



Promoting awareness of Internet safety in Taiwan in-service teacher education: A ten-year experience

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ABSTRACT

The Internet has changed many people's lives, in both positive and negative ways. The Taiwan Ministry of Education has recognized the Internet's possible risks and has initiated the island-wide *Teacher Awareness of Internet Safety (TAIS)* project for elementary and middle school teachers since 2000. TAIS project is the first large-scale, government-run, ongoing project that addresses Internet safety in Chinese. The researchers discuss the development of and the evaluation of the TAIS project over its ten-year history (2000–2009). The researchers also present the processes and products of the TAIS project. The TAIS project has used design-based research (DBR) to outline its initial design, data collection and analysis, macrocycle-level analysis, design adjustment, and theory or policy building in three consecutive stages. The present article also offers some general reflections on the lessons learned and the methodology used in this project, as well as some suggestions for future research in this area.

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1. Introduction

As technology has continued its explosive growth, the Internet has become and will continue to be a large part of our lives. The Internet is central to education systems and classroom teaching in many countries around the world. In Taiwan, promoting the Internet has been a government policy as well as a private-sector business endeavor. For example, the Taiwan Ministry of Education since 1993 has eagerly promoted network-based learning across the 3rd through 12th grades (involving students who are between 9 and 18 years old), as well as at the college level. Policies governing Internet use in Taiwan's schools not only contain provisions for the installation of Internet connections to all computers in computer classrooms and regular classrooms, but also require teachers to use computers/the Internet in their respective core curricula and to let students use information technologies in their learning and daily life (Chou, 2003). By 2009, the broadband Internet penetration ratio to elementary, middle, and high schools reached 100% (Taiwan Network Information Center, 2009). Teachers as well as young people now have easy access to the Internet and use a variety of Internet or network applications in their teaching, learning, and daily lives. It seems that the Internet is not only an information superhighway serving teachers and students, but also a new interpersonal arena in which young people can enhance their opportunities and social experiences.

However, there are problematic and even frightening downsides to introducing the Internet into students' learning and daily lives. For example, the online world of quick, easy information is wide open to students who, without specific training, are unprepared to differentiate sound information from unsound information (Wong, 1995) or may access material that parents may not wish their children to view (Iannotta, 2001; Wishart, 2004; Ybarra & Mitchell, 2005). Without solid guidelines and discipline, students may be unable to use online information appropriately or may have unpleasant experiences by unwisely providing personal information or by downloading inappropriate materials. Moreover, because the Internet provides an incredible array of interpersonal-communication options, students may be unaware of the hidden dangers lurking behind online "friendships" (Wishart, 2004; Chou & Peng, 2007).

Indeed, the media has reported on some events that reveal the downside to Internet use. For example, computer virus warnings and infections are often reported in the mass media; an official Taiwan government report recently cited about 500 sexual harassment charges related to Internet use, but the number of unreported cases was likely much greater. In addition, some troubling news stories concerning net friends have grabbed public attention. For example, a high school student was murdered by a close "net friend," as cited in Chou and Peng's study (2007). The fact that the mass media have sometimes presented the "worst case scenarios" reflects on society's general unease about the new technology (Sharples, Graber, Harrison, & Logan, 2009) regarding which teachers and parents may be unfamiliar but deeply concerned.

When educators embrace the Internet in classrooms and in students' lives, they should consider the potential problems that

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stem from inappropriate use of the Internet. It seems that the Internet is a “double-edged sword” or a “whole package deal” from which its users access sound information yet also unsound information. This complexity creates a central dilemma that schools must address when introducing the Internet to students. Therefore, knowing how to benefit from the Internet’s enhancement of convenience and productivity but at the same time to avoid the Internet’s semi-hidden risks has become a serious issue. Educators want students’ online experiences to be safe and rewarding. This goal requires schools to ensure that students receive appropriate, thorough guidance regarding safe use of the Internet. However, although teachers are expected to be responsible for student safety and for their Internet-related teaching content, teachers themselves may lack an adequate understanding of students’ risky, unsafe, or unethical Internet behaviors. Before the TAIS project, the researchers had conducted a series of surveys in order to understand teachers’ experiences and knowledge in relation to Internet safety issues. The results showed that, few participating teachers had received any Internet safety instructions during their teacher training, and few had the opportunity to receive such training, while they were in-service. In other words, owing to their own limited “Internet safety”-related knowledge and experiences, more and more teachers who can apply information technology to the design and the development of digital-age learning experiences are unable to promote and model digital citizenship and responsibilities to their students (see also NETS-T by ISTE, 2008).

Because of repeated warnings from official reports, from the media, and especially from parents and teachers, the Taiwan Ministry of Education (MOE) has acknowledged through various channels the seriousness of the aforementioned problems and has operated an island-wide awareness project since 2000. The project has gotten underway in conjunction with the research endeavors, supported by the National Science Council, to develop a series known as the Teacher Awareness of Internet Safety (TAIS) Project for elementary and middle school teachers. The specific objectives of the project are

1. to define Internet safety and to identify evolving key concepts meriting coverage in teacher training programs;
2. to develop and implement Internet safety training programs for Taiwan elementary, middle, and high school teachers, thereby promoting teachers’ awareness in Internet literacy and safety;
3. to help teachers advocate, model, and teach the safe, legal, and ethical use of digital information and technology; and finally,
4. to raise Internet safety awareness among policymakers and the public, and to draft protection policies for young people.

The major contribution of this awareness project is that it presents the only large-scale, government-run ongoing project that addresses Internet safety in Chinese. While similar projects or programs include ChildNet International (<http://www.childnet-int.org>) in England, CyberSmart! (Teicher, 1999) in the United States, and the NetAlert CyberSafe Schools Project (http://www.netalert.gov.au/programs/cybersafe_schools.html) in Australia, no similar awareness projects have been available in the Chinese-speaking areas. To sum up, the TAIS project offers a framework within which teachers from elementary and high school levels not only can receive continuous updates regarding “Internet safety”-related issues, but also can discuss these issues with their peers and students. The project provides “Internet safety”-related instruction units that teachers can use to teach students about safe, legal, ethical, and enjoyable Internet use. Lastly, the project collects evaluations, reports, and feedback that facilitate the drafting of protection policies for children and young adults.

