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Web-Based Questionnaires and the Mode Effect

An Evaluation Based on Completion Rates and Data Contents of Near-Identical Questionnaires Delivered in Different Modes

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Most methodological evaluations of web-based questionnaires have focused on the issues of sampling and response rates. Some have considered the issues of privacy and ethics. Relatively few have addressed the question of whether people provide different information depending on the mode of questionnaire delivery. This article contributes to this relatively overlooked aspect of the evaluation of web surveys. It presents initial findings from a survey that was designed to enable near-identical groups to respond to near-identical questionnaires delivered in different modes. Web-based questionnaires and paper-based questionnaires, used as part of a school-based study of young people's health-related behavior, are compared in terms of (a) completion rates and (b) data contents. Issues surrounding the quality of data and the reliability of web-based questionnaires are discussed. It is concluded that, on the basis of the quantitative data from this survey, there is little evidence of a mode effect linked to web-based questionnaires.

Keywords: *web-based questionnaire; mode effect; completion rate; data quality; reliability*

The potential advantages of using the Internet for the delivery of questionnaires have been documented fairly comprehensively (e.g., Dillman, 2000). Relative to their paper-based equivalents, web-based questionnaires are inexpensive and fast and can cover wide geographical areas. They are, therefore, an attractive proposition for researchers. However, the benefits that stem from the efficiency of delivery do not provide sufficient grounds in their own right to adopt the use of web-based questionnaires in preference to paper-based questionnaires. Consideration also needs to be given to quality of the data produced and the possible impact of the Internet mode of delivery on the information collected.

Research to date has tended to concentrate on the impact of the Internet mode of delivery on response rates, completion rates, and the representativeness of the sample from whom the data are collected (e.g., Best, Krueger, Hubbard, & Smith, 2001; Couper, 2000; Couper, Tourangeau, Conrad, & Crawford, 2004; Crawford, Couper, & Lamias, 2001; Heerwegh & Loosveldt, 2002; Kaplovitz, Hadlock, & Levine, 2004; McCabe, Boyd, Couper, Crawford, & D'Arcy, 2002; Porter & Whitcomb, 2003; Ross, Mansson, Daneback, Cooper, & Tikkanen, 2005; Sills & Song, 2002; Stanton, 1998; Witte, Amoroso, & Howard, 2000). Consideration has also been given to the matters of privacy and ethics as they arise in the context of

data collection techniques that use the Internet (e.g., Nosek, Banjani, & Greenwald, 2002). These, of course, are important concerns. What has received far less attention, though, is the matter of how far the Internet mode of delivery might have an impact on the substantive content of the information provided by the respondents. There is, indeed, relatively little research available that has attempted to address the question of whether the mode of delivery of the questionnaire—web based or paper based—might have a bearing on the type of information provided by respondents.

On those occasions when researchers have addressed such issues, it is rare that they have done so on the basis of a direct comparison of findings from web-based and paper-based questionnaire responses from groups who are known to share key characteristics. Where researchers have done this, the evidence would suggest that there is, in fact, little or no difference between the modes. McCabe (2004), for example, investigated self-reported illicit drug use among a sample of 7,000 university students in the United States, the students being randomly assigned to web-based and postal survey groups. Through a direct comparison of the web-based and paper-based surveys, he found that the two modes produced “similar results” in terms of reported illicit drug-use among the students. Lozar Manfreda and Vehovar (2002) similarly found “no major differences in substantive responses” (p. 149). Their research design involved 400 primary and secondary schools in Slovenia that were split randomly into two groups, one that received web questionnaires and the other that received questionnaires by mail. And Bandilla, Bosnjak, and Altdorfer (2003) were driven to conclude from their study that, although the findings from the different modes of delivery were “rather inconsistent,” this was largely attributable to the sociodemographic difference between their two samples. One sample was based on a representative sample of the German population and the other on an online panel that was representative of German Internet users. Where they were able to control for sociodemographic variables—on the high education level factor—they found the responses gathered using the web-survey were “basically identical” to those from the postal questionnaire survey.

