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ABSTRACT

A Technology in Texas Public Schools 1998 Survey instrument was integrated into a Web-based response system enabling the instrument to be accessed, completed, submitted, and instantaneously analyzed over the Internet. A mark-sense or optical scan paper version of the instrument was also developed for mail-out distribution to each school district in the state of Texas. The decision to provide two response options to school administrators for this survey provided the research question for this investigation: "Is there a difference in survey responses submitted by Internet or mail?" The findings revealed no observed differences in responses whether the survey was submitted electronically or by mail. Other issues of cost, time, and human networks were discussed. (Author/AEF)

Building a Case for Conducting Technology Surveys On-Line

By

Jon J. Denton
Arlen Strader

Abstract

A Technology in Texas Public Schools 1998 Survey instrument was integrated into a web-based response system enabling the instrument to be accessed, completed, submitted and instantaneously analyzed over the Internet. A mark-sense or optical scan paper version of the instrument was also developed for mail-out distribution to each school district in the state. The decision to provide two response options to school administrators for this survey provided the research question for this investigation. That is, **"Is there a difference in survey responses submitted by Internet or mail?"** The findings revealed no observed differences in responses whether the survey was submitted electronically or by mail. Other issues of cost, time and human networks are discussed and in general, the authors support the use of the Internet for conducting surveys with large samples.

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BUILDING A CASE FOR CONDUCTING TECHNOLOGY SURVEYS ONLINE

Jon Denton and Arlen Strader

Instructional applications of computer technology have been proposed and tested over the past 30 years. To illustrate, in 1969 Lawrence Stolurow proposed standards for computer based instructional systems designed for the individual learner (Stolurow, 1969). These standards were subsequently applied in secondary school physics classes by the senior author and a colleague in separate investigations on computer managed instruction (note 1). These instructional systems, tailored for individual learners have evolved into intelligent tutoring systems that today remain on the horizon of instructional applications of computer technology for public school classrooms. More often, early classroom applications of computers emphasized tutorials, drill and practice and computer managed learning activities (Kulik, 1984).

High profile reports including one by the President's Committee of Advisors on Science and Technology (1997) suggest that computer technology may have the potential to influence the future of elementary and secondary education. Bringing this goal into focus on student learning and the classroom, Bransford, Brown and Cocking (1999) conclude after reviewing numerous efforts currently underway, that:

> ...technology-based tools can enhance student performance when they are integrated into the curriculum and used in accordance with knowledge about learning... But the mere existence of these tools in the classroom provides no guarantee that student learning will improve; they have to be a part of a coherent education approach. (page 204).

The prospect of computer technology shaping tomorrow's schools to enable learners to succeed academically is certainly more attainable given today's Internet networks and powerful multimedia-networked workstations than 30 years ago. Yet issues associated with policy positions about technology integration, technology infrastructure, technology support provided by school districts, professional staff development on technology applications and use of technology by teachers and their students have become important benchmarks to mark progress with the integration of technology into our classrooms.

Policy Issues and Technology Infrastructure: In 1995, the state legislature passed three acts that have accelerated the development of technology integration in schools. Significant efforts to build technology infrastructure in the state are evident with over 1,000 grants approaching $300,000,000 in total volume being awarded by state agencies. These awards have targeted rural communities serving children often from low-income homes. Given this intensive effort, it is important to consider how these resources have been used to put support systems in place and what professional development activities on these technologies are occurring in the schools.

Staff Development and Technology Support: With schools becoming connected and educators participating in staff development activities about integrating multimedia into classroom instruction, much momentum will be lost if integration is discussed but not

implemented. Few states invest adequately in either pre-service or in-service technology professional development for educators. As a result, most teachers have little direct experience in observing and learning about the wide range of computer-telecommunications applications for classrooms. An Education Commission of the States document (ECS, 1998) states that only 15 percent of the K-12 teachers in the nation have received as much as 9 hours of training in technology. Further, this report notes that the average school district expenditures for technology devoted to teacher training is reported to be 6% while the recommended level is 30%.

Literature on technology staff development indicates that best practice takes place in the school when teachers experience the need to change their classroom practices. Optimal professional development opportunities also center around specific projects and take into account the varied levels of experience of educators with technology that occur across an extended period of time (Clark & Denton, 1998).

