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SUPPLEMENTING A PAPER QUESTIONNAIRE WITH WEB AND TWO-WAY SHORT MESSAGE SERVICE (SMS) SURVEYS

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When deciding which modes to offer, researchers consider cost, known respondent contact information, and potential mode effects. For a short survey on employment, we evaluate the effect of adding one of two new electronic data collection modes to a mailed questionnaire. We sent a survey to principals who previously responded to the National Center for Education Statistics' (NCES) National Teacher and Principal Survey (NTPS) asking about their current job status. This questionnaire, known as the Principal Follow-up Survey (PFS), has typically been administered as a short paper form that is mailed to NTPS respondents. In 2022, the PFS introduced two new modes of completion, and principals were randomly assigned to receive: (i) a paper form only; (ii) a paper form, as well as emails with a direct link to complete a web survey; or (iii) a paper form, as well as invitations by text message to complete an automated two-way short message service text survey by responding to texted "yes/no" questions. This article compares overall response rates and time-to-response by mode to determine respondent preferences for completing short surveys. Adding either electronic mode significantly increased response rates and decreased the number of days in which completed surveys were received, compared to

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offering only a paper questionnaire. Although email and text messages are both forms of electronic communication that may be accessible on a smartphone, the added text message survey resulted in higher response rates than the added web survey. This suggests that respondents interact differently with emails and text messages they receive and that offering an option to complete a survey by text message can increase the speed and efficiency of data collection for short surveys.

KEY WORDS: Multimodal survey; Mixed-mode survey; SMS; Text message; Web survey

Statement of Significance

As new forms of technology are used in day-to-day life, respondents may increasingly expect, and prefer, to be contacted and surveyed through electronic modes. We augmented a short, mailed questionnaire with either a web survey (for which respondents are emailed a direct link to complete the questionnaire) or an automated text message survey (for which respondents are invited, by short message service [SMS], to respond to a series of questions via text). Adding either of these modes increased response rates and collected these responses quickly. This was particularly true for the text message surveys, which suggests that offering a two-way SMS survey is not only a viable data collection option but can be beneficial to both survey researchers and respondents.

1. INTRODUCTION

Survey mode options have changed as new technology broadens the field (Schober and Conrad 2008; Couper 2011). Each mode or mixed-mode option has distinct advantages and disadvantages for both researchers and respondents, and it is imperative to have enough evidence to weigh relevant factors such as respondents' mode preferences, operational costs, known respondent contact information, and potential mode effects when making methodological decisions (Dillman et al. 2014; de Leeuw 2018).

In this article, we compare the relative advantages of adding one of two new electronic data collection methods to a paper-based collection: emailing a direct link to a web survey, or texting invitations to an automated two-way short message service (SMS) survey in which respondents answer a series of survey questions by replying to text messages. This article compares overall response rates and time-to-response by mode to determine preferences for completing short surveys.

1.1 Paper and Web Surveys

Web surveys can be administered by mailing instructions to respondents, for example, sending a letter with a website URL and user ID, or by sending this information electronically by email or text message (Dillman et al. 2014). The former is typically used when only mailing addresses are known for sample members. When a sample frame includes email addresses, researchers can email web survey information directly to respondents.

Emailing web survey invitations may have benefits beyond response rates. For example, directly emailing web survey information lowers respondents' burden compared to a mailed web survey invitation. Survey respondents who receive the invitation via an email or text message can click on a URL, while respondents who receive instructions and login information via a mailed letter must open a web browser, type in the URL, and log into the web survey manually (Millar and Dillman 2011). Additionally, replacing or preceding mailed paper questionnaires with emailed web survey invitations can reduce the cost per completed survey even if the overall response rate does not change (Israel 2013; Newberry and Israel 2017; Cernat and Lynn 2018; Patrick et al. 2018).

For mixed-mode surveys in which paper questionnaires are replaced by mailed or emailed web survey invitations, response rates are generally similar (e.g., Newberry and Israel 2017; Weaver et al. 2019), although there are some cases in which mailed materials outperformed certain mixed-mode designs (Messer and Dillman 2011; Beebe et al. 2018). Fewer studies directly measure the impact of augmenting a single survey mode with an additional survey mode. In two studies of young adults, Millar and Dillman (2011) increased response rates after adding emailed web survey invitations to paper questionnaires, while Patrick et al. (2018) found no effect. The differences between the findings in these two studies may relate to both the specialized populations involved, data collection protocols, or timing, and require further research to understand how they apply to other populations.

