Millennial Generation Leads Changes in Higher Education

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Abstract: In this paper, we share the results of a study which analyzed how prepared the Millenial Generation (MG) of university students are for a technology-driven world in both Taiwan, R.O.C. and Texas, U.S.A. The Millennial Generation is defined to be those people who were born after 1980. To measure technological preparedness, we examined the MG's information and computer technology (ICT) literacy levels as well as their comfort levels with digital life environments (DLE). This comparative quantitative study analyzed data from students' self-report questionnaires from one state university in Texas and one national university in Taiwan. The questionnaire also included the college students' demographic information and their prior experience with computers. Findings show there is a positive correlation between the students' ICT literacy levels with: (a) working hours on computers to complete coursework, (b) technology expectations in higher education, and (c) comfort levels with DLE. As the "technologically comfortable" Millennial Generation enters college, there are an increasing number of institutions internationally utilizing commercial testing methods to determine students' competency levels (ETS, 2006; Messineo & Deollos, 2005; Pope, 2006; SkillCheck, 2006; Young, 2005). Based on the testing results, colleges have modified their basic computer courses from "required" to "developmental" courses (Pope, 2006; Rafaill & Peach, 2001; Young, 2005). Researchers have asserted that ICT literacy levels can be as important as competency levels in mathematics, writing, and reading in higher education (Young, 2005). Our study attempted to understand better how to address the needs of the MG students by analyzing both their perceptions of their ICT literacy levels and their comfort levels with DLE. The results of our study provide valuable information regarding how to best design the curriculum and instruction in higher education in order to prepare the MG for a technology-driven world.
Keywords: Millennial Generation, Information and Computer Technology, Higher Education, Computer Literacy Education, Digital Life Environment, Technology Skills.

In the past 25 years, college enrollment in the U.S.A. has grown from 8.6 million to 16.5 million, and it is predicted that enrollment in college will reach as high as 18.2 million in 2013 (US Government, 2005). According to the U.S. Census Bureau's report *School Enrollment-Social and Economic Characteristics of Students, October 2003*, the number of students under age 25 in the U.S.A. will increase markedly over the next decade as well (U.S. Census Bureau, 2006). With freshman enrollment in higher education steadily increasing, the Millennial Generation (MG) has become the majority population on campus (Howe & Strauss, 2003). The term, Millennial Generation (MG), was coined with Generation Y, Net Generation, and MTV Generation in 1993 and represents the generation born after 1982 (Life Course Associates, 2006).

In order to reach USA national education goals (*No Child Left Behind Act)*, university governing boards, such as the Texas Higher Education Coordination Board (THECB), have

initiated projects like *Closing the Gaps by 2015* to define the future direction of higher education (The Texas Higher Education Coordination Board [THECB], 2006). THECB's *Closing the Gaps* project is intended to: (a) increase participation in higher education and success rates as measured by graduation for all students; (b) increase educational excellence; and (c) guide funded research over the next 15 years. The International Society for Technology in Education (ISTE) and the National Educational Technology Standards (NETS) have similar goals toward which they provide resources to improve educational environments by advancing the effective use of technology for all students (ISTE, 2006). In addition, studies support the accepting of ICT literacy skills to be as important as competencies in mathematic, writing, and reading in higher education (Young, 2005).

At the same time, in Texas, the 79th Texas legislature is currently considering legislation limiting the number of hours undergraduate students can be required to take for a degree (120 semester hours). Through legislation, they are addressing the "Time-To-Degree" issue by offering "…incentives to encourage institutions to structure offerings in ways that students can take the classes they need…." (THECB, 2006). Because of the limitation in the number of required courses, concerns have been raised regarding what classes are vital for students to take and what are not. In some universities, computer literacy courses are a possible target for not being among the required courses.

The Need for Computer Literacy Courses in the USA and Taiwan

USA Studies

Even though the MG is familiar with surfing the web, chatting by instant messages, sharing web logs, and playing computer games, this group may not be developing the technological skills necessary for educational, vocational, and civic success in the 21st century (Kelly, 2006). In 1999, Georgetown College established the Information Technology Literacy Program which included entry level assessments (Rafill & Peach, 2001). Test results from these assessments were used as an advising tool to determine whether each student needed to take an introductory computer course to meet the proficiencies in the use of information-technology resources. A list of schools from 16 states in the U.S.A. participated in this technology assessment project including: Alabama, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Maine, Michigan, Minnesota, Missouri, New York, North Carolina, Pennsylvania, South Carolina, and Tennessee (2001). The results of the testing program conducted by the Information Technology Literacy Program in Georgetown College indicated that the initial information and technology proficiency passing rate was less than 50% (2001), thus there was a significant number of incoming students not technology proficient in 2001.

