

# INTERNET AND PAPER BASED DATA COLLECTION METHODS IN AGRICULTURAL EDUCATION RESEARCH

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## Abstract

*A total of 389 AAAE members participated in this experimental study. Participants were randomly assigned to one of two groups: Web-based and traditional paper based survey groups. Web-based and traditional paper based survey modes were found to be equally valid and reliable for collecting social science research data. A difference between the two groups resulted in the aggregate response rate. The traditional survey group exceeded the Web-based group 157 to 98 in total response rate. However, when considering the number of valid returned responses within the first week of data collection, the Web-based survey group exceeded the traditional paper based group 72 to 7. The authors propose using the W/PSDC Model (Web/Paper Survey Data Collection), a mixed-mode survey, to attain large amounts of data and high response rates in an economically shortened time frame. This study provides strong evidence for using Web-based surveys in future social science research studies.*

## Introduction

The use of different survey modes is usually justified by a desire to cut costs through use of the least expensive mode first. The second or third mode is then used to collect responses from people who are reluctant or will not respond to the prior mode(s). (Dillman, 2000, p. 219)

Since the mid 1990s, the Internet has grown into a multi-billion dollar business that is present in almost all American homes. As the role of the Internet has increased in daily American life, it also has increased its role in today's educational system. Over 90% of schools now have some type of access to the Internet, someplace in their building (Becker, 1999).

The impact of the Internet on higher education is even greater (Gromov, 1995). Since most higher education institutions were connected to the Internet from its birth, it is only natural that educators and researchers will find new uses for the Internet, such as using it as a research tool.

As researchers look for ways to increase the amount of information that can be gathered, it is without exception that they are already looking to the World Wide Web. When researching databases for examples of Web-based surveys, it was possible to find in excess of over 100 different journal articles or dissertations that have used the Web as a survey tool. However, when searching for studies of Web-based surveys' reliability or validity, the number drops to less than ten. This dilemma is magnified further in the agriculture and the human

sciences, where Web-based surveys number about 20 and no research was found in agricultural education regarding the validity of any Internet protocols as a means of conducting social science research surveys.

### **Theoretical Framework**

Traditionally, it was believed that researchers should use the Web only to conduct surveys if a set of five criteria were met. Levine (1998) noted those criteria as:

- 1) When the target audience is online users,
- 2) When the target audience has a profile similar to online users,
- 3) When there are “hard-to-reach” target audiences,
- 4) When a large number of respondents are needed quickly, you have a limited budget, and exploratory findings are adequate in the short term, and
- 5) When the researcher wants to supplement telephone or in-person surveys. (Online)

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The thinking behind this methodology was that Web-based surveys were used as a means of sampling instead of scientific research. Also, in earlier years of the Internet, the population was mostly male and middle- to upper-class persons. Thus, researchers did not believe they could obtain a representative population. Today, Web-based surveying has become a major information source for all researchers. A simple Internet query of “Web-based surveys” produced over 18,500 matches, most of which were from private companies offering to do surveys via email or Web-based formats for other companies.

Current literature suggests that the advantages far outweigh the disadvantages of online surveying (DSS Research, 2000). The major advantage for conducting Web-based surveys is found in the savings of money. When information is transmitted electronically, researchers do not have to

pay for postage, paper, staples, envelopes, or other materials needed. The second major advantage is time. Electronic surveys offer almost instantaneous results. This is in stark contrast to waiting weeks, if not months, for mailed surveys (CASRO, 1996).

The major problems facing Web-based survey methods are that it is not a “mainstream technology” and some online surveys have been the targets of hackers. This situation occurs in open market research where companies invite all interested persons to participate, but could happen to anyone using a Web-based survey. While you may select whom you desire to participate in the survey, you still may not be able to guarantee the desired person is the one completing the survey. However, this problem is encountered with mail surveys too. There is no guarantee that the proper person completes the survey unless the researcher is present to witness it (DSS Research, 2000). Survey length is another factor to consider. The personalities of today’s Internet population make it difficult to lure respondents into completing long surveys.

Courson (1999) and Leung (1998) conducted notable uses of Web-based surveys. Courson surveyed 179 county extension professionals to assess their in-service needs for retraining to become more technologically adept. The individuals were selected and identified from the faculty and staff directory of the Mississippi State University Extension Service.

