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Using scantron versus an audience response system for survey research: Does methodology matter when measuring computer-mediated communication competence?

Ulla Bunz

Department of Communication, Rutgers University, 4 Huntington Street, New Brunswick, NJ 08901, USA

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Abstract

The purpose of this study was to investigate whether results of the computer-mediated communication (CMC) competency scale differ depending on the survey instrument used. Data were collected from 173 undergraduate students (53% female; average age 20). Of these, 96 subjects completed the questionnaire using scantron sheets, while 77 subjects used an audience response system called Classroom Performance System (CPS). All subjects completed a second questionnaire using paper-and-pencil to evaluate their experience with either the scantron sheets or the CPS. *t*-Test results show that using the CPS is more fun for participants ($p < .000$); no more or less difficult ($p = .806$); and does not make a difference with regard to experienced time pressure ($p = .425$). Subjects have higher doubts about the validity of their recorded answers ($p = .007$) when using the CPS. Regression analysis shows that in two out of 12 constructs of the CMC competency scale, scoring was influenced by using a technological data collection method. The two constructs were “message factors” ($p = .002$) and “medium factors” ($p = .002$). Overall, results support the use of the CPS as an alternative to scantron sheets for measuring CMC competence.

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E-mail address: bunz@scils.rutgers.edu (U. Bunz).

As technology develops and increasingly becomes an integral part of everyday life, researchers have examined these technologies as to their reliability, validity, efficiency, and applicability to the collection of social science data (i.e., Bloom, 1998). Some of the newer technologies and methodologies examined include general computerized questionnaires (i.e., Donovan, Drasgow, & Probst, 2000; Fox & Schwartz, 2002; King & Miles, 1995; Mead & Drasgow, 1993; Potosky & Bobko, 1997), email questionnaires (i.e., Schaefer & Dillman, 1998; Sheehan, 2001; Sheehan & McMillan, 1999), web questionnaires (i.e., Andrews, Nonnecke, & Preece, 2001; Dillman, Totoro, Conradt, & Bowker, 1998; Epstein, Klinkenberg, Wiley, & McKinley, 2001; Knapp & Kirk, 2003; Tourangeau, Couper, & Steiger, 2003; Witmer, Colman, & Katzman, 1999), or automated telephone surveys (i.e., Cooley, Miller, Gribble, & Turner, 2000; Knapp & Kirk, 2003).

The focus of this study is on examining another technology, which has existed since at least the 1970s (Everett & Ranker, 2002), though it has usually not been used for survey research or data collection. Instead, it has generally been used as an instructional or group decision support system technology and is marketed as such. The technology in question is the audience response system.

The purpose of this study, then, is to investigate whether the audience response system “Classroom Performance System” (CPS) could provide reliable results when used to collect questionnaire data compared to the more established methodology of using scantron answer sheets.

Numerous manufacturers are offering audience response systems, which are being used in two primary settings: in educational settings (i.e., Abrahamson, 2002; Cox & Junkin, 2002; Everett & Ranker, 2002) and in business settings (i.e., Horowitz, 2002). Comparable to a quick audience poll taken in television shows such as “Who wants to be a millionaire,” these audience response systems offer much more sophisticated ways of conducting a survey – both quick and prolonged.

One could wonder why a researcher would want to use an instructional tool for research, especially one that might be much more expensive to acquire compared to traditional methodology such as scantron sheets. The answers to this question reside in the technology itself and in its ubiquitous availability. First, since instructional audience response systems are generally equipped with a “test-taking” option, collected data are automatically stored in the technology’s database, which eliminates completely any time requirement for inputting survey data. Even scanning hundreds of scantron answer sheets can take considerable amounts of time. Electronic record keeping also eliminates any data entry errors that can occur when data are entered manually from a paper-and-pencil survey. Downsides to using an audience response system include reduced portability, as the researcher requires a laptop and a projector, and limitation to multiple choice or 5-point Likert scale type questions, though this last point is a limitation of scantron sheets too.

Factors such as cost or availability might come to mind. However, for many people these two points will not be limitations because of the easy availability of audience response systems. The audience response system used in this research is called “Classroom Performance System” (CPS) by a company called eInstruction.