In 2005, Hardy conducted a study of Midwest students' technology skills. Findings from this study also indicated that the majority of students did not demonstrate mastery or proficiency on the overall computer/literacy skills assessment. This study demonstrated a need for computer concepts to be taught at the post-secondary level. Results from the Midwest study also indicated that there was no significant difference in students' knowledge of computer concepts with respect to their home state, number of high school courses taken, gender, or major field of study.

Asian Studies

To compare the technology usage in the USA with that of Asian countries, we selected Japan and *the East Asian Tigers* which are Hong Kong, Singapore, South Korea, and Taiwan to represent the Asian countries. These countries and territories are noted for maintaining high growth rates and rapid industrialization comparing with the rest of Asian countries (Grohol, 2006). The CIA (2006) reported the percentages for both internet users and mobile cellular users in Taiwan, Hong Kong, Japan, Singapore, South Korea, and the USA as shown in Table 1.

Table 1: *Percent of Communication Devices Used in Asian Countries and USA, 2003*

Country	Internet User Percentages	Mobile/cellular Phone Use Percentages
Japan	44.89	68.01
Hong Kong	46.57	104.97
Singapore	52.19	79.58
South Korea	11.12	74.90
Taiwan	60.28	109.59
USA	53.76	53.67

Interestingly enough, even with Taiwan's high computer usage, Taiwan universities still require the introductory computer course as a core course for the non-engineering/technology programs. The question "Why are basic computer courses in the U.S.A. being cut from degree programs when in Taiwan they are being required?" lead us to further investigate the needs and expectations of students in both universities.

Purpose of the Study

The purpose of this study was to study the Millennial Generation's (a) ICT literacy levels, (b) comfort levels in digital life environment (DLE), and (c) technology expectations for higher education as before they take the introductory computer course from both selected universities in Texas and Taiwan.

The majority of the general population perceives the MG as a computer wizard generation. Not only do public opinions indicate such, but also according to Sanchez (2003), the MG even overstated its computer skills. In reality, this generation faces a certain degree of difficulties in their academic areas due to the assumption of high computer competency from the public and faculties (Sanchez, 2003). Gaps exist among different ethnicities and races in terms of computer literacy skills and usage. Based on the ethnicity data from the U.S. Census Bureau report (2003), *Presence of a Computer and the Internet for Households, October 2003*, there is a significant gap in the use of technology between the minority and Non-Hispanic White populations in the U.S. (U.S. Census Bureau, 2006). Even in the U.S., the Asian population experiences the highest rate of technology use, and the Hispanic population experiences the lowest rate.

Research Questions

The research questions guiding this study were:

1. To what degree is there a correlation between the Millennial Generation's demographic information and computer technology literacy levels before an introductory computer course was taken?

2. To what degree is there a correlation between the Millennial Generation's demographic information and their comfort levels with DLE before an introductory computer course was taken?
3. To what degree is there a correlation between the Millennial Generation's information and computer technology literacy levels and their technology expectations in higher education?

Population of the Study

The Millennial Generation

The members of the MG are considered to be those born after 1980 (Carlson, 2005; Howe & Strauss, 2003; Lowery, 2001; Sanchez, 2003; Taylor, 2005). Howe and Strauss (2003) stated that the MGs appreciate the college learning as a lifelong experience more than as a cash value element. They are prepared to lay the foundation for something that may come later in their life (Lowery, 2001). Since multimedia technologies have become a main part of the MG's daily lives, this young generation is becoming a multimedia-dependent society (Oblinger, 2003; Picciano, 2006). Consequently, the MG has already been defined by academians, trend spotters, and futurists as *smart* but *impatient* (Carlson, 2005).

Selected Universities

To study the MG university students' computer use and skills, we selected one state university in Texas and one national university in Taiwan and analyzed both their information and computer technology (ICT) literacy levels and their comfort levels with digital life environment (DLE). The universities in Texas and Taiwan were selected for their diverse population, size, and suburban-rural setting. These two selected universities are both situated in the southeastern rural area of their country. The university funding system for both universities is based on governmental budgets and research funds. The universities' mission is also similar for engaging the students in the work of life itself and instilling in the students professional expertise, humanistic concerns, and scientific competence. These two universities offer the academic programs of art and science, business administration, education, and humanities and social sciences. Master and doctoral programs are offered at both universities.

