

## **The study of analyzing digital divide with data mining technique and setting up the cloud-platform to improve it**

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### **Abstract :**

With science and technology advancing day after day, it appeared more and more digital products on market that we have never imagined in the past. Due to computer education popularized, the new generation of young men have little obstacle to use digital product. However, the elder parents have more exclusion to the information equipment which they have never used.

We did telephone interview to investigate the digital ability of parents and ask them how much they understand their children's usage of digital products. In the end, we use cluster analysis and discriminant analysis of Data Mining technique to execute our research and combine cloud technique to set up a digital platform for parents.

According to our study, the parents whose age is above 30 years old, the degree of digital divide is related to sex, age, residence region, education level, family structure, parent-child relationship and the question about whether people use computers on the work, etc. We will not only provide suggestions for industrial, government and academia based on above conclusions but also provide some advice to follow-up researchers.

**Key Words:** Digital divide、Cloud platform、Data Mining、Parent-Child Relationship

## 1.1 Research Background and Motivation

The world has entered the era of the information technology. Along with the development of technology, computers and Internet are more and more common. And compared with computers and network underdevelopments which before ten to twenty years ago, only a few people who engaged in computer-related industries or studying information related departments have the opportunity to contact and use the computers. So the general public believes that the computer and the network are not important for our society. Due to the rapid development of information technology, the public use of computers and the Internet become more and more frequently. Overall, the computers and the Internet have revolutionized the lifestyle of modern people.

This issue caused considerable attention in recent years of the Global. Since the high-tech is the basis of the knowledge-based economy and the development of information education will determine the next round of national competitiveness. In order to strengthen national competitiveness, the domestic government promoted the development of national information infrastructure plan in 1995. In the plan, The Executive Yuan specially set up a cross-ministry “National Information and Communications Initiative Committee”, which would be divided into five execution groups. Among the plan in promoting The Ministry of Education in order to tie this project to promote, so they developed about” Information on education programs to improve the schools at all levels, “Computer-assisted instruction and promotion plan”, “Information talent promotion plan”. And implementation of “IT education infrastructure projects”, “NII talent cultivation medium-range development plan”, “Distance teaching medium-range development plan” and “social education development plan” started in July 1998. It

was expected to comprehensive information education extends to primary and secondary schools.

The above, we can speculate that the high school students information capacity than previously enrolled students better who enrolled after July 1998. However, we can use this as a basis to make assumptions about that parent and child will be a period of the digital divide. And Mr. Marc Prensky proposed in the issue about, "Digital Natives vs. Digital Immigrants". It talked about that we are Digital Natives who born after 1980. Because the promotion of the Ministry of Education, We have more opportunities to use digital products than digital immigrant parents naturally. Thus creating a digital divide gradually. Shu-Fen Tseng (2002), referring to the causes of the digital divide is still with the traditional social hierarchy are closely related which confirms this statement. We hope to improve insight into the reasons for such a digital divide.

## **1.2 Research Purposes**

In order to understand the digital divide in Taiwan cities and counties (including the outlying islands), we conducted a survey on the digital divide. Then, we analyze the reasons that cause parents with a low ability in using computer or Internet, investigating their using requirements and combine common functions that used by teenagers to design a simple and convenient cloud platform in order to make parents easy to get into and reduce digital divide between parents and children.

### 1.3 Research Process

In order to understand the use of digital products as well as level of understanding for parents, in this study, we use the collation of literature to learn more about the previous issue. And refer to correlate papers' questionnaire to design to comply with our study's questionnaire. We use FJS-CATI system carry out telephone survey after completion of the questionnaire design. We combine Fu-Jen Catholic University, the market research group telephone interview center resources; do the analysis of the reliability and validity of the pretest questionnaire. Finally we carry out an official investigation after a little modifies the questionnaire.

After conducting questionnaires, we deal with some missing values and carry out basic descriptive statistics analyze such as percentages on gender or regions, etc. Preliminary understanding of information can help us conduct deeply analyses. On the basis of cluster analysis, we did cross analysis in different target and then, we did discriminant analysis.