Courson’s research employed a Web-based descriptive survey. Participants in the study were asked to access the instrument electronically using a Web browser. Respondents rated 42 skill statements for importance and competence, completed the demographic data, entered an authentication code, and submitted the survey electronically. Upon submission of the survey, data were collected in an

electronic database at Mississippi State University (Courson, 1999). From the initial mailing, Courson obtained a 75% response rate. Two weeks later, a second mailing increased responses to 93%. Data collection was completed in one month.

Leung's (1998) exploratory study was Web-based using a research instrument posted on a popular Web site that provided natural resource information. Unlike the Courson (1999) study, the respondents in Leung's survey were self-selected. Leung's sample was non-random, thereby restricting the external validity or generalizations of the survey. The study remained active to all who wanted to participate for a period of four months. Leung's survey gathered the Web-based habits of people interested in natural resources.

The host Web site for Leung's survey received 2,255 hits, but only 279 responses were considered valid. The disparity was due to hits counting anyone who looked at the page, while valid responses were only those who completed the survey instrument. The Web-based survey was constructed using a Likert-type scale, similar to that of Courson's. Leung's results showed respondents were comfortable using and completing Web-based surveys. Leung concluded that using a Web-based survey for research may save much time and cost, but it also consumed time without accomplishing the desired goal of collecting valid and reliable data.

Web-based surveying has come from small beginnings to wide commercial acceptance, even though the academic acceptance of this surveying methodology is still somewhat suspect. As researchers become more familiar with Web-based surveying and the idea of using it to do research, the numbers for both scientific and non-scientific surveys will increase.

## **Purpose and Objectives**

The purpose of this study was to determine the validity of the World Wide Web as a research tool for surveying and collecting data. As the Web becomes more accessible to diverse audiences, does Web-based surveying provide a valid research methodology for conducting social science research? Research hypotheses tested in this study were if differences existed between Web-based and traditional paper based survey groups, when compared by:

1. Response rates.
2. Response times.
3. Instrument reliability.
4. Criterion related validity.
5. Perceived usefulness of Web-based surveying.

## **Procedures**

A control group post-test only design was applied in this study (Campbell & Stanley, 1963). The study used Web-based and traditional paper based survey methods. This true experimental design allowed random assignments of individuals to treatments ensuring treatment groups were equivalent (Borg & Gall, 1989).

The population for this census study consisted of members of the American Association for Agricultural Education (AAAE). The AAAE member database was attained in February 2001 after all dues had been processed. Using valid email addresses, a total of 424 respondents were selected from the database. Once selected, respondents were divided randomly into two groups.

From the initial population of 424 AAAE members, 35 members (21 in the Web-based group and 14 in the traditional group) were found to not be AAAE members, reducing the population to 389. Data collection began in early April and was

completed in 35 days. The first reminder was sent 14 days after collection began; a second reminder was sent in the third week of collection. Upon conclusion of data collection, respondents totaled 98 (51.3%) for the Web-based group and 159 (80.3%) for the paper based group, for a total of 257 (66.07%).

The research instrument used was similar to Chou's (1997), which was modified by Wingenbach (2000). The instrument contained four sections measuring: 1) computer anxiety, 2) attitudes toward computers, 3) perceptions of using Web-based surveys, and 4) demographics. The first section contained a 12-item, four-point, Likert type scale measuring responses to computer anxiety. Responses could range from Strongly Disagree (1) to Strongly Agree (4). Chou reported a Cronbach's alpha coefficient of .83 and Wingenbach achieved alpha coefficients of .86 and .89 in two rounds of testing. Cronbach's alpha was .89 for this study.

Section two contained the same Likert type scale, but consisted of 26 items that measured attitudes toward computers. Chou's study had an alpha of .94 in section two; Wingenbach's alphas were .92 in the first test and .90 in the second test. The alpha was .90 for this study. The third section was developed by the researcher and was used to measure respondents' perceptions of Web-based surveying. This section contained 12 items based on the same Likert type scale used in the first two sections. Perceptions of Web-based surveying items were derived from the CASRO Web site (2000). This section also was modeled after the Attitudes toward Electronic Exams subscale developed by Wingenbach (2000). Wingenbach (2000) achieved Cronbach's coefficients of .78 and .82 in pilot tests, and a final alpha of .84 for the subscale. In this study, a Cronbach's alpha of .85 was achieved.

