantages of both a practical and methodological nature, and a researcher’s decision to use this type of methodology should be based on the context of the research question to be addressed.

This paper will address the pros and cons of using web-based surveys as well as investigate recent attempts by researchers to address some of the more pernicious methodological concerns with using this mode. Finally, important design considerations of web-based surveys will be considered and evaluated.

Researchers in the social sciences have a variety of tools at their fingertips in terms of accessing groups of respondents for questionnaire completion. From traditional mail to email, using both printed and produced materials or materials based on the World Wide Web (WWW), getting in touch with potential participants and delivering them research materials has never been more laden with methodological and practical considerations than it is today. However, as with every choice made in designing a research project, the decision to use one mode of survey delivery over another must be made bearing in mind not only the context of the research question and the population with which to work, but also the scientific and practical advantages and disadvantages of the mode itself.
The aim of this article is to take a closer look at web-based survey delivery and its implications for research in the field of education, its numerous advantages and troublesome methodological disadvantages, as well as ways in which recent studies have attempted to address these concerns. Finally, more specific design considerations of using this mode will be examined in some detail.

I. ADVANTAGES OF USING WEB-BASED SURVEYS

There are many advantages of using web-based surveys rather than the traditional paper and pencil surveys which have been historically prevalent in social science research. While some of these advantages are of a more practical nature, others contribute to methodological considerations. Table 1 presents a list of both the practical and methodological advantages associated with web-based surveys.

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<td>Ease of use for participants</td>
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a. Practical considerations

One significant advantage of using web-based surveys is the speed at which information completed by the participants can be transmitted to the researcher (Thach 1995; McCabe, Boyd, Couper, Crawford & D’Arcy 2002; Truell, Barlett & Alexander 2002). Additionally, the recruitment time can be significantly diminished (Pettit 2002), and several studies which have used web-based survey technology have found that the vast majority of respondents completed the survey within the first month of solicitations being posted (McCabe et al 2002; Quartaro & Spier 2002). In education research, if schools can offer the necessary resources, secondary and tertiary students can take web-based surveys on school-based computer equipment, further streamlining the process. Additionally, at most tertiary institutions students are assigned email addresses, making it relatively simple to distribute research materials.
Another powerful advantage of using web-based surveys is the efficiency of data cleaning and the subsequent impact on data analysis (Thach 1995; Hallfors, Khatapoush, Kadushin, Watson & Saxe 2000; Daley, McDermott, McCormack-Brown & Kittleson 2003). With participants' responses being collected electronically, quantitative data can be pre-coded and exported to the relevant analysis software application with a few clicks of the mouse, which inevitably helps to eliminate researcher error, created when participants' survey responses must be entered into a computer by hand (Dix & Anderson 2000; Pettit 2002).

The use of web-based surveys expands the geographic boundaries placed on social science and education research. The World Wide Web (WWW) exists outside of the confines of conventional borders or time zones, making it almost as easy and costly for an individual on the other side of the globe to view a survey online, than it is for someone mere kilometres away. The impact of this wide geographic reach is an exciting advantage for social research (Coomber 1997; Bailey, Foote & Thrackmorton 2000; Menon 2002) and portends limitless possibilities for comparative studies in the field of education.

While web-based surveys rely on the use of equipment and software which is often relatively expensive and does require some training on the part of the researcher, using this technology for data collection is far less expensive for the researcher than using traditional paper and pencil methods. From paper and photocopying costs to postage costs for surveys distributed by mail, using the alternative of web-based surveys can be extremely cost effective (Thach 1995; Reips 2000; Lenert & Skoczen 2002; Mathy, Schillace, Coleman & Berquist 2002; Pettit 2002). As previously mentioned, as a matter of course many secondary and tertiary educational institutions house the necessary equipment to make this survey delivery mode even more cost effective for student participants in a education research context.

Web-based surveys are also found to be easy-to-use and less cumbersome than paper and pencil surveys, especially if designers take advantage of the item-branching capabilities of this mode (Dillman 2000; Dix & Anderson 2000; Reips 2000). For participants taking a survey on the internet, the measurement error created by the use of contingency questions can be eliminated as participants can be directed from one set of questions to another, without ever seeing those that do not apply to them. Additionally, where in traditional paper and pencil surveys participants can sometimes inadvertently skip whole pages or provide answers that are difficult to read or place into a specific multiple choice response, computerised surveys eliminate this potential problem, as participants are guaranteed to see all the questions that apply to them and cannot provide illegible answers. For studies such as those in the field of education which can rely upon a younger cohort of participants with questionable handwriting readability, this is a particularly salient advantage.
b. Methodological Considerations

As highlighted above, the wide geographical reach of web-based surveys is a major advantage of this mode of survey delivery. Likewise, as more and more households become connected to the WWW each year, web-based surveys provide the potential for very large samples, the likes of which could prove prohibitively expensive using traditional means (Bailey et al 2000; Buchanan 2000; Couper 2000). Additionally, studies using web-based surveys have reported that survey completion rates are enhanced using this mode (Hallfors et al 2000; McCabe et al 2002; Trueell et al 2002).