Finally, we combine with Google Sites to provide simple computer operations teaching and some information which elder member of family (Digital immigrants) interested. We look forward to reduce the threshold for the operation of the computer and the internet. It achieves our purposes and reduces the digital divide between parent and child. Is hereby presented in Figure 1-3-1 on the research process and the research process:

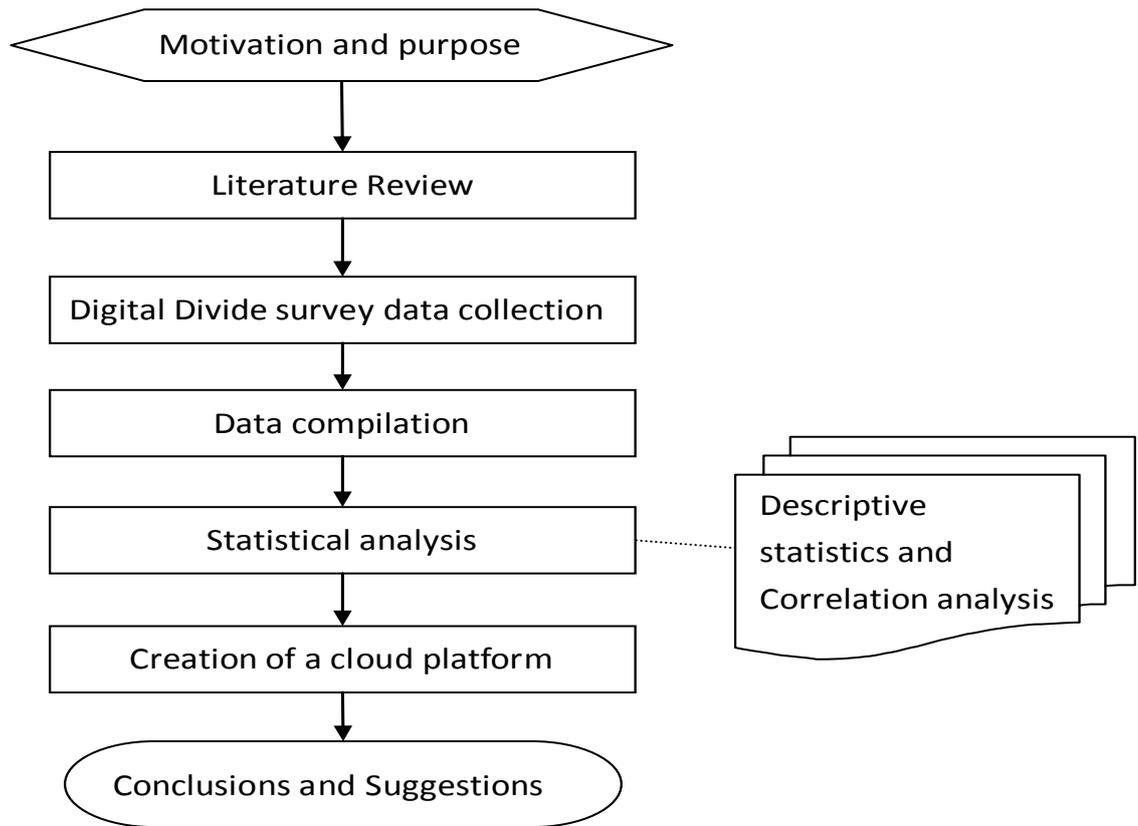


Figure 1-3-1 Research process

## **2.1 Parent-Child Relationship**

In our society, children usually acquire knowledge from their parents. To children, parents play very important roles in the family. They pass their own experiences to their children through the domesticity. They also teach children what is right from wrong, and the manner of dealing with people and situations, as well as all the knowledge about anything.

However, with times changing and the science and technology advancing, traditional knowledge succession may be altered and challenged. Thus, we organize the related discussion of scholars into the following table 2-1-1.

Table 2-1-1 The definitions of parent-child relationship

Researcher	Definitions
周曉虹 (1999)	Parents and children have different rate of adapting to the new things. Therefore. When parents lose their absolutely power of education, children have the capability of “feedback”. In other words, learners may influence people who teach them initially.
李青松 (2000)	Due to the new things and concept, parent-child interaction has changed within family. Because education promotes and easily obtains, children begin to feedback their parents about methods of using new technology.
DonTapscott (2008)	For the first in history, children are more comfortable, knowledgeable, and literate than their parents with an innovation central to society. Already these kids are learning, playing, communicating, working, and creating communities very differently than their parents.

