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# Inequality in the Digital World

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# Inequality in the Digital World

A Thesis  
Presented to  
the Graduate School of  
Clemson University

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science  
Applied Sociology

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by  
Xue Liu  
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Accepted by:  
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## ABSTRACT

This study examines the current trend of digital divide. Social stratification is present not only in social life, but also in the application of information technology. Digital divisions based on unequal access to and usage of the Internet are not uncommon. The analysis of the digital divide over time can reveal the trends of social inequality in daily life. This study reviews previous research on the digital divide and examines the current trends of the digital divide using data from 2000 to 2005 Pew Internet & American Life Project. The research explores differences in several Internet usages among various demographic groups. Popular online activities, such as emailing, hobby searching, use the Internet for work, online shopping, and search engines usage, are chosen to represent daily Internet usage. Demographic characteristics include age, gender, race, income and education. Most findings from this study are consistent with my hypotheses and with what were found in previous studies. The results show that the digital divide as reflected in these online activities still exists and is deepening over time. More and more people are involved in the digital world, but they don't have equal time for online activities. People with lower socioeconomic status tend to be less active online, such as older people, black people, and people with lower level of education and income. In addition, over time, the gap between sociodemographic groups has increased to some extent, especially in racial divide and income divide. People with disadvantageous social and economic status still stay in disadvantageous status in the digital world.

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## CHAPTER ONE

### INTRODUCTION

The Internet first appeared for governmental research use around 1950 and has been prevalent as a communication and information tool since the 1980s. As a network of networks, the Internet connects computers worldwide and allows people to access online information and services. Emailing, shopping online and using search engines are such popular activities that computer skills become important in order to make online and offline activities more efficient. However, access to computers and the Internet and differences in Internet literacy are not equal between demographic groups due to resources and opportunities available to individuals. In addition, Internet literacy became a popular topic in the study of digital divide as it affects online experiences and the efficiency of online activities. The term “digital divide” initially refers to unequal access to computers and later is also used to refer unequal access to the Internet. Although the gap between “haves” and “have-nots” narrowed in some areas around 2000, other areas of the digital divide tend to have grown larger and wider since then (Walsh et al., 2001).

The Internet provides a number of services and voluminous amount of information and has rapidly penetrated into everyday life. It is so widely used that easy access and efficient usage has become more important. Through the Internet, individuals can communicate with friends, purchase products, and search information which makes their work more efficient and improves their life quality. On the other hand, the disadvantageous status in the Internet use and computer literacy can negatively affect work efficiency and quality of life.

The trend of digital divide has been changing over time since it was first observed. Some stated that it narrowed down as we moved towards 2000, but increased recently. For example, recent research found that even in developed countries, there are large segments of individuals

with very little digital experience (Dijk and Hacker, 2003). Therefore, one question that needs to be addressed is how the trend in Internet use has changed in the last decade. Another question is whether or not advantaged and disadvantaged groups stay largely divided. My research examines inequality in various online activities and computer literacy and how they change over time. It mainly focuses on sociodemographic differences in online activities and computer skills. Sociodemographic variables include age, gender, race, education and income. Five popular online activities people do at home are selected, including emailing, usage for work, online shopping, hobby searching and search engines use. Twenty six data sets from 2000 to 2005 Pew Internet & American Life Project are used. First, I examine the prevalence of each online activity and whether it has changed over time. Second, I look at differences in Internet usage among various demographic groups. Third, I examine whether the socioeconomic differences in online activities have changed from 2000 to 2005. By revealing variations in Internet use and computer skills among demographic groups and how they change over time, my research will contribute to our understanding of the current state of the digital divide in the United States. And, since my analysis examines the Internet use for six years, it can contribute to our understanding of the trend in digital divide over time.

My thesis begins with a discussion of Internet culture and the specific online activities that are central to my analyses, emailing, using the Internet for work, searches related to hobbies, online shopping, and using search engines. It goes further with a discussion of the digital divide as an aspect of inequality, and continues with the statement of hypotheses. Next the data, measures, and statistical procedures are described, and the results are presented. After summarizing the results I conclude with a discussion of their implications, particularly with regard to inequality.

## CHAPTER TWO

### LITERATURE REVIEW

#### **Internet Culture**

The Internet was launched as government-funded research by the Defense Advanced Research Projects Agency (DARPA) in the 1950s. Since the 1980s, the Internet Corporation had become responsible for the development and management of the Internet (Adamson, 2002). The social penetration of the Internet has been increasing for 20 years since it became the commercial product rather than a research object. Popular uses of the Internet are no longer primarily limited to emailing but have developed many functions, such as online shopping and other services based on the online communication and information. The Internet is a gateway to considerable amounts of information and is recognized as an information technology first (Kraut, et al., 2002). The Internet provides a multitude of information including news, health, financial, hobby, work, community and commercial information.

Even in 1990s, Kling stated that “Know-how, a mix of professional knowledge economic resources, and technical skills, to use technologies in ways that enhance professional practices and social life” (Kling, 1998). As the Internet became more prevalent and began to provide many services, it became important for people to acquire knowledge of computers and the Internet to gain benefits from online resources. Until 2020, the Internet will exert more social, political, and economic impact on the contemporary society (Pew Internet & American Life Project, 2008).

#### **Online Activities**

In the 1960s, the Internet was created as a medium to facilitate communication within the global academic community. Commercial applications of the Internet began in the 1980s by providing home computer users connection to this worldwide networking. Data from the

Commerce Net/Nielson Internet Demographic Survey revealed that by 1998 there were about 78.6 million Internet users (above the age of 16) in the U.S. and Canada and about 120.5 million global users (Commerce Net, 1998). In addition, by 2000, a marketing study showed that nearly 61% of American homes had a personal computer and access to the Internet (Merkle and Richardson, 2000). By 2004, there were about 93 million Internet users in the United States (Morahan-Martin, 2004).