The fact that web-based surveys can be theoretically be completed at the discretion of the participant (i.e. when and where the subject wants to participate, with the potential for the participant to be alone during completion), has a wide array of benefits from decreasing, if not eliminating, subject-response bias through a lack of researcher-subject contact (Quartararo & Spier 2002; Duncan, White & Nicholson 2003), to creating a more relaxed and enjoyable experience for the participant (Booth-Kewley, Edwards & Rosenfeld 1992; Daley et al 2003). Additionally, while people of a variety of ages have found computerised surveys to be enjoyable to complete, this mode is particularly attractive to younger age cohorts (Skinner, Maley, Smith, Chirrey & Morrison 2001; McCabe et al 2002), a powerful advantage when using web-based surveys with school-aged participants.

Depending, of course, on the method of distribution, web-based surveys can maximise the anonymity of the respondent (Coomber 1997; Duncan et al 2003) as, in many cases, the researcher has no contact with the participants whatsoever. Whilst this issue can also be regarded as a negative effect of using web-based surveys, this guaranteed anonymity is an attractive feature for many participants. Likewise, computerised surveys create a sense of social distance which can contribute to a greater likelihood of respondents disclosing sensitive personal information and/or stigmatised behaviours in which they have engaged (Coomber 1997; Turner, Ku, Rodgers, Lindberg, Pleck & Sonenstein 1998; Bailey et al 2000; Hallfors et al 2000; Duncan et al 2003; Tourangeau, Couper & Steiger 2003).

In a 1998 study by Turner et al., examining adolescent sexual behaviour, drug use and violence, the authors compared data from the US-based National Survey of Adolescent Males (NSAM) using both a traditional paper and pencil survey mode and a computerised version (Audio-CASI) and found that on virtually every measure, participants using the computerised mode were more likely to report having engaged in risk behaviour, drug use, homosexual activities and socially stigmatised heterosexual activities. More specifically, respondents were almost four times as likely to report some form of homosexual activity using the computerised survey then using the paper and pencil mode.

Similarly, a study by Bailey et al (2000) comparing responses to web-based and paper and pencil surveys asked respondents about a variety of sensitive topics including frequency of masturbation, attitudes towards extramarital intercourse and homosexual
activity. Although the samples for both modes in this study are not entirely comparable, with the paper and pencil sample being drawn from university students and the internet sample being open to all individuals who discovered the survey online, the results overwhelmingly support the idea that respondents are more likely to disclose sensitive information whilst using a computer. On the web-based survey, three times as many men and five times as many women as on the paper and pencil survey reported having engaged in same-sex sexual activity, while respondents using the paper and pencil mode reported masturbating at half the frequency of internet respondents.

The internet is an effective mode for accessing populations which are difficult and costly to reach through more traditional methods (sometimes known as ‘hidden populations’). With the advent of internet-based social groups which cater for a wide variety of interests, researchers have access to a vast array of specialised groups via ‘listservs’ and ‘chatgroups,’ potentially creating a more representative sample of such persons (Reips 2000; Hillier, Kurdas & Horsley 2001; Koch & Emery 2001; Epstein & Klinkenberg 2002; Mathy et al 2002; Quartaro & Spiers 2002).

For example, for research conducted with gay and lesbian participants – a notoriously ‘hidden’ subgroup – Mathy et al (2002) point out:

Few researchers have the time and financial resources to conduct surveys of sufficient size to gather a subsample of lesbian, gay male, and bisexual respondents large enough to conduct rigorous analyses...Consider that a sample of 384 gay men and 384 lesbian women would be needed to obtain sample sizes with a 95% confidence interval with no more than a relatively generous 0.05 error or estimation (n=([(1.96)squared*(0.25)]/(0.05)squared]). With about 0.025 of the general population publicly identifying as homosexual to NORC survey interviewers, a random sample of 15,360 men (1.00/0.025 = 40; 40*384 = 15,360) and the same number of women would be needed to obtain the requisite sizes of subsamples of gay men and lesbian women in the general population (pp. 254-255).