Especially in the stage of the children’s growth, they have gradually become independent and opinionative since they changed into teenagers. They keep learning about new things and continue to accumulate knowledge through the school’s education.

People whose age is above teenagers have innovative information to exchange with parents. In order to adapt to changes of society, parents need to accept the new concept and information which are provided from children.

Therefore, researching parent-child interaction whether it will affect the digital divide in households is one of our study's purpose. The governmental report of the digital divide mainly investigates people whose age is more than twelve years old. In addition, IBM introduced its PC, igniting a fast growth of the personal computer market at 1981. It has occurred for thirty years. In other words, people who were born in 1987 are approximately thirty years old now. Thus, this study targets parents whose children are between twelve and thirty years old for the survey.

## **2.2 Digital Divide**

According to the definition of the United States Department of Commerce which says that Digital Divide means the difference in between information haves and information have-nots. According to the Organization for Economic Co-operation and Development which said in 2001 that the definition of "Digital Divide" means the huge gap exists among people, households and companies. It is based on different socioeconomic background or living on the geographical location that people have the chance to use information technology and use the Internet to participate in various activities.

With the vigorous development of the Internet, the concern level of the Digital Divide is changing the issues from personal information devices into the network nearly. The Digital Divide research currently divided into "Knowledge gap", "Technology diffusion", "Communication infrastructure" and "Resources theory". The Digital Divide is mainly impact in economic, social, education and human rights.

Table 2-2-1 The definitions of Digital Divide

Category	Definition
Economic	On the basis of the unequal distribution to the wealth between people have tools of information and the others don't.
Efficacy	The difference between someone can use new information technology more effective and the others can't.
Information Access	Information access means the chance of using the information technology depends on the factors of our Socioeconomic background and it causes the difference of usage amount in touching information and communications technology, and social injustice.
Information Application	Information application means that each person has different position and role in society. So it generated the gap of using the information technology; the gap is the main cause of different individual capacity and social injustice.
Information Literacy	Everyone needs information literacy in modern society. The difference from people own information literacy and people don't own information literacy is the main cause of social injustice

Reference source : 臺灣數位落差的情況(葉怡君, 2006)

The conclusion we got is that people who have more information technology own resources than the others and it would make social injustice.

# Conclusion and Suggestions

## 1 Conclusion

We can induce some conclusions as follows from the cross tabulation in the chapter 4.

### 1.1 Gender

#### 1. Do not use digital products :

The proportion of women who use computers is less than men. By "A Study on The Influence of Gender Difference on Digital Divide within Families" we can confirm the same discourse that men have more opportunity to have computers course than women because of sex-role stereotypes. (Yi-Hisen Wu , 2004)

Therefore, we believe that the reason for women who use the computer less is the uneven distribution of digital accessible opportunity.

#### 2. The gap of ability in using digital products :

The ability of using computers and the Internet in man is weaker than women. The " individual or household Digital Opportunity Survey Report in 2011" from the Research, Development and Evaluation Commission, Executive Yuan, we found that traditionally men have more interest in information technology than women. Thus, there is the digital divide between men and women. However, in recent years the survey shows that the gap is getting narrowed.

Furthermore "Extensions of Digital Gini Coefficient- Digital Divides in Taiwan" shows that the spread of digital information and the commercial publicity stimulate women's interest in digital technology and decrease digital divide in gender. (Pan, Jin-gu , 2000)( Pan, Jin-gu ,

