Overcoming the digital divide: Computer access and use among the differently-abled elderly in Mainland China

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X. Gan, K.H. Wang, L. Liu, P-C. Tuan, H-G. Chen, G. Chen. Overcoming the digital divide: Computer access and use among the differently-abled elderly in Mainland China. Gerontechnology 2016;14(4):204-209; doi:10.4017/gt.2016.14.4.007.00 **Background** While the advancement of computer technology displays the potential to change the life of the differently-abled persons, also called persons with restrictions, these persons do not enjoy equal access to the benefits of equitably inclusive computing. **Method** This study uses the 2014 China Differently-Abled Persons' Survey data to explore the disparities in computer access and use among the differently-abled senior citizens in mainland China. **Results** The findings show that access and use of computers differ by age and type of restriction. Households with differently-abled people aged 60 years and over are less likely to be equipped with computers than the younger households; people with a physical handicap are more likely to live in households with computers, while people who have intelligence related restrictions have less access to computers in the home. When controlled for socioeconomic and other demographic factors, people of older age, people living with intelligence or mental restrictions are less likely to be computer users, while people with speech problems have a higher likelihood to use a computer. The digital gap among the generations is particularly striking. Additionally, male, higher educational level, living in urban areas, employed full or part time, and having self-care ability are also important predictors of being digitally empowered computer users.

Keywords: computer access, differently-abled, the elderly, digital disparity, inclusion

The development of computer technology and the Internet make it possible to broaden the lives of the differently-abled, also called people with restrictions[1], who once could only stay at home and largely have no control of their lives. Now, thanks to the Internet, they can do almost anything online as long as they have access to a computer and the Internet. For example, they can surf for the latest information online and keep pace with modern society; they can make friends online, where they can avoid any residual social stigma and communicate with others freely without leaving their homes; they now have access to various online services, e.g. online shopping, banking, healthcare management, and even online work through telecommuting, which enhance and empower their independence.

These new technologies definitely have great potential for the differently-abled, but little evidence has shown that the coming of the computer age has actually narrowed the digital inclusion gap affecting the differently-abled. In order to take advantage of the empowerment benefits computer technology offers, two basic elements are needed. On the one hand, physical access to a computer and the Internet are necessary, which are factors influenced by socioeconomic status. On the other hand, one also needs the willingness, skills and ability to use a computer and the Internet. Since people with restrictions are often in a less advantageous position in terms of income and educational status, they have much less practical access to computers and the Internet[2]. It is well established that a 'digital gap' exists among people with restrictions.

Moreover, the type of restriction an individual has, as well as the availability of assistive technology, may affect the accessibility of inclusive computer technology[3]. Moreover, considering the natural physical and cognitive changes that come with aging, older people may have different needs and concerns compared to younger adults. For example, decline in vision is a common physical change associated with aging, which makes it much more difficult for the elderly to use a computer. Therefore, it's reasonable to assume that the 'digital gap' not only exists among people with restrictions and the rest of the populace, but also exists in terms of one's specific disability status and age.

Table 1. Description of the sample of differently-abled persons in mainland China[5]; Values of all the variables are 0–1 where the variable gets 1 if the variable's title is in the affirmative (e.g. 'high school' 1=yes, 0=no). The 'Mean' column represents the percentage of each category among all the respondents (n)

Characteristic	Mean % ± SD	All respondents
18-44 years old	0.17±0.38	33,371
45-59 years old	0.24±0.43	33,371
60 years old and above	0.59±0.49	33,371
Gender (male=1, female=0)	0.52±0.50	33,371
Never went to school	0.36±0.48	33,364
Primary school	0.38±0.49	33,364
Middle school	0.19±0.39	33,364
High school	0.06±0.23	33,364
College degree or above	0.02±0.12	33,364
Location (rural=1, urban=0)	0.75±0.43	33,371
Can take care of oneself in daily life	0.84±0.37	33,364
Employed full- or part-time	0.19±0.39	33,343

The existing researches using data from Europe and America demonstrate a 'divide gap' affecting differently-abled[1,2], and correlating with the specific restriction status[2]. In China, some studies exist concerning the relationship between Internet access and use among differently-abled people[4], but there is a paucity of empirical data. This research aims to explore the current status of computer access and use among the differently-abled in mainland China. In particular, much attention is given to computer access and use among the differently-abled senior citizens, as well as their relative status compared to their younger cohorts.

Research questions

Based on the gaps in the existing literature, the main research questions of this study are as follows:

(i) How inclusive are computer ownership, Internet access and Internet use of the differently-abled senior citizens in mainland China? How do they like computers and Internet use as compared to people of younger age?

(ii) How do computer ownership, Internet access and Internet use differ by specific restriction status?