With the penetration of the Internet, online activities became varied over time. First of all, as the initial use of the Internet, the exchange of e-mail is the most common use of the Internet. It has become an alternate to traditional mail. A marketing survey on online dating in 2000 indicated that emailing and other kinds of digital communication are the most popular online activities (Merkle and Richardson, 2000). In addition, as the Internet became more popular within the society, online activity was not limited to exchanging email. People downloaded software, played online games, communicated with others in chat rooms, and got aid in searching for all kinds of information. As Merkle and Richardson concluded the Internet was no longer a simple tool for the information exchange and transmission, it became “an international social microcosm, where online communities are created, social networks thrive, business transactions occur, future marital partners are found, and even sexual desires can be fulfilled” (Merkle and Richardson, 2000, p. 187). Except for Internet addicts, most Internet users usually spend time online on purchasing products, searching information and maintaining relationships (Leung, 2004). The Internet becomes a very important information tool when there are special events. During the 2008 election, more than 74% Internet users participate, or get news and information online (Pew Internet & American Life Project, 2009).

I examine five online activities: emailing, using Internet for work, searching hobby information, online shopping, and using search engines. These five online activities are most popular activities and they together represent typical online behaviors. The analysis of these activities can reveal the extent of Internet access and usage, and the analysis of their relationship with demographic characteristics can help us gain a better understanding of the nature of digital divide. Below I briefly describe each of these five activities.

*Emailing.* “Email is a form of information interchange” that through modems and a telecommunications system, messages could be sent from one computer to another (Anderson, et al, 2001). The use of email first appeared on the ARPAnet in the 1960s. In the 1970s, email use began to increase in the United States and quickly spread and exploded along with the rapid growth of personal computers and the Internet in the 1980s (Anderson, et al, 2001). Besides personal communication, emailing is widely used in the workplace transmitting vast amounts of information among employers. The use of email has so overloaded employees that researchers have even suggested strategies to improve skills of managing emails (Whittaker and Sidner, 1996). In addition, women are found to be more likely to use e-mails than men and they always report advantages of using email in keeping their connections with friends and relatives (Tracking Online Life, 2000). According to the report from Pew Internet and American Life project, by 2009 emailing has remained the most popular online activity (Generations Online in 2009, 2009).

*Internet for Work.* The use of the Internet for work could be an indicator of people’s online activity. According a national survey in 2001, more than half of Americans (56.3%) used Internet at work, especially in urban and central city areas (National Telecommunications and Information Administration, 2001). Nearly all American workers (96%) use new information and

communication tools, such as email and cell phone. By 2008, 62% workers could access the Internet or use email for work (Pew Internet & American Life Project, 2008). According to the Pew report, the longer you work, the more likely you use the Internet. Nearly 40% of those who work overtime use the Internet constantly for work significantly more than employed Internet users who work 40 hours or less each week. In addition, more than 60% of those who frequently or sometimes work from home are more likely to be online constantly than those who never work at home (Pew Internet & American Life Report, 2008).

*Searching a Hobby.* Seeking for hobby information is another popular feature of Internet use. According to Pew Internet survey in 2000, around 79% online users reported that they had looked for information for a hobby online (Pew Internet & American Life Project, 2000). For Internet users, 29% of them research a hobby on a particular day. Between mid-year and end-of-year, there was a large increase in searching hobby information among online users. Within six-month period, there were 20 million online users seeking information related to a hobby online (Pew Internet & American Life Project, 2000). The popular use of searching hobby information is very explicit on younger generation. For example, more than 80% of younger online users pursued their hobbies online reported by a survey in 2000. Even some minority groups show popular Internet use in a hobby searching. Around 77% of blacks searched information on a hobby at the end of 2000 (Pew Internet & American Life Project, 2000).

*Online Shopping.* According to the report from Pew Internet & American Life Project, nearly two-thirds (66%) online American users have ever purchased products online (Pew Internet & American Life Project, 2007). And the number of people doing online shopping increased from 22% in 2000 to 49% in 2007. Most of them believed that online shopping could save time and was a convenient way for them. Some researchers demonstrated that the

ecommerce environment is more complex than other online activities and thus online shopping requires higher computer and Internet skills (Hoffman, et al, 2001). The online shopping behavior is also an important research topic explored by sociologists in the marketing area. Racial differences have also been found in studies of online shopping activities (Walsh, et al, 2001).

*Using Search Engines.* Computer literacy is defined as the ability to use computer technology to solve problems and to locate, evaluate, and use information through a variety of information-gathering strategies (Wisconsin Association of Academic Libraries, 2008). Usually, researchers use the ability to use search engines as a measure of computer literacy, which is an important indicator for the digital divide. Vast amounts of information flood the Internet daily. Most search engines do not make information easily accessible and this requires people to possess a high level of Internet competence in order to improve the efficiency of the Internet use (Lawrence and Giles, 1999). Efficient use of search engines could improve the efficiency of searching. In 1990, search engines are known as “Archie” which made available lists of documents stored on FTP servers (Sonnenreich, 1997). Along with the use of the World Wide Web, search engines became popular around 1995 and was marked by the appearance of inter alia Yahoo, Google, Excite and HotBot (Machill, et al, 2008). There is little available data on user behavior and competence in terms of search engines. Although self-assessment reported high scores on the confidence of using search engines, the user competence is relatively low in terms of using search engines. In America, nearly 44 percent online users only use one single search engines but ignore other available search options when finding specific information online (Falows, 2005). The proportion of searching activity is increasing from 30% in 2004 to 40% in 2005 and finally reached 49% in 2008.

## **Inequality and the Internet**

Beginning with its intellectual origins, inequality has been a key interest of the discipline of sociology. According to Karl Marx, the class divisions in a society result from the organization of production and the resulting class relationships to the means of production. In modern capitalism, where the distinction between the worker and the capitalist is less obvious, there are a variety of positions with relationship to the means of production. Nevertheless, an essential link remains between the positions individuals occupy and the property they possess. The property that they have affects their capability of accessing various resources. Thus, people have different existences and experiences in a society which produce dominant and subordinate classes. And Marx and his followers suggested that the increase of industrialization would aggravate the complexity of the division of labor which finally increases the inequality and the polarization in a society (Karl Marx and Eugene Kamenka, 1983). It is the unequal relationship to the means of production that results in the unequal distribution of material resources, social resources, and culture resources.