Respondents in the experimental group were contacted via email and regular mail at the beginning of the study. A short cover letter similar to that of the paper based group was mailed to respondents to ensure that respondents knew the survey was an academic endeavor and not spam email. The email contained a link ([www.ais.msstate.edu/Research/](http://www.ais.msstate.edu/Research/)) that directed respondents to a Web site on the Agricultural Information Science and Education (AISE) server.

Once on the AISE server page, respondents were prompted for a password (code number). After submitting the code number, respondents could access the survey. The appearance of the Web-based survey was exactly the same as the paper based survey. Once the survey had been completed, respondents submitted it, saving the data to a database. Follow-up emails were sent on the 14<sup>th</sup> and 23<sup>rd</sup> days of collection.

Those selected for the traditional paper based group were sent an initial mailing that consisted of a cover letter, survey instrument, and a self-addressed stamped return envelope. Non-respondents were sent follow-up postcards 14 days after the initial mailing; an additional cover letter, survey instrument, and self-addressed stamped return envelope was sent to all non-respondents 23 days after the initial mailing.

To measure for non-response error, researchers compared early to late respondents (responses received before and after the third mailing). ANOVA was conducted on the responses and showed that for each subscale there were no differences between the two groups. Descriptive statistics were derived for each section and the instrument as a whole. Demographic data were analyzed using percentages and frequencies. Alpha levels were set at .10 *a priori* due to the exploratory nature of this study.

## Findings

Among the respondents were 190 (73.9%) males and 40 (15.6%) females. It was noted that 10.5% of the respondents ( $n = 27$ ) chose not to respond to the gender question. Data showed 81.6% of the respondents in the Web-based group and 69.19% in the paper-based survey group were male (Table 1). Ages ranged from under 29 to over 60 years of age. The majority ( $n = 90$ ) of respondents classified themselves in the 40-49 age group.

Respondents were described on the basis of teaching appointment (Table 1). Full professors made up the largest group with 37.7% of the total ( $n = 97$ ). The "Other" category accounted for 40 respondents (15.6%). Persons in the category of "Other" could be visiting professors, staff, graduate students, and

instructors. Years of teaching experience at the post-secondary level revealed a dichotomy between those with 16+ years teaching experience (44.4%) and those having taught from one to three years (16.0%).

Respondents' level of experience with Internet protocols is illustrated in Table 1. When referring to Internet technologies, questions implied use of the World Wide Web, email, search engines, ftp, and telnet. Internet technology experience ranged from 4 to 15 years. Respondents' number of years using computer technologies is shown in Table 1. Computer technologies experience referred to a general working knowledge of computers, using the programs Word, PowerPoint, Excel, and Solitaire as descriptors. The largest percentage (35%) of respondents had 16+ years of experience in computer technologies.

Table 1. Demographic Frequencies of AAAE Respondents (N = 389)