Use of Technology by Teachers and Their Students: Baseline data collected in 1996 across the state indicate that very few teachers and students accessed the Internet for classroom instruction. If the technology infrastructure changes and staff development programs have been successful, dramatic increases in use by teachers and students will have occurred. These data on level of technology applications by teachers and their students are invaluable to policy makers in determining next steps for funding technology integration in schools.

Context

In 1996, a mailout survey of the technology infrastructure in all public schools in the state was conducted. Over (82)% or (856) of the 1,043 school districts in the state participated in that survey effort. Findings from that effort included:

- Over half (57%) of the school districts reported having 2-6 computers (386Mhz or above) per classroom;
- Twenty percent of the reporting districts reported no staff development on technology was provided in their schools;
- Over one-third of the school districts reported on-going technical assistance being available in their schools;
- Over 80% of the responding districts planned to spend 10 cents of each dollar budgeted for technology on staff development activities over the following three years;
- Nearly half of the responding school districts indicated that the district's technology plan was revised annually;
- Eighty-seven percent of the respondents reported technology hardware expenditures ranged from 0 to 2 cents per dollar of the district budget.

The results of this 1996 Technology Infrastructure Survey are available at http://eEducation.tamu.edu. This novel site provides an electronic file and associated software, *Web Survey Builder* that enables the data to be partitioned and analyzed with respect to different geographic and school size classifications enabling customized reports for each reader. Anecdotal evidence indicates this site has been frequently

accessed and used in developing proposals for technology support by schools across the state. Further, this survey effort was referenced in a state agency communication as a source of information that was used in determining how technology funds were distributed to school districts across the state. Given the level of use by school districts and state agencies with the 1996 Technology Infrastructure Survey, a decision was readily made to undertake another technology survey.

The capabilities of the *Web Survey Builder* were further applied by loading the **Levels and Use of Technology in Texas Public Schools 1998 Survey** instrument into this system enabling the instrument to be accessed, completed, submitted and instantaneously analyzed over the Internet. A mark-sense or optical scan paper version of the instrument was also developed by National Computer Systems (NCS) for mailout distribution to each school district in the state. The decision to provide two response options to school administrators for this survey provided the basis for this investigation.

Research Questions

The following research questions were posed to guide this investigation.

Is there a difference in survey responses submitted by Internet or mail with respect to:
1. policy issues about technology integration?
2. technology support provided by the school district?
3. technology infrastructure of school district?
4. uses of technology by teachers and students?
5. staff development on technology integration?

These questions are important pragmatically for a number of reasons. First, because different response options are available, the Internet response option selected may signal school districts who are early adopters and more aligned with technology integration. Although this potential phenomenon would not pose a problem for a single administration, it could affect interpretations of data across surveys conducted at different times. If the response patterns are different, the different collections procedures would be a limitation in making comparisons across time, (i.e., 1996 Survey (mailout option only), 1998 survey (Internet and mailout options) with a survey potentially being conducted electronically in 2000). Second, the direct costs associated with a mailout survey are considerably higher than an electronic survey conducted over the Internet, once the Internet protocol has been developed and tested. Third, the time necessary to conduct the survey may be decreased if school administrators actually use the Internet effectively in conducting their professional duties.

Method

Instrument Development: An initial draft of the survey instrument was developed based on the 1996 instrument and critiqued by technology representatives from: the state education agency; a regional educational service center; a telecommunication company; a school administrator professional association; the T.H.E. Journal; and SCR*TEC-TX staff (note 2). The instrument subsequently underwent several revisions that incorporated suggestions from staffs of state agencies and legislators resulting in the final version that contained 37 items clustered under five headings: policy (5 items); district's technology support (5 items); district's current technology infrastructure (10 items); use of technology (10 items); staff development related to technology (7 items). Although the distribution of the survey was targeted to the superintendent of schools, directions at the beginning of the instrument encouraged the superintendent to direct the instrument to the district's technology director for completion and remittance. Approval of the instrument and data collection process by the university Institutional Review Board for Human Subjects in Research was attained in late May 1998. The instrument may be viewed at http://eEducation.tamu.edu.

Data Collection

Data collection began with the initial survey mail-out occurring on August 11, 1998 to all 1,043 school districts in the state. An initial mail-out packet was provided to the U.S. Postal Service for first class delivery. This packet contained a personalized cover letter from the Executive Director of the school administrator's association to the superintendent, a distinctive information sheet on accessing the electronic version of the survey instrument, a mark sense survey instrument and a return mailer. During the following eight weeks 468 completed surveys were submitted representing a 44.9% return.