Writing from a Marxist perspective, Erik Olin Wright argues that in addition to the distinction between those who own the means of production and those who do not, there is further stratification within non-owners. Due to the natural scarcities or restricted social status, two further dimensions are created based on whether they possess the skills. Those who are in non-owners status but with organizational skills are in the control of “the organization of work, surveillance and sanctions within production” (Wright 2006, p. 68). Seen in this way, people are differentiated by the ownership of production and skill assets.

The appearance of the Internet did not narrow the inequality between groups, but it became another tool which deepens the divide among social classes. Due to the class advantage,

the dominant groups could access the Internet and use it to facilitate their lives. They have resources which make them more likely to connect to the Internet, at work or at home. The Internet could help them to search job information or take online courses which increases their power and social status in the future. The dominant groups take advantage of their status in the means of production and benefit from the access and the usage of the Internet. However, the subordinate groups have fewer assets that draw them away from the benefits of the use of the Internet due to the means of production. Thus, over time, the Internet is not a tool that shrinks the differences between groups but it enlarges the gap between dominant and subordinate groups.

Individuals may have regular access to the Internet because of his or her work environment and resources while others might not have the opportunity to use the computer because of their tasks. Many studies suggest that individuals in higher social classes are more likely to have the opportunity to access computers and use the Internet since those in the upper classes have more socioeconomic resources than those in lower classes (Schumacher and Morahan-Martin, 2001; Hodge, 2007). Thus, people with fewer socioeconomic resources have limitations on expanding computer and Internet knowledge. While some people get benefits from the Internet, others don't even have an opportunity to access it.

Most studies explain variation in Internet knowledge based on research on the digital divide. Sociologists' concern for Internet usage inequality and differences between Internet-haves and have-nots began in the mid-1990s (Kuttan and Peters, 2003). The term-digital divide emerged and attracted much attention from sociologists. In early 2000, many studies found a decline in the digital gap (Nie and Erbring, 2001; Hoffman et al, 2001). As concluded by Compaine, the rapidly decreasing cost of Internet access is the reason for the increase in Internet access. This may have narrowed the digital divide to an extent (Compaine, 2001).

Although the narrowing of the digital gap between some demographic groups was found to begin in 2000 (Nie and Erbring, 2001; Hoffman et al, 2001), recent research demonstrates that the digital divide still exists and became much wider among a variety of demographic groups (Dijk and Hacker, 2003; Banerjee and Hodge, 2007). Researchers found that socioeconomic status, including the family income level, had a powerful influence on inequality in Internet use. “In the broadest sense, the digital divide is the gap between those people and communities who have access to information technology (personal computers, the Internet, skills, etc.) and those who do not. In other words, it is the disparity between the technology ‘haves’ and the ‘have-nots’” (Kuttan and Peters, 2003, p.3). The influence of the digital divide is not only limited to information access. Since the Internet has become an important tool in social life, the inequality of computers and Internet access could affect “equality of opportunity in social, educational, political, and economic systems” (Kuttan and Peters, 2003, p.4). This means that those who lack access to computers and the Internet would gain less information and resources than those who are rich in Internet access. This forms “an information underclass and thus separating society with a widening economic and social gap” (Kuttan and Peters, 2003, p.4).

Some researchers explored people’s Internet skills by examining search engine usage. In an early study on Internet use, Hargittai (2002) examined people’s skills using search engines and found that many people rarely use search engines. Hargittai found that many people have problems with retrieving information from the Internet. Therefore, variation in Internet skills depends on their knowledge and strategies, especially when using search engines. Many people rarely use search engines and some of them even have difficulty in entering appropriate search terms when using their browsers. In addition, as discussed above, Internet access largely depends on socioeconomic status, including gender, race, education and income. For example, Dijk and

Hacker found that women possess significantly lower digital skills than men (Dijk and Hacker, 2003). The inequality of computer and Internet access is one reason for limiting people's Internet knowledge.

Furthermore, Internet skills vary largely due to the individual's experiences using the Internet. Many studies focus on whether levels of Internet literacy increase over time (Schumacher and Morahan-Martin, 2001; Hargittai, 2002). Gender differences in Internet skills were found in a youth study. This study demonstrated variation in Internet skills which existed even among teenagers who had not used the computer for a long time. Since male students are more likely to have computer-based school courses and own a computer, they have more Internet experiences than female students. Thus, male students gained more computer experiences and had higher skill levels than female students (Schumacher and Morahan-Martin, 2001). One factor affecting people's Internet competence is the amount of time spent online. The Internet competence is associated with the users' experiences gained over time.

It is important to understand how Internet competence varies and why it varies by different groups. In a study of aging among the elderly, 87% believed technology knowledge is important for educational process, 75% thought that technology skills are crucial for one's employability, and about 52% felt that technology is a basis for an independent life (Kuttan and Peters, 2003). Other researchers demonstrated the influence of people's Internet skills is not limited to the usage efficiency, but extends to having a psychological impact. For example, Neuman et al (1996) found that searching skills have an emotional impact and people feel frustrated with new search technology. In summary, the vast amounts of online information and inequality of computer access make it necessary to improve people's Internet competence so they will achieve a higher sense of user satisfaction. It is important to improve Internet skills. We

need to find a way to increase Internet competence. Failing to do so will leave some segments of our society further and further behind.

Computer and Internet skills have been studied by scientists in different fields. Different studies use different definitions for digital skills. Instrumental, informational, and strategic skills are commonly used as measures of the Internet literacy. Instrumental skills refer to the ability to operate the hardware and software. Strategic skills are a kind of advanced possession for individuals' own purpose on how to use information. The current research is on informational skills. This involves the individual's competency in using search engine for finding information. Young people, men, people with higher education and income have been found to be more likely to search online (Pew Internet & American Life Project, 2008).

### **Socio-economic Dimensions of the Digital Divide**

The analyses presented below consider a number of socioeconomic characteristics—specifically age, gender, race, education and income—that have been discussed in the literature as key features of the digital divide.

