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Incidences and correlates of Internet anxiety among high school teachers in Taiwan

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Abstract

Once high schools are connected to the Internet, teachers are the key to the successful use of the Internet for both teaching and learning. Teacher anxiety, however, can often reduce the success of such technological and pedagogical innovations. The purpose of this study was to explore the Internet anxiety experience by Taiwan high school and vocational high school teachers. This study reviewed related literature in computer anxiety and discussed the further development of the Internet Anxiety Scale (IAS), which was used to survey 136 teachers in Taiwan. The statistical data produced by this study identified four aspects of Internet anxiety: Internet use, hardware construction, management of students' Internet-use, and learning computer-related skills and knowledge. Among these, survey respondents ranked anxiety over managing students' Internet-use as the highest problem. Further, results indicated that female teachers had significantly higher Internet anxiety than did male teachers, and teachers' majors or subject areas appeared to contribute significantly to the level of Internet anxiety as well. Results also showed that both computer-use hours per week and Internet-use hours per week were significantly negative factors when correlated with anxiety over Internet uses, hardware construction, and management of students' Internet-use.

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1. Introduction

In the past several years, Internet technology has rapidly and dramatically changed the way people live and learn. The Internet is being used for education systems and classroom teaching by many countries around the world. For example, the Taiwan government (e.g. the Ministry of Education and the National Science

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Council) has eagerly promoted network-based learning across 3rd–12th grades (about 9–18-year-olds),¹ as well as at the college level since 1993.

Policies governing the use of the Internet in Taiwan's high schools may be categorized in two major historical stages (Liu, 2000). The first stage (1997–1999) was marked by the installation of the Internet connections to all computers in computer classrooms in every high school. On average, every computer classroom had about 40 computers, and every class from 10th grade (students 14 years of age) to 12th grade (students 16 years of age) was required to spend 2 h per week in the computer classroom. The objective of these 2 h was computer literacy; that is, learning how to use a computer and the Internet. The topics covered included introduction to computer hardware and software, the use of word processing software, the use of e-mail, surfing the World Wide Web and so on.

The second stage (2000–2007) is characterized by the installation of a minimum of one computer with an Internet connection in every regular high school classroom. The twin goals of this stage are to allow teachers to use computers/Internet and projecting equipment (such as LCD projectors or large-size TV monitors in their core curricula (e.g. computer-assisted instruction), and to let students use computers/Internet in their learning and daily life. Educators and curriculum designers believe that familiarity with the Internet in teaching, learning and daily life will help to create computer- and Internet-literate citizens in this Information Age more successfully than merely presenting computers as a subject matter to study, and for rote examination.

Importantly, this second stage imposes a heavy burden on teachers: they are required not only to be Internet literate themselves, but also to know how to incorporate Internet technology and resources into teaching their respective subjects. In addition, teachers have to manage the use of the Internet in a regular classroom setting and solve any problems related to their use. During the first stage, computer teachers assumed all responsibility in the management of computer classrooms. In the second stage, however, teachers in a *variety* of subject areas are on their own while teaching with the Internet in otherwise traditional classroom settings. Few teachers surveyed have had any computer training during their teacher training, and few have the opportunity for computer-related training now while they are in-service.

Indeed, past research (e.g. Gressard & Loyd, 1985; Lawton & Gerschner, 1982) has shown that teachers are key in the successful implementation of computers in schools. However, if teachers experience anxiety over teaching-related computer-use, this anxiety may impact the success of integrating computers into the school and classroom. As Yaghi and Abu-Saba (1998) stated, “studying teachers’ computer anxiety in various international settings is important because it sheds light on the educational and cultural implications of computers” (p. 322).

A careful examination of past research on computer anxiety, however, revealed that most studies were concluded by 1993, that is, before the Internet had widely connected standalone computers. Some studies, such as Beckers and Schmidt (2001), Bozionelos (2001), McIlroy, Bunting, Tuerney, and Gordon (2001), Scull (1999) and

¹ Since problems with myopia are common among Taiwanese students, primary computer education does not start until the 3rd grade (about 9 years old).

Yaghi and Abu-Saba (1998), were conducted in recent years, but they did not tackle the concept of the Internet or Internet anxiety. If we agree that the Internet has profoundly changed the utility and applications of computers, we can assume that the concept of “computer anxiety” has also changed accordingly. New Internet technology has a variety of properties that a standalone computer did not have. For example, the hyperlinks provided by the WWW allow users to browse and search for information in a non-linear way. Interactivity, another of the Internet’s properties most recognized by users, has two aspects: human–computer and interpersonal. Most Internet applications, such as the WWW, are very easy to use, and thus enhance human–computer interactions. Further, some applications, such as chat rooms and e-mail, are especially good at facilitating interpersonal interactions. These new properties, while highly applauded by most users, may cause anxiety in others. Therefore, the concept of computer anxiety should be reconsidered, and a measuring scale should be re-designed accordingly.