The purpose of the article is to report on Taiwan’s island-wide “teachers’ Internet safety awareness” project as it has developed over the 10 years (2000–2009). The researchers focus on describing and

evaluating the project’s processes and products (e.g., Internet site, training programs, and policies). This article begins by reviewing the literature on Internet safety concepts, concerns, and empirical investigations, and proceeds by discussing core Internet safety areas in the TAIS project. The second part of this article presents design-based research (DBR), which is the project’s methodology, and uses DBR as a grid to report the three stages of the project over the ten-year period. Finally, a conclusion section reflects on this project’s ten-year course and methodology, and discusses future possible work directions and recommendations.

2. Key Internet safety concepts and educators’ related concerns

Safety is a fundamental requirement for everyone, whether online or off. The term “Internet safety” is sometimes also known as “Internet security” (e.g., Anderson, 2003), which refers to the privacy, integrity, and efficiency of Internet technology and information. In schools, educators are concerned with the costs and benefits of students’ Internet use. Students must be able to safely manage their online experiences, know how to deal with uncomfortable and inappropriate information, and know when to seek adult help (Teicher, 1999).

Many studies have tended to identify the risks that sometimes arise on the Internet. For example, Jantz and McMurray (1998) divide the problems into two categories: online relationships and Internet pornography. At least one researcher claims, however, that most of the dangers that children face online come from strangers, not from Web-based information: “The real danger online comes from meeting people offline” (Aftab, 2000, p. 33). When children interact with someone whom they do not know in real life, they face special risks. Aftab (2000) further lists six types of risks that threaten children in cyberspace: exposure to inappropriate or potentially dangerous information, being stalked, other forms of harassment, disclosure of important and private information, online-purchase scams, and enticement by cyber-predators who want to meet children face-to-face. Poflak (2002) worries that the Internet potentially exposes children to pornography, hacking, copyright infringement, inappropriate relationships with adults, flaming (the online posting of inflammatory messages), online bullying, and so forth. In addition, Livingstone (2003) argues that commercialism, privacy, and sexual materials are three major concerns regarding children’s Internet use.

Organizations in the United Kingdom have conducted several reports on information communication technology with emphasis on Internet safety. For example, the British Educational Communications and Technology Agency (BECTA, 2002) commissioned an “Audit of Internet Safety Practices in English Schools” and reported on current practices in the teaching of Internet safety in British schools. Among the safety concerns raised, access to inappropriate materials was the teachers’ single most important concern. In order to protect their pupils from inappropriate materials, schools tend to use filtering arrangements. Another example is ChildNet International (<http://www.childnet-int.org/>), hosted by a non-profit organization in the United Kingdom. While taking a balanced approach to Internet safety issues, this website not only explores the positive and creative ways children and young people can use the Internet, but also suggests that Internet users learn about the dangers that threaten children online; of all these dangers, three main ones are discussed: potential contact with strangers, inappropriate site content, and possible invasion of privacy stemming from excessive commercialism.

Using the model developed by the EU Kids Online project (Hasebrink, Livingstone, Haddon, Kirwil, & Ponte, 2007), the Byron Review (Byron, 2008a) classified children’s online risk in terms of the content (child as recipient), contact (child as participant), and conduct (child as actor) relative to potentially harmful or inappropriate material (commercial, aggressive, sexual, and values-related information). Based on this comprehensive review, an action plan (Byron, 2008b) was presented to the UK government.

In late 1999, the Australian government initiated the NetAlert CyberSafe Schools Project in an attempt to provide Internet safety resources to Australia's primary and secondary schools (Australian Government, 2007). The project disseminated pamphlets identifying both risks and the strategies that might minimize these risks. In their teacher's guide (NetAlert, 2004), the Internet safety issues include exposure to inappropriate material, physical danger, commercialism, privacy, unreliable information, spam, and viruses. It should be noted that this awareness project is designed for children, as well as for teachers and parents.

In their document *National Educational Technology Standards (NETS)*, the International Society for Technology in Education (ISTE, 2002a,b) concentrates on administrators' and teachers' responsibilities to model and enforce social, legal, and ethical practices for the promotion of responsible technology use. These standards address privacy, security, and safety issues regarding the Internet, as well as environmental safety, health practices, copyright laws, and intellectual-property matters. The second editions of NETS for students (ISTE, 2007), teachers (ISTE, 2008), and administrators (ISTE, 2009) introduce the term "digital citizenship," which replaces the phrase "social, legal, and ethical issues" in the first editions to reflect the arrival of digital culture. In line with NETS, Willard (2002) presents useful lesson units through which students can learn about computer ethics, etiquette, and safety; Ribble and Bailey (2007) compiled elaborations on digital citizenship and how to teach it in K-12 settings; and Ribble (2009) composed a handbook for parents about how they should raise a digital child. Also, the CyberSmart (<http://www.cybersmartcurriculum.org>) program has developed free curricula for use in schools and businesses. The curricula consist of more than 65 standards-based lesson plans, student-activity sheets, posters, and information for parents. The CyberSmart website provides various alignments of its student-oriented instructional units to NETS or to individual states regarding advisable technology standards, so that teachers can easily use these alignments to prepare their curricula.

The above review outlines the key concepts of Internet safety, educators' concerns, and organizational efforts to promote Internet safety in general. Of the many questions that could emerge from this review, one in particular presents itself here: what are students' attitudes toward and experiences on the Internet regarding safety issues? Several studies have reported empirical data shedding light on this matter. For example, according to Stahl and Fritz (2002), 74% of 213 respondents (7th–9th graders) reported that they had contacted a stranger via email or chat rooms, and 25% acknowledged that they had shared identifying information about themselves such as name, address, or phone number. In addition, only approximately 25% of the respondents reported having discussed Internet safety with an adult, and virtually no one acknowledged wanting more adult supervision for themselves. The aforementioned study suggested (1) a need for increased teen-centered education regarding identity sharing, (2) tools to block unwanted sites or personal contacts, (3) adults' ongoing supervision of students' Internet use, and (4) further study of Internet safety issues.

