

*Full Length Research Paper*

# The digital divide in Taiwanese unemployed adult population

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**The digital divide refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to their opportunities to access information and communication technology (ICT) and their use of the Internet. On-line learning is an Internet-based technology that provides people with unprecedented opportunities to learn anytime and anywhere in their own environment using ICT. It can be regarded as a way to bridge the digital gap among individuals. This study focuses on unemployed adult population to explore the socio-demographics of the digital divide in Taiwan. Through the empirical study, we can identify certain on-line learning characteristics of the specific user groups, and also can understand their affective and behavioral scales concerning computer attitudes and computer anxiety with respect to individual differences in gender, age, and educational level.**

**Key words:** On-line learning, digital divide, computer attitude, computer anxiety, unemployed adult population.

## INTRODUCTION

During the past decades, computer use at work has increased dramatically. Knowing and understanding computers and their applications is essential today for everyone. However, many users do not appreciate computers to be efficient and useful tools since use of computers requires a certain degree of individual technical skill. This situation can be coined as “the digital divide” describing that the advances of computers and other technologies are not equally accessible and usable to all users (Chalmers, 2003; van Dijk, 2006). The digital divide is one of the ways in which inequality is measured in a knowledge society. According to the Organization for Economic Co-operation and Development (OECD, 2001), the term “digital divide” refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to their opportunities to access information and communication technology (ICT) and their use of the Internet. Countries (the international digital divide) and the groups

within countries (the domestic digital divide) are often the subjects that researchers use to make comparisons (Broos and Roe, 2006; Quibria et al., 2003; Schleife, 2010; Tien and Fu, 2008; Vicente and López, 2006; Waycott et al., 2010). The study of the digital divide remains a contentious issue not only in academic research but also in politics, economics, and education.

Although the digital divide has spawned a growing number of empirical investigations, there is still little agreement among researchers on how to measure it. Academically, there are three dimensions of the digital divide—ICT access, ICT usage, and ICT applications (Attewell, 2001). Earlier digital divide research normally laid stress on physical access. However, since the year 2002, an increasing number of researchers suggest to go ‘beyond access’ and pay more attention to social, psychological and cultural backgrounds (van Dijk, 2006). Research has found that the users’ affective and behavioral scales correlate closely with their physical access. The digital divide has spawned a growing number of empirical investigations. Most research on the digital divide has focused on its socio-demographic correlates and users’ differential access to ICT. Results indicated that age, gender, and education, in particular,

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are major factors structuring the digital divide (Broos and Roe, 2006). Some earlier research pointed out that gender may be particularly salient to technophobia since computing is perceived as a "masculine" activity (Collis, 1985; Wilder et al., 1985). Numerous studies have indicated gender differences in computer work, whereby males have greater level of computer self-efficacy, hold more positive attitudes and develop less anxiety than females do (Broos, 2005; Chou, 2001; Losh, 2004; Zhang, 2005).

However, a different or converse finding about gender differences in computer work has also been evidenced in the literature (Dickhäuser and Stiensmeier-Pelster, 2002; Torkzadeh et al., 1999; Whitely, 1997). In addition to gender gaps, age differences are regarded as an associated factor influencing people's computer-related activities. Research on the educational gerontology has consistently found that, the older the individual the less computer knowledge and interest they are likely to have (Coulson, 2000; White and Weatherall, 2000). Flanagin and Metzger (2001) argued that, elderly people have the lowest adoption rate and level of ICT use of all age categories. They even expressed that a significant proportion of them are more or less completely excluded from the "information society". Next to gender and age, socio-economic factors have also been found to be associated with the digital divide. Some research indicated that users' socio-economic background has a direct positive relationship with computer experience and an indirect negative relationship with computer anxiety (Bozionelos, 2004). Autor et al. (1998) found that, the change in computer use is positively related to the change in the employment share of college graduates whereas it is negatively related to that of high school graduates.