*Age and the Internet.* According to Morrell et al., (2000), age differences exist in online activities, such as playing games online and using the Internet for fun. The age differences in the digital divide primarily refer to the older adults' disadvantaged status in terms of computer and Internet access and literacy. Many studies found that older people are less likely to be active online. According to the report from Pew Internet and American Life Project, the online population tends to be the young generations, since over half of the online population is between age 18 and age 44 while they are half of the adult population (Generations Online in 2009, 2009). Individuals fifty-five years old and older, regardless of income or educational level, are among the least likely to be computer and Internet users (Kuttan and Peters, 2003). In a survey of

household computer and Internet access, older individuals are the group with the least computer and Internet access, while the middle-age people (35-55 years) is the group with the highest digital access. The young household (under age 25) showed lower access rates lying between the middle of other two age groups (National Telecommunications and Information Administration, 2001). Similarly, fairly large age differences were found in emailing activity in America in a comparative study on the Internet use between America and Netherlands (Dijk and Hacker, 2003).

*Gender and the Internet.* Initially it came as no surprise that females possessed lower levels of computer skills than males did. For example, the enrollment and retention of female students in computer science or computer engineering programs are affected by several factors, such as the masculinity of computers, a lack of confidence, and gender socialization (Margolis and Fisher, 2002). The difference of experiences between males and females begins with socialization in the home in early childhood which was followed by “the convergence of adolescence, peer relationships, computer game design, and secondary schooling helping further boys’ claim to and girls’ retreat from computing” (Margolis and Fisher, 2002, p.5). According to a study by the Pew Internet and American Life Project, by 2000 gender parity in Internet access had been reached. Older women are slightly more active online than other users, while gender differences exist only when race is taken into account (Shade, 2003). However, recent studies on Internet access and Internet use found significant differences between males and females. In a study on the digital divide in Netherlands, women were significantly less likely to use all applications than men, including emailing (Dijk and Hacker, 2003). In addition, Banerjee and Hodge (2007) found gender difference in online activities, such as emailing and purchasing products within each race category

*Race and the Internet.* Many researchers found that white people occupy an advantaged position with regard to Internet access and the computer skills they possess, while blacks or those of other minority races are in extremely disadvantaged position. Hoffman and Novak (1998) found that blacks were the newest Internet users and did not do online searching or online shopping at all. Also, in 2001, Hoffman et al. (2001) stated that the gap between whites and blacks are large and persists over time. Fairlie (2004) found that among blacks home computer access and Internet access are only half that of whites. Not surprisingly, white people have higher computer and Internet ownership and benefit more from participating in online activities than blacks and people of other races.

*Education and the Internet.* As the Internet first became widely diffused, people with higher levels of education are more likely to own computers and access the Internet than those at the lower levels of education. Those with a college degree or higher are more than eight times as likely to have a computer at home (68.7% versus 7.9%) and are nearly sixteen times are likely to have home Internet access (48.9% versus 3.1%) as those with an elementary-school education (National Telecommunications and Information Administration, 2001). People with higher education levels are more likely to search health information online and then benefit more from the Internet access and use (Lasker et al., 2005). Mossberger et al. (2003) also found that disadvantaged groups in Internet usage include people with less education.

*Income and the Internet.* People in disadvantaged social-economic status are less likely to have computer ownership and Internet access than those with higher social-economic status. Income differences in computer and Internet access was found in a study of household digital access. Households with higher income levels are more likely to have computers and Internet access than those with lower income levels. The gap widened when region is taken into account.

That is, rural low-income households are the group with lowest level of computer ownership (National Telecommunications and Information Administration, 2001). Mossberger et al (2003) also found that the poor are significantly less likely to have a home computer, an e-mail address, or Internet access. The economic status is an important factor that affects individual's access to the Internet and online activities. The lower income level could prevent people from online health information and then lag the improvement in other areas (Aronson, 2004). Therefore, income is an important variable to reveal differences in Internet use and online activities.

## CHAPTER THREE

### RESEARCH PROBLEM AND HYPHOTHESES

The existing literature suggests that the digital divide still exists in terms of some socio-economic factors. However, few researchers have examined the relationship between a variety of such characteristics and specific online activities and how these relationship may have changed over time. The digital divide needs to be examined more thoroughly to include a variety of socio-economic characteristics and different popular Internet activities. My thesis examines sociodemographic differences in the Internet use, especially focusing on five online activities: emailing, use of the Internet at work, hobby searching, purchasing products, and using online search engines. I am interested in whether demographic and socio-economic factors, such as age, gender, race, education, and family income, differentiate people in terms of these participation in these online activities.

Based on the discussion above, I hypothesize that, in general, an individual with a higher socio-economic status is in an advantaged position compared to an individual with a lower socio-economic status. This means people with a higher social and/or economic status are more active online than people with a lower social and/or economic status. More specifically, I hypothesize that:

- Younger people are more likely than older people to have online activities.
- Females are less likely than males to have online activities.
- White people are more likely than people of other races to have online activities.
- Individuals with higher levels of education are more likely than individuals with lower levels to have online activities.

- Individuals with higher income are more likely than individuals with lower income to have online activities.

As I discussed above, the Internet did not narrow the inequality of Internet usage between groups, but it may have enlarged the gap among sociodemographic groups. Due to the class advantage, the dominant class is more likely to have an access to the Internet and spend more time online than the subordinate groups. For example, an individual who has a stable work may have regular access to the Internet because of his or her work environment and resources while others might not have the opportunity to use the computer because of the tasks they perform or being unemployed. In addition, the existing literature suggests that the digital divide still exists in terms of socio-economic factors (Dijk and Hacker, 2003; Aronson, 2004; Fairlie, 2004; Lasker, et al, 2005; Hodge, 2007). Along with the ever-increasing Internet penetration, it is the time to examine thoroughly on the relationship between the Internet usage and socio-economic variables in order to see how people are largely differentiated by the modern technology—the Internet.