As Presno (1998) argues, although many computer anxiety sub-concepts may be applicable to Internet anxiety, there is still a point where the two types of anxiety diverge. She identifies four areas of Internet anxiety from her qualitative study:

1. *Internet terminology anxiety*: anxiety produced by an introduction to a host of new vocabulary words and acronyms.
2. *Net search anxiety*: anxiety produced by searching for information in a maze-like cyberspace.
3. *Internet time delay anxiety*: anxiety produced by busy signals, time delays, and more and more people clogging the Internet.
4. *General fear of Internet failure*: a generalized anxiety produced by fear that one will be unable to negotiate the Internet, or complete required work on the Internet.

This study attempted to take Internet anxiety into consideration in developing new Internet-related questions (statements) to add to the widely used Computer Anxiety Rating Scale (CARS, Heissen, Glass, & Knight, 1987; Lankford, Bell, & Elias, 1994). For example, questions such as “Search for particular information from numerous Internet resources” echoes Presno’s net-search anxiety. In addition, “Learning computer/Internet terminology” attempts to take Presno’s Internet-terminology anxiety into consideration.

Because the subjects of this study were teachers in high schools and vocational high schools in Taiwan, questions about teachers’ management and supervision of students’ Internet-use were also developed. As mentioned earlier, teachers in these schools face greater challenges than ever before. They not only need to acquire Internet capabilities themselves, they need to actually engage in Internet use, in front of students. Intensive interviews with our target subjects prior to this study indicated that they had strong sources of anxiety other than typical CARS-identified anxieties: classroom management and concerns with students’ abuse, or inappropriate use of the Internet were included in these. Therefore, this study offered several new questions in these areas of anxiety.

2. Previous studies on computer anxiety

Although this study attempted to reconsider the traditional concept of computer anxiety, past research on this topic has already accumulated a whole body of knowledge on it and can serve as the basis of this study. Past studies have defined computer anxiety as the fear, apprehension, and hopelessness people feel when considering using, or actually using, computer technology (Cambre & Cook, 1985), and as a fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer (Howard, Murphy, & Thomas, 1986). Jay (1981) considers that computer anxiety is related to computerphobia, which in turn is one branch of a larger technophobia present in society, engendered by our recent period of rapid technological growth and development. Computerphobia appears generally in the form of a negative attitude toward technology, and manifests itself in three specific forms:

- resistance to talking, or even thinking about, computer technology,
- fear or anxiety, which may create physiological consequences, and
- hostile or aggressive thoughts and acts, indicative of some underlying frustration

Bank and Havice (1989) listed some of the manifestations of anxiety over computers that users may have: looking stupid, encountering indecipherable error messages, losing control, sense of futility, and so on. Marcoulides (1988) suggests that computer anxiety is an important predictor of computer achievement; thus, if the goal is for teachers to achieve the computer skills necessary for both personal and professional use (e.g. computer-assisted instruction), their computer anxiety must be taken into account.

Previous researchers have examined the relationship between demographic variables and computer-anxiety levels. Age is a frequently studied variable. Many studies employ college students as subjects, and report an age effect (e.g. Maurer, 1994). Studies with a wider range of ages find younger subjects have significantly less computer anxiety than do older subjects (Rosen & Weil, 1995a).

Gender difference is another demographic variable frequently studied in relation to computer anxiety, although research results are inconsistent. For example, a study by Farina (1991) showed that women suffer greater anxiety over computers than do men. Liu, Reed, and Phillips (1992) found female pre-service teachers to be more anxious than males. However, many other studies have not found a difference (e.g. Jones & Wall, 1989). Scott and Rockwell (1997) argued that the gender difference appears to be largely a function of different levels of experience with computer technology. In Chua, Chen, and Wong's meta-analysis study (1999), it was found that female university undergraduates were generally more anxious than were male undergraduates across more than 19 studies conducted in 1990–1996.

A number of researchers have commented upon the mediating effect of prior computer experience upon computer anxiety. For example, Reed and Palumbo (1987–1988) suggested that many people who lacked computer experience showed

high levels of computer anxiety. In most studies (e.g. Liu et al., 1992; Violato, Marini, & Hunter, 1989), the general conclusion was that those pre-service teachers with more computer experience had less computer anxiety. Maurer (1994) even found computer experience to have a stronger and more consistent inverse relationship to computer anxiety than any other variable. Chua et al. (1999) also found that computer anxiety was inversely related to computer experience; however, the strength of this relationship remained inconclusive in their meta-analysis study.

Although the scope of this exploratory study focused on Internet anxiety rather than computer anxiety, the earlier-reviewed studies on computer anxiety suggest that demographic differences (e.g. age, gender), background differences (e.g. education level), and prior computer experience are important variables worth researchers' attention. Therefore, this study took these variables as correlates when examining the Taiwan high school teachers' Internet anxiety.

