The Nature of Technology Use in Classrooms:
The Development and Validation of an Instrument to Measure Teachers' Perceptions

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INTRODUCTION

In 1999, Quality Education Data reported that 89% of K-12 schools in the United States had computers connected to the Internet. By June of 2000, over 95% of U.S. schools and 72 percent of classrooms were connected to the Internet (Quality Education Data, 1999, 2000; CEO Forum, 2000). As the availability of computers and the Internet has grown, so has interest in the extent and purpose for which these technologies are being used. The literature regarding the use of technology in the schools is extensive and continues to emerge. Researchers have conducted studies on a variety of educational technologies in vastly different environments and settings. Yet, despite the profusion of interest and inquiry, the research related to the effectiveness of computers in education remains inconclusive (Trotter, 1998; Kearsley, 1993; Oppenheimer, 1997). Many researchers assert that published studies have not been sufficiently rigorous to support findings related to the effectiveness of technology in educational settings (Jones & Paolucci, 1997).

Another issue under scrutiny is the preparation of teachers to effectively integrate technology. In a study conducted by the National Center for Education Statistics, only 20 percent of the teachers believed they were prepared to integrate educational technology into their teaching methods (1999). The National Center for Education Statistics reports that only 16% of the teachers use the Internet to gather information for lesson plans and only 7% access information related to research and best practices for teaching (National Center for Education Statistics, 2000). The issues of training and subsequent computer use were linked by Sandholtz, Ringstaff and Dwyer (1996) who asserted that the benefits of technology in schools could not endure without adequate training and support.

Traditional measures of computer and other technology use in Florida schools have consisted of counting the numbers and types of devices (e.g., computers, internet connections). Such measures either ignore or give minimal attention to more critical issues related to teachers' and students' use of technology as tools for learning. An evaluation of educational technology must not neglect the effect of technology on teachers. Of key importance is the successful integration of technology into the

curriculum, coupled with the ability of teachers to motivate, instruct, and continue to challenge students as technology advances.

The goal of this research was to develop and validate an instrument that would provide data to foster a better understanding of how educators and students use technology in the classroom. In addition, we felt that it was important to explore related areas such as teachers' level of comfort and experience with computers as well as general attitudes toward computer use.

METHOD

Recognition of a need to develop a system for effectively measuring critical aspects related to the use of technology in schools served as the focus for this investigation. The first step of survey development involved the conceptualization of the relevant domains. Exploration of extant literature on the use of technology in schools revealed a wide range of interest and investigation. An examination of the indicators of successful integration of technology and computers in the classroom was made in concert with the development of the major domains. The domains of primary interest for this study fell within four broad categories: integration; support; preparation, confidence and comfort; and attitude toward computer use. Once these domains were established, survey items were constructed based upon existing, validated instruments related to these areas.

The first domain, integration, was divided into three sections and was comprised of both the methods used and the extent to which teachers' were integrating computers and technology in the classroom. The importance of integration as a critical factor in student engagement was noted by Sandholtz, Ringstaff and Dwyer (1996). The integration domain on the instrument included instructional strategies employed by the teacher in the classroom (e.g., individual and small group instruction), software used by both teachers and students to complete school related activities (e.g., word processors, spreadsheets, graphics programs), and teachers' personal use of computers (e.g., for fun / entertainment, as a communication or research tool).

The second relevant domain was conceived to encompass both teacher confidence and comfort using computers. One section of the survey was dedicated to

this domain with items created to measure general confidence and comfort using computers in the classroom. Important elements included the teacher's level of comfort giving computer assignments, enhancement of student performance and comfort with computer terminology. In addition to this central section, a set of related questions was deemed necessary to elicit information regarding the acquisition of computer skills (e.g., skills acquired as part of undergraduate coursework or in-service courses / workshops) and the desire for additional computer-based skills.

The third domain dealt primarily with support of computer use. During the development of this domain, consideration was given to faculty, administrative and technical support. Support was divided into two categories, general school support and technical support. Relevant issues regarding support in these areas included teacher access to computers at school, encouragement from faculty members and administration, and assistance from on-site technical specialists.

