The Impact of Keyboarding Skill on Computer Anxiety in End Users

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Despite the breadth of research surrounding computer anxiety, very little research exists concerning the possible relationship between computer anxiety and keyboarding skill. A 1992-1998 literature review resulted in finding nine articles that utilized keyboarding skill or typing speed as a potential variable. Most of the existing studies relied on self-reported data. Most studies involving keyboarding skill and computer anxiety have concentrated on the individual's ability to improve productivity rather than on whether the skill reduces anxiety. The purpose of this study was to examine the effects of keyboarding skill upon self-reported computer anxiety using a timed-writing method. Subjects consisted of 91 students enrolled in a microbased computer literacy course during the spring semester 1998 at Indiana University of Pennsylvania. An examination of resulting data suggests that keyboarding skill is not a predictor of computer anxiety.

The expansive use of computer technology in today's society leads one to the assumption that computer anxiety has been eradicated as an end-user concern. After all, people from all walks of life find themselves connected to the Internet, using ATMs, and paying bills from home. The number of households with a personal computer has increased and so has the number of classrooms using the computer as a teaching tool. This proliferation in computer use is an encouraging sign of the acceptance of this technological tool. Does this widespread usage, however, infer that computer anxiety is no longer a concern for the end-user?

In this age of the computer, some would argue that computer anxiety no longer exists, if it ever did (Yeaman, 1992). Yet, studies continue to focus on individual reactions to this technology. Researchers are still attempting to find correlates for computer anxiety. Between 1992 and March 1998, according to a review of the Educational Resources Information Center (ERIC) database, over 150 articles that focused on computer anxiety have been published in various journals and magazines. Some of the factors investigated in relation to computer anxiety were gender, critical thinking ability, keyboarding skill, mood, learning style, computer experience, self-efficacy, cognitive abilities, personality types, age, and intrinsic motivation to learn. Given the fact that over 20 articles per year have been regularly appearing in print since 1992, one would surmise that computer anxiety must be alive and flourishing in spite of arguments to the contrary.

Background for the Study

Despite the breadth of research surrounding computer anxiety, very little research exists concerning the possible relationship between computer anxiety and keyboarding skill. According to a literature review, nine articles utilized keyboarding skill or typing speed as a potential variable in previous research published between 1992 and March 1998. Most of the existing studies relied on self-reported data. While self-report data are limited in validity and reliability by subjects' willingness to participate, memory constraints, social desirability response, and truth, this method is still considered the most efficient way to collect survey data.

In an early study, Fauri (1985) examined factors associated with resistance to computer technology in the workplace. Interviewing managers and non-managerial professionals in an attempt to identify characteristics contributing to

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resistance of computers, Fauri uncovered a statistically significant relationship between computer anxiety and keyboarding experience. The results indicated that keyboarding experience was one of the best predictors of computer anxiety.

In 1986, Morrow, Prell, and McElroy attempted to determine attitudinal and behavioral correlates of computer anxiety by examining 10 potential sources of such anxiety. Typing speed was used as one of the measures for the behavioral index. "This behavioral index [of typing speed] was included based on the assumption that a reluctance to use computers may be derived from a misconception that typing skills are a necessary prerequisite" (p. 1201). Subjects were asked to self report typing speed by selecting one of the five categories most representative of the number of words per minute each could type. An examination of the resulting data indicated that typing speed was not related to computer anxiety.

In previous research, Artwohl (1989) found that keyboarding was a basic skill that enhanced individual interaction with the computer. The ability to keyboard enabled concentration to be focused on the task at hand, thereby expanding awareness and understanding about computers and decreasing anxiety.

Charness, Schumann, and Boritz (1992) examined the effects of age, training technique, and computer anxiety when training older adults in word processing. While keyboarding skill (or typing ability) was not a variable in the study, anxiety was found to be related to the subjects' ability to complete required work, and those who could not keyboard, regardless of age, found themselves at a disadvantage. The data indicated that older adults who were trained typists were about 1.5 times slower than young adults, while older adults who were non-typists were 2.5 times slower than young adults in self-paced sessions.