3. Research questions

The present study was motivated by the call of Rosen and Weil (1995b) and Yaghi and Abu-Saba (1998) for further understanding of computer-related anxiety in different cultural contexts, and by the attempt to expand the concept of computer anxiety. In addition, although researchers over the past decades have developed various scales measuring computer anxiety, few of them have constructed scales specifically for teachers' anxiety towards the Internet. Therefore, this study initiated a measurement tool for Internet anxiety and had it validated. The research questions of this study are:

1. Do any differences exist among different aspects of teachers' Internet anxiety?
2. What are the relationships between high school teachers' demographic variables (gender and age) and Internet anxiety?
3. What are the relationships between high school teachers' background variables (school type, degree, major, and teaching computer-related courses) and Internet anxiety?
4. What are the relationships between high school teachers' prior computer experience (time elapsed from first exposure to computers, computer-use hours per week, and Internet-use hours per week) and Internet anxiety?

4. Method

4.1. Subjects

The subjects for this study were 136 high school and vocational high school teachers out of 180 samples (respondent rate = 75.6%), from 36 stratified-sampled high schools and vocational high schools in the Eastern, Northern, Southern, and Central

regions of Taiwan. These schools serve both rural and urban areas. Five teachers of each sampled school were invited to answer a questionnaire. These teachers had to meet one of the following four criteria of experience:

1. having helped purchase and/or setup their school's computers and Internet facilities,
2. having taught/currently teaching computer-related courses (e.g. computer-aided design program, spreadsheet program, etc.),
3. having used/currently using computers in assisting the teaching of academic subjects, or
4. being highly interested in Internet and/or computer-assisted instruction.

It should be noted here that this study delimited the subjects' qualifications because of prior experience during the pilot study, in which all teachers from one high school, with or without computer experience, were invited to participate. Unfortunately, the pilot study results included a significant amount of unusable data: some subjects in the follow-up interviews of the pilot study indicated that because they had no Internet experience, they had answered some questions imaginatively, rather than factually. Therefore, in order to assess the subject's actual anxiety, rather than their imagined anxiety toward the Internet, only teachers with access to and familiarity with computers and/or the Internet were invited to participate in this study. By doing so, unusable data was decreased and the internal validity of the study was improved.

This study invited both high school and vocational high school teachers to answer the questionnaire. Most vocational high school teachers are more computer-literate than their colleagues in academic high schools are, vocational high schools are usually more aware of the Information Age, and are better equipped with computers to help their graduates' futures. Therefore, vocational high school teachers are separated from regular high school teachers in this study.

4.2. Data collection

The instrument used in this study was a four-page, mailed questionnaire consisting of two major sections. The first section had a total of 42 questions, of which 20 were taken from CARS (Heinssen et al., 1987). Because most computers now have Internet capabilities, this study also offered 12 Internet-related questions on hardware, software, and applications, such as "Learning how to set up Internet facilities," "Inputting server's domain name and IP address," "Sending documents to other people through the Internet," and so on. In addition, this study provided 10 questions regarding teachers' management and supervision of students' use of computers/Internet, based on the results of the pilot study and prior interviews of teachers. These questions included "Teachers have to answer all students' questions about the Internet," "Students get inappropriate materials from the Internet," and so on. Therefore, the section entitled "Internet Anxiety Scale" (IAS) consisted of a total of 42 Likert-scale questions. Subjects were required to read the statements and

indicate the extent of their anxiety based on the options provided on a 5-point scale (counted as 1, 2, 3, 4, and 5, respectively, as the input data calculated): Not Anxious, A little Anxious, Anxious, Very Anxious, and Extremely Anxious.

The second section of the survey requested subjects' demographic information, such as gender and age, and background information, including school type (vocational or regular high school), degree, major, and teaching computer-related courses. This section also asked about prior and current computer experience, including time elapsed from the first exposure to computers, computer-use hours per week, and Internet-use hours per week. This section also recruited voluntary interviewees to leave their correspondent methods for further interviews. After all the data were collected, 12 subjects were interviewed by phone or face-to-face. Interview data were mainly used to verify or explain the survey data. Interview questions included why they are anxious about these issues (statements), what happened to their classroom computer management, what kind of help administrators can provide to decrease their anxieties, and so on.

4.3. *Data analysis*

This study used exploratory factor analysis to delete invalid items and clarify the construct structure of IAS. In order to investigate the differences among the four aspects of IAS, the *F* test was used. Likewise, to examine whether subjects' demographic variables (age and gender) and background variables (school type, degree, major, and teaching experience) contribute to their different degree of Internet anxiety, multivariate analysis of variance (MANOVA) was employed. Furthermore, Pearson's product-moment correlation was conducted to investigate the relationships between teachers' age, prior computer experience, and their anxiety toward the Internet.

5. Results

5.1. *Subjects' background*

Among 136 teachers, 71 (52.2%) were male and 65 (47.8%) were female. Subjects' ages ranged from 23 to 55 years. The average age was 35.1 (standard deviation = 6.85). Forty-one (30.1%) subjects came from high schools while 95 (69.9%) came from vocational high schools; this is roughly equivalent to the ratio of high schools to vocational high schools (3:7) in Taiwan. All subjects had bachelor degrees and 25 (18.38%) subjects had master degrees. Regarding their majors, 57 (41.9%) subjects majored in humanities and social science while 79 (58.1%) majored in science and technology.