The fourth domain of interest was concerned with attitudes toward computer use. Of primary importance in this domain were general attitudes regarding the use of computers in the classroom. Critical issues included student access to computers, essential skills for students, the incorporation of computers in the classroom and the impact of technology on teachers. Items developed to measure this domain were based, in part, on the work of Kernan and Howard (1990) and Gardner, Discenza and Dukes (1993).

Each of the requisite domains was examined for comprehensiveness, and when necessary, additional items were drafted to ensure adequate coverage. The survey was designed and reviewed by content experts and was pilot tested with a sample of graduate students, many of whom are in-service teachers. Psychometric information based on the pilot responses and participants' comments about item clarity and importance were used to guide minor revisions to the survey content and item wording.

The revised items, grouped within eight sections, were ordered according to section length and content and assembled into a four-page booklet format. The front page of the instrument was used to collect demographic information (e.g., school name, gender, and ethnicity). Page two consisted of three sections: teacher preparation for computer use (8 items), confidence and comfort using computers (9 items), and general

school support (7 items). Responses to the preparation items were provided on a 5-point frequency scale (ranging from *Not at all* to *Entirely*). Responses to the confidence and comfort and general school support times were provided on a 5-point Likert scale (ranging from S*trongly Disagree* to *Strongly Agree*). The third page was comprised of two sections: types of software used to complete school related activities (14 items) and the integration of computers into the classroom (12 items). Responses to all of these items were provided on a 5-point frequency scale (ranging from *Not at All* to *Every Day*). The last page contained three sections: personal use of computers (5 items), technical support (8 items) and attitudes toward computer use (20 items). Teachers' personal use was reported on a 5-point frequency scale (ranging from *Not at All* to *Every Day*), with technical support and attitude items reported on a 5-point Likert scale (ranging from *Strongly Disagree* to *Strongly Agree*). For all items concerned with the frequency of use (i.e., software use, integration, and personal use), an option of not applicable (NA) was also provided.

The instrument was sent to all of the teachers in Pinellas County Schools. Eighty percent of the schools received the survey in paper form; twenty percent were administered an online web-based version. The surveys were originally bundled and distributed to all Pinellas County Schools via the district's internal mail distribution system. For each school a letter, addressed to the principal, outlined the purpose of the study and solicited assistance with the distribution of the individual surveys to all of the teachers within each school. Once distributed, each teacher received a letter describing the study and either a paper version of the survey or instructions regarding participation using a web-based version. In addition, schools chosen to participate in the web-version were also sent additional paper surveys in the event that individual teachers chose to complete a paper form instead of a web form. In order to yield a better response rate, both individual and school-based incentives were offered. At the individual level, participation was encouraged by allowing participants to register for a chance to be one of ten teachers to win a free technology workshop provided by the Florida Center for Instructional Technology. Participants were also informed that the three schools with the highest percentage of teachers responding would win an on-site training session of their choice. A website was provided to facilitate registration and

allow participants to keep track of the percent of teachers from their school and other participating schools who had responded.

Respondent Sample

The sample of 1890 respondents represents an overall response rate of 39% and was 17% male and 83% female. Sixty percent of the respondents held bachelors degrees, one percent held either a master's degree or specialist degree, and 37 percent held doctoral degrees. A broad range of teaching experience was represented in the sample. While a number of respondents reported that this was their first year teaching, there were others who had been teaching for over 40 years. The average amount of teaching experience for the survey respondents was approximately 15 years. Teachers reported an average number of students ranging from one to sixty with an average class size of 22. Additional information provided regarding grade level and subject area taught, suggested the representation of a wide variety of disciplines and a diversity of teaching experience. Because the comparability of the two modes of survey administration (i.e., web versus paper) has been reported elsewhere (Lang, Raver, White, Hogarty & Kromrey, 2000), only responses to the paper administration of the survey were used in these analyses.