Gordon (1995) examined responses from 116 secondary technical education teachers in West Virginia. After administering Oetting's Computer Anxiety Scale (COMPAS), the researcher collected demographic information pertaining to age, gender, educational level, and typing ability. When Gordon calculated correlation coefficients between computer anxiety and each variable, self-reported typing skills were found to explain two percent of the variance in COMPAS scores. In effect, those teachers indicating poor typing skills were the ones most likely to have higher computer anxiety scores.

Most studies involving keyboarding skill and computer anxiety, however, have concentrated on the individual's ability to improve productivity rather than on whether the skill reduces anxiety. Nonetheless, one study (Hemby, 1997) focused primarily on the potential relationship between computer anxiety and keyboarding skill. Using Oetting's Computer Anxiety Scale (COMPAS) and a researcher-designed questionnaire, subjects were asked to respond "yes" and "no" to the question, "Have you previously had a keyboarding (typing) class where you learned the letter keyboard and other needed controls by use of a touch system?" Subjects were then asked to estimate their words per minute keyboarding speed. Using the self-report method, 84% of the sample ($n = 429$) indicated they had previously participated in a course where they learned keyboarding by touch. In estimating their words per minute keyboarding speed, the majority (62.6%) stated their speed fell in the range of 26 to 54 words per minute. After examining the data using canonical correlation, Hemby reported that the findings suggested a relationship between keyboarding skill and computer anxiety. However, the findings indicated that persons with no previous keyboarding instruction were less confused and anxious than persons who had previously taken a keyboarding class.

Computer Anxiety and Keyboarding Skill

In an article discussing the seven myths of computerism, Yeaman (1992) stated that one myth of computer anxiety was "computer stress is caused by the keyboarding skills prerequisite to computer use" (p. 24). Yeaman buttressed his argument for this statement as a myth by explaining as follows:

> Demanding that everyone learn keyboarding skills as a way of reducing computer anxiety is wrong in two ways.

> The first error is in ignoring that keyboarding is hard to learn and it is not reasonable to expect everyone to reach a high degree of proficiency. Some people are good at typing and some people are not good at typing.
>
> The second error is in ignoring that other input technology is present today . . . . Data input is also possible from OCR . . . scanners and hand lettering on graphics tablets. Equipment like this is common outside the research labs of computer scientists and usually found in library media centers and classrooms (p. 24).

According to Yeaman, there is no reason to assume that future computers will resemble the computers of today so what would be the necessity of learning to keyboard when keyboarding is an archaic skill.

However, Yeaman's myth statement indicates that the absence of keyboarding skill is a contributing factor to computer anxiety. The argument used to diffuse the myth statement revolves around the use of input devices other than the keyboard. Therefore, the position that keyboarding skill is necessary to alleviate computer stress would be a sound one. Since the literature is both scarce and divided in that regard, additional study should be undertaken to add to the body of existing knowledge concerning keyboarding skill and computer anxiety.

Computer Anxiety, Keyboarding Skill and Nontraditional Students

The literature consistently identifies a few variables that are correlated with computer anxiety—age, gender, and prior computer experience (Anderson, 1996; Charness et al., 1992; Morris, 1996-97; Morrow et al., 1986). As expected, older adults tended to experience higher levels of computer anxiety than did their younger counterparts. Women also seemed to be more susceptible to higher levels of computer anxiety than males, possibly because females tend to view the computer as a "male dominated" field of study.

Prior computer experience, however, has been found to be both an advantage and a disadvantage to persons with high levels of computer anxiety. Some individuals gain monumental confidence levels from interacting with a computer while others show a marked increase in anxiety after participating in computer classes. What prompts the one to gain confidence while the other does not? Perhaps the answer lies with other contributory factors that are not being appropriately addressed in the literature.

A natural peripheral issue in prior computer experience research is the factor of keyboarding skill. Since prior computer experience alone is insufficient to consistently explain computer anxiety, perhaps the interrelationship between keyboarding skill and confidence level are acting as underlying contributors in the exacerbation of this problem.

Focusing research on the relationship between keyboarding skill and computer anxiety is important in the identification of factors that increase the likelihood that individuals will experience computer anxiety. Furthermore, examining this relationship, if such exists, from the standpoint of nontraditional students could enhance existing empirical research which indicates that the older the individual, the higher the level of anxiety—in effect answering the question, does keyboarding skill have an effect on levels of anxiety in nontraditional students?