Gender	Total		Web		Paper	
	f	%	f	%	f	%
Male	190	73.9	80	81.6	110	69.2
Female	40	15.6	18	18.4	22	13.8
No Response	27	10.5	0	0.0	27	17.0
<u>Age</u>						
29 and under	10	3.9	6	6.1	4	2.5
30-39	46	17.9	21	21.4	25	15.7
40-49	90	35.0	26	26.5	64	40.3
50-59	79	30.7	35	35.8	44	27.7
60 and over	31	12.1	10	10.2	21	13.2
No Response	1	0.4	0	0.0	1	0.6
<u>Position</u>						
Assistant	59	23.0	21	21.4	38	23.9
Associate	57	22.2	24	24.5	33	20.8
Full	97	37.6	35	35.8	62	39.0
Emeritus	3	1.2	1	1.0	2	1.2
Other	40	15.6	17	17.3	23	14.5
No Response	1	0.4	0	0.0	1	0.6
<u>Years Taught at the Post-Secondary Level</u>						
1-3	41	16.0	19	19.4	22	13.8
4-6	28	10.9	8	8.2	20	12.6
7-9	20	7.8	11	11.2	9	5.7
10-12	28	10.9	9	9.2	19	12.0
13-15	23	8.9	6	6.1	17	10.7
16+	114	44.3	44	44.9	70	43.9
No Response	3	1.2	1	1.0	2	1.3
<u>Internet Technology Experience (years)</u>						
1-3	8	3.1	5	5.1	3	1.2
4-6	67	26.1	20	20.4	47	18.4
7-9	77	29.9	31	31.8	46	18.0
10-12	57	22.2	22	22.4	35	13.7
13-15	28	10.9	13	13.2	15	5.9
16+	19	7.4	6	6.1	13	5.1
No Response	1	0.4	1	1.0	0	0.0
<u>Computer Technology Experience (years)</u>						
1-3	5	1.9	1	1.0	4	2.5
4-6	17	6.6	5	5.1	12	7.5
7-9	28	10.9	11	11.2	17	10.7
10-12	58	22.6	27	27.6	31	19.5
13-15	59	23.0	21	21.4	38	23.9
16+	90	35.0	33	33.7	57	35.9

The first hypothesis was no differences existed in the response rates between Web-based and traditional paper based survey groups. Results showed the Web-based survey group had a population of

191 subjects with a usable response rate of 98 (51.30%). The traditional paper based survey group had a population of 198 with a response rate of 159 (80.30%) (Table 2).

Table 2. *Response Rate of Web-based and Traditional Paper based Survey Groups*

Groups	Number of Respondents	Number in Population	Percentage
Web-based	98	191	51.30
Paper based	159	198	80.30
Total	257	389	66.07

Due to the nature of this census study, a visual comparison showed that the traditional group did have a higher level of response. Thus, the null hypothesis was rejected.

The second hypothesis was no differences existed in the reliability coefficient of the instrument between Web-based and traditional paper based survey groups. Cronbach's alpha was calculated for each section to gain a global perspective for each of the concepts under study. The computer anxiety section had a Cronbach's alpha of .87 for the Web-based group and

.91 for the paper-based group. The two groups combined Cronbach's alpha on the computer anxiety section was .89 (Table 3). Reliability coefficients for the section measuring attitudes towards computers were .90 for the Web-based group, paper-based group, and for both groups combined (Table 3). The section measuring respondents' perceptions of Web-based surveying yielded a Cronbach's alpha of .78 for the Web-based group versus .88 for the paper-based group. A coefficient of .85 was achieved when the groups were combined (Table 3).

Table 3. *Reliability Coefficients*

Sections	Groups		
	Web	Paper	Combined
Computer Anxiety	.87	.91	.89
Computer Attitudes	.90	.90	.90
Web Perceptions	.78	.88	.85

Small differences in selected items' means did occur between the Web-based and paper-based groups. However, researchers found no differences between groups when viewing each subsection as a whole. The researchers failed to reject the null hypothesis that no difference existed in

the reliability coefficients for Web-based and traditional paper-based groups.

The third hypothesis was no differences existed in the response times, as measured by data collected within the first seven days, for Web-based and traditional paper-based groups. Response time was deemed an important factor in conducting

cost- and time-effective research. As noted in Table 4, the Web-based survey group far exceeded the paper-based survey group in the frequency of responses, 72 to 7. It is noted in the second week of collection that the paper-based group produced 92 responses to 12 for the Web-based group. To determine if a difference existed between groups, a Chi-Square Test of Independence was conducted. The calculated value for the

Pearson Chi-Square was 137.77, indicating that for the first week of data collection a significant difference existed between the Web-based and paper-based groups. The null hypothesis that no difference existed in response times, as measured by data collected within the first seven days, for Web-based and traditional paper based survey groups was rejected.

Table 4. Responses of AAAE Members by Week

Week	Responses	
	Web	Paper
April 3 – 9	72	7
April 10 – 16	12	92
April 17 – 30	11	37
May 1 – 14	3	23
Total	98	159

$\chi^2=137.77$

The fourth hypothesis was no differences existed in the criterion related validity of the instrument for Web-based and traditional paper-based survey groups. To gain a better understanding of the individual items that contributed to the summated scale scores for each section, the following descriptive statistics were calculated. ANOVA was administered to the summated

data for each section of the instrument (Table 5). None of the sub-sets were found to have a significance level equal to or less than the acceptable measure of .10. The researchers failed to reject the hypothesis that no differences existed in the criterion related validity of the instrument for Web-based and traditional paper based groups.