RESULTS

The analyses consisted of non-respondent bias analyses, exploratory factor analyses, correlations between factor score estimates, and known groups analyses. Exploratory factor analyses were conducted to provide initial evidence of the construct validity of the instrument. Because the survey was divided into sections, each designed to capture a different aspect of teachers' perceptions, factor analyses were conducted separately for each section.

Several items included on the survey were designed to capture information deemed important to the investigation, yet not central to the domains of interest. These items were not included in the examination of the survey structure. For example, information regarding teacher preparation for computer use was collected to enhance our understanding of how teachers initially acquired their computer skills and to gain

insight regarding any additional training that might be viewed as beneficial. Additional questions were included to augment our understanding in other areas, such as technological support in the schools. As such, information regarding the presence and status of on-site computer specialists were also collected but not included in the analyses of the structure of the instrument. Responses to these items were used to help answer other related questions regarding the use of technology in Florida schools.

Non-respondent Bias Analysis

Careful attention was given to potential differences between those teachers who responded to the survey and the population of teachers in the school district. The χ^2 goodness of fit test and the associated effect size (Cohen's *w*) were used to compare these two groups on several characteristics. A statistically significant difference was evidenced for the two groups when gender, χ^2 (1, N= 1875) = 25.46, p=<.0001, w =.12, and race χ^2 (1, N= 1868) = 9.68, p =<.001, w =.07, was examined. However, the relatively small magnitude of these effect size estimates suggests somewhat minor difference between the two groups.

Psychometric characteristics of the instrument

The psychometric characteristics of the teacher survey were investigated through the use of correlational and common factor analyses. After listwise deletion of missing data, responses were available for approximately 1000 teachers. The results of the factor analyses are presented in Tables 1-8. Factors were extracted based on the proportion of variance explained by each factor (eigenvalues). Squared multiple correlations were used as the initial communality estimates and oblique rotations were employed because of the anticipated correlation between factors. The highest pattern / structure coefficients were used as the criteria for assignment to a given factor. The results of the factor analyses suggested the presence of 11 distinct factors within the instrument. Cronbach's alpha was then calculated for each of the factor score estimates in order to investigate the reliability of the scores.

Integration

The items in three separate sections of the survey were considered related to integration of computers and technology in the schools. Each of the these three sections, types of software used by teachers to complete school related activities, types of software used by students to complete school related activities, and integration of computers in the classroom were analyzed separately.

Software Use. Two factors, accounting for 100% of the variance, were evidenced for the set of items regarding the teachers' use of various software applications to complete school related activities. The first factor, accounting for 77% of the variance, was defined by items that represented use of instructional software, such as the use of tutorials, simulations, drill and practice, integrated learning systems and games. The second factor, accounting for 69% of the total variance, appeared to measure application software use. Items that characterized this factor included the use of word processors, spreadsheets, databases, web browsers, and presentation and desktop publishing programs. Cronbach's alpha for these two factors was estimated to be .79 and.76, respectively, with an inter-factor correlation of .56.

Similarly, two factors, accounting for 100% of the variance, were evidenced for the set of items regarding the students' use of various software applications to complete school related activities. The first factor, accounting for 70% of the total variance, appeared to represent a broad range of application software use, including spreadsheets, databases and presentation software. The second factor, accounting for 46% of the total variance, appeared to capture instructional software use, for example, drill and practice, games, tutorials and simulations. Cronbach's alpha for these two factors was estimated to be .72 and .76, respectively, with an inter-factor correlation of .37.

Integration of Computers in the Classroom. One factor, accounting for 90% of the common variance, was present in the group of 12 items fashioned to measure the extent that computers were being integrated into the classroom. The items developed to elucidate the integration of computers into the classroom included use in both individual and group instruction, and the promotion of both independent and student centered

learning. Additionally, integration included the use of computers as a problem solving / decision making tool, as well as a research, presentation and productivity tool. Cronbach's alpha for this set of items was estimated to be .89.