According to the company website, this technology is used in hundreds and hundreds of elementary, middle and high schools, and also in hundreds of businesses and government offices.¹ The technology is also used in 160 US colleges and universities in all 50 states. At this author's university, two departments are using CPS (Psychology and Communication), while two others (Chemistry and Physics) are using a different, though very similar technology. Thus, many researchers may have easy access to either CPS or a similar audience response system. The system might already be used for instructional purposes at their colleges or universities. This study examines whether audience response systems can be used for a secondary purpose, the collection of survey data, especially when compared to scantron sheets.

The following research questions and hypotheses were developed:

- H1: Due to familiarity and previous exposure, using scantron sheets is perceived to be easier than using the audience response system.
- H2: Due to the inability to review one's answers with the audience response system, using scantron sheets will be perceived as recording results with more validity than using the audience response system.
- H3: Though new technologies can often be intimidating, they can also be exiting, especially for people who are used to email, cell phones, and instant messaging. Scantron sheets, on the other hand, are often associated with test taking. Thus, using the audience response system will be perceived to be more fun than using scantron sheets.
- H4: As all participants can see how fast or slow each individual participant is working when using the audience response system, participants will experience more time pressure when using the audience response system as compared to scantron sheets.
- RQ1: Due to the influencing factors explored in hypotheses 1–4, are there differences in both groups' answers on the computer-mediated communication (CMC) competency scale?
- RQ2: Does methodology influence scoring on the CMC competency scale?

1. Methods

1.1. Sample

Participants in this study ($N = 173$) were undergraduate students at a large Midwestern university, enrolled in a basic public speaking course. Their participation was voluntary, though solicited. Subjects were assigned into groups of no more than 30 participants, and groups were assigned to one of the two conditions randomly. Condition 1 meant using the scantron sheets ($n = 96$). Condition 2 meant using the audience response unit ($n = 77$).

¹ http://www.einstruction.com/master_template.cfm?color=navy&link=whousing

Most participants were 19 years (28.3%), 20 years (34.1%) or 21 years old (20.2%). The gender distribution was almost equal with 52.9% being female. Subjects almost all reported having Internet access where they currently lived (90.6%). Most participants had 4–6 years of experience with CMC technology (44.8%), followed by 7–9 years (23.3%), 1–3 years (22.7%), less than one year (5.2%), or more than nine years (4.1%). Overall, subjects reported their fluency with CMC technology to be “a lot” (38.3%) or “moderate” (37.1%). Only 3% of the participants felt they were “not at all” fluent with CMC technology.

1.2. Measures

1.2.1. Computer-mediated communication competency

The version of the CMC competency scale used here (Bunz, 2003) consists of 88 questions in 13 constructs: coordination, expressiveness, attentiveness, efficacy, general usage, motivation, knowledge, contextual factors, message factors, medium factors, satisfaction, appropriateness, and effectiveness (see Appendix A). All questions followed a 5-point Likert scale, ranging from “strongly agree” to “strongly disagree.” Eight of the 13 constructs reached reliability α s between .64 and .87, while four constructs reached reliability α s between .54 and .59, approaching acceptable reliability levels. For more specific results, consult Table 1. The final construct (contextual factors) reached a reliability α of $-.82$ and was dropped from further analysis.²

Five questions were added to this questionnaire to assess basic demographics. The questions assessed subjects’ age, gender, whether they have Internet access where they currently live, how long they have been using any CMC technology, and how fluent overall they perceive themselves to be with CMC technology.

1.2.2. Scantron versus audience response system evaluation

Two versions of an additional questionnaire were constructed (see Appendix B) to evaluate use of the respective methodology. This second questionnaire, completed by all participants by circling answers on a paper questionnaire after completing the CMC competency questionnaire using either scantron sheets or the audience response system, originally consisted of five items each to assess the four constructs ease of use, perceived validity, fun, and time pressure. Questions were kept as similar as possible. For example, one question for the scantron group asked, “Using the paper and pencils was easy.” For the audience response system group, the question asked, “Using the remote controls was easy.” The audience response system group also completed five questions with regard to the brief training session they received on how to use the technology. All questions followed a 5-point Likert scale ranging from “strongly agree” to “strongly disagree.” One item each was deleted per construct to increase reliability. The remaining items are listed in Appendix B. Each of

² In subsequent uses of this scale, the “contextual factors” construct continues to reach negative reliability. It has since been dropped from the CMC competency scale.