Although educational level does not correlate absolutely with individual computer experience, Roe and Broos (2005) argued that level of education is the strongest predictor of negative attitudes toward ICT. Some research has shown that people with a lower level of education have less access to ICT and use it less often (Flanagin and Metzger, 2001). There are other socio-economic factors structuring the digital divide. Krueger (1993) expressed that computer users earn substantially higher wages than non-users. Some research has also found that people with higher incomes use computers more than those from middle and low-income categories (Walsh et al., 2001). However, Borghans and Weel (2004) argued that the ability to effectively use a computer has no substantial impact on wages as compared with writing and mathematics skills. On the other hand, Falk and Koebel (2004) suggested that, computers increase the demand for high-skilled labor and to a lesser extent of demand for medium-skilled labor in terms of both manufacturing and non-manufacturing industries. However, computer capital significantly decreases the demand for unskilled labor in non-manufacturing

industries only. Mikkelsen et al. (2002) conducted a study to investigate job characteristics and computer anxiety for Norwegian production industry. They found that job demands did not relate significantly to computer anxiety; however, managers had less computer anxiety than non-managers. Martin et al. (2001) found that technicians and older staff have higher level of computer anxiety than secretaries and younger staff. Liaw (2007) indicated that when individuals have more self-efficacy and perceive computers and the Internet as useful, then they have more behavioral intentions to use and learn the information technology for assisting their job performance.

With regard to the domestic digital divide measure for specific subject groups, Van Dijk (2000) found in a Dutch survey that income was the most important factor for physical access, followed by age, and then education. Fisher and Bendas-Jacob (2006) developed two instruments to determine the reduction in the digital divide for Israeli population:

- (1) On-line skills for measuring the improvement in Internet surfing proficiency, and
- (2) The information and attitude questionnaire for measuring changes in Internet use and attitudes toward the Internet.

They suggested that controlled intervention enhancing users' surfing skills can reduce the digital divide in Internet usage. Broos and Roe (2006) used the social cognitive and self-efficacy theories and the locus of control construct to investigate some psychological correlates of the digital divide among a representative sample of Flemish adolescents. They indicated that computer locus of control and ICT self-efficacy supplement socio-demographic explanations of the digital divide, and that gender remains an important differentiating factor in the digital divide even among young people. Peter and Valkenburg (2006) found in their study that Dutch adolescents with greater socio-economic and cognitive resources use the Internet more frequently for acquiring information and less often for entertainment than their peers with fewer socio-economic and cognitive resources.

Moreover, Tien and Fu (2008) implemented a large-scale survey (a total of 2719 valid samples) for first-year undergraduates in Taiwan to analyze the correlates of the digital divide and their impact on the undergraduates' learning. They found that no significant differences in terms of the correlates in both demographic and socio-economic family background in predicting the various purposes behind using computers. However, gender, socio-economic family background, and academic major are factors influencing their computer skills and knowledge.

On-line learning is a novel application of current ICTs. It can provide individuals with learning opportunities that break through the restrictions of time and geographic

areas. Although Taiwan has achieved a large measure of ICT diffusion as compared with other Asian countries (Quibria et al., 2003), there are still considerable disparities in individual computer literacy among adult population (RDEC, 2007). To bridge the gap, the Taiwan government has been executing an "Assisting Unemployed People to Participate Digital Capability Enhancement Training Program" since 2003. This lifelong learning project is being carried out under the auspices of the Bureau of Employment and Vocational Training (BEVT), Council of Labor Affairs, Taiwan. To have learners adapt to the current trend of ICT in our social and educational systems, this program has been changed from traditional face-to-face instruction to on-line learning environments since 2006.

The purpose of this project is to encourage unemployed adults to learn elementary computer skills, enabling them to operate computers and resume their jobs further. Unemployed adult novices possess socio-demographic and socio-economic characteristics in terms of the digital divide perspective. Based on the standpoint, the purpose of this research is to investigate the domestic digital divide concerning the impact of on-line learning on unemployed adult population in Taiwan. Through the empirical study, we can identify certain on-line learning characteristics of the specific user groups, and also can understand their affective and behavioral intentions of using such novel technologies with respect to individual differences in gender, age, and educational level.