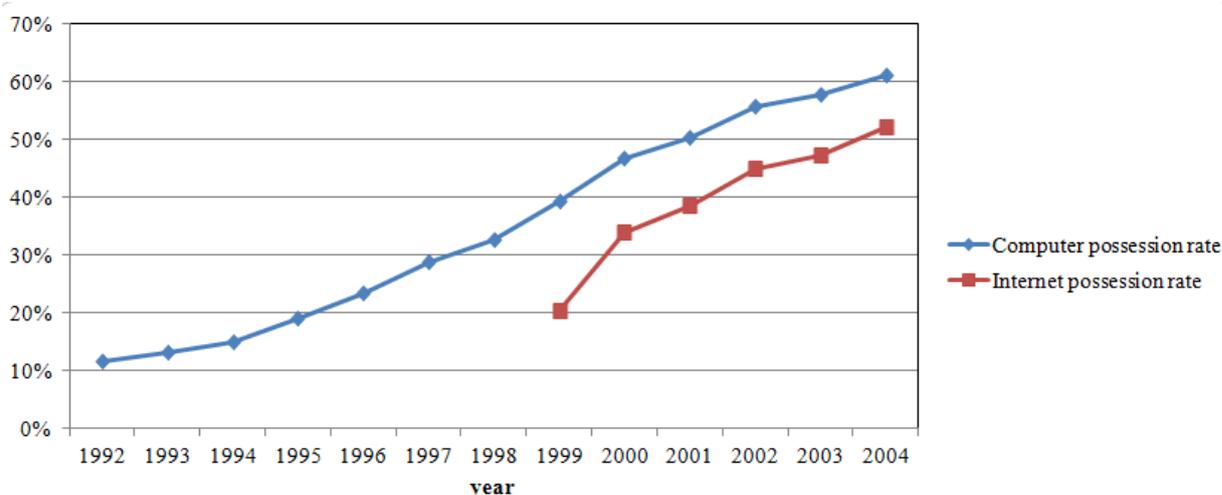
Tseng, Shu-fen 、 Lin, Yu-fan , 2009)

To sum up, the level of education in women isn't weaker than men with universal education, accessible informational products and courses in recent years. Therefore, we believe that once women have the willingness and opportunity to use computer, their digital divide may be reduced or their ability may be even stronger than men.

## 1.2 Age

### 1. Do not use digital products :

In the cluster which people use neither computers nor internet within six months, there is a higher proportion for people who are beyond 60 years old. According to the thesis, The Situation of Digital Divide in Taiwan-by Family Unit, we found that Directorate-General of Budget, Accounting and Statistics, Executive Yuan, (R.O.C) did a sample survey about households' income during 1992 to 2004. The question is about whether there are computers in household but there is no question about whether there is Internet in household until 1999. In 1992, the computer ownership rate is approximately 12%; however, the computer ownership rate is greater than 60% in 2004. The overall growing trend is in the steady state. The Internet growth rate increased from 20% to 50% during 1999 to 2004 and the highest rate of change is about 14% during 1999 to



2000.

Figure 5-1-1 The ratio of Taiwan households owned a computer or network

Therefore, we infer that the thing which is about people who use neither computers nor internet have a higher proportion on the age beyond 60 years is due to the age when the elders age over 60 and computer and internet are not universal.

**2. The gap of ability in using digital products :**

30 to 39-year-old people whose ability in using digital products is lower; 40 to 49-year-old people whose ability in using digital products is medium; it shows that relative to the 40 to 49-year-old people, 30 to 39-year-old peoples' digital ability is weaker. From " Individual or Household Digital Opportunity Survey Report in 2011" by the Research, Development and Evaluation Commission, Executive Yuan, it shows that the rate of using computer for people who are below 40 years old is over 95%, and the rate of using computer for people who are between 41 to 50 years old is 82.1%. In the rate of using Internet, it is similar to the rate of using computer in different generations. Using Internet ratio of the older people is lower. Relative to the low rate of using Internet for people who are middle-aged, the rate of using Internet for people who are below 40 years old have reached up to 92%.

The younger respondents are supposed to be exposed to new technology after they were born. Many studies have pointed out that relative to the 40 to 49-year-old people, 30 to 39-year-old peoples' digital ability is stronger, but the digital ability of children whose parents are 40 to 49-year-old is higher than the children whose parents are 30 to 39-year-old. The parents who age 40 to 49-year-old are influenced by their children so they have higher willingness to learn digital products.

Therefore, we infer that this may be the reason that 40 to 49-year-old people have medium digital ability.