Due to the decrease in the costs of computers and the Internet access, over time, the change in the relationship between socio-economic factors and online activities may become more dependent on different online activities and socio-economic variables. For most popular activities, such as emailing, there might be decreasing sociodemographic differences. However, this may not be the case for the activities that require higher levels of skills, such as using search engines. Because education and income have the most direct impact on Internet access and Internet literacy, we expect that education and income differentials in online activities, especially the activities requiring higher levels of skills, have enlarged rather than narrowed.

## CHAPTER FOUR

### METHODOLOGY

#### **Data**

Data come from the Pew Internet & American Life Project. Pew Internet & American Life Project is funded by the Pew Charitable Trusts and is one of the main projects in Pew Research Center. The project is designed to be “an authoritative source on the evolution of the Internet through surveys that examine how Americans use the Internet and how their activities affect their lives” (Pew Internet & American Life Project, 2009). Using the survey data, the project addresses issues on the social impact of the Internet on families, communities, work and home, daily life, education, health care, and civic and political life. Pew Internet & American Life Project began in March 2000 and the result was published two months later in May 2000. Initially, the projects focuses on two main research areas: (1) basic online activities; and (2) several dimensions of social life that were not much studied by other firms. Along with the penetration of the Internet, there are more and more popular online activities. In addition to common topics such as emailing, the project’s research focus is broadened to a large scope in order to include more important online activities, such as online dating and using online search engines.

All adults aged 18 years or older who are residents of the continental United States of America are eligible for participation in the surveys. Random Digital Dialing was used to select sample respondents, and telephone interviews were conducted by Princeton Research Associates. Response rate for each survey is around 30%. Sample weights are provided in the public release data which can be used to adjust for non-response bias.

My thesis employs a quantitative research design using data sets made available to the public. I use 26 data sets downloaded from the Pew Internet & American Life Project, which covers people's online activities from March 2000 to December 2005. Each data set contains approximately 2,000 to 2,500 cases. Most of them are Pew's daily tracking data on Internet activities, including questions on daily Internet use at home, such as whether going online, emailing or having online shopping. One additional data set is on particular issues-the Post-Election 2004 Tracking Survey. Besides common topics as other data sets have, this data set included specific information on politics and 2004 election. Furthermore, each data set has all the related demographic variables-gender, age, education and family income. For this study, I pooled the 26 data sets so that I can examine the trend of online activities participation; it has about 60,000 cases. After deleting missing cases on age, gender, race and education, 58,736 cases are included in the analyses.

## **Measures**

### *Dependent Variables*

This study examines five online activities: emailing, use of the Internet for work, hobby searching, purchasing products, and using online search engines. The respondents were asked "Now I'd like to ask you some questions about your Internet activities at home. Please tell me if you ever do any of the following when you go online. Do you ever (i) send or read email? (ii) not including email, do any type of work or research online for your job? (iii) look for information about a hobby or interest? (iv) BUY a product online, such as books, music, toys or clothing? And (v) use an online search engine to help you find information on the Web?" If the answer was yes to a question, the respondents were further asked: "Did you happen to do this YESTERDAY, or not?" The response categories for each of these questions are "Yes, did this yesterday," "Yes,

have done (but NOT yesterday),” “No, do not do this,” and “Don’t know/Refused.” In my analysis, I define online users as those respondents who did an activity yesterday and if not yesterday, had ever done that before (coded 1) and compare this group with respondents who had never performed that activity.

While all surveys include the question on emailing activity, other four activities were not collected in all surveys. As described in Table 1, use of the Internet for work was asked in 14 surveys, hobby searching in 10 surveys, online purchasing in 17 surveys, and using online search engines in 4 surveys.

Table 1. The number of data sets that include each online activity.

Emailing	Working Usage	Hobby Searching	Purchasing Products	Search Engines Usage
26	14	10	17	4

### *Independent Variables*

To examine the trend in online activities from 2000 to 2005, I create a new variable named “survey n” to indicate the time period when the survey was conducted. Each survey was assigned the value from 0 to 25 for the “survey n” variable according to the chronologic order. It ranged from “0” for the first survey conducted in March 2000 and “25” for the last survey conducted in December 2005.

Other independent variables include age, gender, race, education and family income. Respondents were asked of their age in years and it is a continuous variable. The respondent’s sex was entered by the interviewer as either male or female. The respondents were asked “what is your race?” and the response categories for this questions are White; Black or African-American; Asian or Pacific Islander; Mixed race; Other. Race is recoded in to three categories:

White, Black, and other race. I used White as reference category. Respondents were asked “What is the last grade or class you completed in school” and the response categories for this questions are None, or grades 1-8; High school incomplete; High school graduate; Business, Technical, or vocational school; Some college, no 4-year degree; College graduate; Post-graduate training/professional school. I recoded the original education variable into three categories: high school education or less, some college education, and bachelor degree or higher. “Bachelor degree or higher” is used as the reference category. For the income variable, the respondents were asked “last year, what was your total family income from all sources, before taxes?” and the response categories for this questions are less than \$10,000; \$10,000 to under \$20,000; \$20,000 to under \$30,000; \$30,000 to under \$40,000; \$40,000 to under \$50,000; \$50,000 to under \$75,000; \$75,000 to under \$100,000; and \$100,000 or more. I collapse those categories into three groups: low-income group (below \$30,000), middle-income group (\$30,000 to \$50,000), and high-income group (\$50,000 to the highest). The middle-income group is selected as the reference category. Since 21.5% of the respondents are missing on family income and excluding those respondents could bias the analysis results, I create a category of “missing income” for these respondents, and create a dummy variable indicating missing family income in the multiple regression analyses.

### **Statistical Analysis**

The analyses are conducted on the pooled data. The results are weighted to represent the U.S. adult population aged 18 years and over. My analysis includes two parts: descriptive analysis and logistic regression analysis. First, I run frequency distribution of each online activity and present the percentages of respondents who did each activity yesterday or if not yesterday, at some other time. I also provide descriptive statistics on respondents’ demographic and socio-

economic characteristics. Next, I run three sets of logistic regression models to examine the trend of online activities and effects of socio-economic factors on online activities. The first set of models regress each online activity on “Survey n,” the variable indicating survey period, to examine whether the participation rate of each online activity has increased over time. The second set of models add demographic and socio-economic variables into the first set of models to see first, whether participation rate of each online activity differs by these demographic and socio-economic factors and second, whether the effect of “Survey n” on online activity participation can be explained by changes in demographic and socio-economic characteristics. In the third set of models, the product terms of “Survey n” and each demographic and socio-economic variable was also added to the models to examine whether the effects of demographic and socio-economic variables on online activity participation have changed over time.