In terms of their computer-related background, 133 (97.8%) subjects had their own computers at home, in addition to computer access in their offices. Ninety-four (69.1%) teachers were teaching computer-related courses when the study was conducted. The average time elapsed since their first computer use was 125.19 months

(about 10 years), with a standard deviation of 49.07 months (about 4 years). On average, they spent 19.38 h on computers (standard deviation = 6.45), and 6.29 h on the Internet (standard deviation = 4.18) per week; 24.8% of the subjects reported that they spend about 1 h on the Internet each week.

5.2. Factor analysis of the IAS

The purpose of the exploratory factor analysis used in this study was to reduce items by deleting invalid ones. This study used principal component analysis with varimax rotation, with a factor loading cut-off of 0.50. The factor analysis of the Internet IAS questionnaire thus distinctively revealed four orthogonal factors: Internet Use (Use), hardware construction (Hardware), management of students' Internet-use (Management), and learning computer-related skills and knowledge (Learning). A total of 27 questions remained after deleting 15 non-reliable or invalid questions. Only five items originally on the CARS were retained for the IAS. The total reliability of IAS is 0.954. Table 1 shows the factor analysis results of the IAS, and the mean and standard deviation for each question.

As shown in Table 1, an analysis of the answers to 27 questions showed that the means of 13 questions were between 1 and 2, that is, between "Not anxious" and "A little anxious." There were 12 questions' means between 2 and 3, that is, between "A little anxious" and "anxious." The mean of question "Students get inappropriate materials from the Internet" reached 3.00, and the mean of question "Internet facilities are damaged in the classroom" reached 3.16; in other words, it was between "Anxious" and "Very anxious." It is worth noting that the means of seven questions in the "management of students' Internet use" category were all more than 2; in other words, subjects expressed some degree of concern about the topics of these statements.

In the following sections, different variables (e.g. gender, age, prior computer experience) were compared to five kinds of anxiety scores: the mean scores of IAS, F1 Use, F2 Hardware, F3 Management, and F4 Learning. Each subject's mean score of every factor was calculated by the sum of the answers to each question (1, 2, 3, 4 or 5) in that factor, and then divided by the number of questions of that factor.

5.3. Differences among four aspects of teachers' Internet-related anxiety

In order to investigate the differences among four aspects of teachers' anxiety regarding the Internet, a multivariate one-way ANOVA was conducted. The results showed that Wilks' Lambda Λ was significant ($F = 44.985$, d.f. = 3, $P < 0.01$). A post hoc test further revealed that the mean score of Factor 1 (Use) was significantly lower than those of Factor 2 (Hardware), Factor 3 (Management), and Factor 4 (Learning). Furthermore, the mean scores of Factor 2 (Hardware) and Factor 4 (Learning) were significantly lower than that of Factor 3 (Management). No significant difference was found between the mean scores of Factor 2 (Hardware) and Factor 4 (Learning). Table 2 shows the results of a multivariate, repeated, one-way ANOVA and post hoc test of aspects of anxiety.

Table 1
IAS factor analysis results and mean and standard deviation for each question

Question	Factor loading ^a				<i>M</i> ^b	S.D.
	1	2	3	4		
Inputting server's domain name and IP address	0.773				1.78	0.94
Searching for information on the Internet	0.758				1.74	0.90
The use of the Internet becomes an indicator of one's capability	0.753				2.02	1.04
Using FTP to get software and data from remote sites	0.739				1.65	0.94
The use of the Internet is required for an information society	0.738				1.74	0.95
Searching for particular information from numerous Internet resources	0.662				2.18	1.11
Sending documents to other people through the Internet	0.617				1.82	0.95
Posting an article onto the Bulletin Board System (BBS)	0.603				1.86	1.00
Learning computer/Internet terminology ^c	0.589				1.47	0.72
Operating new computer software	0.502				1.83	0.88
Installing new software into the computer		0.842			1.84	1.08
Disassembling hardware components, such as hard disks, control board, etc.		0.830			2.02	1.16
Looking at disassembled computer hardware components, such as display card, CPU, etc.		0.796			1.77	1.09
Learning how to set up Internet facilities		0.770			2.50	1.18
Connecting a modem to computers		0.673			1.67	1.09
Setting up the configuration of a computer		0.515			2.17	1.25
Students spend too much time on the Internet			0.826		2.42	1.17
Students get inappropriate materials from the Internet			0.822		3.00	1.24
Teachers have to answer all students' questions about the Internet			0.821		2.54	1.12
Internet facilities are damaged in the classroom			0.719		3.16	1.22
Students are addicted to the Internet			0.699		2.86	1.24
Teachers have to maintain the order of computer classrooms			0.683		2.45	1.04
Teachers have to manage the computers in classrooms			0.518		2.47	1.07
Taking a computer programming class, e.g. Basic ^c				0.761	1.64	0.80
Learning how a computer works ^c				0.741	2.19	1.94
Getting a message of "system crashed" while operating a software ^c				0.682	2.30	1.16
Learning to write programs ^c				0.638	1.88	1.05
Number of items	10	6	7	4		
Eigen value	6.042	4.952	4.795	3.021		
% Of variance explained	18.881	15.476	14.985	9.440		
α Value	0.935	0.882	0.893	0.836		

N = 136, α = 0.954 for entire measure, total variance explained is 58.781.