Table 1
Independent samples *t*-tests and Cronbach's coefficient α for all CMC competency constructs

Construct	<i>t</i>	df	Significance	α
Attentiveness	-1.79	173	.074	.64
Efficacy	.21	173	.833	.87
General Usage	-.43	173	.667	.78
Motivation	-.53	164	.596	.76
Knowledge	.99	170	.323	.81
Satisfaction	1.39	172	.163	.67
Effectiveness	.13	165	.900	.64
Medium Factors	-3.94	169	.000*	.85
Coordination	-.87	172	.377	.57
Expressiveness	-.10	171	.920	.59
Appropriateness	-.09	167	.929	.59
Message Factors	-3.13	163	.002*	.54

* Indicates statistical significance of $p < .05$.

the constructs reached acceptable to high reliabilities. The α for the “training” construct was .97. The “ease of use” construct reached a reliability α of .86 and the “perceived validity” construct reached .65. The “fun” construct was reliable at the .93 α level and the “timing” construct at the .85 level. The CMC competency scale questionnaire and the second questionnaire were matched through a participation number on each that could not be traced to the participants.

1.3. Audience response unit

The audience response unit used was a classroom performance system called CPS (Classroom Performance System, by eInstruction).³ This technology consists of software loaded on a computer and projected through a projector onto a large screen, and remote control pads transmitting answers through infra-red to a receiving unit. The remote controls have only eight buttons, labeled A–H. Each remote control has an identification number printed at the front top of the unit. The software records answers given from each remote control in a database that can be exported to, for example, Excel. From there, data can be imported into statistical software such as SPSS easily.

1.4. Procedures

In the scantron groups, participants were welcomed to the study and informed of the purpose of the study. They then each received a consent form, a scantron sheet with a participation code, a CMC competency questionnaire, and the “experience using scantron” questionnaire. Participants were asked to write the participation

³ For specific information, please see <http://www.einstruction.com/>.

code from the scantron sheet onto the second questionnaire and then begin by completing the CMC competency questionnaire. The scantron groups were allowed 30 min of time for completion of both questionnaires.

In the audience response system groups, participants were also welcomed to the study and informed of the purpose of the study. They then received a consent form and a remote control unit, followed by a 10-min training session on how to use the technology. Three practice questions (gender, year in school, and readiness to begin with study) were completed to acquaint participants with the audience response system. After an additional opportunity to ask questions with regard to the technology, participants then received the CMC competency questionnaire and the “experience using CPS” questionnaire. They were asked to write their group number (provided by the researcher and assigned chronologically) onto the second questionnaire, followed by the number on their remote control, and then begin by completing the CMC competency questionnaire. Due to the training session and in anticipation of potential technological problems, 45 min were scheduled for the audience response system groups.

2. Results

2.1. Hypothesis 1: Ease of use

Independent samples *t*-tests were conducted to investigate how easy participants of each group (scantron or audience response system) perceived their method of completing the questionnaire to be. Results showed that there were no significant differences between using scantron sheets ($M = 3.97$, $SD = .95$) and using the audience response system ($M = 4.01$, $SD = 1.17$), $t(143) = -.25$, $p = .806$. Thus, even though participants can be assumed to be more familiar with scantron sheets as compared to the audience response system, there was no significant difference in the ease of use, and hypothesis 1 was not supported.

2.2. Hypothesis 2: Perceived validity of responses

Though the audience response system used in this research allows users to review their answers, participants were not shown this function to facilitate the training process. As participants, thus, could not double check their answers, it is possible that participants would question the validity or correctness of the answers they entered. Independent samples *t*-tests were conducted and showed that there were indeed significant differences in the perception of validity between the group using the scantron sheets ($M = 3.74$, $SD = .78$) and the group using CPS ($M = 3.38$, $SD = .93$), $t(148) = 2.75$, $p = .007$. The effect size r^2 of .05 indicates a small effect. Thus, hypothesis 2 was supported. Participants in the audience response system group were significantly less convinced of the correctness or validity of their responses compared to the participants in the scantron sheet group. Interestingly, though the audience response system groups were less sure about the validity of their

answers than the scantron groups, there were almost no actual differences in their answers, as later analysis for Research Question 1 will show.