The authors found that using the internet as a means of searching for gay and lesbian persons to participate in their research proved a useful and worthwhile alternative.

Likewise, Koch and Emery (2001) make the point that, ‘internet surveys are an extension of survey research techniques (i.e., purposive samples) that, although not optimal in the classic textbook sense, are used quite frequently in sampling populations where adequate sampling frames are not available’ (pp. 132). In their survey of gay and lesbian adults, the authors posted surveys on a popular website which targets the gay and lesbian community and organised a Computer Centre where those without access to a computer could participate in the research. They collected demographic data on participants and compared it to the 1992 Voter Research and Surveys exit poll, finding that the distribution on six demographic variables, including education, income and age, tended to be similar.

Another ‘hidden population’ which has been accessed successfully through web-based surveys is that of illicit drug users/dealers. Duncan et al (2003) noted that the
majority of research with injecting drug users has relied on persons who have encountered the judicial system, been treated for addiction, or have been contacted through 'street' contacts and has yielded a sample in which white drug users are underrepresented. In their study, the authors found that the respondents felt secure enough to answer questions of a very personal nature using the web-based survey and that the open-ended responses, '...were often powerfully emotional, indicating this population's strong needs to be heard. If given enough safety and security, they appear more than willing to tell their stories' (pp. 215). In his research on the behaviours of illicit drug dealers, Coomber (1997) also found the internet to be a preferable method for both solicitation of participants through relevant internet communities and for data collection itself, having received 80 reliable responses to his survey online.

This last point poses a powerful advantage for using the internet and web-based surveys to collect data from 'hidden' sub-groups of the adolescent population in education research. Same-sex attracted young people, teenagers struggling with anorexia, bulimia or poor body image, drug users or victims of bullying are just a few examples of 'hidden' groups which could be targeted using this mode.

II. DISADVANTAGES OF USING WEB-BASED SURVEYS

While the advantages of using web-based surveys are rather persuasive and clearly beneficial for research with certain difficult to access populations, the disadvantages of using this mode significantly lessen its attractiveness. In addition to other practical concerns, researchers have identified four types of error associated with using this mode, all of which can have a significant impact on the reliability and validity of the data collected (Couper 2000; Dillman & Bowker 2000). Table 2 outlines these disadvantages.

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<th>Practical Disadvantages</th>
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<td>Sampling error (nonprobabilistic sample)</td>
<td>Survey is subject to tampering (i.e. 'hackers')</td>
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<tr>
<td>Coverage error (online population)</td>
<td>Participants' confidentiality fears using the computer for data transmission</td>
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<tr>
<td>Nonresponse rates are difficult/impossible to calculate</td>
<td>Survey completed in uncontrolled environment</td>
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<td>Measurement error (technical difficulties/ data integrity)</td>
<td>Large drop out rates</td>
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a. Error Associated with Web-based Surveys

The first, and most significant, type of error associated with web-based surveys is that of sampling error. When using web-based surveys to solicit a self-selected or volunteer sample, the sample collected is non-probabilistic, which by definition precludes any generalisation to the larger population and limits external validity (Dillman & Bowker 2000; Reips 2000; Couper 2001; Sills and Song 2002; Truell et al 2002). When conducting research with ‘hidden’ subgroups, constructing a sampling frame might not be possible, in which case any information collected is certainly better than no information at all, however in instances where a suitable sampling frame can be generated and where the broader purpose is to make statements about the population at large, using this type of sampling on the internet is not recommended.

Coverage error occurs when all potential members of the target group have not been given the same opportunity to participate in the research. In the case of web-based surveys, coverage error is inherent in using this mode due to the fact that not all members of any given population have access to the internet. The current demographics (specifically those pertaining to race, education level and income) of internet users contribute to selection bias and make using this mode less attractive (Thach 1995; Kaye & Johnson 1999; Pettit 1999; Dillman & Bowker 2000; Duncan et al 2002; Lenert 2002).

While not specific to sampling associated with web-based surveys, a third type of error is nonresponse error. In the instance that participants for this type of research are solicited through public advertisements, either on line or through other media, it is impossible to calculate nonresponse rates because it is not possible to calculate a ratio of respondents to those who viewed the advertisement yet chose not to respond (Kaye & Johnson 1999; Couper 2000; Dillman & Bowker 2000; Lenert 2002; Mathy et al 2002). However, ‘tracking’ software exists and can allow researchers to calculate who viewed the actual survey and either a) dropped out midway or b) chose not to participate after viewing the survey itself, making internet surveys useful in that regard. An additional impact of nonresponse error is pointed out by Dillman and Bowker (2000). In the event that participants are self-selecting and invited to participate through a variety of public media, ‘Response rates are likely to be...heavily influenced by interest in the topic and/or the technology of responding’ (pp. 5).