## METHODOLOGY

### Subjects

A total of 183 subjects were selected from the trainees of an on-line computer-training program in which they participated in the experimental study voluntarily. The participants were qualified unemployed adults who involuntarily left their jobs. The demographic data of this experiment were classified according to gender (male: 45, female: 138), age range (under 44 years old: 85, 45 to 54 years old: 74, over 55 years old: 24), and educational level (junior high school or below the level: 31, senior high school: 105, junior college or above the level: 47).

### On-line learning performance

In order to conduct this experimental research, an on-line learning course was provided for the subjects who learned elementary computer skills. The short-term computer-training course, financially supported by the BEVT, is the most important part of "Assisting Unemployed People to Participate Digital Capability Enhancement Training Program". There were three major units contained in the on-line learning program:

- (1) Fundamental computer operation (300 min),
- (2) Word processing (180 min), and
- (3) Internet application (300 min).

The on-line learning system mainly consisted of three functions:

- (1) Learning information,

- (2) Starting animation, and
- (3) On-line instruction and case practice.

It was constructed in an interactive multimedia environment including text, graphics, animation, audio, and video elements. The tests corresponding to the three main units were followed in the on-line learning system. After finishing each course unit, participants must be examined through the on-line testing system. Twenty items of closed-ended questions were given in each unit test, and each question contained five alternatives with only one correct answer. Each correct response scored 5 points with the full score being 100 points. Participants were required to respond to the questions within the time allotted. The passing mark was 60 points and the testing time was restricted to 10 min for each unit test. All the three unit test results were concurrently scored and recorded by the system. The first set of experimental hypotheses is as follows:

H1a: Gender difference in on-line learning performance was significant.

H1b: Age range difference in on-line learning performance was significant.

H1c: Education difference in on-line learning performance was significant.

### Computer attitude scales

Attitudes consist of what individuals feel (affective components), believe (cognitive components), and plan to do (behavioral components) (Al-Khaldi and Al-Jabri, 1998). A questionnaire was used to measure the subjects' computer attitudes, which was introduced by Garland and Noyes (2004). The questionnaire consisted of 19 statements selected from the Levine and Donitsa-Schmidt's proposed model (Levine and Donitsa-Schmidt, 1998). In addition to the 19-item self-report inventory, the author added a statement that reflects the unemployed subjects' positive beliefs in computer literacy for their vocational competitiveness. For each of the 20 items in the inventory, a 5-point Likert scale was used, ranging from "entirely disagree" (score=1) to "entirely agree" (score=5). The negatively-framed questions were transformed so that the higher the numerical value the more positive a participant's attitude was in the perceived situation. The second set of experimental hypotheses is as follows:

H2a: Gender difference in computer attitudes was significant.

H2b: Age range difference in computer attitudes was significant.

H2c: Education difference in computer attitudes was significant.

H2d: Learning performance difference in computer attitudes was significant.

### Computer anxiety scales

Beckers and Schmidt (2001) proposed a six-factor model of computer anxiety. The six factors include computer literacy, self-efficacy, physical symptoms in the presence of computers, feelings toward computers, positive beliefs about the benefits for society of using computers, and negative beliefs about the dehumanizing impact of computers. Based on their proposed model, we developed a measure scale that consisted of a 15-item self-report inventory. The computer anxiety measure scale comprised 9 positive and 6 negative items. In addition to the six factors, the scale included responses that reflect the inexperienced users' physical interaction with computers such as "I am able to use a mouse with ease" and "Reading from computer screens is acceptable to me". Likert scales comprising 5 points from "entirely disagree" (score=1) to "entirely agree" (score=5) were provided to permit respondents to indicate their level of agreement with each