## CHAPTER FIVE

### RESULTS

#### Descriptive Statistics

Table 2 reports participation rate of each online activity at home based on the pooled data from all survey periods from 2000 to 2005. As we can see, emailing is the common activity with 55.1% of respondents having done it yesterday or before yesterday. Using search engine is also common with a participation rate of 55.4%. About 38.8% of respondents did searched a hobby online, 32.2% went online shopping and 28.6% used the Internet for work.

Table 2. Descriptive statistics of online activities and demographic and socio-economic variables.

	Mean(Std)/%		N
	Unweighted	Weighted	
<b>Activities</b>			
Emailing	57.0%	55.1%	58658
Using for Work	30.1%	28.6%	33821
Searching a Hobby	39.9%	38.8%	23746
Online Shopping	34.4%	32.2%	37635
Using search engines	55.1%	55.4%	9296
<b>Age</b>	47.39(18.00)	45.51(17.67)	58736
<b>Gender</b>	--	--	58736
Women	52.8%	51.9%	--
Men	47.2%	48.1%	--
<b>Race</b>	--	--	58736
White	83.6%	81.5%	--
Black	10.2%	11.6%	--
Other Race	6.2%	6.8%	--

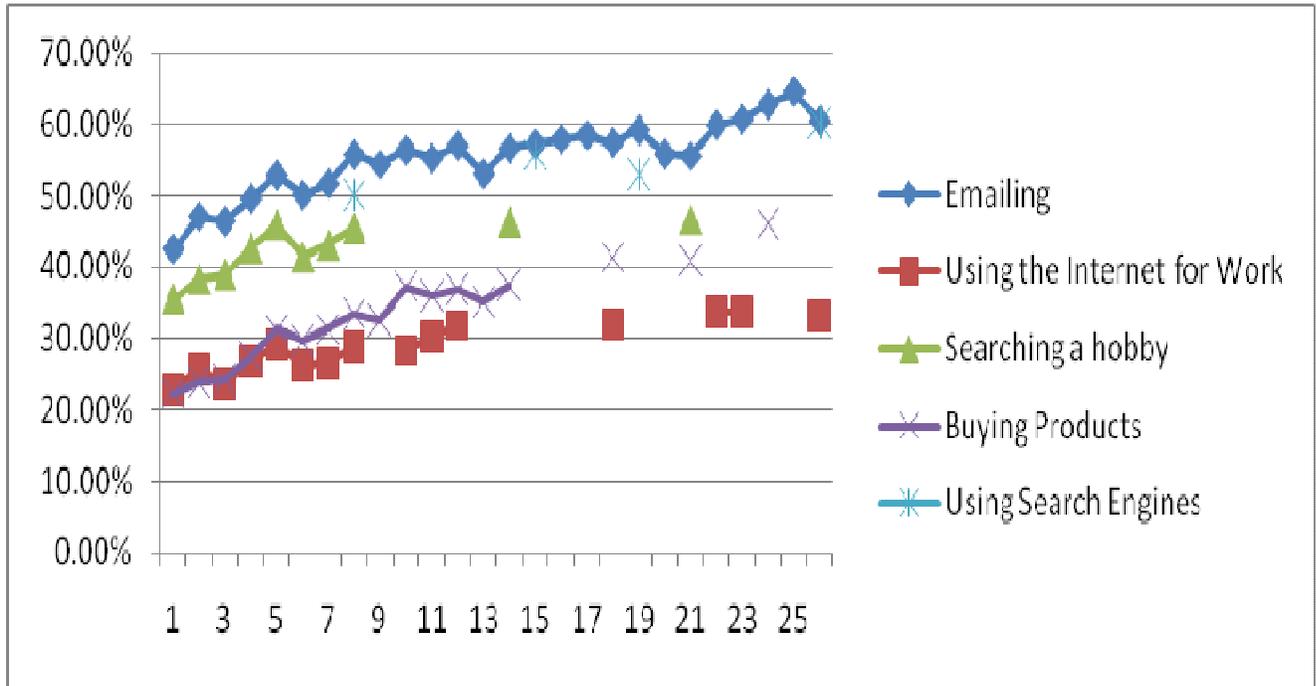
<b>Education</b>	--	--	58736
High School	41.2%	46.8%	--
Some College	28.0%	27.9%	--
Bachelor Degree	30.8%	25.3%	--
<b>Income</b>	--	--	58736
Low Income	26.8%	28.9%	--
Middle Income	20.4%	20.5%	--
High Income	33.3%	31.6%	--
Missing Income	19.5%	19.1%	--

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Note: Based on pooled data from 2000 to 2005.

Figure 1 shows participation rate of each online activity over time. As seen in this figure, participation rate for emailing has increased from 42.5% in March 2000 to 64.7% in September 2005. Participation rate for using the Internet for work has increased from 22.8% in March 2000 to 33.1% in December 2005. Participation rate for the hobby searching activity has increased from 35.6% in March 2000 to 46.8% in December 2004. Participation rate for online purchasing has increased from 22.3% in March 2000 to 46.2% in June 2005. Participation rate for using online searching engines has increased from 50.2% in January 2001 to 60.2% in December 2005.

Figure 1. Participation rate of each online activity over time.



Note: Results are weighted.

Table 2 also presents descriptive statistics of socio-economic variables of this pooled sample. The mean age is 45.51 years old. There are more women (51.9%) than men (48.1%). Nearly 82% are whites, 12% are blacks, and 7% are in other races. About 47% are high school educated, 28% have some college education, and 25% have bachelor degree and the above. Nearly 30% have family income below \$30,000, 21% have family income between \$30,000 and \$50,000, 32% have family income above \$50,000, and 19% did not report family income.