2.3. Hypothesis 3: Fun

Remote controls such as used by the audience response system CPS are similar to television remote controls, and similar to the remote controls subjects may have seen used on entertainment shows such as “Who wants to be a millionair.” The CPS remote controls might even be simpler to understand and use than regular TV controls, as they have fewer buttons. So, participants might have been familiar with the use of remote controls, but they presumably never used remote controls to answer a questionnaire. Scantron sheets, on the other hand, are commonly used in the United States by students of all ages to take examinations, an activity not generally associated with entertainment or fun. Though new technologies are often intimidating to people, it was hypothesized that subjects who are exposed to technologies in the form of TV remote controls, email, cell phones, and instant messages on a daily basis will perceive answering the questionnaire with the audience response system as more fun than completing it via the standard scantron sheets. Independent samples *t*-tests were used to determine whether there was a difference in the amount of fun it was to complete the questionnaire. Results showed that participants of the audience response system group had significantly more fun ($M = 3.72$, $SD = 1.08$) completing the questionnaire than participants in the scantron group ($M = 2.41$, $SD = .93$), $t(153) = -8.51$, $p = .000$. The effect size r^2 of .32 indicates a moderate effect. Hypothesis 3 was, thus, supported. Using the audience response system might be beneficial in research requiring participants to complete more than one questionnaire, as using a technology such as CPS might actually keep participants more entertained and possibly more motivated.

2.4. Hypothesis 4: Time pressure

When using CPS to complete a questionnaire, the answers each individual gives remain anonymous to the group. However, the speed with which each participant moves is apparent as the overhead screen displays what question number each person is going to answer next. Independent samples *t*-tests showed that participants experienced no significant difference of time pressure when using either scantron sheets ($M = 3.62$, $SD = .93$) or the audience response system ($M = 3.50$, $SD = 1.06$) to complete the questionnaire, $t(154) = .80$, $p = .425$. Thus, hypothesis 4 was not supported as participants felt comfortable completing the questionnaire at their own pace, no matter what methodology they used.

2.5. Research Question 1: Differences on the CMC competency scale

To investigate whether participants of each group (scantron or audience response system) scored differently on the primary questionnaire used (computer-mediated communication competency scale), independent samples *t*-tests were conducted for

all constructs. Answers to this question will be especially important in comparison to hypothesis 2. Subjects in the audience response system group had shown less faith in the validity of their answers as had subjects in the scantron group, so it is important to investigate whether this difference is actual, or perceived.

Of the 12 constructs investigated,⁴ only two showed significant differences between the subjects completing the questionnaire via scantron compared to those completing it via the audience response system. These two constructs were: medium factors and message factors. For a complete overview of the *t*-test results, see Table 1.

With regard to the medium factors, results showed that the audience response system group scored significantly higher ($M = 3.92$, $SD = .64$) than the scantron group ($M = 3.53$, $SD = .68$), $t(169) = -3.94$, $p < .000$ on the medium factors. The effect size r^2 of .08 indicates a small effect. As the items in the medium factors construct focus on criteria for choice of medium when a message is to be sent (including amount of information sent, access to medium by sender and receiver, speed of delivery, multiplicity of message, desired speed of response, and benefit of having others present), they address the richness of the chosen medium (Daft & Lengel, 1984, 1986). Scoring higher on the medium factors implies that respondents are more aware of why they choose a certain medium over another. This heightened awareness may be a result of actually using the audience response unit, which may have influenced subjects' answers in this incident. More research is needed to investigate whether using the audience response system simply helped participants to become more accurately aware of their media choices, or led them to overestimate their choosing capabilities.

Though the reliability of the message factors construct does not reach the generally accepted level of .60 ($\alpha = .54$), it is the only other construct showing a significant result. Subjects in the audience response group scored significantly higher ($M = 3.74$, $SD = .63$) than subjects in the scantron group ($M = 3.45$, $SD = .59$) on the message factors, $t(163) = -3.13$, $p = .002$. The effect size r^2 of .06 indicates a small effect. The items in the message factors construct are concerned with issues of reducing ambiguity, accuracy, length of the message, and targeting specific receivers. Possibly, using the audience response system alerted participants more to such issues. More research is needed to see whether such a difference would occur with a different sample, too, or when using the audience response system versus scantron to evaluate actual messages.