The total student enrollment in the spring semester, 2006 was approximately 5,600 from the selected university in Taiwan and 15,300 from the selected universities in Texas. Students enrolled in basic (introductory) level computer literacy courses at each of these universities and colleges participated in the study shown that there were approximately 350 students enrolled in an introductory computer course from the selected university in Taiwan and 1,100 students enrolled in an introductory computer course from the selected university in Texas. Data was collected from 324 surveys, which was 92.6 percent of the purposeful sample from Taiwan. For the Texas population, we analyzed 586 surveys which were 53.3 percent of the purposeful sample from Texas. By selecting this purposeful sample, we were able to analyze the MG students' demographic information, their prior experiences with computers, the MG's ICT literacy levels of knowledge in specific skill areas, and their comfort levels with the DLE by sub-categories.

Background Information

Information and Computer Technology Literacy Levels

NETS for students states the basic operations and concepts of computer literacy are (a) the students demonstrate a sound understanding of the nature and operation of technology systems, and (b) the students are proficient in the use of technology (ISTE, 2006). Carbonara (2005) stated "To succeed in today's higher education and workforce environments, one cannot rely solely on either technological or information literacy skills. The two are complementary, and they must be interlocked to provide a complete inventory of needed skills and knowledge" (p. 65). Tomei (2005) defined literacy as "the minimum degree of competency expected of teachers and students with respect to technology, computers, educational programs, office productivity software, the Internet, and their synergistic effectiveness as a learning strategy" (p. 91).
Implicitly, the vital stage of a successful college life is to promote the students' computer literacy levels. Some general trends are emerging on the MG views technology. Messineo and DeOllos (2005) revealed that students view their computer competence differently depending on whether they are using the technology for personal or course-related tasks. Their findings suggested that faculty members may make false assumptions about students' abilities and the faculty members may jeopardize student success. Messineo and DeOllos' study illustrated that although the students have some computer skills, the students' confidence does not extend far into advanced information technology applications. Additionally, as more children grow up with computers in their homes, teachers spend less time teaching students about computers. Yet, for the time being, many students still come to school without basic computer skills (Thorsen, 2006).

Kvavik (2005) found that academic technology usage is strongly related to the student's academic major and student's senior or freshman class status. The curriculum's technology requirements are major motivators for students to learn the specialized software. The interviews Kvavik conducted with the groups of MG indicated that students are skilled with basic office suite applications but tend to know just enough technology functionality to accomplish their work; they have less in-depth application knowledge or problem solving skills.

Literacy requires students demonstrate knowledge and skill in the use of computers and other technologies as they apply to the classroom. There are certain skills that many agree from essential prerequisite knowledge that will help students learn faster and better using technology-supported lessons:

1. Hardware: knowing the terminologies for different parts of a computer (Thorsen, 2006; Tomei, 2005).
2. Operating System: understanding operating system with commands and interfaces (Tomei, 2005).
3. Troubleshoots: knowing some basic troubleshooting techniques when a computer system or one of its peripherals does not work (Carbonara, 2005; Thorsen, 2006).
4. Input devices: using mouse, keyboard, remote control (Tomei, 2005).5. Output devices: using diskettes and printers (Tomei, 2005).
6. Internet browsers: accessing and accumulating educational materials (Carbonara, 2005; Rafaill, 2001; Tomei, 2005).
7. E-mail: sending and receiving mails and attachments (Carbonara, 2005; Rafaill, 2001; Thorsen, 2006).
8. Software: knowing the software fundamental tools (Carbonara, 2005; Hefzallah, 2004; Thorsen, 2006; Tomei, 2005).

9. Word processing: knowing basic skills in those areas can help the user develop written documents including visual diagrams and charts, and cutting and pasting (Hefzallah, 2004; Rafaill, 2001; Tomei, 2005).
10. Presentation: linking to images and multimedia designs (Rafaill, 2001; Thorsen, 2006; Tomei, 2005).
11. Spreadsheets: writing formulas in worksheets (Hefzallah, 2004; Rafaill, 2001; Thorsen, 2006).
12. Graphic software: knowing basic graphic programs (Hefzallah, 2004; Tomei, 2005).
13. Databases: knowing how to sort and query the data (Carbonara, 2005; Rafaill, 2001; Thorsen, 2006).
14. File management: organizing the computer file system (Rafaill, 2001; Thorsen, 2006; Tomei, 2005).