Another example of this kind of research is Wishart's (2004) study of a national survey involving 577 primary, secondary, prep (ages 5–12), and all-through (age 3 or ages 5–18) schools in the United Kingdom. The report contends that inappropriate material such as pornography and inflammatory (e.g., racist) writings can be easily accessed, whether by accident or on purpose. Children can also be at risk by being approached by strangers, particularly in Web-based chat rooms. It seems that the greatest apprehension concerns children's easy ability to access inappropriate information on the Internet. Wishart's study also reported that 85% of British schools have taught Internet safety and that Information Communication Technology (ICT) curriculum covered these topics, which would be delivered to students through either an Internet-induction

program or homeroom-class teaching. The areas of greatest concern for school ICT coordinators were accessing inappropriate material, filtering, email, ensuring safe Internet access at school, and students' dissemination of personal details.

A study by Valcke, Schellens, Keer, and Gerarts (2007) in Belgium surveyed 1700 4th, 5th, and 6th graders in Flanders. The results indicate a high level of unsafe Internet use, such as chatting with unknown persons (26%), sending personal information (13%) including personal photos (12.7%), and meeting strangers (7.5%) on the basis of an appointment made via the Internet. Of this last group, a frightening 20.9% went alone to such a meeting. In addition, this study reported that 40.7% of pupils had been shocked by inappropriate content (e.g., violent, sexual, or racist content) when surfing the Internet. About 16.7% of the pupils had felt threatened while being online with a person of the opposite sex or of another grade level. In sum, only 13.7% of all pupils had never engaged in unsafe Internet behaviors.

In response to the age of Web 2.0, Sharples et al. (2009) explored the e-safety issues of online activities, including inappropriate content, child abuse, online bullying, and online cheating. Their study contained both a survey of more than 2600 children (ages 11–16) and interviews with more than 150 teachers, managers, and technical staff. The major results indicated that, occasionally or frequently, 74% of children used social-network sites and 78% shared files on social-network sites. The study also found that 42% of the teachers surveyed had never taught students about online safety and that only 11% taught this topic frequently. The study concluded that schools should empower students with Web 2.0 and, at the same time, should educate them about responsible and creative learning in that environment.

Drawing on the above review of Internet safety studies and related websites and programs, as well as the opinions collected in the interviews with network experts and computer teachers, the TAIS researchers undertaking the current study decided to identify here four core Internet safety areas that teachers should be familiar with:

1. Communication security and safety. This area refers to teaching students how to protect themselves from viruses, hackers, spam (junk mail), and illegitimate commercial transactions, and how to safeguard their confidential information.
2. Information decency and appropriateness. This area concerns how to identify malicious rumors, pornography, sexual solicitation, misleading advertising, and other offensive content. Also covered are both respects for copyright and ethical use of digital information.
3. Online interpersonal safety. This area refers to all social interactions, including making friends online, meeting net friends in person, cyberbullying, and digital etiquette, especially in the Web 2.0 age in which social networking is the main focus.
4. Computer-/Internet use safety. This is a miscellaneous category involving proper equipment, a good work environment, eyesight protection, and posture.

The above four core areas served as a basis for the TAIS project when it got underway in 2000. It is noteworthy that the eyesight-protection issue was not covered in any of the above-mentioned websites or studies but in the TAIS project because problems with myopia are common among Taiwanese students.

3. Research approach—design-based research

The TAIS project not only serves practical purposes helpful to administrative endeavors, but also is considered a large-scale research project in the e-learning field. The research methodology is design-based research (DBR, or Design Research, DR; Brown, 1992; Collins, 1992; Collins, Joseph, & Bielaczyc, 2004; Design-based Research

Collective, 2003). Barab (2006) states that DBR “is less a method than it is a collection of approaches that involve a commitment to researching activity in naturalistic settings...with the goal of advancing theory and at the same time directly impacting practice” (p. 155). The research endeavor of the TAIS project uses the DBR method for several reasons. First, DBR involves the creation of a theoretically inspired innovation (a teacher-learning environment) to directly address a local problem (Internet safety issues in Taiwan schools). Second, this project strives not only to advance the frontiers of Internet safety understanding in school contexts, but also to undertake ongoing evaluations of teachers’ actual participation in the project, which consequently undergoes revisions and acquires new strength on the basis of highly valued use-related considerations and feedback. Last and on a related note, DBR usually involves multiple iterations or progressive refinement (Collins et al., 2004). Because the TAIS project, upon its initiation, made a long-term commitment to realizing the stated goals, the TAIS researchers fortunately have had opportunities to refine the project during the course of its maturation, specifically regarding various emerging e-safety issues. As Barab (2006) states, accompanying each iteration can be a further refinement that helps test the value of the innovation and, presumably, stimulate the evolution of theory.

In order to report the processes and products of the TAIS project, the researchers adopted Jonassen, Cermusca, and Ionas’ (2007) suggestions of methodological guidelines as grids in this article: initial design, data collection and analysis, macrocycle analysis, design adjustment, and theory building. To profile the ten-year experience of the TAIS project, the following sections report on the project by dividing its existence into three stages (1st: 2000–2002; 2nd: 2003–2006; and 3rd: 2007–2009). Each stage is elaborated on regarding the aforementioned five major tasks, as shown in Table 1. As the TAIS project has progressed, the focus of the major tasks has undergone adjustments and re-weightings according to changes in Internet technology and the political environment.

4. The development of the teacher awareness of Internet safety (TAIS) project

4.1. The first stage of the project (2000–2002)

4.1.1. Initial design

The initial design of this stage was to build an online learning environment that would address the issue of Internet safety for teachers and that would, more specifically, present basic concepts on four core areas (communication security, information decency and appropriateness, online interpersonal safety, and computer-/Internet use safety). In order to provide a presentation and delivery platform from which teachers can easily access Internet safety information, the TAIS project created the “eteacher” website (in Chinese, <http://www.eteacher.edu.tw>) in early 2001, and placed all related materials on it, including textual information—by areas and sub-areas—on definitions, key points, issues in school context, how to deal with students’ related problems, related links, and research reports. To promote this website, the TAIS project held workshops and lectures for computer teachers.

4.1.2. Data collection and analysis

At the beginning of each stage, the TAIS project has organized a research panel in which related professors and researchers layout the possible research topics, data to be collected, time tables, and resources (budget, manpower, and possible partner schools). After individual researchers conducted the study with assistance from mainly graduate students, the research panel on a demand basis would come together to review the results/interpretations, to make recommendations for TAIS-implementation policies, or to refine the research directions for the TAIS office. The TAIS office, three times each year, regularly reports to the Ministry of Education on the implementation policy and on its progress. By this two-tier structure, participative researchers can focus only on the academic quality of the

Table 1
Major tasks by the three stages of the TAIS Project.