Table 5. Criterion Related Validity of the Instrument

Sections	Total		Web		Paper	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Computer Anxiety	49.61	6.72	49.47	7.32	49.69	6.34
Computer Attitudes	58.22	8.42	58.55	8.57	58.02	8.35
Web Perceptions	34.33	6.28	35.14	5.62	33.82	6.61

The fifth hypothesis was no differences existed in the perceived usefulness of Web-based surveying for Web-based and traditional paper-based survey groups. Combined groups' means for the 12 items in this section ranged from 2.37

to 3.19 (Table 6). ANOVA was calculated for each statement in the section and significant differences were found in two statements, "Web based surveys can be as reliable as paper surveys," (Web, M=3.32; Paper, M=3.11) and "I am confident in

reporting data obtained in Web-based surveys (Web,  $M=3.26$ ; Paper,  $M=3.02$ ).” However, no practical differences materialized between the two groups because both sets of means indicated respondents “agreed” with the statements. It should be noted that higher means indicate respondents’ have a more positive

perception of using Web-based surveying. With no significant differences between groups, researchers failed to reject the null hypothesis that no differences existed in the perceived usefulness of Web-based surveying for Web-based and traditional paper based groups.

Table 6. Descriptive Statistics for Respondents’ Perceptions of Web-based Surveying Instruments

Statements	Total		Web		Paper	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Web based surveys can be as reliable as paper surveys.	3.19	.69	3.32	.61	3.11	.72
Web-based surveys provide a valid means for conducting research.	3.16	.66	3.25	.58	3.11	.70
Using the web for conducting surveys can be a secure method of collecting data.	3.15	.64	3.24	.52	3.10	.71
I am confident in reporting data obtained in web-based surveys.	3.11	.67	3.26	.53	3.02	.73
Web based instruments are applicable for many types of research.	3.09	.54	3.13	.53	3.07	.55
Access to Web-based survey information cannot be controlled.	3.09	.62	3.13	.59	3.06	.63
Web based instruments are only useful for quantitative research.	3.06	.59	3.10	.59	3.04	.59
Web based surveying allows the researcher to gather a representative sample of Web users’ perceptions.	2.90	.74	2.96	.69	2.87	.77
Web based surveying allows the researcher to collect a random sampling of Web users’ perceptions.	2.83	.78	2.86	.76	2.81	.80
Web knowledge is common enough for using Web-based surveys.	2.83	.65	2.84	.67	2.83	.64
Web based instruments are only useful in researching Web users.	2.47	.80	2.52	.81	2.44	.79
I am confident in constructing Web-based survey instruments.	2.37	.85	2.35	.89	2.38	.83

Scale: 1.0-1.5 = Strongly Disagree, 1.51-2.5 = Disagree, 2.51-3.5 = Agree, 3.51-4.0 = Strongly Agree.

Some respondents took the initiative to respond in writing about the instrument, survey, and/or the methodology used in this

study. The most common statement was that there needed to be a neutral category on the four-point Likert-type scale. Respondents

did not like being forced into a category, and some avoided choosing a category by not responding to some statements. Other comments included “*Some of the items (computer anxiety) may have been an issue years ago, but may not matter now. Computer support personnel may have removed a lot of the anxiety about the technical side of the computer use.*” Two respondents were deemed to be anomalies. One respondent chose not to respond to the survey stating that he/she “*had no anxieties or time to complete another survey.*” The other respondent stated that he/she “*would not even use a computer if it were not for email.*”

### **Conclusions and Recommendations**

The Internet was once thought to be a passing trend, but now it is commonplace among most American homes. Younger generations are embracing not only the Internet, but also the world of technology at increasingly younger ages. As society and the commercial sector of America embrace these technologies, the time has come for the academic sector to do the same. While many educators embrace these technologies, no researcher had investigated if Web-based surveys provide a valid means for collecting data. This research was conducted and designed to address the validity of using Web-based surveys. This study does not attempt to change the manner in which research is conducted, but simply adds another tool for researchers to employ.