A second mail-out consisting of a personalized reminder cover letter from the Executive Director to the superintendent, a mark sense survey instrument, return mailer, and a descriptive statistical summary of the initial 450 responses for each survey item was mailed with first-class service to non-responding school districts on October 12, 1998. Five weeks later, 663 completed surveys had been submitted.

A reminder from the school administrator's association was made to nineteen non-participating districts on November 30, 1998, and reminder telephone calls to the remaining non-participating districts began November 30, 1998 by SCR*TEC-TX staff. Offers to send a third instrument (137 districts mailed another copy) as well as encouragement to submit survey information electronically (website addresses provided to 99 districts) and 16 instruments were faxed to districts as a result of these reminders. On Tuesday, January 5, 1999 the closing date for receipt of surveys, slightly less than four months after the data collection began, 789 completed surveys had been submitted.

Because two response options (electronic and mark sense) to the survey were provided to respondents, the type of return was recorded as completed surveys were received. Table 1 provides a summary of the electronic and mailed surveys.

Table 1: 1998 Public School Technology Survey Log

	Mail In Responses	Internet Responses	Cumulative Total
First Mail-Out	291	177	468
Second Mail-Out	165	34	667
Third Mail-Out	50	72	789

During the initial two weeks of data collection, the electronic submissions outnumbered the mailed submissions 2:1. After this initial period, the mailed responses increased resulting in the ratio of 37:63 of electronic to mailed responses by October 12, 1998. Due to an oversight, a distinctive information sheet on accessing the electronic version of the survey instrument was not included in the second mail-out, yet some school officials noted the URL for the electronic version in the directions of the mark sense instrument and submitted the completed survey electronically. At the close of data collection a total of 789 surveys were submitted from 75.6 % of the school districts in the state. Thirty-six percent of the responses were submitted electronically and the remainder was mailed for machine scoring at the university's Office of Tests and Measurements.

Data Analysis

Data received through electronic submissions were verified with respect to the district name and/or district-county identification number. These data were then organized into Excel files. As completed mail-in surveys were received; they were verified with respect to district name and identification number and checked with respect to readability by the machine scoring equipment. Batches of 40-50 mailed surveys were delivered to Tests and Measurements Services for processing at a time. Resulting electronic data files from this process were then concatenated with the electronically submitted data for processing with the *Web Survey Builder.* As noted earlier, this software enables data to be partitioned and analyzed with respect to different geographic and school size classifications enabling customized reports for each reader. Simple cumulative summaries (frequencies and percentages) are provided by this software, but additional statistical analysis using the SPSS statistical package were conducted to answer the research questions posed in this investigation. For most items the data were categorized by item number from the survey instrument and response option (print or electronic) into contingency tables and tested with the χ^2 goodness of fit statistic for differences in response patterns. The χ^2 goodness of fit statistic tests the degree to which differences between response patterns can be assigned to chance.

Findings

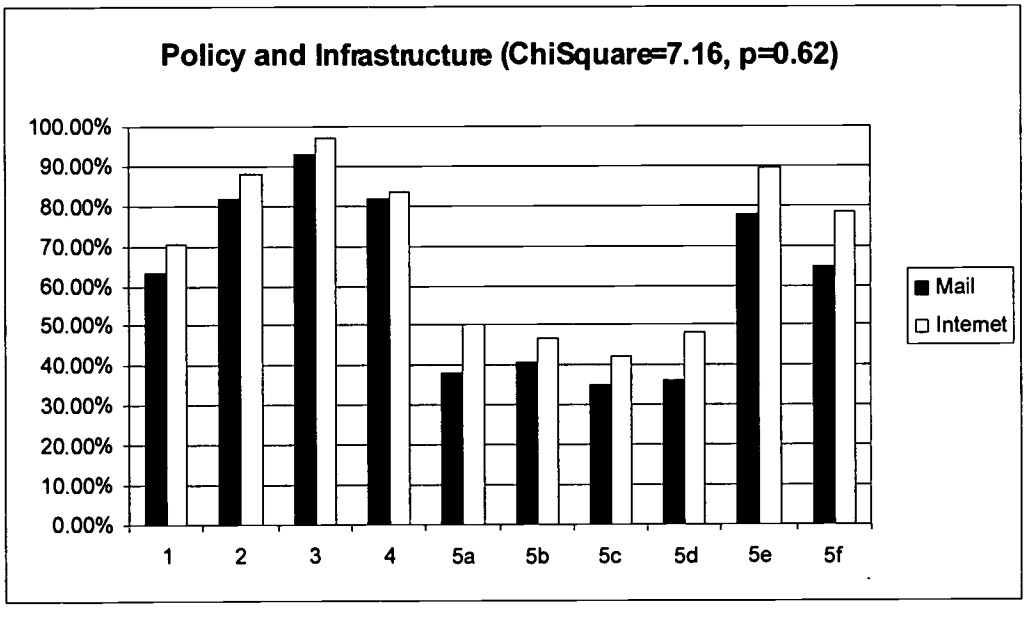
The following data summaries have been prepared to address the research questions that guided this effort. Except for the analyses of all items dealing with policy (question 1), samples of items were drawn to represent the analyses for each of the remaining sections. However, statistical tests were conducted on all 37-survey items with respect to whether the survey was submitted electronically or by mail. The results were very consistent and uniform; that is, no statistical differences were noted with respect to whether the survey item was completed on a computer screen or on paper.