### Logistic Regression Analysis

Results from logistic regressions of each online activity on survey time are presented in Table 3. With the exception of searching the hobby, survey time is positively associated with the likelihood of having each of the other four types of online activities. From one survey period to the next period, people are 3% more likely to have emailing online, 2% more likely to use the Internet for work, no change for the hobby searching activity, 5% more likely to have online

shopping, and 2% more likely to use search engines. We can see that over time more and more people are involved in online activities. Based on Cox & Snell  $R^2$  and Nagelkerke  $R^2$ , the fit of the models are around from .00% to 2.4%, which means at most 2.4% variances could be explained by survey time alone.

Table 3. Odds ratios of logistic regression of each online activity on survey time period.

	Emailing	Using for Work	Searching a Hobby	Online Shopping	Using Search Engines
Surveyn	1.03***	1.02***	1.00	1.05***	1.02***
Constant	.90***	.33***	.62***	.33***	.87***
Cox & Snell $R^2$	.011	.005	.000	.017	.005
Nagelkerke $R^2$	.014	.008	.000	.024	.007
N	58264	33821	23746	37241	9296

Note: Based on pooled data from 2000 to 2005. Results are weighted.

\*  $P < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . two-tailed tests.

Results from logistic regressions of each online activity on survey time and demographic and socio-economic variables are presented in Table 4. Except for searching information on hobby, participation rates for all other four activities are significantly increasing over time after controlling for sociodemographic variables. This finding suggests that the trend of increasing participation in online activities cannot be explained by changes in demographic and socio-economic characteristics. Demographic and socio-economic variables, however, all significantly predict participation rates of these online activities. Not only are most of the effects significant at  $p < .001$  level, but these effects are substantial. The results show that older adults are less likely than younger adults to participate in all five online activities. One year increase in age is associated with 4-5% decrease in the likelihood of participation in each of online activities. The

differences are statistically significant for all online activities. Women are 24% more likely to do emailing, 9% more likely to do online shopping and 8% more likely to use search engines than men, but women are 12% less likely to search hobby information and 10% less likely to use the Internet for work. Blacks are 37-53% significantly less likely to have these activities than whites. People in other races are about 17-42% significantly less likely to have these activities than whites.

Table 4. Odds ratios of logistic regression of each online activity on survey time period, demographic and socio-economic variables.

		Emailing	Using for Work	Searching a Hobby	Online Shopping	Using Search Engines
<b>Survey</b>		1.04***	1.02***	1.00	1.06***	1.03***
<b>Age</b>		.95***	.96***	.96***	.96***	.95***
<b>Gender</b>	Women	1.24***	.90***	.88***	1.09*	1.08*
	Men	--	--	--	--	--
<b>Race</b>	White	--	--	--	--	--
	Black	.52***	.63***	.50***	.51***	.47***
	Other Race	.64***	.83***	.71***	.73***	.58***
<b>Education</b>	High School	.16***	.13***	.28***	.21***	.17***
	Some College	.49***	.36***	.66***	.52***	.47***
	Bachelor Degree	--	--	--	--	--
<b>Income</b>	Low Income	.48***	.57***	.57***	.55***	.50***
	Middle Income	--	--	--	--	--
	High Income	1.95***	1.88***	1.59***	1.86***	2.00***
	Missing Income	.64***	.74***	.71***	.68***	.62***

Constant	22.71***	5.63***	11.06***	4.00***	27.60***
Cox & Snell R <sup>2</sup>	.30	.23	.21	.22	.31
Niegelkerke R <sup>2</sup>	.40	.33	.29	.31	.41
N	58264	33821	23746	37241	9296

Note: Based on pooled data from 2000 to 2005. Results are weighted.

\*  $P < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . two-tailed tests.

The results show a positive association between education and participation rates in online activities. People with high school or less education are 72-87% significantly less likely to have these activities than those with a bachelor degree and above education, while people with some college degree are 34-64% significantly less likely to use the Internet for work than people with bachelor degree or the above. Income is also positively associated with online activity participation. People with low income are 43%-52% significantly less likely to have these activities than people with middle income, while people with high income are 59-100% significantly more likely to participate in these activities than people with middle income. People who did not report family income are about 26-38% significantly less likely to participate in all activities than people in middle income. Based on Cox & Snell R<sup>2</sup> and Negelkerke R<sup>2</sup>, the fit of the models are around from 21% to 41%, which means at least 21% and at most 41% variances could be explained by variables in these models. Compare to what I presented in Table 3, those models are much improved in explaining variances in Internet uses.

Next, I add interaction terms of survey time and each demographic and socio-economic variables to the models in Table 4 to examine whether the effects of these variables have changed over time, and results are presented in Table 5. As seen in Table 5, over time, the age effect is decreasing on emailing, searching a hobby online, and using search engines, and the

interaction term between age and survey time is not significant for using the Internet for work and online shopping. The significant gender and survey time interactions indicate that the gap between women and men in emailing activity and online shopping has increased over time, but the gender gap in searching a hobby online has decreased over time. The gap between blacks and whites is increasing for using the Internet for work and using search engines, but decreasing in online shopping. The gap is also increasing between whites and other race in emailing, using Internet for work and online shopping. The difference between high school graduates and people with Bachelor degree or more education in using the Internet for work and searching hobbies online has decreased over time. The difference between people with some college and those with Bachelor degree or more education has also decreased in using search engines. The difference between low income group and high income group in using search engines has decreased over time, but the difference between high income and middle income groups in using search engines and using the Internet for work has increased over time. No other interaction terms of income and time period are significant.

Table 5. Odds ratios of logistic regression of each online activity on survey time period, demographic and socio-economic variables and interactions of survey time period by demographic and socio-economic variables.