^a Factor 1 = Internet Use (Use), Factor 2 = Hardware construction (Hardware), Factor 3 = Management of students' Internet-use (Management), Factor 4 = Learning computer-related skills and knowledge (Learning).

^b 1 = Not anxious, 2 = A little anxious, 3 = Anxious, 4 = Very anxious, 5 = Extremely anxious.

^c Item retained from CARS with some modifications.

Table 2
Results of multivariate one-way ANOVA and post hoc test

Anxiety factors	Mean	S.D.	Wilks' Lambda Λ	Post hoc test
F1: Use	1.81	0.73	44.99**	F1 < F2**
F2: Hardware	1.97	0.93		F1 < F3**
F3: Management	2.68	0.88		F1 < F4**
F4: Learning	1.98	0.81		F2 < F3**

** $P < 0.01$.

5.4. Demographic differences in Internet anxiety

The demographic differences include two variables: gender and age. The MANOVA indicated that female teachers had higher IAS mean scores ($F = -24.42$, $P < 0.01$) and higher anxiety mean scores of F1 (Use), F2 (Hardware), F3 (Management) ($F = -24.20$, $F = -26.32$, $F = -7.03$, $P_s < 0.01$), and F4 (Learning) ($F = -4.02$, $P < 0.05$) than those of male teachers, as shown in Table 3. Simply put, female teachers showed higher anxiety across all four aspects.

Pearson's Product Moment test results indicated that the subjects' age had a high positive but moderate correlation with F3 (Management of students' Internet use) ($r = 0.18$, $P < 0.05$). However, teachers' ages were not significantly correlated with the total IAS scores or mean scores of F1 (Use), F2 (Hardware), and F4 (Learning) ($r = 0.07$, $r = 0.08$, $r = 0.05$, $r = -0.10$, respectively, $P_s > 0.05$). This means that the older teachers are, the more anxious they feel about students' Internet use.

5.5. Background differences in Internet anxiety

Subjects' background differences include their school type, degree, major, and whether the course they are teaching is computer-related or not. Table 4 lists MANOVA results showing that high school teachers' anxiety mean scores of F3 (Management) and F4 (Learning) were significantly higher than those of vocational high school teachers ($F = -4.38$, $F = -5.28$, $P_s < 0.05$). There was no significant dif-

Table 3
Descriptive statistics and F test of teachers' gender on Internet anxiety mean scores

Anxiety factors	Male teachers ($n = 71$)		Female teachers ($n = 65$)		Wilks' Lambda Λ	F
	M	S.D.	M	S.D.		
IAS	1.80	0.54	2.36	0.65	8.68**	-24.42**
F1: Use	1.47	0.51	2.08	0.77		-24.20**
F2: Hardware	1.57	0.71	2.37	0.92		-26.32**
F3: Management	2.44	0.89	2.88	0.84		-7.03**
F4: Learning	1.83	0.75	2.13	0.83		-4.02*

* $P < 0.05$.

** $P < 0.01$.

Table 4
Descriptive statistics and *F* test of school type on Internet anxiety mean scores

Anxiety factors	Vocational high school teachers (<i>n</i> =95)		High school teachers (<i>n</i> =41)		Wilks' Lambda Δ	<i>F</i>
	M	S.D.	M	S.D.		
IAS	2.00	0.68	2.16	0.58	3.59**	-1.37
F1: Use	1.77	0.77	1.70	0.52		0.28
F2: Hardware	1.88	0.86	2.04	1.01		-0.61
F3: Management	2.53	0.92	2.91	0.78		-4.38*
F4: Learning	1.85	0.76	2.22	0.83		-5.28*

* $P < 0.05$.

** $P < 0.01$.

ference in IAS mean scores, and F1 (Use) and F2 (Hardware) mean scores between high school and vocational high school teachers.

The MANOVA test also indicated that the IAS total scores or mean scores of any teachers who have master degrees were not significantly different from those of teachers with bachelor degrees, as shown in Table 5. This means that the teachers' degrees made little or no difference in Internet anxiety.

In contrast, the MANOVA test indicated that teachers' majors (humanities/social science vs. science/technology) contributed significantly to differences in IAS mean scores, and mean scores of F1 (Use) and F4 (Learning) ($F = 4.88$, $F = 4.19$, $F = 5.25$, $P_s < 0.05$). No significant difference was found in F2 (Hardware) and F3 (Management) by teachers' majors, as shown in Table 6. This means that teachers with a humanities/social science background had higher anxiety levels in two aspects (F1 and F4) than did teachers with a science/technology background.