Question 1: Is there a difference in survey responses submitted by Internet or mail with respect to policy issues about technology integration?

Five items of the instrument were grouped under policy issues, although one of the items contained six parts yielding a group of 10 items. Data from these items were analyzed together. Table 2 presents histograms for each of the items. Histogram plots represent positive responses for all items. The five items addressed whether the school district had:

Item 1. benefited from state legislation on technology infrastructure
Item 2. expressed interest in electronic delivery of class materials
Item 3. considered free or low-cost Internet access to be a state priority
Item 4. applied for federal telecommunications rebate
Item 5a. interest in technology audits
Item 5b. interest in technology use plans
Item 5c. interest in technology infrastructure plans with projected costs
Item 5d. interest in establishing technology consortia
Item 5e. interest in staff development on technology integration
Item 5f. interest in grant writing workshops for technology funding

Table 2: Histograms of Mail and Internet Responses on policy issues



The difference in response patterns across all items in this analysis were not statistically significant (χ^2 = 7.16, p=0.62). This finding supports comparing survey data sets collected either by mail, Internet or both mail and Internet with one another because the observed differences due to the type of response technique can be explained by chance. As anticipated, items about technology audits, technology planning, and technology consortia did not generate the level of affirmation as items addressing state or federal financial support, grant writing support, technology integration into instruction and staff development on technology integration.

Question 2. Is there a difference in survey responses submitted by Internet or mail with respect to technology support provided by the school district?

Five items of the instrument (items 6-10) were grouped under technology support. Items 6 and 7 requested information on expenditures on technology for equipment and staff development yielding interval data. For item 6 (total annual technology expenditures) the medians are $167,000 for the Internet group (n=219) and $150,000 for the Mail group (n=467). This yielded a *p*-value using Wilcoxen W of 0.145. For item 7 (total annual staff development expenditures) the medians for both groups was $5,000 (n=226 for Internet group and n=459 for Mail-In group) yielding a *p*-value of 0.727. Both are insignificant effects.

Question 3. Is there a difference in survey responses submitted by Internet or mail with respect to the technology infrastructure provided by the school district?

Ten items of the instrument (items 11-20) were grouped under technology infrastructure with many of the items containing multiple parts yielding multiple comparisons. As examples for this group, consider "11a. Elementary Campus Computer-to-Student Ratio," "12b. Average Number of computers per middle school classroom," and "13c. Ratio of high school campuses with Internet access." Table 3 illustrates that for these three questions the response distributions of the two groups are very similar. Table 4 shows the χ^2 values for items 11-13. None of these items show statistical significant differences between the Mail-In and Internet groups.