Measurement error can occur when using web-based surveys due to a variety of technical problems that can occur when using the internet as a research tool. The fact that there are several different types of browsers and operating systems in use has a significant impact on how a survey will appear from computer to computer (Couper 2000; Sills & Song 2002). However, it should be noted that this disadvantage may be minimised in education research using school-based computer labs to display web pages in a standardised manner. Additionally, as many researchers do not have the funding to have individual servers for their online data collection, results can be impacted by any viruses or delays occurring with the public server which is hosting the survey (Dillman 2000; Daley et al 2003; Knapp & Kirk 2003). This last point in particular can have
disastrous effects on data collection and results for web-based surveys. Insufficient participant knowledge of computer/keyboard operations can also lead to measurement error, especially for younger subject cohorts.

Additionally, data integrity on web-based surveys can be affected, as it is easy for participants to provide false data online, an action perhaps made less problematic for people given the sense of social distance created by the internet (Lenert 2002; Mathy et al 2002). This acts as another type of measurement error. However, it is ostensibly just as easy for persons to provide false data on surveys using the traditional postal mail mode of delivery or on telephone surveys. Multiple submissions can be a problem with web-based surveys as well (Dillman 2000) but it is increasingly easy to guard against this as researchers can use tracking software to eliminate multiple submissions while still maintaining the anonymity of the participants.

b. Practical considerations

In addition to these four types of error, there are also more practical disadvantages of using this mode of data collection. As the internet is a completely public domain, research conducted in this arena is open to malicious tampering. Andrews, Nonnecke and Preece (2003) provide an example of the effects of tampering in that their survey was ‘hacked’ and purposely infected with a virus. They caution researchers to protect against this possibility by using strong firewall security.

While an advantage of using this mode is that anonymity is maximised, a disadvantage is that some potential participants might not want to provide information using the computer due to fears that their confidentiality may be breached (Couper 2000; O'Neil 2001; Cronk & West 2002). Cronk and West (2002) also point out that while an advantage of online surveys is that participants can complete them at their leisure, respondents also participate unsupervised, with the impact of random events completely unknown and the potential for motivation to be impacted. However, it is noteworthy that a 1997 study by Carlsmith and Fraiser-Chabot found no significant differences in the responses from a supervised and unsupervised group to a web-based survey in their sample of over 650 participants, wherein the unsupervised group took the survey at home or in public computer clusters at their leisure.

Finally, while some researchers have found that web-based survey completion rates have either improved or at least been equal to that of traditional paper and pencil surveys, others have found large drop out rates when using web-based surveys (Couper 2000; O'Neil & Penrod 2001; Epstein & Klinkenberg 2002). This could perhaps be attributed to the ephemeral quality of the internet, where it is easy to flit from one web page to another with a click of a button as one ‘surfs’ the web for more interesting information. Some authors even suspect that as the internet becomes less novel, interest in participation in online surveys will wane (Couper 2000; Daley et al 2003; Knapp & Kirk 2003), while others predict that due to the increasing number of surveys on the internet the mode will ‘collapse under its own weight’ as internet users tire of being solicited for participation (Couper 2000, pp. 465).
III. ADDRESSING METHODOLOGICAL CONCERNS IN WEB-BASED SURVEYS

Given the types of error associated with web-based surveys listed in the previous section, a number of researchers have conducted studies with the aim of addressing these issues. There are three main areas which have received considerable attention from researchers using surveys on the internet: sampling concerns, the preservation of data integrity and assessing the equivalency of web-based and paper and pencil surveys. Additionally, piloting in web-based surveys is especially important given the differences in how information is comprehended which apply to the internet. These issues will be addressed in brief below.

a. Sampling concerns

In attempting to access hidden populations, some researchers have simply ‘cast a wide net,’ placing solicitations in a variety of areas and through a number of different media courses to obtain the largest possible sample where a complete sampling frame is unavailable. However, this type of non-probabilistic sampling has received negative feedback from the research community, with scepticism levied as to the reliability and validity of the data collected, even when the known difficulties of accessing certain population groups are considered.