Personal Use. One factor, accounting for 100% of the common variance, was present in the group of five items designed to elicit information about teachers' personal use of computers. This factor was defined by items that suggested the use of computers as a research tool, a productivity and communication tool, and for multimedia and fun / entertainment related activities. Cronbach's alpha for this set of items was estimated to be .73.

Support

Two sections of the survey were devoted to items created to measure the level of school support of computer use.

General School Support. One factor, accounting for 99% of the common variance, was present in the group of seven items designed to gather information about support provided by the faculty and the administration. This factor was defined by items concerned with encouragement on the part of both the administration and faculty, administrative support for computer related training and a sufficient level of access to computers at school. Cronbach's alpha for this set of items was estimated to be .82.

Technical Support. One factor, accounting for 100% of the common variance, was present in the group of nine items created to capture information related to the support provided by technical specialist in the schools. This factor was defined by items regarding assistance in problem solving and trouble shouting, and help with techniques to integrate computer technology into the classroom. Cronbach's alpha for this set of items was estimated to be .86.

Confidence and Comfort

One factor, accounting for 99% of the common variance, was evidenced in the group of nine items designed to measure teacher confidence and comfort using computers. This

factor was characterized by items regarding comfort and efficient use of computers during classroom instruction and the enhancement of teaching and student performance. In addition, this factor was defined by items suggesting the effective use of computers, the development of expertise and comfort with giving computer assignments to students. Cronbach's alpha for this set of items was estimated to be .91.

Attitude toward computer use

Two factors, accounting for 95% of the common variance, were present in this group of twenty items fashioned to measure general attitudes toward computer use. Due to complexity of a single item (*I like using the computer to solve complex problems*), it was necessary to exclude it from the analysis. The first factor, accounting for 60% of the total variance, contained 10 items and appeared to be indicative of technological aversion. This factor was defined by statements such as "I feel tense when people start talking about computers", "I avoid the computer whenever possible" and "I feel pressure from others to integrate the computer more into my classroom." The second factor, accounting for 60% of the total variance contained 9 items. This factor appeared to capture elements of technological affinity. The inter-factor correlation between these two factors was estimated to be -.51.

Because the results from the factor analysis supported, in large part, the anticipated structure of the instrument, 11 composite variables were created based on the proposed classification scheme. For the 11 subscales, the mean ranged from 4.07 for the subscale measuring teachers' technological affinity, to 1.51 for the subscale measuring teacher instructional software use. The mean and standard deviation for the subscales variables are presented in Table 9.

Subscales scores were first used to explore the relationship between teachers' perceptions of computers and technology and integration in the classroom. The correlation matrix for the subscales is presented in Table 10. Moderately positive relationships were observed for the integration of computers in the classroom and the use of software in the classroom for both teachers and students with correlations ranging from .63 to .31. Positive relationships were also witnessed for teachers' confidence and comfort and application software use (r = .54). Lastly, the subscale

scores were correlated with respondents' years of teaching experience. Surprisingly, there appeared to be no relationship between teaching experience and any of the technology subscales indicating an absence of a linear relationship between years of teaching experience and this set of measures.

Relationships with Other Variables

Further evidence for construct validation was sought by examining the relationships between subscale scores and other variables external to the scores (e.g., evidence of a gender gap as suggested by Ogletree & Williams, 1990, and anticipated differences between teachers in primary and secondary schools). Profile analyses were conducted for respondents classified by gender and school level and differences in responses on the subscales were investigated using ANOVAs. When gender differences were investigated, the results of the ANOVA suggested a statistically significant main effect for subscale ($F(10,13120) = 1137.43$, $p < .01$,), as well as a significant interaction effect ($F(10, 13120) = 8.97$, $p < .01$,). Because of the statistically significant interaction effect, differences between cell means were tested to guide the interpretation of the results. Holm's modified Bonferroni procedure was used to control the familywise Type I error rate at .05 for the set of pairwise tests. The results of these tests revealed that the mean responses for females and males differed significantly from each other on two of the 11 subscales. Female respondents evidenced significantly higher means on the integration and students' instructional software use subscales.