Such research does not provide sufficient basis for a firm conclusion, but it does provide some foundation for the null hypothesis that there is no difference in the results obtained using web-based questionnaires and paper-based questionnaires. This article reports initial findings from research designed, among other things, to test this null hypothesis.

Method

The survey findings referred to in this article are drawn from the Perceptions of Social Issues (PSI) project. This is an on-going enquiry into voluntary risk taking and the health-related behavior of young people. Specifically, the data come from a survey conducted among 15-year-old students in one school in the East Midlands of England in July 2004. Students in year 10 were organized in 21 groups, 4 of which completed the web-based version of the questionnaire. The groups completing the web-based questionnaire were selected on a random basis; the number of such groups was restricted by the availability of computer labs within the school at the specific time of the survey. It is worth bearing in mind that the school had IT specialist status and that visiting the computer labs was a normal, commonplace feature of the working environment within the school. There was, therefore, no sense of special privilege attached to being allocated to the computer lab groups. The other groups completed a paper questionnaire that was distributed by teachers in other classrooms (most of which had

computers in them). There was no statistically significant difference between the samples in terms of the two variables sex ($\chi^2 = 1.49$, $df = 1$, $p = .222$) and ethnic origin ($\chi^2 = 6.461$, $df = 6$, $p = .374$). Respondents in either group, therefore, could be assumed to share a very similar profile in terms of key demographic features such as age, sex, ethnicity, academic ability, and area of residence. In total, 338 students completed the questionnaire. There were 269 valid paper-based questionnaires (79.6%), and 69 valid web-based questionnaires (20.4%).

The paper-based questionnaire and the web-based questionnaire had identical questions, and they were designed to be as similar as possible in appearance. The wording and sequence of questions was identical, and the web-based questionnaire had multiple questions on each page. To minimize the prospect of systematic measurement errors, the web-based questionnaire did not make use of pull-down menus or flash buttons and was deliberately designed using just the basic HTML radio buttons, check boxes, and text boxes. Like the paper questionnaire, the web-based questionnaire was monochrome—black text on white background. Importantly, too, the web-based questionnaire did not make use of the forced-answer option. Online respondents were as free as their paper questionnaire counterparts to skip over questions and leave specific items in the questionnaire incomplete. Only on this basis was it possible to make a reasonable comparison between the two modes in terms of completion rates.

In essence, then, the school-based location of the study enabled a research design that allowed near-identical groups to respond to near-identical questionnaires delivered in different modes (paper based and web based).

Before the questionnaires were distributed, students were assured, both verbally and in writing, that they were under no obligation to complete the questionnaires, that any information they provided would be treated in the strictest confidence, and that their responses were to be anonymous. Information was also supplied about who was conducting the research, the purposes for which the findings would be used, and a web site address at which the general findings from the research would be made publicly available. None of the students declined to participate, and none were withdrawn from the research at the request of their parents.

Findings

Completion Rates

The success of a questionnaire as a data collection tool depends not just on getting a sufficient, representative number of returns. It depends, as well, on getting returns that have been fully completed by the respondents. The quality of the data suffers when questionnaires are returned with various items not completed and significant questions left unanswered. The completion rate, therefore, is a key factor in relation to the overall quality of the data. In the case of the paper-based questionnaire,

- a total of 220 out of 269 respondents fully completed the questionnaires (81.8%);
- in all, 31 missed just 1 item. If these were included in the count of completed questionnaires, the percentage would rise to 93.3%;
- a total of 7 missed just 2 items. If these were included in the count of completed questionnaires, the percentage would rise to 95.9%.