1.2 SMS Survey Invitations and Reminders

Text or SMS messages are increasingly used for survey data collection to recruit and remind respondents, send links to complete online surveys, and conduct interviews (Conrad et al. 2017). The use of SMS is limited to populations for whom cellphone numbers are available and for whom researchers have permission to text (if needed). In mixed-mode surveys, research has shown that adding SMS survey invitations to other contact modes has no notable effect on overall response rates, though they reduce time-to-response when compared to email invitations alone (De Bruijne and Wijnant 2014; Mavletova and Couper 2014; McGeeney and Yan 2016).

1.3 Two-Way SMS Surveys

During a two-way SMS survey, an interviewer or automated system sends questions to which a respondent replies by texting back one of the offered predetermined response options, although collection of open-ended data is possible (Olson et al. 2022). Automated systems may require an exact match to proceed. For example, when instructed to reply "1" if the answer is "yes," automated systems might not recognize "yes" or any variations or typos, such as "yeah," as valid responses. An interviewer-administered text survey, in which a live interviewer sends and receives text messages, can accept such variations. Automated systems allow respondents to answer questions at any time and receive an immediate response, while interviewer-administered text surveys require an available interviewer. Automated text surveys are relatively more common than interviewer-administered text surveys, so unless otherwise specified, further discussion of SMS surveys refers to automated systems.

Limited research on SMS surveys suggests higher and quicker response rates compared to other modes. Both Schober et al. (2015) and Olson et al. (2022) found higher response rates for a series of automated, short two-way text surveys compared to telephone or web surveys, although Lau et al. (2019) and Brenner et al. (2022) found higher breakoff rates for texted surveys than for other modes. This may partially reflect differences in survey content, population, or preference for texting.

Respondents primarily reply to SMS questions within the same day, if not within a few hours, of receiving initial or reminder messages (Cooke et al. 2003; Hoe and Grunwald 2015; Johnson 2016). Although the time to complete a survey can be longer for SMS surveys than other modes (Schober et al 2015; Brenner et al 2022), this may reflect respondents' communication preferences rather than perceived burden (Yan et al. 2020).

We hypothesized that adding new survey modes would increase response rates and decrease time-to-response compared to paper only, and an automated text survey would perform better than an emailed web survey link. While there is limited research directly comparing these two electronic modes, texts may be perceived as less burdensome while being more immediate, are accompanied by alerts, and require less additional action to reply (Conrad et al. 2017).

2. DATA

2.1 National Teacher and Principal Survey and Principal Follow-Up Survey

This study was conducted as part of the Principal Follow-up Survey (PFS) from March—June 2022 with public and private school principals who had completed the National Center for Education Statistics' (NCES) National Teacher and Principal Survey (NTPS) Principal Questionnaire during the

2020–2021 school year. As a longitudinal follow-up, the PFS contacted all public and private school principals who had responded to the NTPS during the previous school year (Taie and Lewis 2023) to ask about their current employment status. Because the PFS is short, previous collections have only used a paper questionnaire. In this study, we tested the feasibility of adding additional electronic modes.

For the NTPS, principals were asked to provide personal contact information (i.e., postal address, email address, home and cellphone numbers) and work contact information (i.e., email address, phone number) for follow-up purposes. Principals were also presented with a check box to indicate whether they "consent[ed] to receive text messages for follow-up purposes only." Approximately 89.93 percent of principals provided postal addresses, 55.83 percent provided home email addresses, 21.33 percent provided home phone numbers, and 53.92 percent provided cellphone numbers. Among those who provided a cellphone number, approximately 45.29 percent consented to receive follow-up text messages (Spiegelman and Zotti 2021).

This experiment was conducted within the larger PFS data collection, which occurred in several stages. During the initial school-level stage of data collection, schools were mailed a paper questionnaire to report on the job status of the prior school year's principal. Principals whose school did not reply were then contacted directly during the second self-administered phase of data collection and asked to provide their own employment information (table 1).

All principals in the self-administered stage received at least one mailed paper questionnaire. Depending on their assigned experimental group, principals also received email reminders to complete the paper questionnaire, emails including embedded URLs to complete the questionnaire online, and/or text messages inviting them to complete the questionnaire by responding directly to the text message (table 1).

At the end of the self-administered stage of data collection, principals who had not responded by paper, web, or text message were then called and asked to complete the survey over the phone.