As the millennial generation is categorized as "technological comfortable" and prepared to enter college, there are an increasing number of institutions internationally utilizing the commercial automation of ICT testing methods to determine the students' competency levels (ETS, 2006; Messineo & Deollos, 2005; Pope, 2006; SkillCheck, 2006; Young, 2005). Based on ICT testing results, colleges have modified their basic computer course from a required course to a developmental course (Pope, 2006; Rafaill & Peach, 2001; Young, 2005).

Digital Life Environment

Carlson (2005) observed that the MG carries an arsenal of electronic devices – the more portable the better. They are able to juggle a conversation on Instant Messenger, a Web-surfing session, and an iTunes play list at the same time. The new media/telecommunication/computer technology has been introduced to society as the "digital life style/ digital work style" (Gates, 2006). It is an intellectual environment in which media items present themselves simultaneously to young consumers as totally individualized experiences and as pathways into a community of individuals sharing the same experiences, interests, and worldviews (Gura & Percy, 2005).

Introductory computer courses in Taiwan

The mission of Taiwanese education is to cultivate citizens with higher competitiveness (Ministry of Education, R.O.C. [MOE], 2006). It is a tradition in Taiwan that society and families place an extreme amount of importance on education. Since the 1980s, Ministry of Education, R.O.C. (MOE) was the main central government to establish educational policy. Thus, common social members had very little to do with the process of planning on the educational system. In 1994, "the Alliance for the Education Reform Movement" was established by the common people (MOE, 2006). This movement pushed for the concepts of education modernization and helped forge a consensus for education reform among the general public. In September, 2003, MOE held "the National Conference on the Development of Education" and provided the guidelines and directions for future education policy and planning in Taiwan. Figure 1 shows the existing educational structure in Taiwan and the levels at which local governments are correlating the reform process to extend their services (MOE, 2006). There are two secondary education systems in Taiwan: one is a vocational high school system and the other is a general high school system. The vocational high school system is designed to align with vocational colleges. The general high school system is designed to align with universities and does not include the computer literacy course (MOE, 2006).

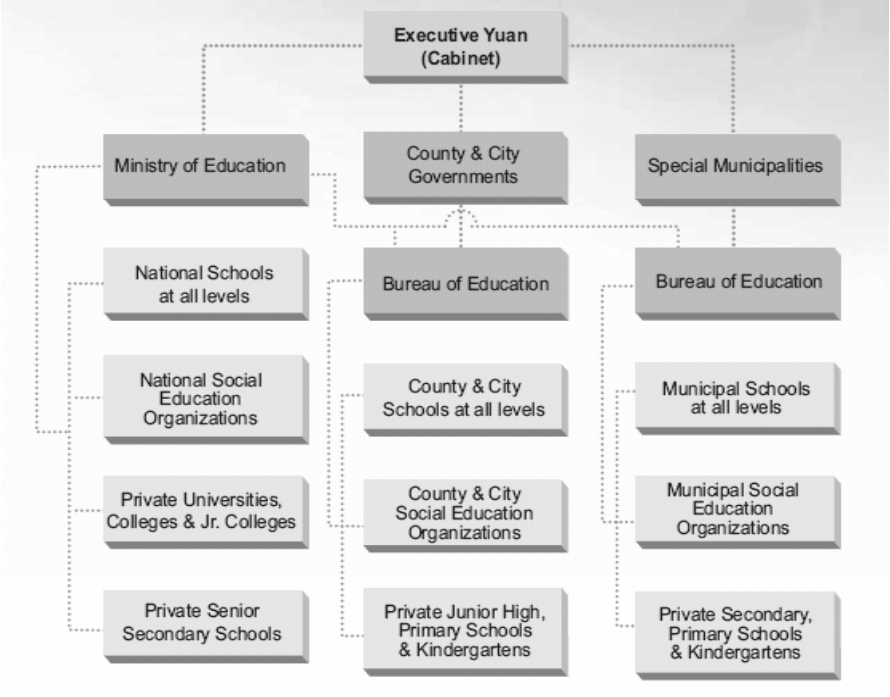

Figure 1: *Educational System in Taiwan, ROC, 2005*.
Note. From *MOE,* 2006. Copyright 2006 by MOE.
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Competency in technology is a primary goal for the MOE in order to promote students' success in life. Since the early 2000s, the Ministries of Education of Taiwan and Japan require their colleges and universities to provide a basic computer education for undergraduate students in general to make up the deficiency of computer literacy education (MEXT, 2006; MOE, 2006). In Taiwan, the introductory computer literacy course is a required class for any non-engineering/ technology undergraduate program. The introductory computer courses provide format, guidelines, and parameters which enhance the MG's comfort levels with their DLE.