Focus of Study

This study was conducted to gain a better understanding of the relationship between keyboarding skill and computer anxiety. Since the extant literature is scant, and the studies which are available are divided on the effect of keyboarding skill on computer anxiety, this study attempted to add clarity to a vague relationship. Specifically, the research question was two-fold: (1) to determine to what extent computer anxiety can be predicted or explained by the independent variable of keyboarding skill and (2) to determine what impact the variable of enrollment status

(traditional or nontraditional) might have on that relationship, if any existed.

Instrumentation

The long form of Oetting's Computer Anxiety Scale (COMPAS) (1983) was used to obtain self-reported computer anxiety scores from the participants. The COMPAS was developed around the construct of "concept-specific" anxiety. The COMPAS consists of a set of items that describe occasions wherein persons would interact with a computer. These situations range from just being in the same room with a computer to taking classes in computer programming. Each short description is followed by a pair of adjectives. One adjective indicates relative comfort in that particular situation; the other indicates relative anxiety.

The COMPAS consists of 48 Likert-type items to which the respondents mark the selection that corresponds with the degree of anxiety that each situation elicits. Many of the adjective pairs utilized in this scale have been reproduced from a long series of studies focusing on other anxieties. As such, these adjective pairs have proven to be "accurate and sensitive to differences in anxiety between groups that should differ in anxiety, and they show differences in anxiety that occur as a result of treatment for anxiety" (Oetting, 1983, p. 16).

Computer anxiety scores for the COMPAS are based on scales and percentages. When measuring general computer anxiety, the COMPAS uses the following scale to compute overall computer anxiety: 40-119, generally relaxed, comfortable; 120-139, some mild anxiety present; 140-159, anxious and tense; and 160+, very anxious.

Population

Students enrolled in seven sections of microbased computer literacy classes at a state-supported university in western Pennsylvania during the spring 1998 semester served as subjects for the study. These classes covered basic computer concepts and applications in word processing, spreadsheet, database, and presentation graphics. This course is a freshman level course that satisfies a liberal studies requirement for graduation for all students.

Data Collection Procedures

In each class, a survey packet consisting of a participant notification letter, demographic questionnaire, a machine scorable answer sheet, and the COMPAS was administered. The demographic questionnaire was used to gather data to answer questions concerning enrollment status and prior keyboarding instruction. Definitions for nontraditional student and prior keyboarding instruction were included on the questionnaire so that participants were able to select the appropriate responses based on these definitions.

Nontraditional students were defined as those students who were 25 years old or older or who had assumed at least one of the social roles characteristic of adult status, including (a) being primarily financially self-supporting; (b) acting as a primary caregiver for a relative(s); or (c) being married and living with spouse, or being divorced or widowed and not living with parents or receiving primary financial support from others. Prior keyboarding instruction was defined to indicate having taken a course either in junior high, high school, college, etc., where you received training in "any input activity involving the manipulation of the letter and figure keys, space bar, return key, tab, and shift keys [**on a computer or typewriter keyboard**] by the use of a touch system" [emphasis added] (Erickson, 1993, p. 1).

An observer approach was used to obtain words per minute scores for the participants in this study. Prior studies focusing on the relationship between keyboarding skill and computer anxiety had primarily relied on the self-report method. In comparison to other types of research, the self-report method is much more efficient in that it requires less time, is less expensive, and permits collection of data from larger samples (Gay, 1992). In terms of validity and reliability, however, self-report data are limited by subjects' willingness to participate, memory constraints, veracity, and social

desirability response. Therefore, timed writings to establish keyboarding skill were administered. The timed writings were chosen at random from the text, *Keyboarding and Document Processing* (Ober, Poland, Hanson, Rossetti, & Johnson, 1994), and participants were asked to take a one minute, a three minute, and a five minute timed writing. Participants utilized a computer controlled timed keyboarding program where they were asked to enter the number of seconds for each timed writing. The computer then controlled their ability to input by locking the keyboard at the end of the requisite time period. This method produced a more reliable measure of keyboarding speed since participants could not begin typing before or continue typing past the allotted time.