Stage	Initial design	Data collection and analysis	Macrocycle (stage) analysis	Design adjustment	Theory or policy building
First (2000–2002)	<ul style="list-style-type: none"> An eteacher website was built to deliver related information Sporadic training programs available for computer teachers 	<ul style="list-style-type: none"> Surveys and interviews on teachers’ awareness, knowledge, and major concerns 	<ul style="list-style-type: none"> A lack of systematic training programs for all teachers A lack of data on students’ Internet safety awareness, knowledge, and behaviors 	<ul style="list-style-type: none"> More investigations were needed on students’ Internet behaviors 	<ul style="list-style-type: none"> Teacher Internet awareness and training programs for all teachers
Second (2003–2006)	<ul style="list-style-type: none"> More instructional units developed in the eteacher website for teachers to use A more systematic training program conducted for all in-service teachers 	<ul style="list-style-type: none"> Surveys and interviews on students’ “Internet safety”-related knowledge and behaviors Formative evaluations of eteachers’ instructional units 	<ul style="list-style-type: none"> Teachers’ lack of personal e-safety experiences and peer support A lack of systematic training programs for school administrators A lack of data on parents’ awareness and guidance needs A lack of online teacher training programs 	<ul style="list-style-type: none"> A more proactive approach to promoting e-safety awareness A community geared toward teacher Internet safety teaching and learning Training programs for school administrators Online courses on e-safety for teachers 	<ul style="list-style-type: none"> Involvement of school administrators and parents in the Awareness of Internet Safety campaign
Third (2007–2009)	<ul style="list-style-type: none"> Teacher training programs available both at central and local levels New emerging e-safety issues added to the eteacher website Alignments of instructional units with educational technology standards 	<ul style="list-style-type: none"> A large-scale survey on teachers’ self-evaluation of their computer/Internet literacy Summative evaluation of eteachers’ instructional units in three phases 	<ul style="list-style-type: none"> A lack of attention paid to e-safety issues affecting college-level teachers and students (including pre-service teachers) 	<ul style="list-style-type: none"> Two editions of pamphlets for parents A 2-credit-hour “Information Literacy and Ethics” course for all college students 	<ul style="list-style-type: none"> Awareness of Internet safety should involve all stakeholders inside and outside schools A policy requiring all public sectors and inviting non-governmental organizations to join the information campaign

studies and would not be “monitored” directly by the funding source (i.e., MOE).

In the first stage of the project, surveys on teachers' awareness and knowledge were a continuous endeavor. For example, Chou (2003) conducted a survey study on 136 Taiwan high school teachers' Internet anxiety regarding the following four: Internet use, hardware construction, management of students' Internet use, and learning computer-related skills and knowledge. The results indicate that high school teachers ranked anxiety over managing students' Internet use as the biggest problem. The reasons included some teachers' beliefs that students were more computer-literate than the teachers themselves, that students were unable to govern their own use-time in appropriate ways, and that students were unable to satisfactorily evaluate the information on the Internet. This finding reflects teachers' unease about new technology and is consistent with the findings of Iannotta (2001) and Wishart (2004).

All together, the TAIS researchers interviewed and surveyed more than 550 computer teachers, school counselors, and school administrators and asked them to prioritize their concerns. It was found that all the interviewees were concerned about communication safety, such as virus awareness; therefore, this issue was tackled in the TAIS project first. In addition, researchers identified different needs among teachers. For example, elementary school teachers worried most about the issue of students' proper use of computer equipment, since myopia is common among Taiwanese students and many teachers believe that long-term, extended computer use can be a major contributor to this problem. Middle and high school teachers were especially concerned about issues of decency and morality (e.g., obsession with online pornography) involving these teachers' male students and about the safety of interpersonal relationships involving the teachers' female students.

4.1.3. Macrocycle-level analysis and design adjustment

The above-mentioned teachers' entry knowledge and needs analysis shaped the succeeding steps in the development of the TAIS project. Reviewing individual teacher surveys and interviews, it was found that teachers themselves in general acknowledged the arrival of the Internet for education, recognized the differences between the teachers themselves and their students regarding digital literacy, and were concerned about the appropriateness of students' Internet behaviors. However, sporadic training programs for teachers seemed insufficient in the project's efforts to meet teachers' demands. In addition, the training programs available only for computer teachers seemed ineffective because these teachers did not consider that they were responsible for student-oriented guidance relative to some Internet safety areas (such as interpersonal safety and information-content safety). Therefore, the TAIS project needed to endow its training programs with greater efficiency and with larger scales for all teachers.

At this stage, the TAIS project collected only information on teachers' awareness and, therefore, lacked data on students' awareness, knowledge, and behaviors (see also Stahl & Fritz, 2002). Several questions exemplify this matter: what are middle school students' attitudes toward and knowledge about Internet communication safety? What do middle school students consider a “net-friend” and what are their online relationship experiences? Therefore, the TAIS researchers decided to collect more student-oriented information in order to establish effective evidence-based training programs for teachers.

4.1.4. Theory or policy building

In terms of local theory building, the TAIS researchers thus made an assertion that Internet safety awareness in the school context should be not only a responsibility or a job requirement of computer teachers, but indeed part and parcel of all teachers' concerns and routine practices. The TAIS researchers asserted that all teachers

should be equipped with appropriate knowledge, experience, and teaching materials. The alignment of governmental policy with implementing the TAIS project would help all teachers receive training opportunities that could enhance the teachers' computer/Internet skills, the teachers' knowledge of technology integration into curriculum, and the teachers' awareness and teaching of e-safety topics.

4.2. The second stage of the project (2003–2006)

4.2.1. Initial design

On the basis of the data collected and analyzed from the first stage, the TAIS project presented two major tasks re-engineered for the second stage: implementing more systematic training programs for all in-service teachers and developing more instructional units with which teachers could instruct their students about e-safety issues.