## **1.3 Residence Region**

### **1. Do not use digital products :**

The eastern and outlying islands have the highest proportion of people who use neither the computer nor Internet technology. The thesis “The current situation and challenges of e-government Execution to reduce the digital divide in the eastern region” by Ting-Yang, Song said that most information equipment is invested less in the region of lower urbanization degree because it will make expensive sunk cost and population cannot reach quite economics of scale. With difference of regional degree, the information literacy, information application and digital technology access will present notable difference. The higher the urbanization degree the region is, the higher the usage rate of information equipment the region has. According to the report of investigating the digital chance of individuals and households in 2011 of Research, Development and Evaluation Commission Executive Yuan, in Hsinchu City, Taipei City, Hsinchu County, Taoyuan County, New Taipei City, Taichung City, the ratio of families which have a computer is over 90 % and the ratio of being able to surf the Internet at home is over 85%. So we conjecture that the reason why the eastern and outlying islands have the highest proportion of people who use neither the computer nor Internet technology is lower urbanization degree.

## **1.4 Education**

### **The gap of ability in using digital products :**

University student's educational level is higher, but interviewees who have lower digital ability are mainly Bachelor degree. The 13th TWINC "Personal basic network use survey" of investigating the usage

of broadband network shows that the ratio of people who graduated from elementary school using the Internet is 17.30% and the others is 82.70%; the ratio of people who graduated from junior high school using the Internet is 59.40% and the others is 40.60%; the ratio of people who graduated from senior high school using the Internet is 82.17% and the others is 17.83%; the ratio of people who graduated from training school using the Internet is 91.45% and the others is 8.55%; people who graduated from university using the Internet is 97.96% and the others is 2.04%; people who graduated from graduate institute using the Internet is 99.87% and the others is 0.13%. It shows on the following table 5-1-2:

Table 5-1-1 Internet usage percentage of different educational level

Education	Internet use	Internet unused
Elementary and below	17.30%	82.70%
Junior	59.40%	40.60%
Senior	82.17%	17.83%
Specialist	91.45%	8.55%
Bachelor degree	97.96%	2.04%
Master and above	99.87%	0.13%

According to above statements, we know that the educational level and the usage of Internet have positive correlation. The higher the educational level people have, the higher proportion people use the Internet. Our conclusion is the same as the report of investigating the digital chance of individuals and households in 2011 of Research, Development and Evaluation Commission Executive Yuan made.

But university student with higher educational level showed that they have the highest proportion in the low cluster of digital ability. We thought the reason to be that we adopted subjectively personal cognition of interviewee to value the ability. The interviewees who graduated from

university with higher educational level have more experience than other interviewees with lower educational level. They can understand what they shortage so it cause the result of low grades.

## **1.5 Family Structure**

### **The gap of capacity of use digital products :**

Most of the low cluster is single-parent families; most of the high cluster is nuclear family. From the thesis, or “Family structure has an influence for teenagers’ earning achievement”, we can find that family structure's change for the children has the negative influence in learning achievement. (Wang, Chi Chan, 2009)

Generally speaking, conversion from nuclear family to single-parent family is due to unforeseen event. Parents in single-parent families often have a lot of restrictions on self-enrichment or parent-child interaction. It results that parents in single-parent families belong to the low cluster. Relatively, the nuclear family has more resources of time or money.

## **1.6 Whether people would use computer in workplace**

### **The gap of capacity of use digital products :**

The interviewees who don't use computers on the work have lower ability of using digital product than the others. According to the report of investigating the digital chance of individuals and households in 2011, we find that the labors which are defined by Council of Labor Affairs have a high proportion (63.7%) on using computers in workplace and 52.2% of them have demand on using the Internet in workplace. It shows that over a half of labors have more chances to touch and use computers than the others. The people house computers also have over a half of them use network function, so their digital ability will be comparatively better.

## **1.7 Whether Parents Acquire Digital Information from Children**

### **The gap of capacity of use digital products :**

To The interviewees which belong to the cluster of low digital ability, they mainly acquire digital information from their children. On the other hand, parents who belong to the interviewees which belong to the cluster of medium digital ability do not need to acquire digital information from their children due to they have basic digital ability.

According to “The Study of Junior High School Student’s Usage of the Internet and Parent-child Interaction”, we can know that to response to the behavior in surfing on the Internet of junior high school students, parents have motivation to learn computer and the Internet for increasing the topics with their children.(駱莉萍，2011)

We conjecture that parents have a lot of different ways to learn computer and the Internet, but acquiring digital information form their children is the most convenient and direct for the interviewees which belong to the cluster of low digital ability. After all, with the digital environment being more popular nowadays, understanding the behavior in surfing on the Internet of children is very helpful for patents to promote the parent-child relationship. For the interviewees which belong to the cluster of medium digital ability, they can choose other ways to learn computer and the Internet themselves due to they have basic digital literacy. Thus, they can share their own experience with children to promote the parent-child relationship.