(iii) Among those having access to computers and the Internet in the household, who are more likely to be computer users? What is the computer using status of the differently-abled senior citizens compared to the younger ones when controlled for other factors?

Data source and method

We used data from the China Differently-abled Persons' Survey administered in 2014 by the China Disabled Persons' Federation (CDPF)[5]. Direct information concerning Internet usage among differently-abled people in China is scarce. Differently-abled people are not included as a separate group in the regular surveys on Internet usage. This data set is the only suitable existing data available to answer the questions of interest presented in this paper. First, the data set is collected on a large number of respondents randomly sampled from the Chinese differently-abled population. The survey covers 31 provinces in China, involving 734 counties and 34,649 respondents answered the survey. Second, the survey collected detailed information about people's computer and Internet uses. Third, the survey contains detailed information relevant to the topic of the study, such as age, specific restriction, and educational attainment.

The survey collects data on selected differently-abled people of all ages. Considering that those who are under 18 years old have largely not yet graduated from high school, their access and Internet use may be assumed to be strictly limited by their parents, so we restrict our analysis to adults aged 18 years and over. There are 33,371 respondents in our data set (*Table 1*).

The age of the sample is slightly older, with people aged 60 and above constituting 59% of the sample. Male respondents account for a larger proportion, representing 52% of the sample. The educational level of respondents is relatively low and the majority has never attended middle school, constituting 74%. 84 Percent of respondents can take care of themselves in daily life and 19% are employed full or part-time.

In our research below, we start by analyzing how Internet access and use differ among people of different age cohorts. The needs and concerns of using computers are different among older adults and younger adults, and this tends to become more noticeable at approximately age 45

because of the natural physical and cognitive changes[6]. Therefore, the people aged below 60 are divided into two groups at age 45. People aged above 60 are automatically combined as a separate group since the starting point of the definition of senior citizens is 60 years old in mainland China. The comparison is carried out in three age group cohorts (18-44 years old, representing young adults, 45-59 years old, standing for the middle-aged, 60 years and above, representing senior citizens) and three aspects (the availability of a computer in the household, the access of Internet connection in the household and whether the respondent uses the computer to surf the Internet at home). We list the relevant statistics for the entire sample and then for people of different age group cohorts, respectively.

In order to discover the difference of Internet access and use of people with different specific disabilities, we also analyze the data by specific handicap. The respondents are divided into seven groups according to their specific restriction, being visual, hearing, speech, physical, intelligence, or mental related, or of a multiple nature.

Finally, we analyze in depth the factors predicting computer use of the differently-abled in the household. We use logistic regression to predict likelihood of computer use when controlling for several demographic characteristics such as age, gender, education, specific restriction status, and living location.

Results

Internet access and computer use at home

Table 2 presents descriptive statistics by age group cohorts and by specific restriction respectively concerning whether the respondent (i) lives in a household with a computer; (ii) has Internet access in the household; or (iii) uses a computer at home.

When presenting data, we also take into consideration the access or use of the various technology upon which the respective access or use is contingent. To be more specific, possessing a computer at home is the prerequisite for having household internet access. Therefore, apart from listing the percentage of the different-abled who live in households with internet access among all respondents, we also present what these figures look like among those who have a computer in the household.

According to the data presented in *Table 2* indicating the availability of computers, those who live in households with computers only make up a small number, 12.6% among all the respondents. When comparing different age group cohorts, people aged 60 years old and over are less likely to be living with computers at home as compared to the younger ones. The percentage is 10.5%, 5.6% below the 45-59 year-old group.

Also seen from *Table 2*, the percentage of people with access to computers in the household differs by specific restriction. People with a physical handicap have a higher chance to own home computers, accounting for 15.1%. The least equipped households are those with people who have intelligence restrictions, with only 8.9% of such households having access to computers.

Figures in *Table 2* show the disparities of household internet access among different age group cohorts and by specific restrictions. When using all the respondents as denominator, it's self-evident that the percentage of people with household internet access will be lower than those who

Table 2. Sample distribution over age cohorts and specific disabilities of a sample of differently-abled persons in mainland China[5]