Introductory computer courses in Texas

In the USA, higher education institutions have the authority to individually design their own programs to fulfill the students' needs in ICT literacy levels. The institutions may adopt an assessment tools to test the students' computer levels and then offer a developmental computer course to overcome the computer literacy deficiency or place the students in a required introductory computer course (ISTE, 2006; Rafaill, 2001; THECB, 2006). The NETS Standards for Students (NETS*S) and the NETS Standards for Teachers (NETS*T) offer broad categories of foundation skills entitled "Basic Technology Operations and Concepts" and "Technology Operations and Concepts" which closely parallel the tasks set for students and teachers operating at the "literacy level" of the taxonomy (ISTE, 2006). At the state level, 49 of the 51 states have adopted, adapted, aligned with, or referenced at least one set of standards in their state technology plans, certifications, licensures, curriculum plans, assessment plans, or other official state documents (ISTE, 2006). The state of Texas adopted the NETS*T and referenced the NETS*S for administrators as well.

One of the top issues for the 79th Texas legislature is to promote the Advanced Technology Program and "increase funding levels for the first time since 1987 from $19.4 million to $40.6 million per biennium to support technology research" (THECB, 2006). ISTE (2006) provided leadership and service to improve teaching and learning by advancing the effective use of technology in education to promote students' technological competencies towards technology standards. Since the *No Child Left Behind Act* of 2001 was established and the project of Closing the Gaps by 2015 was organized in higher education systems, advancements in technology have made it possible for teachers and students to develop elaborate multimedia programs in the classroom (Essex, 2006; & THECB, 2006). Funding and policies are offered for the educational institutions to close the educational gaps by providing students with a variety of ways to express themselves through a varied types of media such as text, audio, video, graphics, animation, and sound in both linear and nonlinear formats.

Methodology

We distributed a self-report questionnaire to the students who are members of the MG and who were enrolled in an introductory computer course from both selected universities in Taiwan and Texas. The Statistical Package for the Social Sciences (SPSS) version 14.0 was utilized to analyze the independent and dependent variances.

To discover differences, relationships, and effects between the two selected universities, the statistical power analysis was utilized for studying the likelihood of MG's ICT literacy levels and comfort levels with DLE between these two universities. Cohen (1988) stated that the larger the sample size, the smaller the error and the greater the reliability or precision of the results. The total usable sample for this study was 910 which strengthened the reliability of our results.

Instrumentation

This quantitative research method was designed to collect data from the MG computer users. The self-report questionnaire addressed the following three areas; (a) the MG's demographic information and prior experiences with computers, (b) the MG's comfort levels with the DLE by sub-categories, and (c) the MG's ICT literacy levels of knowledge in specific skill areas.

Since Chinese is one of our authors' native languages. We did not need to depend on a translator to convert this research questionnaire from English to Chinese. Hua stated (2006) that in China, Singapore and Malaysia, people use simplified characters; and in Taiwan, Hong Kong, and Chinatowns around the globe, traditional characters are most commonly used. We used a traditional form of Chinese for the language of the survey used in Taiwan. To prevent the language bias and misuse of technological terms, the faculties of the Division of Student Life Services from the selected university in Taiwan authenticated this Chinese questionnaire version.

To investigate the MG's background information, the questionnaire collected information regarding demographics and experiences with computers. The demographic information included:

(a) year of birth,
(b) student classification,
(c) college major,
(d) gender, and
(e) ethnicity

Questions regarding computer experience included:

(a) experiences with multimedia classroom environments,
(b) communication methods preference,
(c) hours working with computers for coursework,
(d) grade point average in coursework, and
(e) ownership of digital devices.

To study the MG's comfort levels with the DLE by sub-categories, the questionnaire was constructed using a Likert scale of 1 to 5 using the following measures: "Strongly Disagree", "Minor Disagree", "Neutral" , "Minor Agree", and "Strongly Agree". The nine sub-categories in this section included questions related to the student's beliefs regarding:

(a) how multimedia technologies enhance students' learning,
(b) how web enhancement programs improve students' learning experience,
(c) how web enhancement programs should be integrated into the course,
(d) the degree to which technology should be implemented in classes,
(e) how on campus technology impacts the students' life,
(f) the degree to which required computer literacy courses are valuable,
(g) the degree to which technology implementation at the university influences the decision to graduate,
(h) their willingness to take online courses, and
(i) their comfort level working with computer applications.