**Table 1.** Descriptive statistics of the on-line learning achievements.

		Mean score	Number	S.D
Learning achievement	High performance (scored more than 80)	83.02	27	3.55
	Medium performance (scored between 70 and 79)	73.96	69	2.82
	Low performance (scored less than 69)	65.02	87	2.55
Gender	Male	70.18	45	6.97
	Female	71.33	138	7.08
Age range	Under 44 years old	72.14	85	6.63
	45-54 years old	70.13	74	7.55
	Over 55 years old	70.00	24	6.59
Educational level	Low education level (Junior high school or below the level)	67.58	31	5.69
	Middle education level (Senior high school)	71.57	105	7.04
	High education level (Junior college or above the level)	72.16	47	7.31

item. The scoring for positive items was reversed, so that high scores indicated high computer anxiety. The third set of experimental hypotheses is as follows:

H3a: Gender difference in computer anxiety was significant.

H3b: Age range difference in computer anxiety was significant.

H3c: Education difference in computer anxiety was significant.

H3d: Learning performance difference in computer anxiety was significant.

### Procedure

The empirical study used a post-test design and was implemented under a lifelong learning project supported by the BEVT, Taiwan. Participants learned elementary computer skills in their own rates of progress through the on-line learning system. An assistant was available in the classroom, whose major assignment was not to teach the courses but to assist participants in dealing with the hardware and software problems. Three on-line tests were given in order, after they had finished the corresponding three course units. All test results were scored and recorded by the system, which were used for analyzing the subjects' on-line learning achievements in this study. Having completed the overall on-line learning courses and the corresponding tests, a paper-version questionnaire for measuring users' computer attitudes and computer anxiety was provided to the subjects (Appendixes A and B). Each subject responded to the questions according to his/her own on-line learning experience and knowledge.

## RESULTS

### On-line learning achievements

Descriptive statistics are presented in Table 1. The mean score of the overall responses was 71.05 (S.D=7.05). According to the score ranges, we divided the subjects into three groups: high performance (scored more than 80), medium performance (scored between 70 and 79), and low performance (scored less than 69). The mean scores of the on-line tests were 83.02 (N=27, S.D=3.55) for the high-performance group, 73.96 (N=69, S.D=2.82)

for the medium-performance group, and 65.02 (N=87, S.D=2.55) for the low-performance group. Out of the 183 subjects, nearly half did not perform well in the on-line tests.

With respect to individual differences in learning achievements, the mean scores of the on-line tests were 70.18 (S.D=6.97) for the male subjects and 71.33 (S.D=7.08) for the female subjects. Females were better than males in terms of the mean score results. The mean scores of the on-line tests were 72.14 (S.D=6.63) for the young adult subjects aged under 44, 70.13 (S.D=7.55) for the middle-aged subjects aged between 45 and 54, and 70.00 (S.D=6.59) for the elderly subjects aged over 55. There was little difference between middle-aged and elderly subjects.

The young adult subjects had better learning achievements than the other two age groups in terms of the mean score results. Of the three different education groups, the mean scores of the on-line tests were 67.58 (S.D=5.69) for the low-education subjects, 71.57 (S.D=7.04) for the middle-education subjects, and 72.16 (S.D=7.31) for the high-education subjects. It appears the computer novices that have higher education had better on-line learning achievements. The descriptive statistics also showed that the unemployed adult novices, especially the elderly novices and the low-education novices, had the worst on-line learning achievements in the word processing unit as compared with the other two course units.