Table 3. Technology infrastructure response comparisons

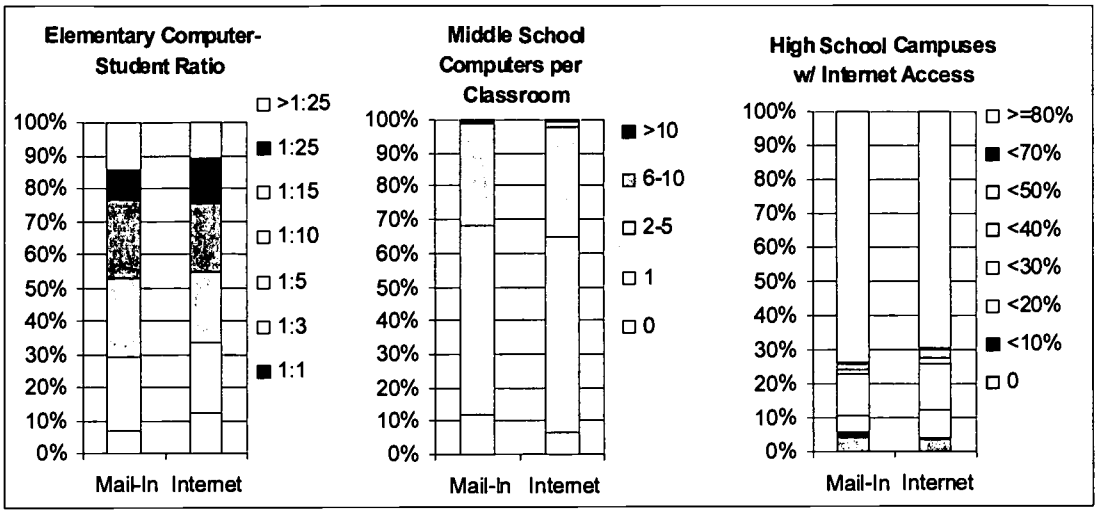


Table 4. χ^2 values for items 11-13

	Elementary		Middle		High School	
	χ^2	p	χ^2	p	χ^2	p
11. Campus Computer to Student Ratio	9.32	0.10	8.33	0.14	5.89	0.32
12. Computers per classroom	4.57	0.21	5.39	0.15	2.56	0.46
13. Campuses with Internet Access	6.51	0.48	7.74	0.36	6.59	0.47

Question 4. Is there a difference in survey responses submitted by Internet or mail with respect to use of technology by teachers and students in the school district?

"Use of technology by teachers and students" consists of ten items within the instrument (items 21-30). Many of these items containing multiple parts yielding comparisons. Items 21, 22, 29, and 30 illustrate this section. Item 21 compares the number of teachers using the Internet for classroom instruction and the data are pictured in Table 5 (χ^2 = 10.02, p=0.53). Item 22 compares the frequency of classroom use of the Internet. This data are shown in Table 6 (χ^2 = 8.44, p=0.21). Table 7 depicts the data from items 29 and 30 that compare students' access to computers and the Internet at home (29. χ^2 = 6.40, p=0.09; 30. χ^2 = 8.27, p=0.08).

Table 5. Comparison of classroom use of the Internet

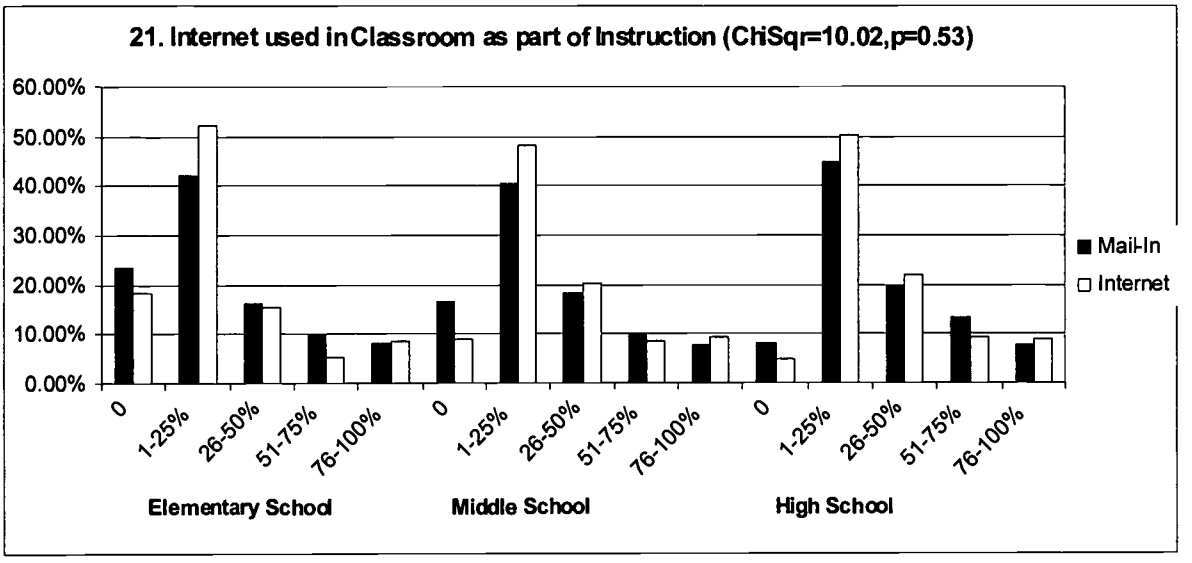


Table 6. Histogram for Item 22.