When differences across school level were examined (i.e., elementary, middle, and high), the results of the ANOVA suggested statistically significant main effects for both school level ($F(2, 1262) = 20.94$, $p < .01$,) and subscale ($F(10,12820) = 1899.70$, $p < .01$), as well as a significant interaction effect ($F(10, 12820) = 27$, $p < .01$). Once again, Holm's modified Bonferroni procedure was used to control the familywise Type I error rate at .05 for the set of pairwise followup tests. The results of these tests revealed that the mean responses across school level differed by a significant amount on six of the 11 subscales (*General School Support, Student Application Software Use, Student Instructional Software Use, Integration of Computers, Technical Support* and *Technological Aversion*). With the exception of the technical support subscale, elementary school teachers consistently

evidence higher mean responses across the various subscales. The subscale responses by school level are presented in Table 11.

Because teachers' gender was not independent of school level (i.e., elementary educators have a larger proportion of females in their ranks than do secondary educators), we tested for gender differences in responses after statistically controlling for school level. These analyses revealed that no statistically significant gender differences remained after controlling for school level ($F(10, 12730) = 1.97$, $p = .06$), but school level differences remained even after controlling for gender differences ($F(20, 12730) = 8.99$, $p < .001$).

CONCLUSIONS

The goal of this research was to develop and validate an instrument that would provide data to foster a better understanding of how educators and students use technology in the classroom. A comprehensive instrument was developed and multiple evidences were sought for the construct validity of scores derived from the survey. Exploratory factor analysis resulted in the expected pattern of item loadings, with reliability estimates ranging between .92 to .76.

In summary, the evidence gathered to date support the validity of scores derived from the survey. We hope that the instrument will prove useful in future efforts to measure teachers' attitudes toward computer use and provide insight into the extent to which teachers are integrating technology in the classroom. Finally, it is hoped that the results of this study will serve to provide educators, researchers and administrators with information to guide and monitor efforts toward improving the use of technology in our schools. The current survey can provide a potentially rich array of variables for analyses addressing substantive questions about the use of computers in schools. In addition to such substantive cross-sectional research, trends across time in computer use can be readily obtained in longitudinal studies, and the instrument may be useful to provide one measure of the effectiveness of teacher preparation for technology use in classrooms. Finally, parallel instruments that may be used to gather information from students, principals, and support personnel may provide a foundation for a comprehensive technology use assessment system.

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Table 1
Factor Pattern Matrix for Confidence and Comfort Items.

Item	Factor One
I am comfortable using computers during classroom instruction	0.84
My use of computer technology enhances student performance	0.82
The computer enhances my teaching	0.80
I use computers effectively in my classroom	0.79
I am developing expertise in the uses of technology in the classroom	0.76
I am comfortable giving computer assignments to my students	0.75
I am comfortable with computer terminology	0.67
I have had adequate training in using computers	0.56
Incorporating multi-media into lessons enhances teaching	0.54

Table 2
Factor Pattern Matrix for General School Support Items.

Item	Factor One
The administration actively encourages the use of computers in the classroom	0.80
The administration supports computer related training	0.77
Faculty members encourage the use of computers	0.69
The administration actively encourages the use of computers outside the classroom	0.66
I receive a sufficient level of computer related support at my school	0.63
I have sufficient access to computers at my school	0.54
I have adequate time to learn computer skills	0.34

Table 3

Rotated Factor Pattern and Structure Matrices for Types of Software Used by Teachers Items.

	Factor One *Instructional Software Use*		Factor Two *Application Software Use*	
	Pattern	Structure	Pattern	Structure
Tutorials	0.72	0.72	0.01	0.41
Simulations	0.70	0.73	0.05	0.44
Drill and practice	0.68	0.63	-0.09	0.29
Integrated learning Systems	0.53	0.52	-0.02	0.27
Games	0.53	0.51	-0.04	0.26
Programming / authoring tools	0.48	0.52	0.07	0.34
Web publishing programs	0.38	0.52	0.24	0.45
Word processors	-0.14	0.21	0.63	0.55
Spreadsheets	-0.03	0.32	0.62	0.61
Databases	-0.02	0.29	0.57	0.55
Web browsers	0.05	0.50	0.48	0.61
Presentation software	0.23	0.31	0.48	0.51
Desktop publishing programs	0.15	0.42	0.48	0.56
Graphics Programs	0.33	0.54	0.38	0.56
	Total Variance Accounted For			
	Total Variance	Unique Variance	Total Variance	Unique Variance
	.77	.39	.69	.30

Note: Inter-factor correlation= 0.56.