## **1.8 The Influence of Parent-child Relationship**

### **The gap of capacity of use digital products :**

There is a positive relationship between parents know how many items of computer or the Internet their children use and parent’s ability of using digital products. According to the results of our study, the fewer items of computer or the Internet children use, the weaker digital ability

their parents have. Therefore, we conjecture that the better ability of using computer or the Internet children have, the more ability children can assist their parents in using digital products. Thus, it can reduce the digital divide between parents and children. If we want to enhance parent's ability of using digital products, we can directly reinforce the parent's ability or raise children's digital ability.

## **1.9 Discovery and Contribution**

### **1. In our questionnaire, we combine the aspects of computer and the Internet to investigate digital divide.**

The questionnaire of our study consists of two parts including computer and the Internet. It is clearer to present digital ability with collecting data of both computer and the Internet than just investigating the single aspect of digital divide. In addition, we combine the score of computer and the Internet to divide into groups which have different digital ability. Thus, we can thoroughly evaluate the digital ability of people who are interviewed.

### **2. Children are the key to lead their parents into digital field**

According to the above analyses, we know that children are the key to lead their parents into digital field. The families include the different generation of age, because the background in age of birth is different, their degree to accept new technology is difference. To get digital information from children is the most convenient and direct way and it is the most easy to create a parents and children's topic.

Nowadays, the digital environment is more and more universal. It is benefit for parents to understand their children's the behaviors of using digital product. The family is miniature of a society and an enlighten ground of each person. Consequently, if we can reduce digital divide and make the families be good interactive, it may bring a positive effect; for

the member's growth and learning and it will also help to improve the whole digital divide to reach the ideal of civil knowledge and the network equity

### **3. The building of platform according to the characteristic of clusters to reduce digital divide**

Through cluster analysis, we found the different characteristic at different digital level in clusters. We aimed at the sides of preference, energy of learning to design different education policy and build digital learning platform. The advantages we provide are people can recognize the education model of platform and let people reduce the obstacles of entering digital field via self-learning on platform for the development of platform education in the future.

## **2 Suggestions**

Our study provides different suggestions for each department after analyzing above. In addition, we also provide some suggestions and direction of development for future researchers.

### **2.1 Our suggestions**

The issue of digital divide is closely related to our life. It involves a very wide range. If we combine industry with government and education, the digital divide can be effectively reduced. The following statements are our suggestions for industry, government and education.

#### **1. For Information Industry**

According to our study, people who do not use the Internet and computer are mostly live in remote districts of Taiwan, such as Eastern and Outlying Islands. In order to improve present situation, with the technology of the Internet being more progressive and wireless Internet access being more popular, we suggest that the information industry can cooperate with computer hardware industry to develop a built-in wireless LAN Card for desktops. In addition, they can also enhance the ability of

receiving wireless network for computers. Therefore, they can not only increase competitive advantage for their companies but also eliminate the inequality of access information for remote districts. In the other hand, the fear of operation of computers can increase exclusion from digital knowledge, products and applications. Thus we suggest that software industry can develop some programs and software to let people easily use, such as much friendlier interface which is like pointing pictures to output words or outputting words through speaking. It can not only expand potential markets but also help people who have troubles using computer and the Internet.

## **2. For government**

We found that eastern and outlying islands region have the highest proportion of reject using neither computers nor internet in cluster without using computer or Internet. In order to avoid the occurrence of sunk cost, we suggest that government can make a policy to encourage institutions to donate computer equipment which has reached the end of its estimated useful life but still can be used to remote region where residents can have more opportunity to know more about computer or Internet. Then, we expect to effectively reduce psychological repulsion of learning in most elders.

Furthermore, can promote digital learning from setting up application digital information education courses in community college and cooperate with township office or village office to hold some activities or contests which are related to digital information application. For example, we can hold some courses of training ability for re-employment. We can improve the model of authorized cram school; for example, make a survey at business community and civil society to make sure the education policy is fit the expectation of business community and civil society, then we can enhance mass participation and

make efficient use of resource to reduce the sunk cost. By such corporation, these activities not only can enhance residents' digital application ability in work place but also promote exchanges between residents to achieve the goal of promoting digital information application.