Data Analysis

Using computer answer sheets for the COMPAS allowed data for scores to be calculated through scanning. In addition, the keyboarding program calculated the gross words per minute for each of the three timed writings per subject. Data were analyzed using the Statistical Package for the Social Sciences for Windows (Norusis, 1992) and consisted of descriptive and correlational statistics. Frequencies were computed for student classification, enrollment status, prior keyboarding instruction, and the 48 individual questions on Oetting's Computer Anxiety Scale (COMPAS). A t-test was used to compare traditional and nontraditional students and computer anxiety scores and to compare students with and without prior keyboarding experience and computer anxiety scores. A Pearson Product Moment Correlations Coefficient (r_2) was computed between computer anxiety score and typing speed. The decision rule or level of significance was the accepted convention of $p < .05$ (Borg & Gall, 1989; Kerlinger, 1986).

Descriptions of Respondents

Survey instruments were completed by 106 respondents, producing 91 usable responses. A majority of respondents ($\underline{n} = 80$) were classified as traditional students; 10 met the definition for nontraditional student. One participant did not respond to the question. The largest number of students were enrolled as freshmen ($\underline{n} = 45$); juniors accounted for 24 subjects. Sophomores ($\underline{n} = 17$) and seniors ($\underline{n} = 2$) brought the total usable responses to 88. Three participants did not respond to the enrollment status question. Over half ($\underline{n} = 73$) of respondents had prior keyboarding instruction; only 16 respondents had no prior keyboarding course. Again, two participants failed to respond to the prior keyboarding query.

After administration of the three timed writings, the computer-calculated gross words per minute scores were examined. Of the 91 subjects, only 85 completed all three timed writings. As seen in Table 1, the mean typing speeds for the timed writings were very closely aligned.

Table 1: Calculated Means per Timed Writing

Time	Number of Usable Responses	Mean	Standard Deviation
1 minute	85	40.89	13.06
3 minutes	85	40.47	13.51
5 minutes	85	41.19	13.57

In the study, the 91 subjects achieved gross computer anxiety scores between 66 and 131. The scores were tightly clustered in the range between 100 and 131. Out of the 91 usable responses, only 6 achieved gross computer anxiety scores below 100. The mean score fell at 114.40 with a standard deviation of 10.70. Since 66 was the lowest score, it was removed and the mean recalculated in an attempt to reduce the standard deviation. Removing the lowest score modestly improved the standard deviation to 9.45 and recalculated the mean to 114.93. Table 2 indicates minimum and maximum gross computer anxiety scores for the subjects, means, and standard deviations.

Table 2: Gross Computer Anxiety Score, Mean, and Standard Deviation

GCA	N	Minimum Score	Maximum Score	Mean	Standard Deviation
	91	66	131	114.40	10.70
	90	84	131	114.93	9.45

The first statistical analysis determined if there was a relationship between self-reported computer anxiety scores and keyboarding skill. Since the number of usable timed writing scores was 85, only the gross computer anxiety scores for those subjects were utilized in the Pearson Product Moment Correlation.

The mean score for the COMPAS was 114.12 ($\underline{n}$ = 85) and the mean for typing speed was 40.85 ($\underline{n}$ = 85). The Pearson correlation between computer anxiety score and typing speed resulted in .061 with a significance of .577. Using the standard alpha level of $p < .05$, there was no statistically significant relationship between computer anxiety score and keyboarding skill. Table 3 presents the correlation between typing speed and gross computer anxiety score for the 85 subjects.

Table 3: Correlation of Typing Speed and Gross Computer Anxiety Score

	N	Mean	Standard Deviation	Pearson	Significance
Computer Anxiety	85	114.12	11.00	.061	.577
Typing Speed	85	40.85	13.17		

Using a t-test, COMPAS scores were examined for subjects who had prior keyboarding instruction and for those who had no prior keyboarding experience. The mean computer anxiety score for subjects with prior keyboarding instruction was 114.08 ($\underline{n}$ = 73) and the mean computer anxiety score for subjects with no prior keyboarding instruction was 115.13 ($\underline{n}$ = 16). Given the fact that the number of subjects with prior keyboarding instruction totaled 73 and the number with no prior keyboarding experience totaled 16, the resulting means are closely aligned for a group this size. In effect, no significant differences exist between those subjects with prior keyboarding experience and those without in relationship to computer anxiety.