Table 4
Rotated Factor Pattern and Structure Matrices for Types of Software Used by Students Items.

	Factor One *Application Software Use*		Factor Two *Instructional Software Use*	
	Pattern	Structure	Pattern	Structure
Spreadsheets	0.77	0.73	-0.10	0.18
Web publishing programs	0.72	0.70	-0.06	0.21
Databases	0.69	0.66	-0.08	0.17
Programming / authoring tools	0.63	0.62	-0.03	0.21
Presentation software	0.62	0.65	0.07	0.30
Web browsers	0.55	0.58	0.08	0.29
Word processors	0.47	0.56	0.23	0.40
Desktop publishing programs	0.46	0.54	0.23	0.40
Integrated learning Systems	0.37	0.42	0.13	0.27
Drill and practice	-0.11	0.17	0.75	0.71
Games	-0.05	0.20	0.69	0.67
Tutorials	0.07	0.30	0.62	0.65
Simulations	0.28	0.43	0.42	0.52
Graphics programs	0.33	0.46	0.37	0.49
	Total Variance Accounted For			
	Total Variance	Unique Variance	Total Variance	Unique Variance
	.70	.53	.46	.29

Note: Inter-factor correlation = .37.

Table 5
Factor Pattern Matrix for Integration of Computers into the Classroom Items.

Item	Factor One
To promote student centered learning	0.80
Independent learning	0.79
Individual instruction	0.76
To tutor	0.71
Small group instruction	0.71
Cooperative groups	0.71
As a problem solving / decision making tool	0.67
As a research tool for students	0.60
As a classroom presentation tool	0.58
As a productivity tool	0.53
As a reward	0.49
As a communication tool	0.44

Table 6
Factor Pattern Matrix for Personal Use of Computer Items.

Item	Factor One
As a research tool	0.71
For multimedia activities	0.60
As a productivity tool	0.59
As a communication tool	0.52
For fun / entertainment related activities	0.51

Table 7
Factor Pattern Matrix for Technical Support Items.

Item	Factor One
The on-site specialist / coordinator adequately assists me in problem solving and trouble shooting	0.89
The on-site computer specialist / coordinator is dedicated to helping teachers.	0.86
I have adequate access to our on-site computer specialist / coordinator.	0.82
Our computer specialist / coordinator shows me techniques to integrate computer technology into the classroom.	0.61
I have to contact our specialist / coordinator several times before I get assistance.	-0.53

Table 8
Rotated Factor Pattern and Structure Matrices for Attitudes Toward Computer Use Items.

Item	Factor One *Technological Aversion*		Factor 2 *Technological Affinity*	
	Pattern	Structure	Pattern	Structure
I feel tense when people start talking about computers	0.78	0.71	0.14	-0.25
I avoid the computer whenever possible	0.73	0.76	-0.05	-0.42
I feel pressure from others to integrate the computer more into my classroom	0.65	0.53	0.22	-0.10
Computer instruction is just another fad	0.57	0.68	-0.20	-0.49
Computers are dehumanizing	0.57	0.65	-0.16	-0.45
The use of computers should be confined to computer courses	0.55	0.63	-0.18	-0.45
Learning computers make high demands on my professional time	0.48	0.36	0.22	-0.02
Computers diminish my role as a teacher	0.47	0.58	-0.20	-0.44
Computers further the gap between students along socio-economic lines	0.25	0.23	0.05	-0.08
I can help others solve computer problems	-0.50	-0.51	0.03	0.28
Computer skills are essential to my students	0.06	-0.31	0.74	0.71
I would like every student in my classes to have access to a computer	0.03	-0.33	0.71	0.69
Computers should be incorporated into the classroom curriculum	-0.05	-0.40	0.68	0.71
I would like my students to be able to use the computer more	0.03	-0.30	0.65	0.64
Computers enhance classroom instruction	-0.15	-0.46	0.61	0.68
Computer skills will help me as a professional	-0.14	-0.44	0.59	0.66
More training would increase my use of the computer in the classroom	0.21	-0.04	0.50	0.40
Computers make my job easier	-0.29	-0.48	0.37	0.52
Computers change my role as a teacher	0.15	-0.04	0.36	0.29
	Variance Accounted For			
	Total Variance .60	Unique Variance .35	Total Variance .60	Unique Variance .34