In sum, of the 12 constructs investigated, nine reached a reliability α of at least .60. One of these reliable constructs (medium factors) showed significant differences with the audience response group scoring higher than the scantron group. Of the three constructs approaching a reliability level of .60, one showed significant differences (message factors). Here, also, the audience response group scored higher than the scantron group. Whether these differences are caused by statistical chance, or because the CPS unit influenced results, or because of other, undetermined factors is not clear and calls for further research. Results show, however, that in 10 out of 12

⁴ The 13th construct "contextual factors" was dropped from the analysis due to a reliability α of $-.82$.

constructs, there is no statistical difference between the scantron group and the audience response system group. In the two cases where there is a statistical difference, the participants of the audience response group score higher than the participants of the scantron group, and not vice versa, possibly indicating heightened awareness due to the use of the technology. Thus, even though hypothesis 2 showed that subjects assigned to the audience response group had less faith in the validity of their recorded answers, analysis of the actual answers given show very few differences between the two groups.

2.6. Research Question 2: Relationship between method and CMC competency scoring

In order to investigate whether the methodology used influenced subjects' scoring on the CMC competency scale correlation and regression analyses were conducted. Methodology was significantly correlated with results of the message factors, $r = .233$, $t(173) = 3.15$, $p = .002$. Approximately 5% of the variance of message factors was accounted for by a linear relationship with the methodology used. Methodology was also significantly correlated with results of the medium factors, $r = .286$, $t(172) = 3.91$, $p < .000$. Approximately 8% of the variance of medium factors was accounted for by a linear relationship with the methodology used. Thus, in these two incidences, methodology seems to have influenced subjects' answers on the CMC competency scale. This study should be replicated with a non-technology related questionnaire to see if the topic of the questionnaire influenced results in any way.

3. Discussion

The purpose of this research was to compare a traditional method of collecting questionnaire data (scantron sheets) with a new method (audience response system, CPS). Results showed that although subjects in the audience response system group were less certain about the validity of their answers on the main questionnaire, t -test results of the actual questionnaire completed showed no significant differences in 10 out of 12 constructs. Previous research on computer-mediated communication technologies has shown that the use of technology can lead to lessened confidence in one's work. For example, Straus and McGrath (1994) and Watson, DeSanctis, and Poole (1988) investigated the use of a group decision support system (GDSS) for decision making. They found that though there were no differences in the quality of solutions found by face-to-face versus GDSS groups, the GDSS groups had less confidence in their solutions. Thus, in cases where quality or validity of responses is of prime importance, the use of technology such as GDSS or the audience response system CPS seems supported. However, in cases where subjects' confidence in their results is of prime importance, more traditional means of data collection seem appropriate.

Using independent samples t -tests, statistical differences between the two groups (scantron and audience response system) were found for two constructs (medium

factors and message factors). In both cases where statistical differences were found, the participants in the CPS audience response system group scored higher (more positively) than the participants in the scantron group. Further investigation in the form of correlations and regression analysis showed that the differences between the two groups with regard to the two constructs are indeed, due to the methodology used. Further research ought to investigate whether these differences speak of a heightened awareness due to the methodology, and thus, a more accurate measurement, or an over estimate or possible social desirability effect produced through the use of the technology. Also, the questionnaire used here was comprised almost entirely of the computer-mediated communication competency scale. Thus, for the audience response system group, both the methodology used and the survey topic were of technological nature. As at least one of the constructs showing significant differences is clearly technology related (medium factors), this combination may have been the reason for the difference in results. Future research ought to investigate whether using an audience response system compared to scantron sheets leads to significant differences with a non-technology related survey.

In conclusion, the results presented here provide an important addition to the field of social science research. This research shows that using the audience response system CPS for the collection of social science data yields no less reliable results than using a more traditional methodology such as scantron sheets for 10 out of 12 constructs. In addition, using the audience response system is perceived just as easy, more fun, and presenting no additional time pressure while completing the questionnaire. Advantages of using CPS include reduced cost (after initial purchase of the system), more fun for participants, easier and quicker questionnaire construction due to digitized question database, especially for research using certain instruments repeatedly, and digitized storage of data instead of paper sheets. Disadvantages include the initial purchasing cost of the system (which may be alleviate if the researcher's organization or university already owns such a system), limitation of group size (currently limited to approximately 500 simultaneous users), and having to spend approximately 10 min to train participants. Despite these disadvantages, the audience response system CPS seems to provide a new and reliable alternative to established methods of collecting social science data. Researchers who have access to such a system can benefit from its use greatly, though it remains questionable whether an audience response system should be purchased solely for the purpose of data collection. In the end, rather than substituting for the traditional methodology of scantron sheets, under certain circumstances the system can be used as a reliable alternative.