To evaluate the MG's ICT literacy levels of knowledge in specific skill areas, the questionnaire was constructed using a Likert scale of 1 to 5 which measures the skill areas from "No Knowledge", "Basic", "Average", "Advanced", to the "Expert" level. Overall, there were 55 survey items included for the 13 specific skill areas. The 13 skill areas included:

(a) computer hardware including hardware components, *CPU* process, input and output devices, and memory;
(b) computer software including network, *BIOS* boot process, and operating concept;
(c) file management including explorer, organization, desktop, and screen shots;
(d) *Microsoft Word* including alignment, font, format, page setup, insert, WordArt, and web page;
(e) *Microsoft Excel* including formula, chart, fill handle, function, merge cell, and organization;
(f) *Microsoft Access* including database design, calculation, sort, link, query, report, and import data;
(g) *Microsoft PowerPoint* including design, bullet, border, table, slide master, import data, slide view, and animation;
(h) web design including *Microsoft FrontPage*, html, and link;
(i) internet browsers including browsers, search engines, and save data;
(j) email including attachments, global emails, and save emails;
(k) *CD* burners including data, and music file;
(l) file transfer applications including *FTP*, and *WinZip* applications; and
(m) multimedia editing software including web design, audio, movie, and graphic software.

Reliability

Utilizing the self-report measure, this study provided an analysis of the MG's ICT literacy levels and their comfort levels with their DLE before the MGs complete their introductory computer literacy course from the selected universities. Specifically, we were able to obtain comparative result between the two selected universities from Taiwan and Texas. "A self-report measure is a paper-and-pencil instrument whose items yield numerical scores from which inferences can be made about how individuals differ on various aspects of self" (Gall, Gall, and Borg, 2003, p. 189). An analysis of variance was used to analyze the data in order to assess the effect of each measurement error source and their interactions. Also, to ensure the internal consistency, the Cronbach's alpha test was utilized to determine the degree of coefficient level for each individual item.

Validity

In designing the instrument for this study, we relied on both our own knowledge and experience in technology and computer science and those of experts in the field. To enhance the validity of this study, the self-report questionnaire was reviewed and edited by colleagues and chair-persons in the Department of Computer Science as well as the Director of Educational Leadership and Counseling. The authors have over fifteen years of experience in each of their fields. The computer science colleagues and the department chair of computer science worked closely to provide guidelines of teaching objectives for the introductory computer literacy courses. Merging the guidelines with the context of CTL from the literature reviews, the instrument content might be able to provide a deeper view from the individuals.

Data Collection

At the beginning of spring semester, 2006, the students voluntarily completed a hard copy form of instrument. The faculty of the Computer Science Department from the university in Texas distributed and collected the questionnaires. The faculty of the Division of Student Life Services from the university in Taiwan distributed, collected, and mailed the questionnaires back to us.

Data Analysis

In the subsequent sections, the Statistical Package for the Social Sciences (SPSS) version 14.0 was utilized to analyze this study. We reviewed the normality tests to determine whether this sample data were normal or not. Then we tested and reviewed the variance of each variable to investigate the stableness at all levels of the variances. For interval data and independence assumption, the categories and specific skill areas were measured more than one experimental condition. We reviewed the critical value of F ratio to determine the difference between the variances. By using multivariate analysis of variance (MANOVA), the statistically significant differences in between the independent and dependent variances were analyzed. To examine the reliability of MANOVA, we used analysis of variance (ANOVA) and independent t test to confirm the findings.

We also compared the correlations between the variances at an alpha of 0.05. To ensure internal consistency, we determined the effect size (ES) to the following standards. The ES can be measured as the standardized difference between two means (Cohen, 1988). Or the ES can be measured as the correlation between the independent variable classification and the individual scores on the dependent variable (Rosenthal & Rosnow, 2000). To prevent the future difficulties

from occurring, the effect size measures for two independent groups and in analysis of dependent variances were analyzed as well. We examined *F* ratio, *M*ANOVA, and Bivariate Correlation for each of our research questions.

Findings

Research Question 1. To what degree is there a correlation between the Millennial Generation's demographic information and their computer technology literacy levels before an introductory computer course was taken?

As Table 2 shown, we found there is a statistically significant positive correlation between the MG's ICT literacy levels with (a) their preferences of using email to communicate with professors, (b) the hours working on coursework with computers, and (c) the ownerships of having digital devices from the selected university in USA. We also found there is a statistically significant positive correlation between the MG's ICT literacy levels with the hours working on coursework with computers from the selected university in Taiwan.

