Article

Digital Divide: How Do Home Internet Access and Parental Support Affect Student Outcomes?

Jing Lei [1],* and Jingye Zhou [2]

[1] Department of Instructional Design, Development and Evaluation, Syracuse University, 336 Huntington Hall, Syracuse, NY 13244, USA

[2] Department of Instructional Design, Development and Evaluation, Syracuse University, 330 Huntington Hall, Syracuse, NY 13244, USA; E-Mail: jzhou10@syr.edu

* Author to whom correspondence should be addressed; E-Mail: jlei@syr.edu; Tel.: +1-315-443-1362; Fax: +1-315-443-1812.

Abstract: This study examined the relationship between home Internet access/parental support and student outcomes. Survey data were collected from 1,576 middle school students in China. Data were analyzed using descriptive analysis, independent-samples T-test, and regression analysis. Results indicate that students who had home Internet access reported higher scores than those without home Internet on all three dimensions: Computer and Internet self-efficacy, Attitudes towards technology and Developmental outcomes. Home Internet access and parental support were significantly positively associated with technology self-efficacy, interest in technology, perceived importance of the Internet, and perceived impact of the Internet on learning. Findings from this study have significant implications for research and practice on how to narrow down the digital divide.

Keywords: digital divide; Internet access; home and school; student outcomes

1. Introduction

Digital divide refers to the technology capacity gap between those who have access to rich digital information and those who have not [1], and the root of this "troubling digital gap" is the inequity of access to computers and the Internet [2]. This inequity exits both in schools and at home. In the last two decades, much attention has been paid to narrowing the gap in schools, and as a result, significant

progress has been made on closing the gap in school Internet access: in the United States, the percentage of instructional rooms with Internet access rose from 64% in 1999 to 94% in 2005 [3]. However, the gap in home Internet access is still a serious concern [4]. Studies show that, in the United States, Black, Hispanic, Native American and poor students are less likely to have access to computers and the Internet at home than their Caucasian and Asian counterparts [5,6] Similarly, a federal study on the Internet use of 56,000 households revealed that minority students are falling far behind white students in the use of the Internet [7]. In a study focused on five low-socioeconomic (SES) and three high-SES schools in California, Warschauer and colleagues [8] found that students in low-SES schools were heavily impacted by the sparse access to computers and the Internet at home. These findings indicate a serious digital divide in terms of home Internet access between poor students and affluent students [9].

A review of literature reveals that, however, despite the severity of the digital divide at home, there is little research on Internet use at home [10]. In addition, several other important issues have been largely overlooked in the research on Internet access and student outcomes. The first issue is parental support. Research points outs that students' online behaviors at home are mostly shaped by parents and close friends [11], yet there is very little research looking at the impact of parental support on student Internet use. The second issue is that most of the research treats Internet access as a simple concept, without looking into the nature and the quality of student use of the Internet. It is necessary to differentiate the use experience of different types of Internet applications [12,13]. The third issue is the lack of a comprehensive view of the Internet's impact on students, including student learning performance, ICT skills, collaboration and problem solving skills and their Internet usage behavior at school.

Therefore, to address these issues, this study intends to examine the following questions: (1) How do home Internet access and parental support relate to students' school and home Internet usage pattern? (2) Do home Internet access and parental support relate to students' self-efficacy of and attitudes toward technology? And if yes, to what degree? (3) Do home Internet access and parental support relate to students' perceptions of their collaboration skills, problem solving skills, self-esteem and interest in different cultures? And if yes, to what degree?

2. Literature Review

Researchers have examined how students' Internet use affects their academic achievement, yet the overall results are ambiguous. For example, Jackson and colleagues [14] found that children who use the Internet more had higher scores on standardized tests of reading achievement and higher GPAs than children who used it less did. A three-year longitudinal study discovered that the access to and the use of home computers and the Internet were correlated positively with student academic achievement [5]. On the other hand, the National Bureau of Economic Research recently completed an evaluation on eRate, a large federal program intending to increase the Internet access in schools and libraries. They found no evidence of the impact of access to the Internet on test scores in the study [15].