In order to develop more instructional units for teachers to use in their classroom, the TAIS researchers collected design guidelines from literature (e.g., Willard, 2002) and such similar projects as CyberSmart! and the Big6 (at www.big6.com, see also Eisenberg, Lowe and Spitzer, 2004). By the end of 2005, the researchers had developed 23 instructional units covering four core Internet safety areas. The instructional units were all placed on the eteacher site, so that this website served as a channel not only for strengthening teachers' awareness of Internet safety issues, but also for providing teachers with handy downloads of relevant materials for classroom use. The TAIS researchers tried to use a variety of media formats (Flash, slideshows and real-time videos) to present authentic real-world examples instead of textbook-like content. For example, Fig. 1 shows the Flash animation “Don's New Friends: A Computer and the Internet” for 3rd graders, and Fig. 2 shows the slideshow-format material “Nana's Net Friends” for middle school students. Teachers can easily use these materials to facilitate students' reflections on and discussion of these issues. For example, elementary school students can discuss their encounters with flu viruses in relation to computer viruses; middle school students can discuss news stories related to sexual harassment of net-friend dates; and high school students can debate the merits and drawbacks of blocking offensive content versus restricting the availability of desirable information.

For each piece of multimedia material, the eteacher website has featured related materials such as students' activity sheets, teacher guides, and supplementary materials. Teachers can easily download materials to use in their classrooms. Teachers are also encouraged to revise the materials to fit their students' needs. The eteacher website has collected related news stories and lists of related websites that teachers can use as helpful links. Resources such as related research reports or special clinics for young people and local guidance counselors are also mentioned on the site.

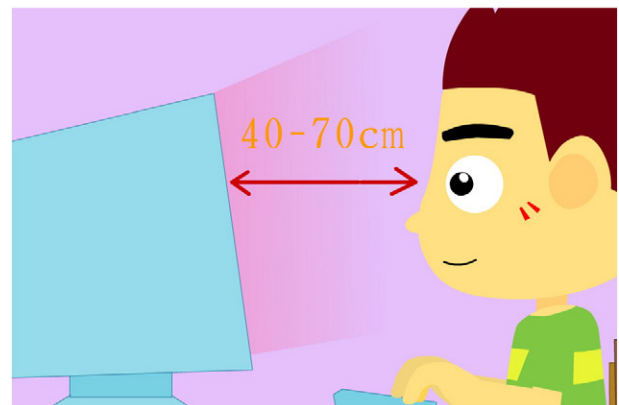


Fig. 1. Sample screen from Flash animation “Don's New Friends: Computers and the Internet” for instruction on general Internet safety and literacy.



Fig. 2. Sample screen from slideshow “Nana’s Net Friends” for instruction on interpersonal safety. Translation of the subtitle: “He wants a date...should I go?”.

The second major task at this stage was to conduct systematic training programs for all in-service teachers. As mentioned above, the TAIS training programs for only computer teachers in the first stage was not as effective as had been expected. Therefore, rather than holding four large-scale training programs in the north, middle, south, and east of Taiwan, the TAIS project held smaller-scale training sessions in 25 geographic areas throughout Taiwan; in this case, teachers could have better access to nearby sessions. By the end of 2006, more than 400,000 teachers had participated in these sessions (Yang, 2007), and this number constituted around 35% of all elementary and middle school teachers. Moreover, the TAIS project established workshops on special e-safety issues (e.g., anti-virus, anti-hacker, anti-phishing, and cyber-copyright issues) and offered them to more than 39,000 computer teachers and school-technology coordinators (Yang, 2007).

4.2.2. Data collection and analysis

While continuing to investigate in-service teachers' awareness of Internet safety, the second stage TAIS researchers analyzed students' Internet-related attitudes and behaviors, especially as the Web 2.0 concept and technologies emerged, through a series of region-wide stratified surveys and interviews over 4 years. For example, Chou and Peng (2007) surveyed 1067 Taiwan middle and high school students. The researchers found that 76.1% of students had used the Internet to communicate with their friends and 46.3% had done so to form completely new online friendships. It is worth noting that students generally had very positive attitudes regarding their online relationships. Some students had even gone beyond online interactions to meet their net friend in person, often without telling their parents or teachers in advance or afterward. The above-mentioned study also interviewed 21 computer teachers and student-affairs administrators and discovered their deep concerns about students' making net friends and meeting them in person. The teachers and the administrators thought that students are too naïve and not mature enough to deal with online relationships. On the basis of this study, the TAIS project developed more instructional units for the eteacher website regarding the safety of online relationship formation.

In a large-scale stratified-sampling survey study, Chou, Yu, Chen, and Wu (2009) used a 5-T framework (tool, toy, telephone, territory, or treasure of information) to investigate the attitudes of 2253 elementary school students toward the Internet. The results indicate that although these fifth-grade students considered the Internet a powerful *tool* for their academic work and life convenience, they also considered the Internet a *toy*: it would thus appear that the students identified no clear-cut difference between the Internet as a toy and

the Internet as a tool. In addition, the *territory* dimension, in which fifth graders could virtually voice, share, and present themselves, and record their daily lives, was the third most popular function of the Internet. Given the popularity of blogs since 2005, the TAIS researchers have suspected that children have had different perceptions of and attitudes toward the roles that the Internet has been playing in their lives, and that these differences could evolve into conflicts between the children and adults (namely, teachers and parents). In terms of the e-safety issue, the TAIS researchers were concerned about some children's over-involvement in some Internet activities (such as online games and instant messaging) and about the children's disclosure of personal-identity information (e.g., on blogs and social-network sites). As Sharples et al. (2009) mentioned, the advent of Web 2.0 ushered in an era in which schools began facing the central dilemma of addressing both students' Web 2.0 activities (to engage in productive and creative social learning) and e-safety issues (to avoid undue harm). TAIS researchers have shouldered the obligation of providing even more help to schools and teachers in dealing with this two-fold dilemma.

While collecting data on young people's Internet-related use, knowledge, and attitudes, TAIS researchers at this stage collected considerable data in the formative evaluations of eteachers' instructional units. The researchers hoped that these results could lead to improved designs of units in the future. The formative evaluation methods used in this effort comprised field tests of the units, observations of the classrooms, and interviews with teachers and students (Peterson, 2003). Based on the overall field evaluations pertaining to more than 1950 students in 69 classes in 25 schools for 23 units, the results indicate that high school students were highly attracted to situation dramas performed by real persons, such as the drama presented in Fig. 2. Some of the students explained their attraction by noting that they could personally relate to the stories. In contrast, most of the elementary school students were attracted to animation features such as those in Fig. 1. Rapid tempos and cute characters held the key to the presentations' popularity. More than 90% of the elementary school students agreed that pictures helped them understand the abstract concepts of e-safety. In general, students expressed positive attitudes toward the instructions and enjoyed the presentations and activities. For TAIS researchers, the most important finding was that, in questionnaires, over 80% of the students indicated that they had begun to consider Internet safety an important issue capable of affecting their lives greatly.