With regard to the potential effect student enrollment status might have on computer anxiety, an examination of traditional and nontraditional subjects was conducted through the use of a t-test. Again, the effect of enrollment status, much like keyboarding skill, indicates no significance in gross computer anxiety scores. Just as reported earlier in the examination of computer anxiety score and prior keyboarding instruction, the sample size is skewed—this time in the number of traditional subjects ($\underline{n}$ = 80) versus the number of nontraditional ones ($\underline{n}$ = 10). Table 4 presents group statistics for gross computer anxiety scores for traditional and nontraditional subjects.

Table 4: Gross Computer Anxiety Scores and Enrollment Status

Status	N	Mean	Standard Deviation	Standard Error Mean
GCA Traditional	80	114.36	10.52	1.18
GCA Nontraditional	10	114.30	13.12	4.15

Discussion

In prior research, the impact of keyboarding skill on computer anxiety had produced divided results. Some studies indicated that keyboarding skill was an important factor in determining whether or not a subject would suffer from computer anxiety. Other studies found opposing results—keyboarding skill or typing skill had no impact on a subject's computer anxiety level. Because of this schism in the literature, this study sought to re-examine the relationship between self-reported computer anxiety and keyboarding skill, if such exists. Rather than relying on self-report data concerning keyboarding skill, three separate computer-generated timed writings were utilized. Furthermore, an examination of the effect of enrollment status on computer anxiety was also explored, particularly focusing on traditional versus nontraditional subjects.

After an examination of the gross computer anxiety scores (COMPAS) and keyboarding scores, computer anxiety was found to have no statistically significant relationship with keyboarding skill or with enrollment status (traditional versus nontraditional subjects). One

serendipitous finding, however, centered on the range of computer anxiety scores subjects achieved on the COMPAS. When Oetting normed his instrument in 1983, he used a sample of 435 entering college freshmen. The mean score for this norming sample was 93.47 (Oetting, 1983). The mean score for the sample in the current study was $\pm$114. Since the highest percentage of subjects in this study scored between 100-131 on the COMPAS, one would feel compelled to pose the question, "Since computers are obviously more prevalent and easier to operate today than in 1983, why would the scores for a mixture of college freshmen, sophomores, juniors, and seniors produce a higher mean score than the norming sample from 15 years earlier?"

One possible explanation for this unusual finding is the sample size. Oetting used 435 subjects to produce his norming data. In this study, 91 usable responses were obtained, roughly 20% of the original norming population. Also, Oetting only used entering freshmen for his population. Subjects in this study were a mixture of college freshmen, sophomores, juniors, and seniors. Approximately half the sample (49%) were freshmen.

Another key factor in this finding might involve technology overload. Scores up to 119 indicate that the subject is generally relaxed and comfortable with the computer. However, scores between 120 and 139 indicate some mild anxiety present. The majority of scores among the subjects in this study fell in the 100-131 range, raising the suspicion that an intervening variable might be at the core of the issue. That variable could be technology overload.

Today's fast-paced society has come face to face with rapid technological advances. One no more than achieves proficiency with a particular software package or hardware component, than that software or hardware is upgraded—often with very little resemblance to the prior model. Trying to keep up with these advances can produce anxiety, not about the computer itself but about change.

An examination of the mean scores for each of the 48 questions on the COMPAS produced some interesting findings. Several questions ($\underline{n}$ = 19) elicited mean scores at +3.00 with 5.00 being the highest possible score and 1.00 being the lowest. On all 19 questions, the higher the score, the more anxious, insecure, frightened, strained, worried, or confused the subject. These 19 questions are presented in Table 5 below, including the mean score and standard deviation for each.

One possible explanation for the higher mean scores for each of these 19 questions lies in the scoring method. Out of the 19 questions, 13 of them are reverse scored. If subjects are careless in their reading or reading comprehension, they may mistakenly believe that all questions follow the same pattern. Out of the 48 questions on the COMPAS, 20 of them are reverse scored and 13 of those appear in Table 5. Nonetheless, subjects are unaware of the scoring method for the COMPAS. They merely see the question and the concomitant adjective pairs. However, if they assume that a particular "test-taking" pattern exists based on the first few statements, then they may fail to fully read and comprehend the remaining statements.

Limitations

This study was conducted utilizing a convenience sample of students enrolled in a microbased computer literacy course during the spring semester of 1998 at a state-supported university in western Pennsylvania. These subjects may or may not be representative of the entire population of college or university students, so care should be taken when making generalizations of the findings to other groups or locations.