Characteristic	Differently-abled persons											
	In households with						Using a computer at home					
	Computers		Internet access				All respondents		In households with			
			Total		+ Computer				Computers		Internet	
	n	%	n	%	n	%	n	%	n	%	n	%
All respondents	33,367	12.6	33,367	11.3	4,218	89.7	33,367	3.6	4,218	28.5	3,784	31.4
Age cohorts												
18-44 years	5,762	15.2	5,762	13.6	876	89.7	5,762	9.7	876	63.4	786	70.2
45-59 years	7,964	16.1	7,964	14.5	1,284	90.0	7,964	5.5	1,284	34.0	1,156	37.1
≤ 60 years	19,641	0.5	19,641	9.4	2,058	89.5	19,641	1.1	2,058	10.2	1,842	11.2
Specific restrictions												
Visual	5,121	11.2	5,123	10.0	574	89.0	5,121	2.0	574	17.8	511	19.8
Hearing	7,655	13.2	7,655	11.8	1,013	89.2	7,655	2.4	1,013	18.2	904	20.0
Speech	630	11.1	630	9.7	69	88.4	630	5.6	69	50.0	61	54.1
Physical	11,556	15.1	11,556	13.7	1,739	90.9	11,556	6.0	1,739	39.9	1,580	43.5
Intelligence	2,243	8.9	2,243	7.8	200	87.5	2,243	1.8	200	20.5	175	23.4
Mental	2,706	10.7	2,706	9.4	289	87.5	2,706	2.5	289	23.4	253	26.1
Multiple	3,454	9.6	3,454	8.7	334	89.8	3,454	2.2	334	23.1	300	25.7

with home computers. As shown, 89.7% of the households with a computer have Internet access. The differences regarding age group cohorts and specific restrictions take on the same pattern as home computers ownership, with 60-year-old and over taking up the lowest percentage, households with people of a physical handicap accounting for the highest proportion while those with intelligence restrictions making up the lowest. When considering the prerequisite to having home internet access, that is, having computers in the household as the denominator, there is little difference of the percentage of people living in households with Internet access among age group cohorts and specific restrictions.

In addition, *Table 2* demonstrates computer use of people with restrictions in the home. Only 3.6% of all the respondents with restrictions use a computer to go online at home, which is relatively low compared to the percentage of all people in mainland China (33.9%[7]). As age increases, the percentage of people going online at home decreases dramatically. Only 1.1% of the people aged 60 years and over use a computer at home, which is 8.6% below the 18-44 year-old group and 4.4% below the 45-59 year-old group. When controlling for computer ownership and home internet access, we can see the same age pattern of computer use at home.

Contrasting by specific restriction, the percentage of people using a computer at home among all the respondents with physical restrictions is still the highest because of a higher percentage of computer ownership. When computer ownership and home internet access are controlled, people with speech restrictions are considerably more likely to be computer users. Over half of such subsets use a computer in the homes as long as they have access to a computer and the internet, while less than 20% of those with a vision problem do so, highlighting the considerable disparities. People with physical restrictions are the second most likely to be computer users with a percentage around 40.

Computer use and specific restriction

In the following part, we explore the factors predicting computer use of people with restrictions. As the availability of a computer and the access to the internet are the preconditions for using computers to go online, only those who have access to a computer and the internet are included in this part. There are 3,781 respondents in the dataset. We use logistic regression to examine whether various socioeconomic factors (gender, educational attainment, location, self-care ability and employment status) associated with age and specific restrictions explain the inequality in level of home computer uses among people with different disabilities. *Table 3* presents the results of logistic regression analyses, demonstrating the likelihood that a respondent is a computer user controlling for various demographic characteristics.

In the first model, age and specific restriction are not included so that we can make clear the relationship between other socioeconomic factors and computer use independent of our main focus. As is shown in the first column of *Table 3*, all the variables in the model are significant at p<0.01 level. We find that among those who have computers and internet access in the household, males, people with higher educational level, and living in urban areas are more likely to be computer users, as are those who have self-care ability and are employed part- or full-time.

In Model 2, age is added into the regression as a categorical variable. We find that the effect of age on the likelihood of being a computer user can never be overlooked. After entering age into the regression, the power of the model

*Table 3. Logistic regression in three models to predict computer use at home for differently-abled persons in mainland China; Reported coefficients are the odds ratio; SE=Standard Error; *=p<0.01*

Variable		Model, Mean ± SE		
		1	2	3
Gender (male=1, female=0)		1.32±0.12*	1.45±0.14*	1.35±0.13*
Never went to school		0.02±0.01*	0.02±0.01*	0.02±0.01*
Primary school		0.06±0.01*	0.06±0.01*	0.06±0.01*
Middle school		0.25±0.04*	0.20±0.03*	0.20±0.03*
High school		0.47±0.08*	0.37±0.07*	0.37±0.07*
Location (rural=1, urban=0)		0.78±0.07*	0.59±0.06*	0.53±0.06*
Can take care of oneself in daily life		1.50±0.23*	1.67±0.28*	1.67±0.29*
Employed full- or part-time		3.07±0.30*	1.51±0.17*	1.40±0.16*
18-44 years old			16.35±2.23*	23.19±3.62*
45-59 years old			2.73±0.33*	2.96±0.37*
Restrictions	visual			0.91±0.21
	hearing			1.41±0.30
	speech			3.11±1.22*
	physical			1.75±0.33*
	intelligence			0.44±0.12*
	mental			0.38±0.10*
Intercept		1.19±0.24	0.56±0.12*	0.42±0.12*
n		3,781	3,781	3,781
Pseudo R^2		0.2482	0.3565	0.3776

has largely been improved, as the pseudo R^2 increases from 0.2482 to 0.3565. When controlling for characteristics such as gender, education, self-care ability and employment status, people of older age are less likely to use computers. In particular, the likelihood of 18-44 year-old people being computer users is 16 times that of people aged 60 and over, which indicates a tremendous digital gap between the generations.