2.2 Experimental Design

Table 2 shows the number of respondents randomly assigned to each treatment group (about 200) and their demographic characteristics. All three groups were demographically similar, which was confirmed by using Pearson's chi-square tests. Our experiment is limited to the self-administered and telephone-administered phases of data collection only. It excludes principals whose school had already provided information about their job status, did not provide a postal address or cellphone number, or did not consent to receive text messages.

Table 1. Data Collection Procedures for K-12 Principals, by Mode(s) Offered

	Paper Only	Paper + Web	Paper + SMS
3/16/22		Emailed web survey invitation #1	Texted SMS survey invitation #1
3/17/22	Mailed paper questionnaire #1	Mailed paper questionnaire #1	Mailed paper questionnaire #1
3/22/22	Emailed reminder #1 to complete paper questionnaire		Emailed reminder #1 to complete paper questionnaire
3/29/22		Emailed web survey invitation #2	Texted SMS survey invitation #2
3/31/22	Mailed paper questionnaire #2	Mailed paper questionnaire #2	Mailed paper questionnaire #2
4/5/22	Emailed reminder #2 to complete paper questionnaire		Emailed reminder #2 to complete paper questionnaire
4/20/22 to 5/17/22	Telephone follow-up to complete survey by phone	Telephone follow-up to complete survey by phone	Telephone follow-up to complete survey by phone
6/24/22	Closed data collection	Closed data collection	Closed data collection

Table 2. Sample Characteristics by Mode(s) Offered

	Paper Only	Paper + Web	Paper + SMS	Pearson's Chi-square
Total	$N = 189$	$N = 185$	$N = 195$	
Sex				$\chi^2(2) = 4.97$, $p = .0835$
Male	87	94	77	
	46.03%	50.81%	39.49%	
Female	102	91	118	
	53.97%	49.19%	60.51%	
Race/ethnicity				$\chi^2(2) = 0.30$, $p = .8614$
White and non-Hispanic	120	120	129	
	63.49%	64.86%	66.15%	
Non-White or Hispanic	69	65	66	
	36.61%	35.14%	33.85%	
Age				$\chi^2(4) = 1.39$, $p = .8461$
Under 45	53	60	57	
	28.04%	32.43%	29.23%	
45–54	86	78	82	
	45.50%	42.16%	42.05%	
55 or older	50	47	56	
	26.46%	25.41%	28.72%	
Highest degree earned				$\chi^2(2) = 0.77$, $p = .6812$
Bachelor's or less	10	10	14	
	5.29%	5.41%	7.18%	
Master's or higher	179	175	181	
	94.71%	94.59%	92.82%	

Paper Only respondents received a paper questionnaire as the first means of contact during the self-administered stage of data collection. About five days after the questionnaire was mailed, respondents were also sent an email reminder asking them to complete and return the form. See appendices 1 and 2 in the supplementary data online for the full paper questionnaires and appendix 3 in the supplementary data online for sample emails.

Paper + Web respondents were first contacted by email. This introductory email included an embedded URL that brought principals directly to the web survey. After confirming their identity, respondents were asked their current occupational status (see appendices 4 and 5 in the supplementary data online for screenshots and appendix 3 in the supplementary data online for sample emails). All principals in this condition also received a paper questionnaire,

mailed after the initial email was sent. Depending on whether and when they responded, they may have also received an additional email invitation and/or mailed paper questionnaire.

Paper + SMS respondents were sent an automated, introductory text message that explained why they were contacted, cited the U.S. Department of Education and U.S. Census Bureau as the federal agencies that sponsored and collected data for the study, and offered the opportunity to learn more about the study (see appendix 6 in the supplementary data online for screenshots). To attempt to guarantee the texts would be received in order, this introductory text was followed five minutes later by the first survey question: "Are you still working as a principal?." Once they provided a valid response, respondents were sent an additional question. Depending on the answers provided and the subsequent follow-up questions, respondents were asked a total of two, three, or four questions (see figure 1), which were slightly less detailed than the questions on the paper and web questionnaires.