Table 2: *Correlation between the MG's demographic information and their ICT literacy levels*

Demographic	N	Pearson Correlation	Pearson Significant	Spearman's rho	Spearman's rho Significant	Groups
Email	586	.070	.091	.102	.014	Texas
Working hours	586	.192	.000	.180	.000	Texas
Digital devices	586	.202	.000	.213	.000	Texas
Working hours	324	.309	.000	.276	.000	Taiwan

Using independent *t* test, the results showed that the selected university in Taiwan, the female MGs have a significant higher ICT literacy levels than the male MGs' ICT literacy levels (F=10.866, t<0.001). We also compared the MGs' ICT literacy levels for both universities and found that MGs from the selected university in Texas evaluated themselves with a higher level than MGs from the selected university in Taiwan for all of the ICT items, excepted FTP item. Four applications showed a significant different in MGs' ICT literacy levels: Word, Excel, Access, and Multi-media applications.

Research Question 2. To what degree is there a correlation between the Millennial Generation's demographic information and their comfort levels with DLE before an introductory computer course was taken?

We found a very different pattern of correlations for these two countries as showed in Table 3. In Texas, the selected university showed that there is a statistically significant positive correlation between the MGs' demographic information and their comfort levels with DLE in the following areas:

1. Ownership of digital devices as it relates to belief in the web-enhancement integration into the courses
2. Working hours on the coursework with computer as it relates to preference to graduating from the university that implemented more technology
3. Preferring sending emails to communicate with professors as it relates to willingness to take online courses

4. Preferring sending emails to communicate with professors as it relates to comfort levels working with digital life computer applications

Table 3: *Correlation between the MG's demographic information and their comfort levels with digital life environment from the selected university in Texas*

Demographic Information and Comfort level	N	Pearson	Pearson Significant	Spearman's rho	Spearman's Significant
Digital Devices and Web-enhancement	586	.080	.052	.087	.036
Working Hours and Technology in the University	586	.103	.013	.117	.005
Emails and Online Courses	586	.113	.006	.138	.001
Emails and Digital Life Environments	586	.144	.000	.163	.000

In Taiwan, the selected university showed there is a statistically significant positive correlation between the following areas:

1. Web-enhance program experiences in university as they relate to multi-media technology enhance their learning
2. Ownership of digital devices as it relates to graduating from the university that implemented more technology
3. Ownership of digital devices as it relates to willingness to take online courses
4. Preference for using the phone to communicate with professors as it relates to online courses

Table 4: *Correlation between the MG's demographic information and their comfort levels with digital life environment from the selected university in Taiwan*

Demographic and Comfort Level	N	Pearson	Pearson Significant	Spearman's rho	Spearman's Significant
Web-enhance program Experiences and Multi-media learning	324	-.175	.002	-.229	.000
Digital devices and College decision	324	.175	.002	.141	.011
Digital devices and Online courses	324	.186	.001	.160	.004
Phone and Online courses	324	.185	.001	.179	.001

Using ANOVA and an independent *t* test for the MGs in the selected university in Taiwan, we found there is a statistically significant different between (a) the MGs' birth year and the levels of believing that multi-media technology will enhance learning; and (b) the gender and their comfort levels working with digital life environments regarding computer applications. The results showed that the older groups of MGs have a significant higher belief that multi-media technology will enhance learning (f=3.962, t=0.020). We also found that the female groups have significantly higher comfort levels working with digital life computer applications than the male groups have (f=7.828, t=0.008).

Research Question 3. To what degree is there a correlation between the Millennial Generation's information and computer technology literacy levels and their technology expectations in higher education?

Analyzing the data from both selected universities, we found there is a significant positive pattern between the MGs' ICT literacy levels and their technology expectations in higher education. We found that the higher ICT literacy levels at which the MGs evaluated themselves, the higher technological expectations they have as shown in Table 5 and Table 6 below.

1. MGs believe multi-media technology will enhance learning.
2. MGs believe the use of web-enhancement program improve their learning experience.
3. MGs expect technology to be implemented in the classes.
4. MGs believe technology campus support impacts their student life.
5. MGs feel that the web–enhancement program should be well-integrated into the courses.
6. MGs agree that the degree to which technology is implemented in a university influences their decision to graduate at the selected university.
7. MGs are willing to take online courses.

Contrarily, the correlations between the MGs' ICT literacy levels and their belief that the introductory computer course is valuable for their academic performance were different for the two university groups of MGs. The MGs in the selected university in Taiwan had a significant positive correlation (p=0.141, *rho*=0.195, t<0.001). The MGs in the selected university in Texas showed a negative correlation (p=-0.009, *rho*=0.002, t>0.05), although the correlation is not statistically significant.