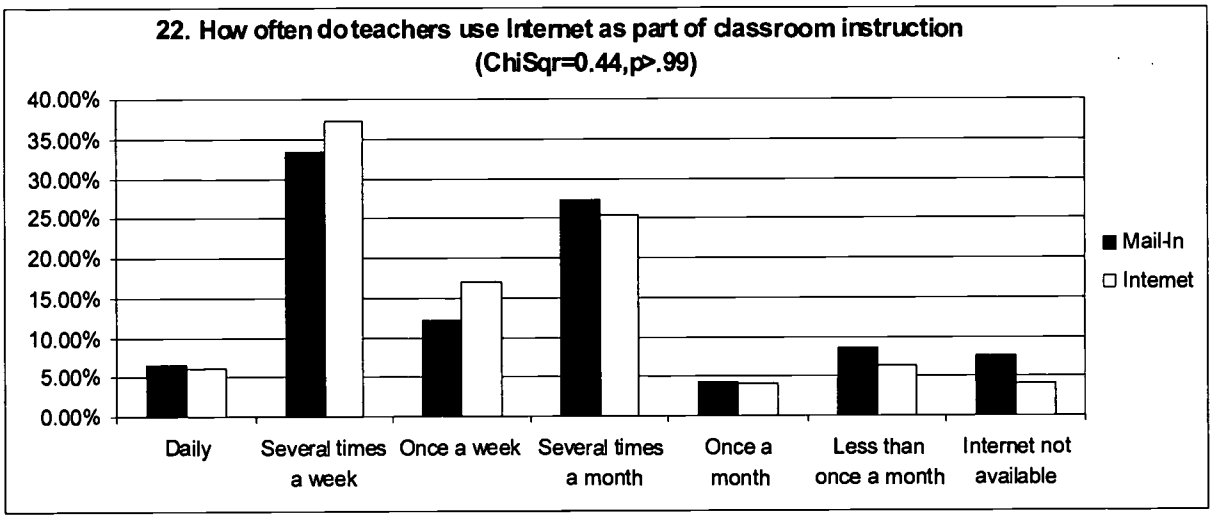
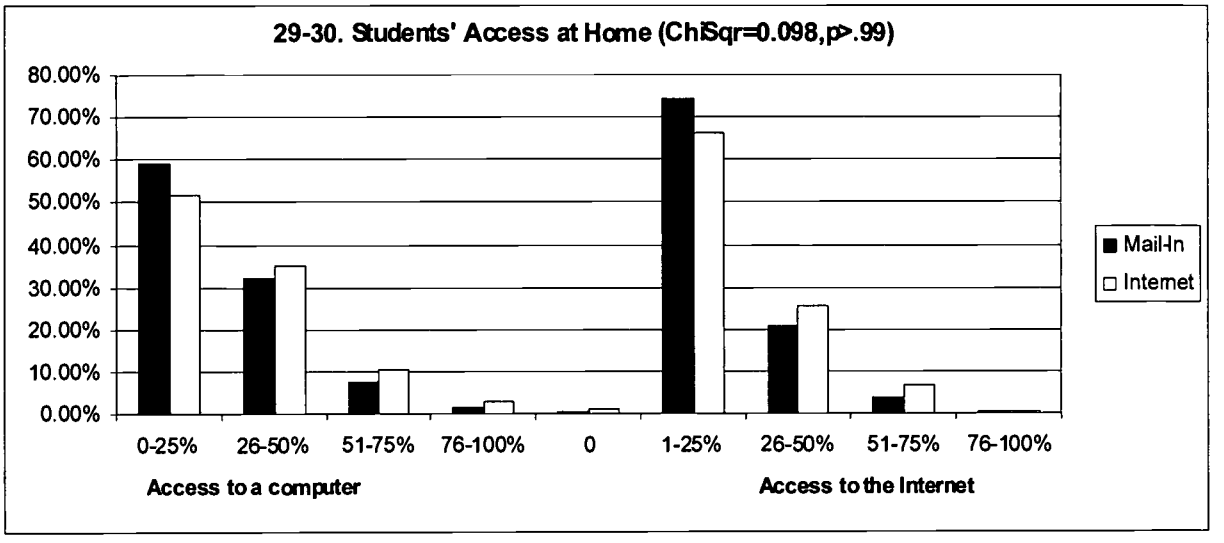


Table 7. Histogram comparing Items 29 and 30.