Further, the MANOVA test in Table 7 indicated that teachers who were teaching computer-related courses had significantly lower mean scores of F1 (Use), IAS mean scores, F2 (Hardware) mean score, and F4 (Learning) mean score, and than those who did not teach computer-related courses ($F = -3.35$, $P < 0.05$; $F = -9.79$, $F = -10.56$, $F = -26.10$, $P_s < 0.01$). However, the difference in mean scores of F3

Table 5
Descriptive statistics and *F* test of teachers' degree on Internet anxiety mean scores

Anxiety factors	Teachers with only bachelor degrees (<i>n</i> = 111)		Teachers with master degrees (<i>n</i> = 25)		Wilks' Lambda Δ	<i>F</i>
	M	S.D.	M	S.D.		
IAS	2.08	0.64	1.95	0.70	0.61	0.84
F1: Use	1.79	0.66	1.63	0.84		0.97
F2: Hardware	1.99	0.90	1.73	0.90		1.70
F3: Management	2.65	0.92	2.65	0.82		1.00
F4: Learning	1.99	0.83	1.87	0.71		0.46

Table 6

Descriptive statistics and F test of teachers' major on Internet anxiety mean scores

Anxiety factors	Teachers in humanity/social science majors ($n=57$)		Teachers in science/technology majors ($n=79$)		Wilks' Lambda Δ	F
	M	S.D.	M	S.D.		
IAS	2.21	0.74	1.92	0.57	1.58	4.88*
F1: Use	1.90	0.87	1.61	0.53		4.19*
F2: Hardware	2.09	0.94	1.79	0.84		2.75
F3: Management	2.78	0.99	2.53	0.84		1.67
F4: Learning	2.21	0.88	1.83	0.74		5.25*

* $P < 0.05$.

Table 7

Descriptive statistics and F test of teachers' computer-related teaching experience on Internet anxiety mean scores

Anxiety factors	Teachers who teach computer-related courses ($n=94$)		Teachers who do not teach computer-related courses ($n=42$)		Wilks' Lambda Δ	F
	M	S.D.	M	S.D.		
IAS	1.94	0.62	2.35	0.66	7.02**	-9.79**
F1: Use	1.68	0.64	1.95	0.83		-3.35*
F2: Hardware	1.76	0.78	2.36	1.06		-10.56**
F3: Management	2.57	0.94	2.83	0.76		-1.94
F4: Learning	1.74	0.67	2.52	0.84		-26.10**

* $P < 0.05$.** $P < 0.01$.

(Management) between teachers of computer-related courses and teachers of non-computer-related courses was not significant.

5.6. Different prior computer experiences and Internet anxiety

A teacher's prior computer experience included three variables: time elapsed from first exposure to computers, computer-use hours per week, and Internet-use hours per week. The Pearson's product-moment test results indicated that the time from the subjects' first exposure to computers was negatively correlated with mean scores of F1 (Use) and F2 (Hardware) at a significant level ($r = -0.32$, $P < 0.01$; $r = -0.18$, $P < 0.05$). Computer-use hours per week were found to be negatively correlated with the total IAS mean scores and mean scores of F1 (Use), F2 (Hardware), F3 (Management) and F4 (Learning) at significant levels ($r = -0.47$, $r = -0.42$, $r = -0.43$, $r = -0.24$, $r = -0.29$, $P_s < 0.01$). Statistics also indicated that Internet-use hours per week were negatively correlated with the mean scores of IAS, factor 1 (Use), factor 2

(Hardware), and factor 3 (Management) at significant levels ($r = -0.33$, $r = -0.35$, $r = -0.28$, $P_s < 0.01$; $r = -0.21$, $P < 0.05$).

6. Discussion

In this study, 136 Taiwan high school and vocational high school teachers were surveyed. The questionnaire contained some questions from the Computer Anxiety Rating Scale (CARS), but most were brand-new questions on Internet anxiety. It is worth noting that seven questions on the management and supervision of students' Internet use in the classroom and 15 questions on Internet use and hardware construction were also incorporated in the questionnaire, and the results indicated that teachers experienced some kind of anxiety across all aspects.

One should also note that the means of seven questions in the factor "management of students' Internet-use" were between "anxious" and "very anxious" in this study. The fact that teachers had some degree of anxiety over students' Internet use echoed the findings of Dawes (1999). Teachers in her interviews expressed their concerns about secondary students' access to Internet information without assessing suitability, accuracy or relevance. Teachers believed that students are very keen to use computers, but they may see computers as mere game machines. In addition, some students may dominate the computers. In our follow-up interviews, high school teachers here indicated similar concerns: students get inappropriate materials from the Internet without checking their accuracy and decency; students spend too much time on the Internet, particularly, for on-line games; and some (over)confident students monopolize computers in the classrooms, thus creating management problems for teachers and intimidating less-confident students.