In Model 3 we take a more nuanced look at the influence of specific restrictions. The findings show that the nature of the restriction has a profound influence on computer use. After controlling for people's socioeconomic background and other demographic characteristics, people living with speech restrictions are most likely to be computer users, followed by people with a physical handicap. People with intelligence and mental restrictions are those least likely to use a computer. There is no significant difference of being computer users among those with multiple restrictions and visual or hearing problems. This indicates that people with speech handicaps are less constrained when using a computer as they have no difficulty typing, seeing or hearing. While despite being intelligently and mentally normal, people with visual or hearing restrictions are prevented from going online because of technological barriers. The digital gap between different age group cohorts becomes even larger after controlling for specific handicaps.

Discussion and conclusions

This research demonstrates that paying attention to the 'digital gap', represented in this study by access to and use of computers, within people with restrictions is just as important as paying attention to that among those with handicaps and the rest of the digital populace. The inequality of computer use or digital gap among the differently-abled people is mainly caused by two channels.

On the one hand, some of the public do not have equal access to computers in the household. According to the 35th Statistical Report on Internet Development in China[7], 10.7% of people become non-internet users because of a lack of computer equipment. This problem also exists among people with restrictions. Those who live in households with computers only make up 12.6% among the surveyed respondents. When compared by different age group cohorts, the households with differently-abled people aged 60 years and over are less likely to be equipped with computers than the younger households (4.7% and 5.6% below that of the 18-44 year-old and 45-59 year-old group respectively). Taking specific restrictions into consideration, people with physical handicapss are more likely to live in the households with computers, while people who have intelligence restrictions have less access to computers in the home.

On the other hand, when the access to home computers and the internet is controlled, differently-abled people's tendency to use a computer to go online at home is still different by age group cohorts and specific restriction. When controlled for socioeconomic and other demographic factors, age and specific restriction still play an important part in predicting computer use at home. People of older age and people living with intelligence or mental restriction are less likely to be computer users, while people with a speech handicap have a higher likelihood to use a computer as they have no difficulty typing, seeing or hearing. The 'digital gap' between the generations here is particularly striking. The likelihood of 18-44 year-old people being computer users is over 15 times higher than that of people aged 60 and over. From the analysis above, we also see that males, people with higher educational level, and those living in urban areas are more inclined to be computer users, as are those with self-care ability and who are employed part- or full-time.

Modern society is very deeply influenced by computer technologies, so the ability to access and use computers is critical for equitable and empowered social inclusion[8]. As is shown, computer users among people with restrictions are typically those in an advantageous position (e.g. younger, male, higher educational attainment, the employed, those living in urban areas). The more vulnerable groups are excluded from the technology. These technological forms of exclusion may reinforce and deepen existing disadvantages in return, such as low income, unemployment, poor education, ill health and social isolation[9].

Implementation

Since we have realized where the 'digital gap' exists, the next step is to take some measures to narrow this gap so that more diverse people can benefit from the development of computer technology. Offering computer access to those who do not have it at present is just the tip of the iceberg, since the majority of those who have the following characteristics choose not to use computers even though they have one available at home: older, with an intelligence or mental restriction, female, lower educational level, unemployed, and those living in rural areas.

To begin with, this, to some degree, reveals the importance of assistive technology in helping

the differently-abled persons, especially the differently-abled senior citizens to go online. There is a good reason to believe that if computers and websites are designed properly to satisfy the needs of people with restrictions, it will make it much easier for them to use a computer[10]. If assistive tools and technology are accessible, such as voice activated systems, enlarged text, a trackball, people of older age, then senior citizens and people with visual or physical restrictions, will benefit more from the computer technology[11]. Besides, this also demonstrates that providing basic knowledge and training about computer operating is of great significance in promoting computer access and use among differently-abled people.

In China, the lack of knowledge and operating skills of computers is still a major cause of the digital divide between the Internet users and non-users[7]. With a better understanding of computers, senior citizens, people of low educational level or those living in rural areas, will be more likely to be computer users.

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