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Appendix A. Computer-mediated communication competency questionnaire

Note. For a review of the development of this and a shorter version of this instrument, see Bunz (2003). Items in *italics* were deleted during reliability analyses to achieve higher reliability. Headings were omitted during administration of the questionnaire. All items on a 5-point Likert scale (strongly agree to strongly disagree) unless otherwise indicated.

Coordination

1. When I receive a message from someone, I generally reply within 24 hours.
2. I often forget to reply to particular aspects of another person's message.
3. I am usually the one who initiates new topics and/or agendas.
4. I am good at managing the timing of my CMC conversations with others.
5. Sometimes I don't know when or how to close down a topic of conversation.
6. I manage CMC interactions skillfully.

Expressiveness

7. I am very articulate and vivid in my CMC messages.
8. *I use a lot of the expressive symbols [(e.g.:) for 'smile'] in my CMC messages.*
9. I think a lot of my CMC messages are unclear or ambiguous to others.
10. I try to use a lot of humor in my CMC messages.
11. I hide my true feelings in most of my CMC interactions with others.
12. I am skillfully expressive in my CMC conversations.

Attentiveness

13. I send comforting messages to others when I sense they are down.
14. *I say just what I think, not what others want to hear.*
15. I adapt my word choices and writing style to the style of the person I'm corresponding with.
16. *I generally stay on my topic or agenda in my messages.*
17. I ask a lot of questions of the other person in my CMC.
18. I am skillful at showing concern for and interest in the person I'm conversing with in CMC.

Efficacy

19. I don't feel very competent in learning and using communication media technology.
20. I feel completely capable of using almost all currently available CMCs.
21. I am confident that I will learn how to use any new CMCs that are due to come out.
22. I am nervous when I find I have to learn how to use a new communication technology.
23. I am generally the last person of friends and colleagues to adopt or purchase a new CMC.
24. *My colleagues/friends look to me frequently for help with their CMC questions or needs.*
25. *I spend a lot of time just exploring CMCs just to see what I can do with them.*

26. I am excited by the prospect of getting and learning new CMCs.
27. I find changes in technologies very frustrating.
28. I can almost always figure out quickly how to use a new CMC.
29. Having to learn new technologies makes me very anxious.
30. I may not “know” a given CMC, but I know I can learn to use it.
31. I usually master a new CMC before most of my friends or colleagues.
32. *If a CMC isn't user friendly, I'm likely not to use it.*

General usage

33. I rely heavily upon my CMCs for getting me through each day.
34. I use computer-mediated means of communication almost constantly.
35. I can easily go a week without any CMC interactions.
36. I am a heavy user of computer-mediated communication.
37. If I can avoid using a computer for communicating, I do.

Motivation

38. I enjoy communicating via computer media.
39. *I get nervous using CMC.*
40. I am not very motivated to use computers to communicate with others.
41. *Communicating with higher-ups through computers relieves some of my tension.*
42. I look forward to sitting down at my computer to compose messages.
43. I like tinkering with options to make my CMC messages more effective.

Knowledge

44. I am very knowledgeable about computer-based communication techniques.
45. I simply don't understand CMC hardware or software very well.
46. I am very familiar with e-mail and communication networks.
47. *I generally can't diagnose or fix what the problem is when my e-mail doesn't work.*
48. *I never seem to know how to say things the way I mean them using CMC.*
49. I feel quite comfortable when communicating via computer-mediated media.

Contextual factors

50. *Most of my messages I send to persons “above me” (i.e., of higher status) in the organization.*
51. Most of my messages I send to persons of the same status as me.
52. In my work my CMC messages are “all business” and only about the task at hand.
53. *I treat my CMC messages as opportunities to work on relationships as well as tasks.*
54. I never seem to have enough time to compose my CMC messages as well as I'd like.
55. *I like CMC because it gives me time to prepare drafts of my messages.*
56. *Most of my CMC messages are to people who are geographically far away.*
57. *I send most of my CMC messages to people I could just as easily talk to face-to-face.*
58. I am rarely far away from a computer with which I can communicate with others.