Among the four aspects of Internet anxiety identified by this study, Factor 3 (anxiety over management of students' Internet-use) was the highest concern, followed by Factor 4 (anxiety over learning computer-related skills and knowledge) and Factor 2 (anxiety over hardware construction). Factor 1 (anxiety over Internet Use) was the least noted. This means that, relatively speaking, teachers expressed greater anxiety over the management and supervision of Internet-use by students than the other three aspects. This finding also shows that this key aspect of teachers' anxiety identified in this study—management and supervision—was *not* identified by CARS, whose anxiety types typically included interactive computer-learning anxiety, observational computer-learning anxiety, etc. (Rosen & Weil, 1995b).

Table 8 shows the statistical summary of all comparisons and correlations. Results indicated that gender was the only demographic variable contributing to all aspects of anxiety, including Internet use, hardware construction, management of students' Internet-use, and learning computer-related skills and knowledge. Female teachers consistently showed higher anxiety levels in all four aspects. This finding was consistent with those of Farina (1991), Liu et al. (1992), and Yaghi and Abu-Saba (1998), in which females often had greater anxiety toward computers. The results of the present study showed that when computers have Internet facilities, female teachers also have greater anxiety toward the Internet.

Table 8
Summary of statistics results

Variables	Internet Anxiety Scale (IAS)	Factor 1: Anxiety toward Internet use	Factor 2: Anxiety toward hardware construction	Factor 3: Anxiety toward management of students' Internet-use	Factor 4: Anxiety toward learning computer-related skills and knowledge
<i>Demographic</i>					
Gender	Female > male	Female > male	Female > male	Female > male	Female > male
Age	-	-	-	Positively correlated	-
<i>Background</i>					
School type	-	-	-	High > vocational high	High > vocational high
Degree	-	-	-	-	-
Major	Humanity/social science > science/technology	Humanity/social science > science/technology	-	-	Humanity/social science > science/technology
Teaching computer-related courses	No > Yes	No > Yes	No > Yes	-	No > Yes
<i>Prior computer experience</i>					
Time elapsed from first exposure to computer	-	Negatively correlated	Negatively correlated	-	-
Computer-use hours per week	Negatively correlated	Negatively correlated	Negatively correlated	Negatively correlated	Negatively correlated
Internet-use hours per week	Negatively correlated	Negatively correlated	Negatively correlated	Negatively correlated	-

-, No statistically significant result.

This study showed that teachers' ages were not correlated with IAS mean scores, as related to Internet Use anxiety, hardware construction anxiety, and learning computer-related skills and knowledge anxiety. This finding was similar to [Gressard and Loyd \(1985\)](#), whose data indicated that age was not a contributing factor in teachers' attitudes toward computers. However, it is interesting to note that teachers' ages were positively correlated with the management of students' Internet-use mean scores in this study. This means that the older teachers were, the more anxious they felt about students' use of the Internet in the classroom. Teachers of all ages exhibited no difference in anxiety levels toward the three anxiety categories over which they felt they had the most control, but older teachers did show greater anxiety toward student's Internet-use, solving student's Internet-related problems, and managing and maintaining the order and equipment of computers in the classrooms.

The results of this study indicated that high school teachers experienced the greatest anxiety over the management of students' Internet-use and the learning of computer-related skills and knowledge. Some high school teachers in our follow-up interviews indicated that they have never used computers in the classroom for teaching, and that they believe some students are more computer-literate than they themselves are. In further comparisons, some teachers thought themselves slower to learn computer-related skills, and to gain computer-related knowledge, than students. On the contrary, some vocational high school teachers are teaching computer-related courses, and, therefore, have experience in managing what happens in a computer classroom.

This study found that teachers' levels of education (degree) made no difference in the degree of Internet anxiety. One explanation for this might be the limited number of subjects involved in this study, that is, this study limited subjects to those with some experience in computer/Internet applications in schools, regardless of educational level. Therefore, the degree as such did not contribute to teachers' levels of anxiety over computers and the Internet.

The subject of the teachers' majors, however, was shown to be a contributing factor in IAS mean scores and mean scores of F1 (Use) and F4 (Learning). This finding was consistent with the result of [Rosen and Weil's study \(1995a\)](#) that many secondary humanities teachers are to some degree technophobes, and the common belief that humanity/social science majors are more anxious about using computer technology than are science/technology majors. Nevertheless, teachers in all fields demonstrated the same level of anxiety toward the management of students' Internet-use.

This study showed that teachers who teach computer-related courses (e.g. Computer-Aided Design programs, spreadsheet programs, etc.) experienced less anxiety toward the Internet than did those who do not teach such courses. Results indicated that teachers of computer-related courses had lower mean scores of IAS, Factor 1 (Internet Use), Factor 2 (hardware construction), and Factor 4 (learning computer-related skills and knowledge). This result was consistent with that of [Yaghi and Abu-Saba's study \(1998\)](#) that teachers who use computers in teaching have less computer anxiety. The explanation for this could be that they have more experience

in software and hardware, or that they continue learning new computer skills and knowledge because their teaching requires them to do so. However, it is worth noting that teaching computer-related courses did not result in teachers experiencing less anxiety over the management of students' Internet-use. Teachers are equally anxious about this aspect of teaching with the Internet, regardless of prior teaching experience.