Question 5. Is there a difference in survey responses submitted by Internet or mail with respect to staff development related to technology in the school district?

Seven items (items 31-37) were grouped under the final section of the instrument, staff development related to technology. For this group we use item 31 to illustrate the point of this paper. Item 31 compares the types of professional development provided by school districts for their teachers. The response patterns are portrayed in Table 8. These values were analyzed using the χ^2 test with the results given by $\chi^2 = 5.82$ and p=0.67. The χ^2 statistics for the remaining items are summarized in Table 9.

For the items in this group
and coordinators (Chi Square = .004, p> .99), effectiveness/constraints for technology staff development (Chi Square = .245, p> .99), and technology planning frequency (Chi Square = .038, p> .99) were not statistically different with observed differences being attributed to chance. In 1998, common topics for staff development included Internet access, content-focused applications, and ethical/legal issues associated with technology integration into the classroom. While a number of districts reported their staff development programs were effective, other districts reported time and funding to be the major constraints in providing effective technology staff development programs. Also, technology plans appear to be revised often, suggesting technology integration is dynamic and rapidly evolving into the curricular programs of these school districts. None of these analyses resulted in statistically different responses between the groups.

Table 8. Response patterns for Item 31 regarding professional development of faculty.

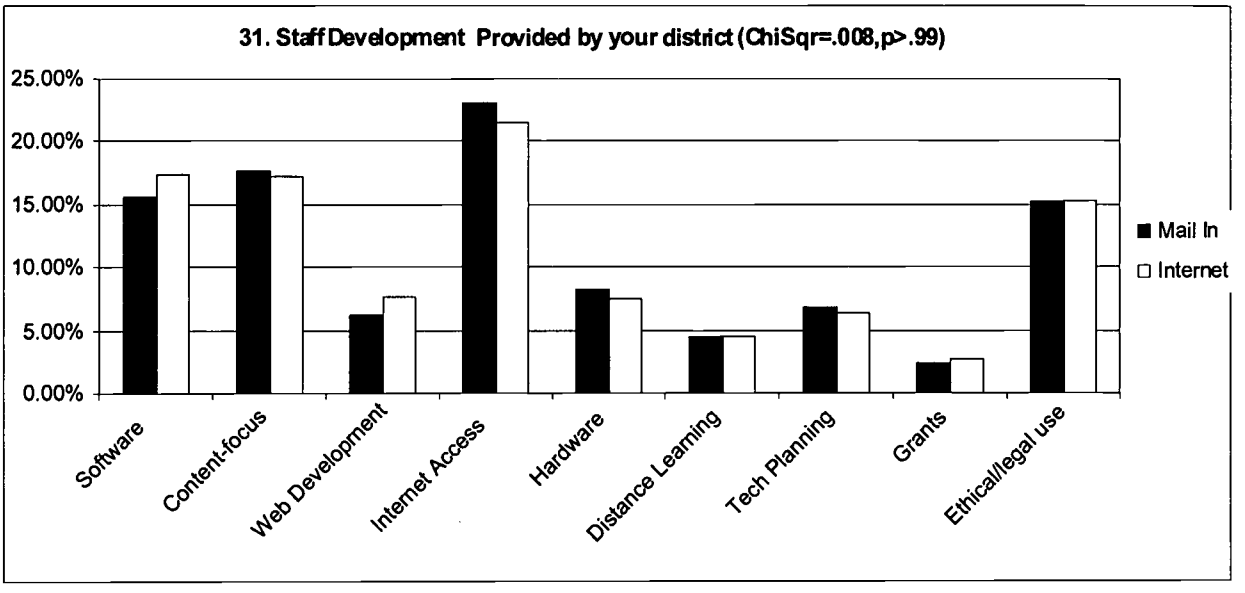


Table 9. Summary statistics for technology professional development questions

	χ^2	p
32. Number of professional development sessions annually available to teachers.	7.32	0.12
33. Types of professional development provided to technology coordinators	4.13	0.84
34. Frequency of technology plan revisions	7.09	0.13
35. Who provides technology staff development?	3.03	0.55
36. Is current technology staff development sufficient?	0.14	0.71
37. Stumbling blocks for more technology staff development	2.52	0.47

Conclusions and Discussion

The answers to the research questions regarding whether the submission option of mail or Internet affected the response patterns are five unequivocal "No"s. All of the statistical analyses conducted across the five research questions provided the same response; no difference in response patterns whether the data were submitted by mail or the Internet.