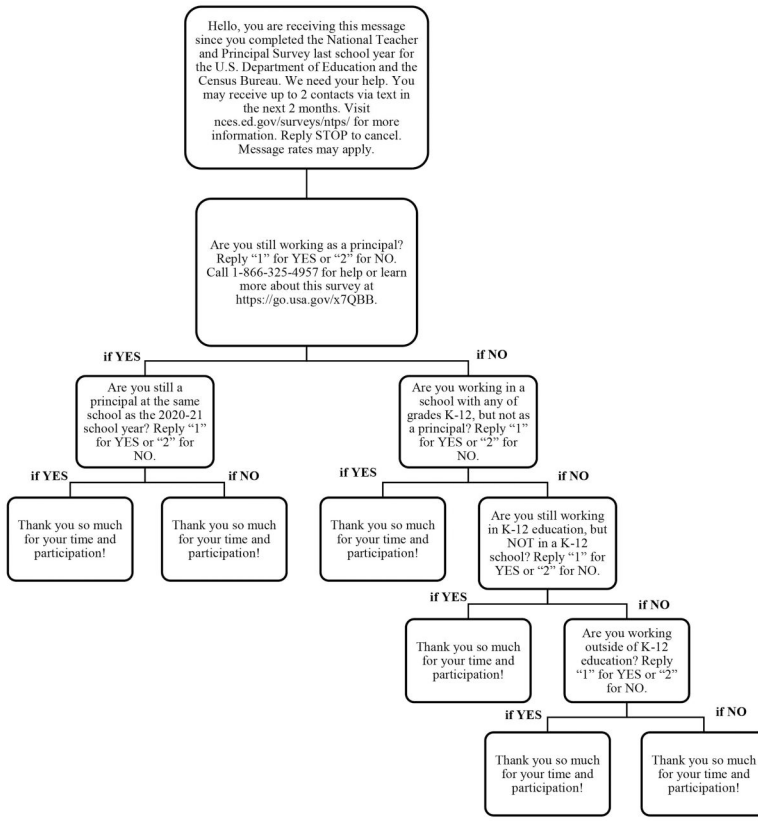

Figure 1. Content and Question Order for the SMS Survey.

If principals did not reply within 48 hours of receiving the first message, the text message option timed out. They then had to either wait for an additional text message invitation or respond through another mode. Similar to the email condition, all principals in this condition also received a paper questionnaire, mailed after the initial text message was sent. Depending on whether and when they responded, they may have also received an email reminder asking them to complete and return the paper form, an additional text message invitation, and/or an additional mailed questionnaire. Since principals in the Paper + SMS group received separate emails and SMS survey invitations, they may have received more contacts than principals in the Paper Only and Paper +← Web groups.

3. ANALYTIC METHODOLOGY

3.1 Response Rates

For principals in this experiment, a case was considered complete if we received current employment status information directly from the principal regardless of the mode (e.g., paper, web, text message). Because all principals in sample have known eligibility by requisite of having completed the base year survey, unweighted response rates in this report are calculated using AAPOR RR5 (AAPOR 2023). To compare the response rates across the different experimental groups, we used Pearson's chi-square tests to determine the effect a treatment had on response.

Some principals submitted a survey through more than one mode, for example, both paper and web. To better measure the impact of augmentation, we attributed these cases to the electronic mode (i.e., web or SMS) rather than paper and removed duplicate responses because respondents who completed a survey in either electronic mode indicated their willingness to do so.

3.2 Time-to-Response

We calculated time-to-response by determining the number of days from when we initiated our first principal contact on March 16 until the date we received a completed survey. For surveys completed online or by SMS, the completion date was the time of electronic submission of the web questionnaire or texted responses to all applicable survey questions. For paper questionnaires, the completion date was the day on which the survey was checked in at the U.S. Census Bureau and included outgoing and incoming mail time. To determine significant differences in the response timeliness between the various experimental groups, we used Mood's Median test to compare the median number of days (Mood 1954):

$$\chi^2 = \sum \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}.$$

We chose to look at median time, rather than mean, because these data are typically positively skewed. The Mood's Median test is a nonparametric test which allows for the comparison of median response time across two experimental groups without making assumptions about their distributions.

4. RESULTS

Both the Paper + SMS and Paper + Web groups had higher response rates than the Paper Only treatment, and the Paper + SMS group had higher response rates than both other modes during the self-administered phase of data collection (table 3). About 62.05 percent of Paper + SMS respondents completed the survey by paper or through the SMS survey, which was higher than the self-administered response rate for Paper + Web (48.65 percent). Both were higher than the self-administered Paper Only response rate (38.10 percent). All differences are statistically significant unless otherwise noted.

Principals in the Paper + SMS group completed an electronic survey at a higher rate than those in the Paper + Web group. About 47.18 percent of Paper + SMS principals completed the SMS survey, which was higher than the 25.95 percent of Paper + Web principals who completed the web survey ($\chi^2(1) = 18.40$, $p < .0001$). The Paper Only group had a higher percentage of paper completions than the augmented modes.