Mathy et al (2002) have presented an interesting approach to address this dilemma through the use of ‘Cybersurvey’, a method which uses random sampling of internet chat rooms to collect a sample for participation in their research. Their goal was to move one step closer to obtaining a random sample of the gay and lesbian population, albeit the gay and lesbian online population. Using this method, the authors conducted a search using multiple search engines to create an exhaustive list of ‘chat rooms’ associated with gay and lesbian topics, interests, etc. Once this list was compiled, a random number key was used to invite individuals in each chat room to participate in the study. Using this methodology, potential participants are invited to either accept or decline the invitation and if they decline, the next person on the list is invited to participate. For those who accept, they are provided with the URL address and a link to the web-based survey.

Using this method to ‘sample’ lesbian and bisexual females, Mathy et al recruited 82 participants. The goal was to obtain a representative sample and, towards this end, the authors compared demographic data from their sample to a number of other (U.S.) national samples. While their sample was not comparable to U.S. Census data, there were no statistically significant differences between their sample and a Gallup Poll of internet users, leading the authors to conclude that using the Cybersurvey sampling methodology is more robust than non-probabilistic sampling methods often used with web-based surveys for hidden populations. It is worth noting, however, that while ‘Cybersurvey’ sampling methods can easily be adapted for education research to target secondary and tertiary students through age-specific chat rooms, the ethics of this approach seem questionable at best.
Couper (2000), in his discussion of sampling as it relates to web-based surveys, details a number of probability-based methods for collecting samples using this methodology. He presents the following five types of probability-based methods:

1. **Intercept surveys**: Every nth visitor to a website is invited to participate in the web-based survey. The sampling frame is thereby defined as consisting of all visitors to the website.

2. **List-based samples of high-coverage populations**: This method should be used when the researcher has a complete list of a population with Web access (i.e., university students). Invitations are sent by email to participate and access is controlled to prevent multiple submissions.

3. **Mixed-mode designs**: After a random sample of a given population is created, participants are given a choice of delivery methods, with the internet being one of a group of choices.

4. **Pre-recruited panels of internet users**: Participants are recruited using probability sampling methods such as RDD telephone surveys to obtain a probability sample of those with access to the internet.

5. **Probability samples of full populations**: As above probability samples are collected using RDD telephone surveys, however those reporting no access to the internet are provided with the necessary tools in exchange for their participation in the web-based survey.

As illustrated, it is not impossible to conduct a web-based survey with probability-based sampling methods. That said, it is important to be context, as well as cost sensitive, as a few of the methods listed above are rather expensive and, as noted by Couper (2000), 'We need to learn when the restricted population of the Web does not matter, under which conditions low response rates on the Web may still yield useful information...’ (pp. 490).

**b. Preservation of data integrity**

Multiple submissions can be a significant source of error for studies using web-based surveys. Participants can either purposely or accidentally complete and submit their responses a number of times unless certain precautions are taken. The following section outlines the work of researchers who have taken such precautions and the outcomes of these decisions.

While some researchers might decide to ask participants for their email address or some other form of identifying information to deter/detect multiple submissions, users might prefer to remain completely anonymous, more so if the survey asks them to reveal sensitive personal information. The choice not to ask participants for identifying information does not preclude researchers the opportunity to detect multiple submissions, whilst still protecting the anonymity of the participants. As Lazar and Preece (1999) discuss, when pages are accessed online, the network location of the computer requesting the webpage is recorded by the server which hosts the page. It is
possible for website designers to write code for their sites which includes a request for the internet domain name (or IP address) of the survey respondent. By entering this information into a database, researchers are able to delete multiple submissions from a single IP address (Lazar & Preece 1999, pp. 65). However, it is noteworthy that it is possible for web-based surveys to be completed using computers with the same IP address, yet not from the same participant (i.e. a computer in a public space, such as an internet café, school-based computer lab or library, or multiple submissions from within the same household). It is important for researchers to bear this in mind to avoid needlessly deleting responses.

However, as most household internet users are not directly connected to the internet and, alternatively, use a service provider each time the user connects to the internet, an IP address is randomly assigned from a pool of numbers available to that network or service provider (Epstein & Klinkenberg 2002). This means that duplicate IP numbers are not necessarily being generated from the same computer or that a single user has provided information twice. Epstein and Klinkenberg (2002) used an alternative method for identifying repeat submissions using ‘cookies,’ or a small text file that is written onto a participant’s computer’s hard drive. Accordingly, they program their survey to detect the ‘cookies’ on participants’ hard drives to examine the results for multiple submissions (i.e. if the program detected their ‘cookie’ on the hard drive, they could tell that a participant had already visited the site). Because, as above with IP addresses, multiple submissions from the same computer would not necessarily indicate multiple submissions from the same person, the authors instead examined all cases with a ‘cookie’ status greater than one and deleted cases where the responses were clearly identical to other entries in the database.