Implications for the Office Systems Educator

Believing that computer anxiety has been eradicated is an egregious mistake. The sheer number of research projects published since 1992 that have indicated that computer anxiety is flourishing in society should be enough warning to educators not to become complacent. However, many choose to ignore what these studies indicate—that students are still anxious and that those anxiety levels are higher now than they were

Table 5: Questions from COMPAS Resulting in ±3.00 Mean Scores

Question	N	Mean	Standard Deviation
4. Trying to use a small computer to balance a checkbook would usually be frustrating----------comfortable 5 4 3 2 1	91	3.44	1.26
9. Making a mistake when entering data for analysis because of nervousness likely----------unlikely 5 4 3 2 1	91	3.02	1.26
11. Deciding which type of personal computer to buy secure----------insecure 1 2 3 4 5	91	3.07	1.39
12. Explaining a problem that you have not been able to solve to a computer consultant frightened----------fearless 5 4 3 2 1	91	3.33	1.12
16. Taking a job where you have to regularly enter data into a computer concerned----------unconcerned 5 4 3 2 1	91	3.68	1.40
20. Reading a book about how computers can be used enjoy it----------avoid it 1 2 3 4 5	91	3.29	1.18
21. Looking at the keyboard of a small computer anxious----------comfortable 5 4 3 2 1	91	3.71	1.39
22. Trying to use a small computer to solve math problems frustrating----------useful 5 4 3 2 1	91	3.56	1.24
23. When a message appears on the screen that you have not seen before confident----------worried 1 2 3 4 5	91	3.19	1.16
24. Trying to operate a small computer when you are all alone worried----------unworried 5 4 3 2 1	91	3.48	1.38
26. Getting a bank statement printed by a computer distrust----------trust 1 2 3 4 5	91	4.22	1.12
28. Learning how to enter long lists of data into a computer scared----------comfortable 5 4 3 2 1	91	3.59	1.35
36. Consulting a computer manual to find out what you did wrong anxious----------relaxed 5 4 3 2 1	91	3.31	1.36
40. Correcting a mistake you made when typing information into a computer concerned----------unconcerned 5 4 3 2 1	91	4.10	1.19
44. Reading a technical book about programming small computers enjoy it----------avoid it 1 2 3 4 5	91	3.70	1.29
45. Playing a game on a computer where you have to type in answers to questions strained----------relaxed 5 4 3 2 1	91	3.95	1.35
46. Solving simple problems on a small computer with someone nearby to answer questions anxious----------confident 5 4 3 2 1	91	4.24	1.05
47. When the keyboard stops working confident----------anxious 1 2 3 4 5	91	3.32	1.38
48. Knowing what to do with a small computer confused----------clear 5 4 3 2 1	91	3.25	1.35

15 years ago. Educators, trainers, and practitioners need to understand that computer anxiety is still a problem in society. Also, they need to come to terms with the fact that the rapidity of change within the technology field is likely to cause a continued rise in computer anxiety levels.

Instead of assuming that computer anxiety will disappear as the younger generation migrates from secondary schools into the university setting and finally into the workplace, educators must acknowledge the existence of computer anxiety and take steps to aid students and trainees in overcoming this stumbling block to the acquisition of skills and knowledge.

While keyboarding skill may not be related to computer anxiety, its presence or absence does not seem to change the fact that students are anxious. In fact, the use of new technologies for input—voice recognition software, scanners, etc.—may lead keyboarding skill to diminish in importance. The question to ask, though, is whether these new technologies will increase or decrease computer anxiety levels. As office systems and business technology educators, each person should seek to identify and to assist those students who feel threatened by the overwhelming deluge of technology.

Recommendations for Future Research

More study is needed in the area of computer anxiety. Obtaining a mean score higher than the original norming sample from 15 years ago should cause a warning light to blink. This study should be replicated using other variables such as gender and prior computer experience as a potential means for identifying computer anxious individuals.

Instructors need to assess incoming students' computer anxiety levels. A pretest may allow instructors to identify those students with anxiety and to design instructional approaches which will assist them in lowering or eradicating that anxiety.

More study is needed in the area of technology overload. Perhaps this variable is affecting the levels of computer anxiety that are being measured by existing scales**.** Maybe a new scale needs to be developed, one that measures individuals' reactions to changes in technology rather than anxiety about the use of the computer.

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