Table 3. Response Rates by Mode(s) Offered and Mode Completed

	Paper Only ($n = 189$)	Paper + Web ($n = 185$)	Paper + SMS ($n = 195$)
Web	†	25.95	†
SMS	†	†	47.18
Paper	38.10	22.70**	14.87***
Any self-administered mode	38.10	48.65*	62.05***,^^
Phone	19.05	20.00	5.13***,^^^
Overall	57.14	68.65*	67.18*

NOTE.—†Not applicable.
*Significantly different from Paper Only response rates with χ^2 (1) at $p < .05$.
**Significantly different from Paper Only response rates with χ^2 (1) at $p < .01$.
***Significantly different from Paper Only response rates with χ^2 (1) at $p < .001$.
^^Significantly different than Paper + Web group with χ^2 (1) at $p < .01$.
^^^Significantly different than Paper + Web group with χ^2 (1) at $p < .001$.

During telephone follow-up operations, fewer surveys were completed by phone for the Paper + SMS group than Paper Only and Paper + Web groups (5.13 percent, compared to 19.05 and 20.00 percent). Response rates during the self-administered phase of data collection differed across treatment groups, and thus the proportion of cases that required nonresponse follow-up also varied. Telephone follow-up operations helped close the gap between Paper + SMS and Paper + Web response rates, which ended data collection with similar response rates (67.18 and 68.65 percent, respectively), although both modes outperformed Paper Only (57.14 percent).

Figure 2 shows the cumulative response rates over the full data collection period. Since respondents could complete the online or SMS questionnaire immediately upon receipt, we recorded completed questionnaires on the first day of data collection. For the Paper Only group, response rates did not increase for about a week, since even eager respondents had to wait for the mail to be delivered, return the questionnaire, and we had to process the survey. This suggests that delaying paper questionnaire mailings by a few days, only sending them to respondents who did not quickly complete an electronic questionnaire when contacted by text or email, could further reduce costs.

On the first day of data collection, the response rate for the Paper + SMS group was 33.85 percent. Nearly one-third (30.43 percent) of respondents who completed the survey by SMS did so within five minutes of receiving

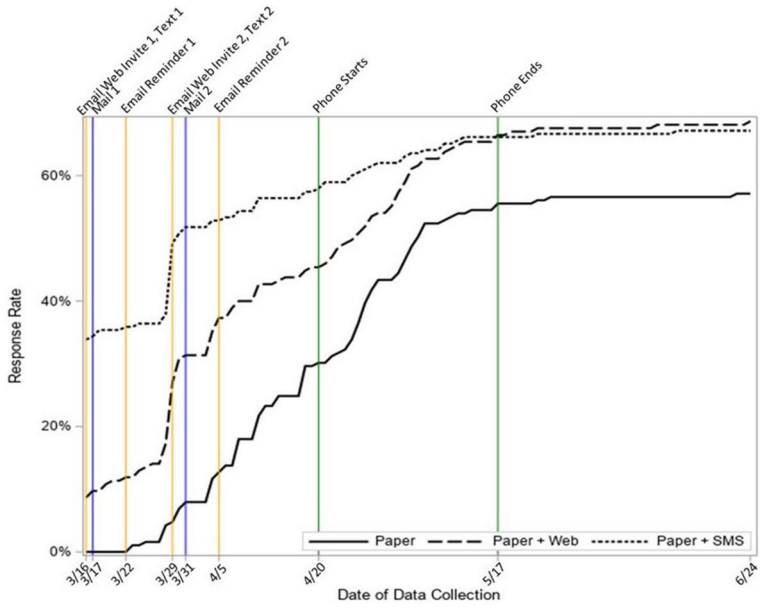

Figure 2. Cumulative Response Rates by Mode(s) Offered.

the invitation, and an additional 40.22 percent completed the survey within an hour. While 7.69 percent of principals opted out of receiving text messages (by replying "STOP" at any time), most completed the survey through another mode, such as by paper or during telephone follow-up operations.

Figure 3 shows the number of elapsed days since the start of data collection on which a respondent self-completed a questionnaire. Because such a large proportion of the Paper + SMS group completed the SMS survey, and 33.85 percent completed the SMS questionnaire on the same day it was sent, the median number of days for a Paper + SMS principal to complete the survey was 0 days, the same day on which they were first contacted by text message; just over half of self-completed surveys in the Paper + SMS group were completed on the first day of data collection. The Paper + Web group was also able to complete the survey on day 0, when they were first sent an email message. However, that group had a more even split between completed paper and web questionnaires, although about 16.67 percent of self-completed questionnaires were submitted online on day 0. Overall, the median days for Paper + Web respondents to self-complete the survey was 13 days, which was longer than 0 days for the Paper + SMS group, but shorter than 26 days for the Paper Only group.