Table 6: *Correlation between the MG's ICT literacy levels and their technology expectation from the selected university in Texas*

Technology Expectation	N	Pearson	Pearson Significant	Spearman's rho	Spearman's Significant
Multi-media technology	586	.211	.000	.202	.000
Learning & Web-enhancement	586	.186	.000	.179	.000
Technology implemented	586	.217	.000	.197	.000
Technology support	586	.146	.000	.120	.000
Integrated Web-enhancement	586	.176	.000	.170	.000
College decision & Technology	586	.072	.083	.045	.282
Online Courses	586	.162	.000	.161	.000

Table 6: *Correlation between the MG's ICT literacy levels and their technology expectation from the selected university in Taiwan*

Technology Expectation	N	Pearson	Pearson Significant	Spearman's rho	Spearman's Significant
Multi-media technology	324	.191	.001	.224	.000
Learning & Web-enhancement	324	.203	.000	.201	.000
Technology implemented	324	.317	.000	.313	.000
Technology support	324	.141	.011	.156	.005
Integrated Web-enhancement	324	.172	.002	.167	.003
College decision & Technology	324	.281	.000	.295	.000
Online Courses	324	.242	.000	.229	.000

Comparing the MGs from both universities, we found that the MGs from the selected university in Taiwan have a significantly lower technology expectation than the MGs from the selected university in Texas for the following four areas:

1. Believing multi-media technology will enhance learning
2. Believing the use of web-enhancement program improve their learning experience
3. Believing technology supports impact their student life.
4. Believing that the web–enhancement program should be well-integrated into the courses.

We found that MGs from the selected university in Taiwan have a significant higher technology expectation than the MGs from the selected university in Texas in the following two areas:

1. Agreeing that technology implementing in university influences their decision to graduate at the selected university.
2. Feeling comfortable working with digital life computer applications.

Implementation

The results shows a consistent and positive correlation among the MGs' ICT literacy levels, their comfort levels with DLE, and their technology expectations in higher education regardless of the cultural differences. The CIA (2006) report that the percentages for mobile cellular users in Taiwan was 109.59% and in the USA was 53.67% well supported the different technological perspectives in both countries. The MGs in Taiwan prefer to communicate with professors by phone and the MGs in Texas prefer to do so by sending emails. We also found that the MGs in Taiwan are more comfortable working with digital life computer applications; even though their ICT literacy levels are lower than the MGs in Texas. Whether these groups overstate or understate their ICT literacy levels cannot be answered from this study; but the patterns did show a positive correlation between their ICT literacy levels and how they value the introductory computer course in Taiwan. To further study the impact of introductory computer courses, we recommend that an identical follow-up survey be given at the end of the introductory computer

course to determine how helpful the courses are in promoting the success of the MGs student life. We also suggest that a future study may consider evaluating the students with a research-based ICT test program to measure their ICT literacy levels for placement in courses and designing or modifying curriculum.

Conclusion: Where are we headed?

To live in the digital environment, there is an obvious need for computer literacy and technology skills and knowledge in schools, the workforce, and society. Bill Gates, Microsoft chairman and chief software architect, shared his view of the digital future at the 2006 Consumer Electronics Show. He thinks that consumers will be able to track their family, news, and business projects seamlessly as they move between home and the workplace (Gates, 2006). While studies have called for computer skills acquisition and development, some educational programs have a clearer and better-developed vision than others of what those skills are and how they may be introduced and cultivated. The growing emphasis on computer skills is an indication that what began as a fundamentally technology-oriented discipline is evolving into a technology-based profession (Carbonara, 2005).

Today, colleges and universities have made major investments in technology and are still exploring and creating ways of applying technology's potential to improve learning outcomes. More institutions will collaborate in the development of technology in order to increase the quality and affordability of services for students who expect easy access to all services all the time (Komives, Woodard, & Associates, 2003). For example, whether the ICT literacy levels differ from the MG in Taiwan and in the USA should be investigated because an introductory computer course may be a vital tool for the institutions to closing the technological gaps between student groups.

To reach the goals of *Closing the Gaps by 2015* in Texas, higher education institutions currently have the resources to find the balance between the relationships of the students' ICT literacy levels, the students' DLE, and their expectation for the curricula designs, if they act in a timely manner. Studies supporting the need for introductory computer courses in higher education should be a "wake up call" for universities.

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