Respondents in this study were mostly male (73.9%) and were full professors (37.7%). The respondents had a wealth of experience in teaching at the postsecondary level with 44.4% having taught 16 or more years. This skill base contrasts respondents’ Internet technology skills, where 59.2% of respondents had nine or less years of experience. However,

respondents reported high levels of computer technology skills with 80.6% having ten or more years of experience. While there was a significant difference in response rates between groups, the researchers felt this difference was unique to the population under study and can be explained when considering the demographics. Age affected response rates; 77.8% of the population was over the age of 40, and 42.8% of the population over the age of 50.

In all other hypotheses tested, no statistical differences were found. These findings indicate that Web-based surveying methodology has the same reliability and criterion related validity as traditional paper based survey methods. The findings support the idea that Web-based surveying is a valid and reliable method of conducting social science research.

It should be noted that this study had two measures of response rates. The first measure was for response rate of the entire collection period; the second was for data collected within the first seven days of the study. In the first measure, the paper-based survey group far exceeded the Web-based group, 157 to 98. However, in the second measure, the Web-based survey group far exceeded the paper-based group, 72 to 7. This result is consistent with the current literature that states if researchers want to collect a large amount of data in a short time frame, one should use a Web-based survey mode. However, if researchers want to attain high response levels, a traditional survey mode should be used. While literature on survey methodology describes the benefits and barriers of each data collection process, it does not propose a combination of both modes within the same study for agricultural education research. Based on results of this study, the researchers recommend a new model for the social science research data collection process.

The proposed W/PSDC (Web/Paper Survey Data Collection) Model suggests that researchers employ a mixed-mode survey to attain large amounts of data and high response rates in an economically shortened time frame. Consistent with the findings in this study, researchers should create their research instrument in a Web-based format initially and follow-up non-respondents using a traditional paper based survey. Researchers should email all respondents about the study and collect responses via the Web for three days. At the end of the three-day period, researchers should mail paper versions of the research instrument to those who had not responded, but include the option to complete the instrument using the Web. Additional follow-up reminders should be mailed seven days after the initial paper based survey mailing.

The results of this study agree with those found by Courson (1999) and Leung (1998) and support the mixed-mode survey proposed by Dillman (2000). Web-based respondents are confident and comfortable completing online surveys. This study shows that Web-based survey instruments provide a valid and reliable means of collecting data. It demonstrates that Web-based data collection provides quick response rates (within the first seven days) and is an economical means of conducting social science research. The cost of the Web-based survey mode in this study cost less than \$50 for software. However, the paper-based survey mode was in excess of \$550 dollars in postage, paper, and other supplies. In a time of budget crisis, Web-based surveys could be a cost cutting alternative. This scenario becomes important when researchers multiply the costs of one study by the number of annual department, college, or university studies.

The question remains, “Can researchers accept using the Web-based survey mode?” In the case of the academic world, repeated tests comparing Web-based and traditional survey modes will provide a more definitive answer. The economic world has embraced Internet technologies and steadily expands Web surveying possibilities. Researchers must consider if their target population has Internet access before employing the W/PSDC Model. In this study, all respondents had valid email addresses, so the researchers deduced that the respondents had Internet access. However, researchers at the forefront of the technological race must remember that not everyone has the access or ability to use the Internet for responding to surveys.

Additional recommendations resulting from this study include further research in the effectiveness of Web-based survey modes in a variety of academic settings. Possible research studies might include investigating the differences in response rates using incentives for Web-based survey modes. Also, an investigation of the differences in response rates using other mixed-modes such as pre-letters, email, follow-ups, and other means to increase response rates should be completed. A replication of this study with a different population would allow researchers to re-test the hypotheses for consistency. One possibility is a study with incoming freshmen’s perceptions of the college of agriculture, while using the W/PSDC Model. Research is needed to determine if the proposed W/PSDC Model would bring about the same response levels as seen in this study.

In viewing this study from a cumulative perspective, Web-based and traditional paper based survey modes were found to be equally valid and reliable for

collecting social science research data. This study provides strong evidence for using Web-based surveys in future social science research studies.

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