Of 6,187 possible responses (23 items \times 269 respondents), there were 6,091 actual completions (98.4%). Each separate item in the questionnaire achieved a completion rate of 95.5% or more. With the exception of 2 items, the completion rate for each other item was 97.4% or higher. One respondent failed to complete nearly half of the items (47.8%) in the questionnaire (the second half), and 3 others missed more than a quarter of the items in the questionnaire.

In the case of the web-based questionnaire, it should be remembered that the facility to insist on the completion of questions before proceeding further through the questionnaire was not used. Despite this,

- of 69 respondents, 67 fully completed the questionnaires (97.1%);
- one missed just 1 item. If this were included in the count of completed questionnaires, the percentage would rise to 98.5%;
- of 1,587 possible responses (23 items \times 69 respondents), there were 1,572 actual completions (99.0%). Each separate item in the questionnaire achieved a completion rate of 98.6% or more. One respondent failed to complete 61.0% of the items in the questionnaire (the second half), and these noncompletions accounted for almost all the noncompleted items in the web survey (all but 1 missing response).

On a strict measurement of completion, web-based questionnaires did better than paper questionnaires (97.1% vs. 81.8% total completion). On a slightly more relaxed measurement that includes those questionnaires with all but 1 or 2 of the 23 quantitative items completed, again the web-based questionnaires fared better (98.5% vs. 95.9%), but the gap is much narrower.

Substantive Content of the Quantitative Data

If a mode effect exists, it might be expected that the responses given in the context of answering a web-based questionnaire would differ from those given when answering a paper-based questionnaire; the substantive content of the answers would be shaped by the mode of delivery of the questionnaire. Data from the PSI survey were analyzed to see if there was evidence of such a disparity. In particular, attention was focused on the 23 items on the questionnaire that involved fixed-choice answers and that produced quantitative data. (There were also 4 open-ended text boxes that produced qualitative data.)

Of the 23 quantitative items, 10 produced quantitative data that were categorical or dichotomous in nature. Participants were asked whether they agreed with 7 statements about smoking and were offered the options of yes, no, or don't know as the response (see Table 1). For none of the items was there a statistically significant relationship between the response and the type of questionnaire, though in two instances the probability of the results being because of chance came relatively close to the conventional alpha value of $p < .05$.

One item involved a simple dichotomous response. Respondents were asked to say yes or no to the following question: "Do you think people make too much fuss about 'healthy food' and the need for a good diet?" Nonparametric statistical analysis of the dichotomous data revealed that there was no statistically significant relationship between responses to this item and the type of questionnaire that had been completed ($\chi^2 = 202.0$, $df = 1$, $p = .653$, 0 cells had an expected count of less than 5). Two other items involved categorical data: gender and ethnic origin, which were independent variables. These were analyzed in relation to the equivalence of the two samples (see above).

Table 1
Would You Agree or Disagree With the Following Statements?

	Web-Based Questionnaire		Paper-Based Questionnaire		χ^2	df	p
	n	%	n	%			
Smoking gives pleasure to those who smoke.							
Agree	37	53.6	137	51.3	1.749	2	.417
Disagree	10	14.5	57	21.3			
Don't know	22	31.9	73	27.3			
0 cells have an expected count of less than 5							
Smoking is a waste of money.							
Agree	64	94.1	237	89.8	1.9	2	.387
Disagree	1	1.5	14	5.3			
Don't know	3	4.4	13	4.9			
2 cells have an expected count of less than 5							
Smoking is OK in moderation.							
Agree	11	15.9	71	27.1	5.07	2	.079
Disagree	46	66.7	137	52.3			
Don't know	12	17.4	54	20.6			
0 cells have an expected count of less than 5							
Smoking helps people relax.							
Agree	44	63.8	174	65.7	1.745	2	.418
Disagree	14	20.3	38	14.3			
Don't know	11	15.9	53	20.0			
0 cells have an expected count of less than 5							
Smoking is a danger to health.							
Agree	67	97.1	254	96.2	0.378	2	.828
Disagree	1	1.4	7	2.7			
Don't know	1	1.4	3	1.1			
3 cells, 50%, have an expected count of less than 5							
Smoking makes young people look grown up.							
Agree	5	7.2	19	7.3	5.366	2	.068
Disagree	57	82.6	234	89.3			
Don't know	7	10.1	9	3.4			
1 cell has an expected count of less than 5							
Smoking should be banned in all public places.							
Agree	44	63.8	147	55.7	2.593	2	.273
Disagree	13	18.8	75	28.4			
Don't know	12	17.4	42	15.9			
0 cells have an expected count of less than 5							