59. *I have access to computer communication media both at home and at a place of work.*
60. Most of my computer-mediated communication is about very specific tasks.
61. I generally use CMC simply to get an idea of what I'm supposed to be doing on a project.

Message factors

62. When the situation calls for it, I compose CMC messages to leave room for interpretation.
63. *I always try to be as specific and clear as possible in all my task-related CMC messages.*
64. The more people I need to send a message to, the more likely I am to use an address list.
65. The more messages I have to send out on a project, the briefer I am in my message.
66. The more detailed a message is, the more careful I am in making sure it is accurate.
67. The more technical a message is, the more I try to be selective in who reads it.

Medium factors

68. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how much information is involved in the message.
69. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how much access I have to each channel or medium.
70. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how much access the person I need to communicate with has to each channel or medium.
71. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how quickly I need to get a message out to people.
72. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how long I need people to hang on to the message.
73. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how many different uses and forms are needed (e.g., hardcopy, image processing, voice-mail, computer language, etc.).
74. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how immediate I need the feedback to be.
75. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how much benefit there would be to having the other(s) present.
76. I choose which medium to send some messages by (i.e., CMC, mail, phone, or face-to-face), based on how lively the interaction and feedback need to be.

Satisfaction

77. I am very satisfied with my communication abilities using computer media.
78. I don't enjoy my CMC relationships as much as I would like.
79. *I find my CMC interactions less satisfying than face-to-face interactions.*
80. My CMC conversations are very satisfying.
81. More of my CMC interactions are unpleasant than my face-to-face interactions.
82. I usually wish I could communicate better with computer media than I actually can/do.

Appropriateness

83. *I avoid saying things I shouldn't on CMC.*
84. I often end up saying things in CMC that turn out to offend the other person.
85. My CMC interactions are always very appropriate to the relationship.

Effectiveness

86. I generally get what I want out of my CMC interactions.
87. I find most of my CMC conversations frustrating.
88. My CMC interactions are effective in accomplishing what I set out to accomplish.

Demographics

89. Age:
 - (1) 18
 - (2) 19
 - (3) 20
 - (4) 21
 - (5) other
90. Gender:
 - (1) Female
 - (2) Male
91. How long have you been using any CMC technology (such as email, the web, ICQ, etc.)?
 - (1) Less than one year
 - (2) 1–3 years
 - (3) 4–6 years
 - (4) 6–9 years
 - (5) More than nine years
92. Do you have Internet access where you currently live?
 - (1) Yes
 - (2) No
93. Overall, how fluent are you with CMC technology?
 - (1) Not at all
 - (2) A little
 - (3) Moderate
 - (4) A lot
 - (5) Advanced

Appendix B. Audience Response System (CPS) version of the “experience using...” questionnaire

Training

- T1. The introductory explanations on how to use the technology were sufficient.
- T2. The introductory explanations on how to use the technology were clear.
- T4. After the introduction, I still wasn't sure how to use this technology.
- T5. Listening to the introductory explanations, I understood quickly how this technology works.

Ease of use

- E1. Using the technology was easy.
- E2. Using the remote controls was easy.
- E4. I don't really understand how this technology works.
- E5. I had no problems with the technology.

Perceived validity

- V1. Having to use the technology influenced the way I answered questions.
- V3. I'm not sure my answers were accurate.
- V4. Having to use CPS had no effect on how I answered the questions.
- V5. I wasn't always able to answer the way I wanted to because of the technology.

Fun

- F1. Using the remote controls was fun.
- F2. I always enjoy using a new technology.
- F3. This way of completing a questionnaire is exciting.
- F5. I really enjoyed using CPS.

Timing

- M1. I felt pressure to complete the survey quickly.
- M2. I completed this survey at my own pace.
- M3. Seeing that other people moved faster through the survey affected me negatively.
- M4. A sense of competition caused me to answer questions quickly.

Deleted items

- T3. The introduction didn't provide enough explanation on how to use the technology.
- E3. Using CPS is pretty hard.
- V2. I never thought about the technology while answering questions.
- F4. The technology was annoying.
- M5. Using CPS had no effect on the speed with which I answered the questions.

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Ulla Bunz (Ph.D., University of Kansas) is an Assistant Professor in the Department of Communication, Rutgers University. Her main area of research is technology-mediated communication competence and fluency, and the application of these in a variety of contexts. Dr. Bunz also conducts research on a variety of other topics, including instructional technology and cybergeography.