It is worth noting, however that neither method accurately allows researchers to detect false entries and determined individuals could create a large number of disingenuous personas, completing the survey using each persona. Even so, using IP addresses and ‘cookies’ provide an additional check for researchers attempting to further protect the integrity of their data collected online. The only way to concretely protect a web-based survey from false/multiple responses is to assign a PIN number to potential respondents, however this does entail having an adequate sampling frame of email addresses through which to solicit participants and provide them with PIN numbers, as well as being acutely aware of the response effects of requiring personal information from respondents (Heerwegh & Loosveldt 2002a).

c. Equivalency of web-based and paper and pencil surveys

Given the number of challenges to the reliability and validity of web-based surveys, as well as the proliferation of negative critiques of the methodology, a number of researchers have sought to examine the similarities and differences with regard to sample characteristics and data collected between web-based and paper and pencil surveys. The conclusion of much of this research is that the two methods of survey delivery are virtually equivalent.
In 1992, Booth-Kewley et al conducted a study to investigate the effects of computer-based surveys. Participants were recruited from a bounded sampling frame and randomly assigned to either a paper and pencil questionnaire, a computerised questionnaire with backtracking allowed, or a computerised questionnaire which did not allow backtracking. The authors did not find any significant main effects for any of the three delivery modes, coming to the conclusion that all three modes were equivalent. Additionally, the reliability coefficients for the two scales that they utilised were similar between both methods.

Pettit (2002) attempted to investigate whether or not data collected via the internet was able to adequately replicate data collected via a paper and pencil survey. In her study, participants taking the web-based questionnaire as well as those taking the paper and pencil questionnaire were recruited in the same manner using online search engines, research lists and newsgroups and were randomly assigned to a survey mode. Pettit examined a number of response effects for both groups, including random responding and item nonresponse, as well as univariate and bivariate results and scale properties and found no significant differences between the data collected using the two different modes of survey delivery. Pettit concluded that given the advantages of using web-based surveys such as speed and cost, as well as the equivalency of the data collected, that the internet was an attractive venue for recruitment and the delivery of questionnaires.

In a 2002 study by Truell et al, the authors examined response rates, speed and completeness for web-based and paper and pencil questionnaires. Using a bounded sampling frame, participants were randomly assigned to either mode. In their critique of the mode the authors were able to report no significant differences in return rates for both methods of survey delivery. Additionally, they found the response completeness and the speed of return of their web-based survey to be significantly higher than the paper and pencil version. Likewise, both McCabe et al (2002) and Knapp and Kirk (2003) randomly assigned groups of university students to either a paper and pencil or web-based survey delivery mode. After data analysis, the authors of both independent studies concluded that the internet was as effective or more effective than the mail as a method of collecting survey data from populations that have near universal access to the internet.

With regards to the sampling issues which affect the equivalency of these two methods of survey delivery, Couper (2001) notes that web penetration is increasing daily and that the web population increasingly resembles the broader population demographically. He points out that at one point, social scientists were just as concerned about the use of the telephone for random sampling and survey delivery, a method that is now a widespread method of data collection. Couper advises that, in the event that the sample collected does not exactly match the known characteristics of the larger population, weighting can easily be used to force sample characteristics to conform to those of known populations.

d. Piloting with web-based surveys

When using the internet as a means of hosting a survey, the same piloting considerations should apply but additional checks should be made to ensure data compatibility, user
comprehension and to essentially scour the site for ‘glitches,’ or small technical problems which would interfere with data collection. While pre-pilot and pilot tests should be conducted with members of the population cohort to be examined in order to determine completion time, readability and response rates (Dix & Anderson 2000; Daley et al 2003), based on a review of the relevant literature Andrews et al (2003) recommend a four-step survey piloting process.

The first stage in their process consists of a colleague test wherein the issues of question completeness, efficiency, relevancy, scale and format appropriateness are addressed. In applying this first step to their own web-based research, Andrews et al (2003) sent the URL for their survey to a mailing list of a group of internet researchers. As they relay it, the feedback received from this mail-out was incredibly useful. In the second step of the piloting process, a subgroup of the target population take the survey online using a ‘think aloud’ technique to help the researchers refine the appropriateness of the language used, consistency of question interpretation, logical question sequencing and the ‘look and feel’ of the survey itself. This step is especially useful when creating survey materials for a younger cohort, such as in the case with some education research. By having adolescents complete the survey in this way, researchers can more genuinely evaluate their own attempts at making the website ‘teen-friendly.’ The third step, the live test, consists of what is traditionally viewed as a pilot, where all procedures proposed in the main study are followed. The final step is a last cleaning process where a final check is imposed on the survey for any spelling or typographical errors and any remaining ‘glitches.’