Table 2
Where Do You Feel You Fit on the Scales Below?

	χ^2	<i>df</i>	<i>p</i>
Body image			
Thin or fat	10.63	4	.031
1 cell has an expected count of less than 5			
Healthy or not healthy	6.91	4	.141
2 cells have an expected count of less than 5			
Tall or short for age	12.34	4	.015
0 cells have an expected count of less than 5			
Sporty or not sporty	7.62	4	.107
0 cells have an expected count of less than 5			
Personality			
Popular or not	9.18	4	.057
2 cells have an expected count of less than 5			
Confident or shy	4.46	4	.348
1 cell has an expected count of less than 5			
Easy going or serious	13.01	4	.011
2 cells have an expected count of less than 5			
Fashion conscious or not	5.53	4	.237
0 cells have an expected count of less than 5			
Prefer to go out or stay home	0.24	4	.993
2 cells have an expected count of less than 5			
Attitudes to risk			
Like risks or prefer safety	12.93	4	.012
1 cell has an expected count of less than 5			
Adventurous or cautious	8.68	4	.070
2 cells have an expected count of less than 5			

There were 13 items on the questionnaires that produced ordinal data. One item asked the young people to specify how much spending money they had a week in terms of four categories ranging from *less than £5* to *more than £20*. There was no statistically significant difference on this item ($\chi^2 = 0.895$, $df = 3$, $p = .827$, 0 cells had an expected count of less than 5).

Eleven more items related to measures of self-image. The young people were asked to respond on a 5-point semantic differential scale. In the case of 6 of these, there was no statistically significant difference between the web-based sample and the paper-based sample in terms of responses. Five items, however, produced data that might indicate some variation between the two modes of questionnaire delivery in terms of the data produced. As Table 2 shows, there were four items where the chi-square test indicated a probability value of less than .05 and one where the value comes very close to this ($p = .057$).

Alternative statistical tests based on ranking, however, offered a different picture in relation to these five items. The Mann-Whitney and Kruskal-Wallis tests produced probability values above .05 in all five cases (thin or fat $p = .189$; tall or short for age $p = .265$; popular or not $p = .176$; easy going or serious $p = .077$; like risks or prefer safety $p = .089$). Without getting embroiled in the statistical debate over the nonparametric analysis of ordinal data and merits of using rank-based statistical methods such as the Kruskal-Wallis test (see Shah &

Table 3
Self-Reported Amount of Smoking per Week

	Web-Based Questionnaire		Paper-Based Questionnaire	
	<i>n</i>	%	<i>n</i>	%
Never smoked	35	50.7	108	40.3
Tried smoking but never liked it	23	33.3	73	27.2
Used to smoke but have given it up	4	5.8	34	12.7
Smoke less than 6 cigarettes a week	1	1.4	9	3.4
Smoke between 6 and 20 cigarettes a week	6	8.7	6	2.2
Smoke more than 20 cigarettes a week	0	0.0	38	14.2
χ^2	21.31			
<i>df</i>	5			
<i>p</i>	.001			
2 cells have an expected count of less than 5				

Madden, 2004), this puts question marks against these five items in terms of their challenge to the null hypothesis that there is no mode effect.