		Emailing	Using for Work	Searching a Hobby	Online Shopping	Using Search Engines
<b>Constant</b>		25.50***	6.16***	14.95***	4.07***	61.23***
<b>Age</b>		.95***	.96***	.95***	.96***	.94***
<b>Gender</b>	Women	1.13***	.87***	.83***	1.03	.93
	Men	--	--	--	--	--
<b>Race</b>	White	--	--	--	--	--
	Black	.55***	.71***	.50***	.46***	.66**
	Other	.75***	.97	.70***	.86*	.63*
	Race					
<b>Education</b>	High School	.17***	.12***	.25***	.21***	.14***
	Some College	.48***	.37***	.63***	.53***	.32***
	BA or	--	--	--	--	--

<b>Income</b>	Higher					
	Low	.49***	.56***	.55***	.55***	.34***
	Income					
	Middle	--	--	--	--	--
	Income					
	High	1.90***	1.77***	1.64***	1.84***	1.28
	Income					
	Missing	.74***	.77***	.71***	.72***	.50***
	Income					
Surveyyn		1.03***	1.01**	.95***	1.06***	.98
i_age		1.00***	1.00	1.00***	1.00	1.00*
i_woman		1.01***	1.00	1.01**	1.01*	1.01
i_black		1.00	.99**	1.00	1.01*	.98*
i_otherrace		.99**	.99**	1.00	.98***	1.00
i_hs		1.00	1.01*	1.02***	1.00	1.01
i_somcoll		1.00	1.00	1.01	1.00	1.02**
i_lowinc		1.00	1.00	1.01	1.00	1.02**
i_highinc		1.00	1.01*	1.00	1.00	1.03***
i_misinc		.99***	1.00	1.00	.99	1.01
Cox & Snell R <sup>2</sup>		.30	.23	.21	.22	.31
Nagelkerke R <sup>2</sup>		.40	.33	.29	.31	.41

Note: Based on pooled data from 2000 to 2005. Results are weighted.

\*  $P < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . two-tailed tests.

## CHAPTER SIX

### DISCUSSION AND CONCLUSION

In this thesis, I explored the theoretical background of the Internet usage and the social inequality, reviewed previous research on the digital divide, and analyzed the current trend of digital divide. The strengths of this research include more recent trend data from a reliable source, large sample size, multiple popular online activities, and multiple sociodemographic characteristics. My thesis not only reports the trend in online activities and sociodemographic differences in these activities, but provides new information on how sociodemographic differences in online activities have changed over time. The data set is large and contains 26 sub data sets dated from March 2000 to December 2005 and over 60,000 cases in total. With a large data size and proper weighting, our results can be generalized to the larger population. In addition, my research uses more socio-economic variables in predicting social inequality in the use of Internet. Age, gender, race, education, and income are important socio-economic factors in explaining social behaviors and phenomena. The research applies Marxism's theory about means of production to explain the digital divide, and the findings can help further our understanding of social inequality from the perspective of the division of labor and human capital. Moreover, the research explores the people's Internet literacy by examining the usage of online search engines. This is a new area and only a few studies examined the usage of online search engines in predicting the digital divide.

Most findings from this study are consistent with my hypotheses and with what were found in previous studies. More and more people are involved in the digital world; according to the participate rates listed in th Figure 1, for all online users, more and more people participated in those five typical online activities from 2000 to 2005. Yet, not all people have equal time for

online activities. Some findings of my research are not surprising. For example, older people are less likely to be active online, blacks and people in other races are significantly less likely to have online activities than whites. In addition, the effects of education and income on online activity participation are substantial and statistically significant.

Over time, we do not see uniform increasing or decreasing patterns in sociodemographic differences in the five popular online activities. Just a few interaction terms between time period and sociodemographic variables are statistically significant, suggesting the gaps in most areas are largely maintained. Out of the eighteen significant interaction terms, nine point to decreasing gaps while nine point to increasing gaps. This finding suggests that some progress has been made in reducing the digital divide, but the job is not done. Racial divide in digital technology seems to have worsened. The gap between high income and middle income groups is also increasing.

The findings from this study generally support Marx's view of social inequality. As Marx and his followers predicted that the increase of industrialization could aggravate the complexity of the division of labor which finally increases the social inequality (Karl Marx and Eugene Kamenka, 1983). The Internet was created to facilitate human's daily life, but ironically, it became a tool to differentiate people and brought the unequal distribution of social resources and cultural resources. Along with the penetration of the Internet, people are differentiated not only by the Internet access, but also by the ownership of Internet skill assets. Finally, it created extremely unbalanced relationship between social classes and became another form of human capital which deepens the divide among social classes. The advantage groups would take advantage of their status and benefit from the access and the usage of the Internet.

Somewhat unexpected, women are more likely than men to use emails, have online shopping and use online search engines, but men are significantly more likely to use the Internet

for work related activities and to search a hobby. These gender differences may reflect different gender roles in our society. For example, since women are more responsible for housework and men for breadwinning outside home, and men enjoy more leisure time than women, it is not surprising to see that more women use the Internet to shop while more men use the Internet for work-related activities and for searching a hobby. Women's greater participation in emailing may be because women like to socialize and tend to have a larger social network. In this study, using search engines is used as a proxy for Internet literacy. However, it could also be possible that women do this more because they have a greater need to search the Internet for more information and for better deals.

For future research, since the Internet literacy is an important indicator for the digital divide, it would be better for researchers to measure directly Internet literacy and test the relationship between Internet literacy and online activities. Detailed analysis of Internet literacy is important for understanding changes in digital divide over time. For example, the future research could examine people's Internet literacy across the socio-economic variables which is helpful to understand the phenomenon of digital divide and the effect of Internet exposure. Future studies could also further examine the effect of searching a hobby in predicting the digital divide. In the current research, there is no explicit relationship between searching a hobby online and a variable measuring time. However, as seen in Figure 1, clearly there is an increasing trend in the early period, but this trend is not steady, and there are some indications that this trend differs by age, gender and education. It would be interesting to continue monitoring this trend, and examine whether this trend differs by sociodemographic groups.

In sum, along with more people participating in online activities, unequal Internet usage and digital exposure still exist. And over time, despite some progress were made in reducing the

digital divide, the gap between sociodemographic groups has increased somewhat, especially in racial divide and income divide. People with disadvantageous social and economic status stay disadvantaged in the digital world. They are significantly less likely to have a variety of popular online activities.

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