IV. WEB-BASED SURVEY DESIGN CONSIDERATIONS

Given the limitless possibilities for survey construction using the internet, a growing body of research has begun to address the impact of a variety of design considerations on outcomes of web-based surveys – some simply aesthetic and others more methodological in nature. Table 3 lists the various design considerations discussed in this section.

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<td>Requiring personal information from participants</td>
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<td>Indication of survey progress</td>
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<td>Response form format (radio buttons vs. drop-down boxes)</td>
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<td>Complexity of design</td>
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a. Financial Incentives

While the choice to use financial incentives is an important one for most forms of research with human subjects, this is a particularly interesting issue for web-based surveys in that participants and researcher never come into face-to-face contact and therefore incentives must somehow be offered through online methods, whilst still attempting to preserve the anonymity of the participants.

In a 2001 study by O’Neil and Penrod, the authors compared drop out rates and substantive results in two different versions of web-based surveys, one which offered financial incentive in the form of a lottery for monetary prizes and another which did not. They did not find any significant effects of offering payment on drop out rates, either at the outset of the survey (welcome and introduction pages) nor at the beginning of the substantive questions. In a follow up study (O’Neil, Penrod & Bornstein 2003), the authors compared drop out rates and sample characteristics as they were related to a) not offering a financial incentive, b) offering a lottery for one large prize ($250) or c) offering a lottery for several smaller prizes at a slightly higher probability. In contrast, their results support offering a financial incentive to increase sample size, finding a 10% increase in sample size when participants were offered the lottery, while seeing no effects on the sample characteristics. They also found that participants who chose the option of inclusion in the lottery with multiple smaller prizes were more likely to continue the survey than those who preferred the option of one larger prize. More research on the effects of offering financial incentives in web-based surveys needs to be completed before any definitive statements can be made in this area.

b. Requiring personal information

Anonymity is a key advantage of using web-based surveys. However, in some cases researchers many want to collect some form of identifying data for a variety of reasons germane to the research. As Lenert (2002) points out, the decision to obtain personal information should be made within the context of the research problem. ‘Anonymous surveys are most important for topics for which researchers suspect strong social response bias (drug abuse, sexuality, and racism). The choice should not be based on logistics’ (pp. 253).

O’Neil and Penrod (2001) found that requiring participants to enter their email addresses on the introductory page of the web-based survey had a significant effect on drop out, causing a 12% reduction in completion. Similarly, Lenert (2002) found that 40% of qualified participants dropped out of an online study by the University of California when presented with a request for a username and password, which would have linked respondents with their personal data. Irrespective of drop out rates, Lenert argues the advantages of using identified individuals as the following: immediate identification of repeat enrollees, the option of follow-up with participants, the ability to contact participants to confirm identity as a check against false responses and the option of allowing for individuals to log on and off to the website, thereby completing the survey over multiple time periods at their convenience (pp. 253).
c. Forced responses

Another tool inherent in using web-based surveys is the ability to require participants to provide an answer for each question before allowing them to move on to the next question, unlike paper and pencil surveys where participants can either accidentally or purposefully skip individual questions or entire pages of a survey. Whilst some researchers are of the opinion that taking a closer look at which survey questions participants skip provides valuable information regarding survey design, others find forcing participants to respond is a useful tool in eliminating missing data. Additionally, adding the ‘don’t know’ option is yet another quandary in questionnaire design.

In a study which speaks to this dilemma, DeRouvray and Couper (2002) examine several design approaches for web-based surveys with a variety of variables including both ‘decline to answer’ options and reminder prompts when participants did not select a response. The authors found that the version of the survey which did not include a ‘decline’ option but which did include a reminder prompt had the lowest missing data rates (4%), while including the ‘decline’ option and not a reminder prompt had the highest (11%). They also concluded that including a prompt screen does help to decrease missing data but does not have any affect on whether or not participants choose the ‘decline to answer’ option.