4.2.3. Macrocycle-level analysis and design adjustment

In this stage, the three major data collections were (1) students' e-safety-related attitudes and behaviors, (2) classroom observations on how teachers taught e-safety issues to their students, and (3) interviews with teachers. It seemed that the major emerging issue in terms of teacher awareness was the lack of teachers' personal e-safety experiences (and, therefore, the lack of their understanding of students' e-safety experiences). Some teachers in the interviews contended that they had not acquired sufficiently strong background knowledge or experience to teach the issues; for example, many teachers had never personally formed online relationships themselves. Such feedback helped the TAIS researchers consolidate the idea of creating learning communities in which teachers can share their personal and classroom experiences with peers. The concrete design adjustment was to set up chatrooms and forums on the eteacher website to help form teachers' e-safety learning communities in early 2006, corresponding to the arrival of the Web 2.0 age (see also Solomon & Schrum, 2007; Sharples et al., 2009).

From the regular classroom observations, the TAIS researchers concluded that teachers' attitudes toward the safety issue constituted a key factor in how the teachers taught the subject. That is, if teachers in general think that Internet safety is an important issue, then their students will also take this issue seriously, and vice versa. Therefore,

the TAIS project has started to apply more proactive approaches to the promotion of e-safety information and instructional units. For example, the eteacher website has sent monthly newsletters to teachers' mailboxes rather than wait for the teachers to visit the website.

The TAIS researchers found that school atmosphere and school administration, in addition to teachers' own attitudes and teaching practices, played an important role in school-based e-safety promotion. Since Taiwan society is relatively collective (see also Tuan, 2006), school teachers are more likely to follow accepted school practices and to heed the advice of school administration. Therefore, if a school principal could fully recognize the importance of e-safety and establish school-wide policies for safe, legal, and ethical use of digital information and technology, then teachers, as well as students, would be very likely to follow the corresponding guidelines. In order to promote and have administrators model e-safety in school environments, the TAIS project held 14 conferences in which 714 administrators from 325 schools participated over the course of 2006 (Yang, 2007).

When reviewing relevant practical and research tasks in the second stage, the TAIS researchers found that they had focused mainly on school environment, not on outside school contexts; namely, family and the home. Wishart (2004) had already noticed that, while the vast majority of British schools were teaching Internet safety, educators ran the risk of neglecting children's home use of the Internet for chatting and instant messaging—an environment that could be unfiltered and unsupervised by parents. Indeed, as more than three-quarters of the homes in Taiwan have access to the Internet (Taiwan Network Information Center, 2009), parents will need to take more responsibility to protect their children from being exploited online. There is a pronounced need in Taiwan for research on practices that increase parents' Internet literacy in terms of supervising and guiding their children to safe and appropriate uses of the Internet; as soon as researchers have identified and vetted these practices, information on them should be disseminated to parents across Taiwan (ref. Livingston, 2007; Ribble, 2009; Valcke et al., 2007).

4.2.4. Theory or policy building

The local theory at this stage was that e-safety promotion should include administrators within the school context and should address a wider technology-use environment, one that includes the family homestead, which lies outside school boundaries. Therefore, the aligning policy guiding the TAIS project postulated that parents should be involved in promoting the awareness of e-safety. The project scope of the next stage might feature better e-safety information and better e-safety support to families.

4.3. The third stage of the project (2007–2009)

4.3.1. Initial design

The initial design of the TAIS project at this stage has basically continued the two major tasks in the previous stages: teacher training programs and development of the eteacher website. The teacher training programs on e-safety now have come to be routine activities undertaken by local education authorities, but the TAIS project has continued to offer six large-scale training sessions per year and small-scale workshops touching on such special, emerging issues as cell-phone safety.

In the development of the eteacher website, new issues, such as cyberbullying (e.g., Hokoda, Lu, & Angeles, 2006; Wei, Jonson-Reid, & Tsao, 2007; Huang & Chou, 2010) have been incorporated into the website collection. In particular, the website has emphasized safety issues related to Web 2.0 tools, such as photo sharing and editing, video showcasing, blog creation, and social-network sites (Solomon & Schrum, 2007), which have somewhat confused teachers. As usual, the eteacher website has provided instructional multimedia materi-

als, the teachers' packages, and related links and information. At the end of 2009, the eteacher website presented 41 instructional units, covering four major core Internet safety areas and emerging issues. And the eteacher website currently aligns these instructional units with Taiwan educational technology standards so that teachers can easily locate and use the materials.

4.3.2. Data collection and analysis

As the TAIS project has completed its ninth year of operation, Hsu (2009) conducted a large-scale survey on teachers' self-evaluation of computer/Internet literacy. A total of 33,996 respondents contributed valid data, the number constituting 21.8% of Taiwan's total 155,637 elementary and middle school teachers. Among all valid respondents, 63.2% (21,494 teachers) have participated in information ethics, safety, and health-related training programs; 80.3% (27,304 teachers) believe themselves capable of teaching related topics to their students; and 43.5% (14,789 teachers) actually have used the instructional units provided by the eteacher website at least once in their classroom in the past 3 years.

Regarding the eteacher website in its third stage, the TAIS researchers have conducted summative evaluations to identify the extent to which teachers actually use the instructional units and to judge the worth of them. The TAIS project conducted three phases of summative evaluations. The first phase comprised a distribution of an online survey to those administrators and teachers who had participated in all the TAIS training workshops and conferences held from 2005 to 2007. The main inquiry of this phase centered on the question "Can the instructional units meet your needs?" According to the 755 returned surveys, 509 participants (67.41%) had used those units in their teaching practices, and 385 participants (50.99%) acknowledged frequent visits to the eteacher site. More than half of the participants were satisfied with the website's content (82.91%), function (77.09%), and instructional units (79.8%), and 493 participants (65.30%) agreed that these units were helpful in their teaching.

In the second phase, the TAIS researchers interviewed 92 teachers who had actually used the eteacher instructions in their classrooms. All the teachers expressed their appreciation of these free and easy-to-use materials. Some of the teachers had revised at least one worksheet to meet their own needs in specific teaching contexts while other teachers helped the TAIS researchers modify the existing materials. Most important, 82 teachers (89.13%) indicated that, since the classroom-based implementation of safety-related instructional material, they had increased their sensitiveness to related news stories and possible Internet safety cases involving their own students.