### **3. For education organization**

School can hold activities or competitions of digital learning platform building, volunteer of digital education, digital learning seminar, or on-line digital education, etc. students not only can learn the field of learning information application but also show the spirit of service learning. For example, FU-JEN Catholic University held a course which is called as “沒大沒小數位知識學堂” of service learning from the semester of 2006 academic year. Besides promoting digital education in administrative regions, we can go on the activities of overseas volunteer through Internet platform or going abroad. Students not only open their vision, learning via service but also develop Taiwanese culture and passion. Make digital learning no longer a boring study but a kind of challenge that we step into international society.

For other for-profit education organization such as cram school or train courses, we analyzed four different kinds of clusters via cluster analysis and we recommend design exclusive digital education courses according to different clusters. For example, for the low cluster that children use less on computer and Internet, we recommend designing a discount project of parents learning with children and serve these people another choice of on-line video learning in order to achieve platform as learning and decrease the cost of human resource allocation. For the high cluster and other cluster that people use computer in workplace and they are willing to pay more money for their learning, we can find that education of digital information is helpful and needed to their work. We recommend design a professional digital course to high cluster and design

a course that is about life application or professional field to other cluster. On-line video learning is suitable to these two clusters.

For medium cluster, non-profit education organization, such as colleges and universities or China Youth Corp, can cooperate with for-profit education organization to provide the service platform of digital learning. As mentioned previously, take the Advanced and Intermediate Distance-Learning (AIEDL) for example, institutions can provide the ability of setting up platform which is free to apply for membership at the first establishment to promote the platform and education to people. In this way, institutions not only can provide more multiple courses but also can make more people using the platform and learning together via sharing effect. In order to develop future project of digital learning platform, we can obtain funds from governments, such as Ministry Education, Research, Development and Evaluation Commission, Executive Yuan, National Youth Commission, Executive Yuan, and Ministry of Culture and Council of Labor Affairs, promoting competitiveness in academia, expanding a large potential market to achieve the purpose of corporation in these three fields.

## **2.2 The suggestions for the future researchers**

Digital Divide shows the social resources injustice and the divide between the clusters. Our study expects through questionnaire understanding every groups' information access. Designed to meet the needs of digital learning platform to reduce the digital divide after Find them the same characteristics. According to experience of this research, we give some suggestions to future researchers.

### **1. Increase research variables**

We measured respondents' digital ability by their basic operating capacity with single index so it's hard to check their ability

comprehensively. We suggest that future researchers can investigate other professional competence, for example, computer graphics, assembled computers, programming languages, and other professional.

In addition, you can also add the important variables affecting the Digital Divide, for example, Industry, occupation, ethnicity, lifestyle, degree of urbanization. It can make the research to be perfected.

## **2. Expand the scope of the study**

Our study targets parents whose children are between twelve and thirty years old for the survey in order to understand the digital divide between the household. But we did not do a thorough survey of the children within the same household. Suggested that future researchers can further children within the same household survey of the digital divide to understand the digital capacity of parents and children within individual households. For this reason do the analysis of household paternity digital divide. It can effectively reduce the inter-generational digital divide.

Besides, it can expand the scope of the investigation. Don't limitations in the survey of parents who have between twelve and thirty years old children. We can observe an intergenerational information access and extensive discussion of the digital divide between generations. We hope can understand the digital divide respondents changed at different times, so recommend that can be used to track investigation.

## **3. More in-depth study**

Firstly, our study uses literature discussion and CATI system to do quantitative statistical analysis and statistical inference. We recommend that future researchers can do qualitative research. Maybe can do more in-depth site visits a weak ability groups for digital. We can invite experts on the topic of the digital divide in industry, government and academics held on small-scale seminars. Everyone can together to discuss the

direction of improving the digital divide, then by the forum consensus to develop new questionnaire to survey.

Secondly, we set up the digital learning platform is a preliminary Exploration. Future research may extend this idea to improve and extend the platform, expansion, and to provide a network of digital learning resources to reduce the digital divide. We can design digital divide survey questionnaire on the digital learning platform in order to track survey for learners, then understanding of the digital divide to improve the situation.

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