Note: Inter-factor correlation = -0.51.

Table 9

Descriptive Statistics for the Subscales.

Subscale	N	Mean	Standard Deviation
Confidence and Comfort (CC)	1783	3.27	0.84
General School Support (SS)	1785	3.42	0.71
Teacher Application Software Use (TA)	1721	2.61	0.80
Teacher Instructional Software Use (TI)	1685	1.51	0.69
Student Application Software Use (SA)	1774	1.89	0.75
Student Instructional Software Use (SI)	1538	2.39	1.09
Integration of Computers in the Classroom (IN)	1687	2.54	0.97
Teachers' Personal Computer Use (TPU)	1770	3.25	0.92
Technical Support (TS)	1663	3.57	0.96
Technological Affinity (TAF)	1785	4.07	0.58
Technological Aversion (reflected – TAV)	1785	3.96	0.58

Table 10

Correlations Between the Subscales.

	CC	SS	TA	TI	SA	SI	IN	TPU	TS	TAF	TAV
CC	1.00										
SS	0.33	1.00									
TA	0.54	0.18	1.00								
TI	0.29	0.17	0.48	1.00							
SA	0.38	0.17	0.60	0.52	1.00						
SI	0.32	0.24	0.31	0.40	0.49	1.00					
IN	.51	0.28	0.43	0.37	0.44	0.63	1.00				
TPU	.48	0.19	0.57	0.37	0.44	0.32	0.47	1.00			
TS	.22	0.48	0.12	0.12	0.08	0.14	0.17	0.19	1.00		
TAF	.40	0.07	0.30	0.10	0.17	0.11	0.26	0.30	0.06	1.00	
TAV	.52	0.16	0.43	0.16	0.23	0.17	0.30	0.42	0.18	0.47	1.00

Table 11

Subscale Response by School Level.

Subscale		Elementary	Middle	High
Confidence and Comfort (CC)	M	3.35	3.28	3.24
	SD	0.74	0.86	.093
* General School Support (SS)	M	3.52	3.38	3.28
	SD	0.66	0.76	0.71
Teacher Application Software Use (TA)	M	2.61	2.58	2.59
	SD	0.78	0.79	0.83
Teacher Instructional Software Use (TI)	M	1.54	1.49	1.52
	SD	0.74	0.68	0.61
* Student Application Software Use (SA)	M	1.80	1.75	1.91
	SD	0.64	0.63	0.76
* Student Instructional Software Use (SI)	M	2.77	1.97	1.98
	SD	1.00	1.01	0.98
* Integration of Computers in the Classroom (IN)	M	2.79	2.24	2.28
	SD	0.85	0.94	0.97
Teachers' Personal Computer Use (TPU)	M	3.30	3.23	3.17
	SD	0.87	0.92	1.01
* Technical Support (TS)	M	3.62	3.67	3.32
	SD	0.95	0.97	0.96
Technological Affinity (TAF)	M	4.09	4.16	4.06
	SD	0.53	0.63	0.57
* Technological Aversion (TAV)	M	4.01	3.98	3.88
	SD	0.53	0.62	0.61

* Statistically significant ($p < .05$ familywise) factor score difference across school level.