Dillman, Tortora and Bowker (1998), in their description of eleven ‘Principles for Conducting Web Surveys,’ caution against forcing participants to choose a response category before continuing to the next question. They assess that ‘The frustration associated with this requirement seems likely to lead to premature terminations. In addition, it poses a problem for surveyors when human protection committees legitimately insist that people be told that their response to each question is voluntary’ (pp. 11). It seems reasonable for researchers using web-based surveys to make their decision regarding this issue based on the content and context of their survey and to offer alternative (‘don’t know’) responses rather than forcing a choice.

d. Providing an indication of survey progress

Dillman (2000) and Dillman et al (1998) note that observations from web-based surveys suggest that participants sometimes quit surveys although they are close to completion due to being unaware of the exact length of the survey. A number of different ways that respondents can be kept informed of their progress are suggested: using questionnaires that scroll (respondents can judge the length of the survey by the position indicated on the scroll bar), placing a ‘progress bar’ somewhere on the screen to graphically demonstrate how much of the survey is left to complete, or including some type of creative, motivational animated graphic. Dillman et al (1998) caution for designers to be aware of how much of the available computer resources could be taken by using this last option and also offer the alternative of using transitional sentence language to inform participants of their progress in the survey. Dix and Anderson (2000) echo this suggestion, and advise that a progress monitor should be included on each new screen of the web-based survey to allow participants to judge their completion progress.
In their attempt to reach 'difficult to access populations,' Andrews et al (2003) broke their web-based survey into three different sections each with a 'submit' button. Early in their report, they note that participants may be more likely to drop out of a web-based survey based on their perceptions of the amount of effort required to complete the survey. It seems reasonable to conclude that providing respondents with a sense of progress and/or accomplishment during survey completion helps to prevent drop out and boost completion rates.

**e. Radio buttons vs. drop down boxes**

Another design option for web-based surveys, which differs from those available using traditional paper and pencil surveys, is that of response format. When constructing computerised surveys, researchers can choose between a number of response formats, the two most widely used being radio buttons and drop down boxes. Heerwegh and Loosveldt (2002b) conducted a study to investigate the effects of these two response formats on data quality. In their study, respondents needed more time to complete the survey which used drop down boxes, supporting their hypothesis that drop down boxes are more difficult to use. Additionally, they found that the survey which used this format also resulted in higher levels of dropout. However, the authors note that given that drop down boxes can be downloaded faster than radio buttons, there are important benefits to using such a response format, especially if it is speculated that members of the sample population will use computers with older operating systems and limited memory to access the survey.

Dillman (2000) advises against the use of drop down boxes, noting that when the participant displays all response choices and the participant chooses a response located lower on the screen, once the response is activated the cursor remains at that point on the screen. If this point is located several lines below the original question, respondents may be likely to continue from that point, inadvertently skipping a question or two in the process (pp. 393). Additionally, Dillman points out that when researchers use drop down boxes, they should be sure to leave the default response empty, rather than place the first answer category as the default response to avoid causing response bias.

**f. Simple vs. complex design**

Given the possibilities for website creation on the internet, there are many attractive possibilities for web-based survey designers including colour, animation, sound, boarders and layout. Whilst these variables can be manipulated, contributing to the ease of survey completion and greater level of comprehension by participants, more complex designs may actually have a negative impact on data quality. O’Neil et al (2003) compared both a simple (grey background, several items per table, fixed width of 600 pixels) and a complex (one table per question, alternating colour backgrounds, 120% of participants’ screens) design for their web-based survey, finding that the use of complex tables provoked dropout. The authors speculated that this finding resulted from
increased download time for the more complex visuals in the survey (pp. 224). Likewise, Dillman et al (1998) suggest that web-based questionnaires should be presented in a similar format/layout to their paper and pencil counterparts. In doing so, the authors argue that respondents become more likely to be guided by ‘questionnaire logic’ then by ‘computer logic’ (pp. 8-9). In terms of simple design, researchers writing for internet publishing are encouraged to use shorter sentences for ease of reading on the screen (Andrews et al 2003).

V. CONCLUDING POINTS

As echoed by many of the authors cited in this paper, a researcher’s decision to use one mode of survey delivery over the next must, first and foremost, be based on the context of the research question and next on the potential effects of the methodological and practical considerations associated with the method. As discussed, there are a number of attractive advantages to using web-based survey technology in education research, especially when attempting to access difficult to reach or ‘hidden’ populations, or in the event that the population is known to have near universal web access, as with students in tertiary education. The methodological concerns associated with web-based surveys are not to be ignored, however, specifically the sampling effects on reliability and validity inherent in using this mode. That said, a growing number of researchers in education, and the social sciences in general, are turning to web-based surveys as a practical method of recruiting their participants and delivering their materials. Their work contains valuable lessons and ‘tips’ for both design considerations and methodological concerns. It appears that in time, as more and more individuals access the World Wide Web, web-based survey research will take its place next to traditional paper and pencil survey research and telephone RDD research.

NOTES

1 Adapted from Couper (2000).

REFERENCES