Consistent with previous studies (e.g. Marcoulides, 1988; Reed & Palumbo, 1987–1988), this study found that a statistically significant negative relationship existed between prior computer experience and computer anxiety. The more access teachers have to computers, the less anxiety they experience over their use in the classroom. Likewise, the less Internet anxiety they felt, the more they used computers in class. Computer-use hours per week were also found to be negatively correlated with IAS mean scores and mean scores for Factor 1 (Internet Use), Factor 2 (hardware construction), Factor 3 (management of student's Internet-use), and Factor 4 (learning computer-related skills and knowledge).

However, the data gathered in this study does not show the *direction* of the relationship: does more computer experience lead to less Internet anxiety, or do people who have higher anxiety toward the Internet use computers less? The same question can be applied to another finding: does more Internet experience lead to less Internet anxiety, or does more Internet anxiety leads to less Internet use? Either way, it seems clear that teachers who have ample opportunity to work with the Internet, such as in staff development programs, may experience decreased Internet anxiety.

How can we help teachers overcome Internet Anxiety? Training in Internet use seems a possible way to increase teachers' familiarity with computer and the Internet, and may thus decrease Internet anxiety. In the follow-up interviews, some teachers stated that training sessions would help them increase their Internet competence and might reduce their anxiety. In Dawes' study (1999), training was universally mentioned by interviewed teachers who claimed it would enable both professional development and integration of computer technology into practice. Almost two decades ago, Gressard and Loyd (1985) already suggested that such training opportunities would make for significantly less computer anxiety and significantly greater confidence and pleasure in computer-use. Reed and Overbaugh (1993) also demonstrated that even a short (6-h) training module can effectively reduce pre-service teachers' anxiety levels.

Another way to provide ample opportunity for teachers to work with computers and the Internet is to supply personal computers, laptops in particular, to every teacher. A study in the United Kingdom has already shown that teachers made dramatic progress in their use of instructional technology when they had access to their own portable computers (National Council for Education Technology, 1997). In fact, this policy is under serious consideration by Taiwan government and is being implementing in some selected schools. If more computer and Internet experience would lead to less Internet anxiety, then one can assume that, by gaining more experience from their own portables, teachers would have less Internet anxiety.

This study also found that teachers' computer-use hours negatively correlated with their anxiety over learning computer-related skills and knowledge. In other

words, those who use computers less may have higher anxiety toward learning computer-related concepts, and vice versa. This finding suggests that, if training programs, as suggested above, are meant to decrease teachers' anxiety, they should be conducted in a stress-free fashion for teachers. Presno (1998) suggests that particular instructional techniques and behaviors will decrease Internet anxiety in novice adult students; these techniques and behaviors should provide the same results for teachers. Presno's techniques and behaviors include:

- providing ample practice time on the Internet,
- welcoming spontaneous questions and addressing concerns and anxiety immediately,
- encouraging peer help,
- allowing play on the Internet, and
- modeling non-anxious behavior.

Besides instructional techniques, findings from this study deserve consideration when designing such training sessions. The follow-up interviews in this study indicated that teachers already recognize the benefits of the Internet: the speed in finding and transferring information, an increase in teaching flexibility, and an increase in students' motivation to learn. However, teachers in this study also expressed, among other things, concerns over students' abilities to evaluate the information they find on the Internet, and to govern their own use-time in appropriate ways. Therefore, when teacher-training is planned and implemented, the concerns of teachers should be addressed, in addition to the particulars of hardware and applications. For example, those developing training sessions might help teachers to address questions such as:

- What is the decent or appropriate use of computers/Internet in classroom settings?
- How should teachers deal with students who are over-involved with computers/Internet?
- How might teachers effectively integrate Internet resources into their teaching?
- How can teachers use computers/Internet to increase students' motivation to learn?
- How should institutions deal with damaged or stolen computer equipment?

7. Concluding remarks

The results of this study describe the relationships among teachers' demographic, background, and prior computer experience differences and their Internet anxiety. If we believe that teachers are the key persons for successful implementation of Internet-use in high school and other classrooms, then teachers' Internet-related anxieties

must be taken into consideration. In particular, this study identified and confirmed teachers' anxiety over the management of students' Internet-use, a particular type of anxiety not included in the previous studies. This study analyzed four different aspects of Internet anxiety, examining their relationships to teacher-variables such as demographics, personal backgrounds, and prior computer experiences. Perhaps further studies tackling other variables, such as teachers' beliefs, computer efficacy, computer attitudes, information literacy and so on, can be based on the findings presented here to continue advancing our understanding of a new kind of computer anxiety—Internet anxiety among teachers.

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