In the third phase, the TAIS researchers conducted in-depth interviews with the 18 teachers who were acting as cohort teachers and who had been using the materials for more than 5 years. The main focus of the interviews centered on whether students, after having received the Internet safety instructions, had changed their knowledge, attitudes, or behaviors regarding their Internet usage. In addition to agreeing that the implementation of the resources was both feasible and affordable, all of the cohort teachers observed that at least some, if not most, students exhibited positive changes in their attitudes and performance after the students had used the eteacher's instructional materials. For example, one teacher often heard his students warning each other not to be too close to the computer screens for fear of damaging their eyesight. Another example is of a computer teacher who was invited by his students to a net-friend meeting of "high school technophiles" in a neighborhood Internet café after school. "I was surprised and so happy to go," he said.

The results of the summative evaluations reveal that the teachers had positive perceptions of the safety instructions (presented through the eteacher website) in relation to content, design, congruency, and feasibility; in addition, the feedback from field teachers revealed agreement that the instructional units were valuable to the students.

Both the surveys by teachers participating in the training sessions and the interviews by cohort teachers validate the overall effectiveness and the feasibility of e-teacher's teaching materials. These reactions point to the effectiveness of and users' satisfaction with the TAIS project in general.

4.3.3. *Macrocycle-level analysis and design adjustment*

Reviewing all past teacher training programs, the researchers found that the TAIS project had held only face-to-face training sessions over the past 9 years (up to 2009). As more and more teachers acquire better Internet skills and fuller Internet experiences, teachers will be more and more likely to accept the proposition that online learning can be an effective and efficient approach to teacher training. In other words, online training programs could be one alternative format in which teachers can acquire and share their knowledge of e-safety issues. Therefore, at the end of 2009, experimental online courses on e-safety for teachers have been initiated in two geographical areas in Taiwan. Researchers are currently collecting and analyzing the data on evaluations of courses. If these courses achieve their intended goals and meet with users' (teachers') satisfaction, then similar online courses will become a regular practice in the remaining 23 geographical areas.

In response to the local theory (developed in the second stage) that parents—in cooperation with teachers—should be highly involved in Internet safety awareness, the TAIS project has considered whether it should broaden its services to parents directly, or embark on a brand new parallel parents-oriented project, amounting to a societal information campaign. The TAIS project, as its name suggests, is mainly for teachers, and e-safety-related teacher education is by no means complete; therefore, the scope of the TAIS project still focuses on teachers and on school contexts.

Nevertheless, in May 2007, the TAIS project published a 36-page pamphlet entitled "Knowing Your Child's World of the Internet: A Parents' Guide" (Chou, 2007). With a forward by Taiwan's Minister of Education, this pamphlet lists 22 of parents' most frequently asked questions such as "Should I put a computer in my son's room for him to study with?" "My daughter wants to meet her net friend; should I let her go?" and "What should I do if I find my son watching pornography online?" Later, the second edition was published (Chou, 2009) in which the first edition's questions made room for 12 more questions pertaining to such matters as cyberbullying and e-trade. Thus far, the TAIS project has scheduled for parents' pamphlets to be updated and published every 2 or 3 years until TAIS initiates a specific project for parents.

Because the TAIS project has focused only on in-service teachers, its scope has not covered pre-service teachers, that is, students in teacher education programs at the undergraduate and graduate levels. Indeed, Internet safety issues are clearly not limited to elementary and middle school students or their teachers. College students, whether they are pre-service teachers or not, are important components of Internet safety issues and are, therefore, worthy components of Internet safety research projects. Some professors and university-level student-affairs officers who attended TAIS workshops indicated in the interviews that they felt the need, but did not know how, to deliver those e-safety-issue messages to their charges. These faculty and staff argued that college students, in theory, are more mature than high school students but that the former may still be dangerously unaware of the Internet's darker sides despite spending generally more time online than high school students do. Therefore, college students are more likely to be exposed to inappropriate materials and hidden dangers. Although the e-teacher website and all of its safety materials are designed primarily for elementary and middle school teachers and their students, future research efforts and action plans on Internet safety awareness for teachers and students at the college level are warranted. For example, topics could include how to screen inappropriate content and monitor Internet use in

dormitory networks, how to design interesting and rich content, and how to integrate such content into existing required Basic Computer Concepts courses. In addition, a 2-credit-hour "Information Literacy and Ethics" course was developed by TAIS for all Taiwan college students.

4.3.4. *Theory or policy building*

The local theory on the promotion of both Internet safety and Internet literacy in schools thus far is that this promotion should involve all stakeholders inside and outside school. Therefore, governmental policy should require all public sectors—and should invite specific non-governmental organizations (NGOs)—to get involved in the campaign for e-safety. As the Byron Review Action Plan (Byron, 2008b) suggested, young peoples' e-safety should not be limited to within-school contexts: involvement should extend to a new council (or forum), better regulation, a "public information and awareness" campaign, and parents' support. At the end of 2009, the TAIS project reached the end of the third stage: a wide range of participants have played their individual roles in, and have taken their respective actions for, the promotion of e-safety. The TAIS project, as one of the participants, shall continue to perform its expected functions in teacher education.

5. Conclusions

5.1. *Reflections on the ten-year-old TAIS project*

Since 2000, when the TAIS project was initiated for elementary and middle school teachers, it has provided e-safety-related training programs and the e-teacher website, at which in-service teachers have familiarized themselves with e-safety issues and have collected related teaching materials for classroom instruction. The TAIS project has evolved from serving only computer teachers in the first stage, to all teachers and school administrators in the second stage, to some—but not all—parents in the third stage, and to college-level teachers and students, and pre-service teachers in the future. The teacher training programs offered by the TAIS project contain a variety of formats—training sessions, workshops, and conferences. In addition, the 24/7 e-teacher website has been up and running since 2001, constantly delivering e-safety information relative to school contexts, helping set up and maintain online teacher-learning communities, and providing instructional units that teachers can use in their classroom teaching. In this sense, the TAIS project in general and the e-teacher website in particular have, through teachers, also served elementary and middle school students.