There was just 1 of the 23 quantitative items where the substantive content of the answers varied fairly unequivocally between the two modes. This item investigated how many cigarettes the young people smoked a week and asked them to place themselves in one of six categories ranging from *never smoked* to *more than 20 cigarettes a week*. The chi-square statistic in this instance ($\chi^2 = 21.313$, $df = 5$, $p = .001$) was corroborated by Mann-Whitney and Kruskal-Wallis tests (both with $p = .015$). On this particular item, those participants using a web-based questionnaire reported a lower level of smoking than did those using the paper-based questionnaire (see Table 3).

Discussion

The completion rate for the web-based questionnaires was slightly higher than it was for the paper-based questionnaires. The findings, in this respect, support previous research that has concluded that e-surveys and e-questionnaires generate more complete information (Stanton, 1998; Truell, Bartlett, & Alexander, 2002; Yun & Trumbo, 2000) and contain fewer missing responses (Boyer, Olson, Calantone, & Jackson, 2002; Schaefer & Dillman, 1998). However, the completion rates were very high for both the web-based questionnaires and the paper-based questionnaires in the survey, and the impact of the school context needs to be recognized as a likely influence on this. A captive audience motivated to complete a task construed as schoolwork will almost certainly artificially boost completion rates (Denscombe & Aubrook, 1992).

In terms of the substantive information supplied by respondents—the data content—the statistical analyses of the quantitative data did not provide much persuasive evidence of a mode effect. In this respect, the findings presented in this article support the conclusions drawn by some similar investigations (Best et al., 2001; Kaplovitz et al., 2004; McCabe et al., 2002; Stangl, 2004; Yun & Trumbo, 2000). Only 1 item out of 23 produced data on which there was unequivocally a statistically significant difference between the information gath-

ered by the alternative questionnaire modes. On 4, possibly 5, items, there were indications of some difference in the information supplied depending on the mode of questionnaire, but the statistical significance of the variations was not conclusive. Taken alongside the single item where there was a clear difference in the data, these might be interpreted as grounds for further investigation and as a reasonable basis for pursuing the possibility that people respond differently depending on the mode of delivery of the questionnaire. On balance, though, they do not provide sufficient basis for rejecting the null hypothesis.

To put a positive perspective on this, the indications from this study and others are that the benefits of web-based questionnaires do not appear to come at the expense of consistency. Web-based questionnaires appear to provide a reliable data collection method as measured against equivalent paper-based versions. It might be premature, however, to conclude on this basis that a migration from paper-based to web-based questionnaires is methodologically unproblematic. For one thing, the amount of research evidence that is available is still very limited. For another, very few studies have incorporated a research design that allows direct comparison involving matched samples responding to near-identical questionnaires. Further research on like-for-like questionnaires is needed before concluding that there is no mode effect. The research reported here, though it provides evidence based on matched samples completing near-identical questionnaires, is based on responses from a specific group (15-year-olds) from a particular geographical region who completed the questionnaires in a distinctive context (a school). The findings are also derived primarily from the quantitative data produced by the questionnaires and have not covered the four items that asked for open-ended responses. There are some indications that e-questionnaires evoke different responses in relation to more open-ended, text-based responses. There is evidence that they produce longer answers to open-ended questions (Schaefer & Dillman, 1998; Yun & Trumbo, 2000), and there have been indications that e-questionnaires evoke more self-disclosure from respondents (Loke & Gilbert, 1995; Stanton, 1998).

Conclusion

The findings reported in this article form part of a small but growing body of evidence that should encourage social researchers to use web-based questionnaires with confidence. There is no conclusive evidence pointing to a mode effect associated with web-based questionnaires. Indeed, the findings give grounds for optimism that the substance of the data produced by web-based questionnaires is equivalent to that produced by paper-based questionnaires. However, further research is needed before a firm conclusion can be drawn on this matter. Crucially, there needs to be more research that employs a direct comparison of the two kinds of questionnaires using matched samples of respondents. There also needs to be more research on qualitative data produced by web-based questionnaires.

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