The first null hypothesis was tested by using independent-t and one-way ANOVA tests. As shown in in Table 2, gender difference ( $F=0.051$ ,  $P=0.822>0.05$ , rejecting the null hypothesis H1a) and age range difference ( $F=1.919$ ,  $P=0.15>0.05$ , rejecting the null hypothesis H1b) in on-line learning performance were not significant, whereas education difference in on-line learning performance was significant ( $F=4.821$ ,  $P=0.009<0.05$ , confirming the null hypothesis H1c). A Tukey post hoc

**Table 2.** Independent-t and ANOVA test results.

t-test		t-test for equality of means				Levene's test for equality of variances		Result
		t	df	Sig.	M./SE D.	F-value	Sig.	
Gender	Mean score	-0.944	181	0.346	-1.14332/1.21063	0.051	0.822	rejected
<b>ANOVA test</b>			<b>Sum of squares</b>	<b>df</b>	<b>Mean square</b>	<b>F-value</b>	<b>Sig.</b>	<b>Result</b>
Age range	Mean score	Between groups	188.876	2	94.438	1.919	0.150	rejected
		Within groups	8857.603	180	49.209			
		Total	9046.478	182				
Education	Mean score	Between groups	459.911	2	229.955	4.821	0.009	confirmed
		Within groups	8586.568	180	47.703			
		Total	9046.478	182				

comparison confirmed significant difference among the three education groups. The test results also indicated that education difference in word processing and Internet application was significant in terms of the subjects' on-line learning achievements.

### Computer attitude measures

The Cronbach alpha measure of internal consistency reliability was acceptable at 0.89 for the computer attitude scales. The mean computer attitude score of the overall responses was 75.45 (S.D=8.35). The composite attitude score results indicated that, the unemployed adult novices characterized by male gender, young group, high education, or low learning performance were found to be more positive toward computer use. The young adult subjects and high-education subjects perceived higher level of computer attitudes, whereas the low-education subjects had the lowest level of all of the classified groups. The results also showed a salient attitude feature that most of the unemployed adult novices perceive that having sufficient computer literacy can advance their vocational competitiveness.

The Friedman test was used to check the dependent measures. According to the test results, gender difference ( $n=20$ , Chi-square=4.263,  $df=1$ ,  $P=0.039<0.05$ , confirming the null hypothesis H2a), age range difference ( $n=20$ , Chi-square=11.114,  $df=2$ ,  $P=0.004<0.05$ , confirming the null hypothesis H2b), and education difference ( $n=20$ , Chi-square=20.734,  $df=2$ ,  $P=0.000<0.05$ , confirming the null hypothesis H2c) in computer attitudes were significant, whereas learning performance difference ( $n=20$ , Chi-square=3.900,  $df=2$ ,  $P=0.142>0.05$ , rejecting the null hypothesis H2d) in computer attitudes was not significant at the 0.05 level.

### Computer anxiety measures

The Cronbach alpha coefficient ( $\alpha=0.865$ ) indicated

that, the computer anxiety scales were acceptable. The mean computer anxiety score of the overall responses was 34.11 (S.D=6.50). The unemployed adult novices characterized by female gender, elderly group, low education, or medium learning performance were found to be more anxious toward computer use. The low-education subjects perceived the highest level of computer anxiety, whereas the low-performance subjects had the least anxiety of all of the classified groups. A salient anxiety feature indicates that, most of the unemployed adult novices experience it difficult to understand the technical aspects of a computer.

Further testing the experimental hypotheses, we found that gender difference ( $n=15$ , Chi-square=3.267,  $df=1$ ,  $P=0.071>0.05$ , rejecting the null hypothesis H3a) and age group difference ( $n=15$ , Chi-square=0.644,  $df=2$ ,  $P=0.725>0.05$ , rejecting the null hypothesis H3b) in computer anxiety were not significant; however, education difference ( $n=15$ , Chi-square=10.475,  $df=2$ ,  $P=0.005<0.05$ , confirming the null hypothesis H3c) and learning performance difference ( $n=15$ , Chi-square=6.407,  $df=2$ ,  $P=0.041<0.05$ , confirming the null hypothesis H3d) in computer anxiety were significant according to the Friedman test results.

## DISCUSSION AND CONCLUSION

Most studies have explored the socio-demographics of the digital divide, focusing on differential access to ICT and highlighting substantial differences according to factors such as age, gender, education, and socio-economic status.