These findings support a move toward conducting future surveys with school districts in this state via the Internet. One of the reasons this investigation was conducted was our concern that a response bias might occur with early adopters of technology answering the questions differently than districts responding by mail. This hunch was initially

supported by submission behavior of districts when the electronic submissions outnumbered the mailed submissions dramatically over the initial two weeks of data collection. The consistent "no significant difference" findings across the entire survey also quieted our concerns about whether we could compare the 1998 survey results with survey data obtained at different times with only one submission option (mail or Internet). In fact, a companion paper (Denton, Davis, Strader, Jessup & Jolly, 1999) has been prepared that examines technology infrastructure changes between 1996 and 1998 across the state. Had these analyses revealed a number of items with significant differences due to the type of submission, a source of error variance would have been identified that would have reduced the significance of that paper for state policy makers.

The consistent findings of this investigation also support using the Internet to gather future needs and trends data from school districts across the state. Pragmatically, the cost of conducting a statewide survey is potentially lower using the Internet as the delivery system compared to mail delivery. In the case of this effort, each electronically submitted survey saved over a dollar in mailing costs alone. Additional costs for machine scoring of the mailed survey added a few additional cents to the mail method of data collection as well as the considerable cost of printing the mark-sense paper version of the instrument. However, the cost of the computer equipment and telecommunication system needed to support the Internet delivery system far offsets the preceding costs noted for conducting a survey by mail. Fortunately, the development (and related costs) of the Web *Survey Builder* had already occurred and development issues for the 1998 Survey required about 40 hours. Also, information gathered from the 1998 survey (see Denton, et al., 1999) indicate the telecommunications infrastructure is in place across the state to support the use of Internet surveys.

A related issue is whether the level of response will be maintained if Internet submission is used. In 1996, a response ratio of .82 occurred from school districts in the state, while in 1998, a response ratio of .756 occurred. Although the response ratio in 1998 was less, it still was quite good and the resulting data are thought to represent the status of technology in the state's public schools. It is felt the primary reason for the substantial response ratios for these surveys was the influence of the school administrator professional association in convincing school administrators to accept responsibility for submitting a complete and accurate survey because of their potential impact on state policy support for technology. Thus, influential human networks are necessary for substantial responses to statewide survey requests.

Finally, the variable of time and just-in-time information may be important considerations in how future statewide surveys are conducted. By using the data management capabilities and report production functions of the *Web Survey Builder*, status reports were developed frequently during the data collection phase of the survey and shared with state policy groups. These reports provided descriptive quantitative summaries on each survey item. Because the database of the *Web Survey Builder* is dynamic, it was updated with each electronic submission. This attribute of the system enabled a preliminary report to be developed by the system, printed and included in the second mailout to non- respondents. It also enabled the project team to deliver a printed

report to all 1,043 school districts within two weeks of the end of data collection phase of the survey effort.

In closing, the findings of this investigation support processes of submitting a survey electronically or by mail or using both mail and the Internet as viable options because no observed differences in responses occurred due to the delivery of data. Other issues of cost, time and human networks were discussed and in general, the authors support the use of the Internet in conducting surveys with large samples.

Note 1: Two dissertation research efforts occurred that incorporated tenets proposed by L. Stolurow. These investigations were:
Denton, J.J. (1972). *A methodological study of a computer managed instructional program in high school physics*. Unpublished doctoral dissertation, University of Missouri, Columbia, MO.

Paden, J.S. (1970). *An experimental study of individualized instruction in high school physics using the computer to prescribe activities as a function of selected ideographic factors.* Unpublished doctoral dissertation, University of Missouri, Columbia, MO.

Note 2: The South Central Regional Technology in Education Consortia - Texas (SCR*TEC-TX) staff consists of six people including the two authors. This staff was supported with funds from the U.S. Department of Education to facilitate the integration of technology into public school classrooms through September 2000.

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Note on cover page

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