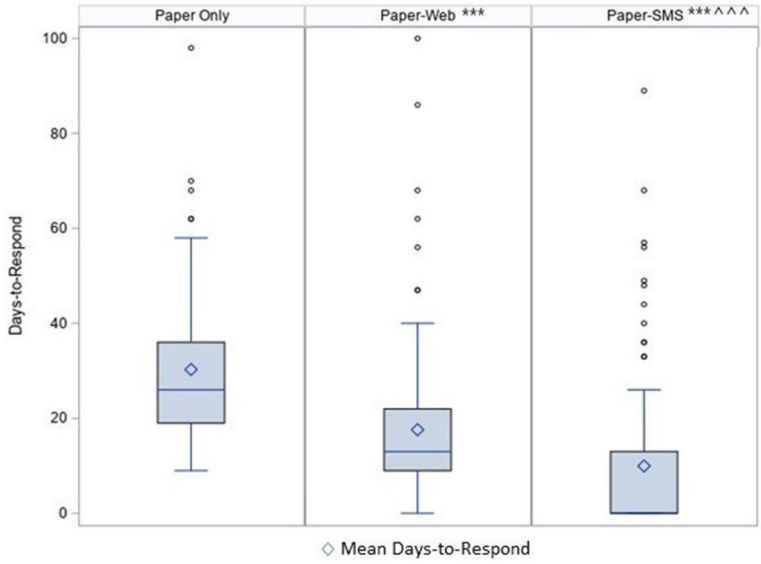

Figure 3. Number of Days to Complete a Self-Administered Questionnaire by Mode(s) Offered.

5. DISCUSSION

While prior research on mixed-mode surveys varies as to whether electronic modes increase response rates (Millar and Dillman 2011; Patrick et al. 2018), our results show that augmenting a paper survey with electronic modes can both increase response rates and decrease respondents' time-to-response window, therefore increasing data gains from self-administered data collection and reducing the need for costly follow-up operations. Similarly to Schober et al. (2015) and Olson et al. (2022), SMS provided the most notable advantages in our analyses. However, web administration should not be discounted if survey teams are not yet operationally prepared to offer SMS as an option, cellphone numbers are unknown, or their target population is not particularly amenable toward texting.

Since an SMS-only survey may not reach as many or similar respondents as a mixed-mode survey, collecting data by both SMS and a delayed supplemental mode could increase response rates and efficiency. When creating a data collection strategy, the inability to receive immediate day 0 responses is a fundamental limitation of mailed paper questionnaires. Reducing reliance on telephone and other follow-up operations can ameliorate both budgetary and timeline concerns. There was no difference in response rates for the Paper + SMS and Paper + Web groups after the completion of the telephone operation, and the Paper Only group had a lower response rate after telephone follow-up; it seems that offering both paper and an electronic mode (either web or SMS) prompted responses from people who otherwise would neither complete a paper form nor complete the survey over the phone. This does not necessarily mean that those who completed electronic surveys preferred those modes to paper, since they likely received the email invitation or SMS survey request before the paper form (see table 1), but were willing to complete the survey using web or SMS.

While we did not have sufficient power to do so here, future analyses could examine whether SMS surveys can reduce nonresponse bias. For example, the PFS collects information on job status. Former principals may be less inclined than current principals to open an envelope and complete a survey from the U.S. Department of Education, while a text message that directly asks whether they are still serving as a principal may seem more relevant. Analysis of survey responses and respondents by mode could help determine whether the increase in response rates when adding an SMS response option increased, decreased, or had no effect on nonresponse bias.

For this experiment, we were limited by the type of contact information we had available. We asked respondents to provide both their home and work email addresses in the baseline survey, but we used their work email address if the former was unavailable. Since some principals may have lost access to their work email addresses, the differences between self-administered surveys

for the Paper Only and Paper + Web groups may be understated, and the differences for the Paper + Web and Paper + SMS groups may be overstated.

While our analysis focuses on school principals, the results can be reasonably extrapolated to better understand mode preferences in other highly educated populations included in a longitudinal or panel survey (for example, medical professionals, professors). Further study is warranted to determine effect differences for other populations, longitudinal panel maintenance, longer surveys, and questionnaires with more sensitive items on response mode preferences during a mixed-mode SMS survey.

Supplementary Materials

Supplementary materials are available online at academic.oup.com/jssam.

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Research Note