In our experimental findings, gender difference and age range difference in on-line learning performance were not significant, while both in computer attitudes were significant. Learning performance difference in computer anxiety was significant. Males and the young adult subjects were found to be more positive toward computer use, while the medium-performance subjects perceived a

higher level of computer anxiety. Education is a critical factor influencing unemployed adult novices' on-line learning behaviors. It was significantly and positively related to on-line learning performance. Education difference in both computer attitudes and computer anxiety was significant. The higher the subjects' educational level the more positive attitudes and less anxiety they were in the perceived situation. The majority of unemployed adult novices believe that on-line learning is useful for enhancing their job performance; nevertheless, the use of on-line learning technology seems not to be effective to them.

The findings of this study must be considered in light of its limitations. First, the independent variables in the experiment are within-subjects (repeated-measures) factors, which involve comparisons of the same subjects under different demographic characteristics. The weakness of the within-subjects factors can be referred to as "carryover effects" that the participation in one demographic characteristic may affect performance in other characteristics. The difference between the two demographic characteristics would not be due to the independent variable; rather it would be due to classification with the assessment.

Second, the Likert-type and self-report questionnaire approach is not free of subjectivity in the respondent. The questionnaire was a single snapshot instead of a longitudinal study, which did not allow researchers to measure the change of user reactions over time at the individual level.

Finally, the study's results were obtained within the context of a short-term computer-training program and would need further validation across other on-line learning systems. In addition, the subjects were restricted to unemployed adult novices who have had no computer experience before participating in the elementary computer-training program. The possible influence of the inexperienced learners' self-efficacy on on-line learning might be a limitation.

Unemployed adult novices possess socio-demographic and socio-economic characteristics in terms of the digital divide perspective. This paper contributes to our knowledge by using the scales of computer anxiety and computer attitudes to investigate the domestic digital divide concerning the impact of on-line learning on the specific user population. Although much we know about digital divide research is focused on physical access, this study provides a distinct perspective on measuring users' affective and behavioral intentions of using on-line learning technologies.

According to our experimental findings, education has a great impact on unemployed adult novices' on-line learning behaviors. This study suggests that a novice's educational level should be taken into account when developing an on-line learning system. Further research could focus on how to improve the potential efficiency of on-line learning technology to the specific user population.

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## **APPENDIX**

### **Appendix A. Computer attitude measures**

1. A computer is like a good friend.
2. A computer is like a private tutor.
3. A computer stops me from being bored.
4. Computers are fascinating.
5. Computers are smarter than people.
6. Every home should have a computer.
7. I find using a computer easy.
8. I hope I never have a job that requires me to use computers.
9. I learn more rapidly when I use a computer.
10. I use the computer when I have nothing else to do.
11. Interacting with a computer is a good way to pass the time.
12. One can learn new things from a computer.
13. People managed in the past without computers, so they are not really necessary now.
14. People who like computers are often not very sociable.
15. The computer is an educational tool.
16. The computer is an effective learning tool.
17. The world would be better off without computers.
18. Using computers broadens your horizons.
19. You can get on in life without knowing about computers.
20. Having sufficient computer literacy can advance my vocational competitiveness.

### **Appendix B. Computer anxiety measures**

1. I am able to use a computer mouse with ease.
2. I am able to use keyboard with a computer correctly.
3. Reading from computer screens is acceptable to me.
4. I can well comprehend the information presented on a computer screen.
5. I find it difficult to understand the technical aspects of a computer.
6. Nowadays, everyone can learn to use a computer.
7. I am confident that I can learn computer skills.
8. The computer has simplified my life.
9. I think the computer inaccessible.
10. I feel like I am short of breath when I am in front of the computer.
11. I have sweaty hand palms when I work with the computer.
12. Computers make people become isolated.
13. Computers destroy human creativity.
14. Computers bridge the information gap between rich and poor countries.
15. Computers help to effectively fight the large world problems, such as poverty, knowledge disparity,... etc.