The TAIS researchers have concluded that although many of Taiwan's teachers have not grown up with the Internet and lack younger generations' keen familiarity with it, all teachers have grown fully aware of not only the popular phenomenon among elementary and middle school students but also its powerful effects on students' social and psychological development. And indeed, teachers have developed serious reservations or concerns, though not necessarily fears, about their students' online safety, and many of these teachers have empowered themselves with a variety of training programs, website information, community practice, and teaching materials on e-safety. The TAIS project has performed its functions in support of these self-empowering endeavors by furnishing teachers with information, training, community, and instructional units over the past 10 years.

Definitely, the TAIS project has experienced some challenges over the past 10 years and expects to face some in the future. For example, in the first and early second stages, the budgets from the MOE and the National Science Council were on a yearly basis; therefore, the TAIS project office has expanded much effort in writing proposals, quarter-term reports, and final reports every year, and some of the training activities could only be implemented in a short timeframe.

Fortunately, in the later parts of the second stage and in the third stage, the TAIS project has been funded on a two-year or three-year basis. This greatly helps reduce the TAIS office's paper workload, the implementation complexity of TAIS projects, and TAIS personnel's uncertainty regarding these matters.

5.2. Reflections on the research methodology

As Barab (2006) stated, the goals of the DBR are to understand learning in complex environments, to engineer new learning environments, and to improve learning for participants in studies. In the TAIS project, researchers have tried to understand the processes by which teachers, in complex and evolving Internet environments, learn about Internet safety. Drawing on its newfound understanding of these processes, the project has built and will continue to build new learning environments online as well as offline. In addition, this project has improved the Internet safety grounding of the participating school teachers and their students in Taiwan. In terms of the research procedures of the current study, the TAIS project has dealt with a real-world learning environment where, of course, not all variables of concern have been known in advance: as would be expected, some emerged during the study. Therefore, the TAIS project has kept its research procedures flexible and allowed them to evolve during the project's course. Unlike traditional educational experiments, in which hypotheses are proposed and tested in isolation from participating individuals, DBR inserts itself in actual settings and amidst actual practices, emphasizing social interactions where collaboration and sharing take place among students, teachers, researchers, and education authorities. Finally, both the TAIS researchers and the participants have been active and influential in the design of the project.

However, the TAIS project based on the DBR method has some limitations, which need to be dealt with. For example, although DBR has been introduced as a research approach for a period of time (Design-based Research Collective, 2003), real large-scale exemplary projects based on DBR seem scarce. Therefore, the TAIS project has faced considerable methodological ambiguity and has lacked related empirical reports for reference. Nevertheless, the TAIS project has followed the DBR framework of Bannan-Ritland (2003) and the approach of Jonassen, Cermusca and Ionas (2007), in which a five-task structure has helped the TAIS researchers articulate both project scopes, progress and product. It is hoped that this article not only helps researchers structure similar large-scale, long-term projects, but also provides references for future DBR-based studies.

6. Future efforts and concluding remarks

At the end of 2009, the Taiwan Ministry of Education renewed the TAIS project for its fourth stage (2010–2012). Again, this stage will focus on students' as well as teachers' e-safety knowledge, attitudes, behaviors, teaching, and learning. The project's main tasks during the fourth stage includes a survey study of 50,000 students in grades 4–12 and at the college level, training programs for college-level teachers, more instructional units for college students, online training on teachers' integration of e-safety into various subject areas' teaching and learning, experimental workshops for parents, and the promotion of Internet-content classification systems.

In particular, the fourth stage will start to design instructional units for pre-service teachers, that is, units regarding the integration of e-safety issues into existing teacher education curricula. For example, required courses such as Instructional Media and Operations, Computers in Educations serve to teach pre-service student-teachers a variety of media- and computer-related concepts and skills, but do not contain any information on how to direct students' safe use of new technology. As college students are more and more technology savvy, these courses may strengthen digital generations' safe, legal,

and responsible use of digital information and technology, and these generations include pre-service teachers themselves and their future students. In addition, the eteacher website over the past 10 years has collected many examples of students' (in)appropriate uses of digital technology and many comprehensive instructional materials, and this collection can help pre-service teachers conduct their own case studies, micro-teaching, and so on.

From the perspective of research, future studies should continually update existing knowledge of Internet safety. Just as the concept "network" is evolving in ways that may signify a variety of technologies, so also the concepts of "Internet safety" (used in the first and second stages) and "e-safety" (used more prominently in the third stage) are evolving in ways that reclassify or introduce related concepts. For example, accessing Internet content and forming interpersonal relationship via students' mobile devices such as cell phones or PDAs presents a new safety concern. The TAIS researchers need to keep redefining and revisiting definitions of, aspects of, and teachers' and students' knowledge of and attitudes toward Internet safety. By doing so, educators can derive solid, evidence-based policies and can design student-oriented learning content and evaluation criteria for theoretical and empirical research results.

The TAIS project will continually explore more varieties of Internet safety learning content: for instance, Internet-trading safety, Internet addiction (see also Chou & Hsiao, 2000; Chou, Condron, & Belland, 2005), online games (see also Chou & Tsai, 2007), and safe use or safe creation of Internet materials (i.e., non-infringement of copyright laws; see also Chou, Chan, & Wu, 2007; Solomon & Schrum, 2007). Indeed, these four topics were mentioned by student-affairs officers and teachers. The project will, in addition, address learning units on critical thinking and verification skills as they apply to Internet content (see also Metzger, 2007). In the future, the eteacher website will feature a greater variety of formats, including comic strips, open-ended or multiple-ending slide shows, and role-playing games (see also Wishart, Oades, & Morris, 2007). The design will feature more learning activities that accompany the instructional materials, and these activities will include videoconferences with anti-virus experts, interviews with law-enforcement officers and judges, and role-playing where, for instance, a school principal responds to offensive school-wide chatroom postings. Owing to the availability of these varied Internet safety approaches, Taiwan school teachers will have a broader choice of instructional units in their classroom teaching. Further, the TAIS project would like to share its 10 years' worth of experiences, including all instructional units, with the greater Chinese community.

As it grows ever more dependent on the Internet, the society grows just as more concerned with the social costs, the social benefits, and the personal safety attached to Internet use, especially for young people. To help ensure that students use the Internet safely and wisely, educators need to give their charges proper guidance. The ten-year Teacher Awareness of Internet Safety Project in Taiwan presented in this article is an important first step toward addressing this need.

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