Some studies looked into the impact of the use of Internet on students' technology skills. For example, Hohlfeld and colleagues [9] found that students in high SES schools used production software significantly more frequently than students in low SES schools. They suggested that a

possible cause might be the different levels of access to computers and the Internet at home. The inequitable access led to the varied levels of ICT skills among students and subsequently led to their differential use of production software in schools. Similarly, Kuhlemeier and Hemker [10] revealed that using email, online chatting and browsing the Internet were significantly predictive of Internet and computer skills.

Other than academic achievement and technology skills, however, there is a dearth of research making a step forward to investigate the impact of home Internet access on students' attitudes toward technology and students' development characteristics, such as self-efficacy and attitude to technology, collaboration skills, problem solving skills *etc*. All those skills and positive attitudes towards technology are critical to the youth's success in the digital world in which participants are expected to not only actively participate in but also contribute to various digital activities [16,17].

Also of interest in our study is parental support for the Internet use. Parental support has been identified as positively associated with their children's development [18,19]. However, the effects of parental support on narrowing the digital divide largely remain unknown. Studies focusing on relationship between parents and their children's use of the Internet are scarce. Aslanidou and Menexes [4] reported that parental supervision and monitoring of children's use of the Internet was largely absent. Espinosa and colleagues [20] suggested that children did not benefit much from mere technology access if adults didn't provide appropriate guidance to mediate the children's use of technology.

Although educators and researchers advocate for the parents' role in students' Internet use, there is a lack of empirical evidence in their arguments. The majority of literature on this topic is articles published in professional magazines and reports. For example, an article reports that parents worry about that the Internet might become the biggest threat to their children's safety after TV [21]. Some articles call for parent to filter out inappropriate Internet content for their children [22,23]. It is critically important to empirically examine how parental support shapes students' Internet usage, skills and attitudes.

3. Methods

Data were collected from 7th–9th grade students in seven middle schools located on the east coast and in Beijing, China, as a part of a program evaluation of an international technology project. Data were collected through an online survey that was administered in the schools. The survey included the following sections: Demographic information such as gender and grade; Internet background information such as home Internet access and parental support of Internet use; Internet usage information such as total time spent on the Internet per week in school, at home, and in other places, and types of Internet activities; Outcomes variables such as students' perceived technology skills, perceived collaboration skills, perceived problem solving skills, self-esteem and interest in different culture. For this set of questions, students were asked to rate their level of agreement on a series of statements on a Likert scale of 1−5, with 1 meaning "strongly disagree" and 5 meaning "strongly agree".

A total of 1,576 valid surveys were collected. Among them, 52% was female and 48% was male. To answer the research questions, data were analyzed using descriptive analysis, independent-samples T-test, and regression analysis.

4. Results

4.1. Internet Access

About half of the students (53.5%) reported that Internet access was available at home, and 83% of students reported they had access to the Internet in the school. About two-thirds (78.2%) of the students reported that their parents supported their Internet use. About a quarter of the students reported using the Internet for less than 1 hour per week, over half of the students (59.8%) spent 1 to 5 hours on the Internet per week, 9.8% of the students spent 5–10 hours, and a small portion of the students (6%) used the Internet for more than 10 hours per week.

4.2. Home Internet Access, Parental Support and Internet Usage

Unsurprisingly, results (see Table 1) indicated that students who had home Internet access tended to report longer Internet usage time than did students who did not have home Internet access. Likewise, students who had parental support for Internet access also tended to spend more time on the Internet than those who did not have such support.

Table 1. Descriptive Statistics on Internet Usage.

Variables	Home Internet Access		Parental Support	
	Without (%)	With (%)	Without (%)	With (%)
Hours spent using the Internet				
Zero hours	36.5	10	46.0	18.1
About 1 to 5 hours	56.8	63.4	46.6	63.7
5 to 10 hours	3.8	14.9	4.1	10.3
More than 10 hours	2.9	11.7	3.2	8.0
	100	100	100	100
Variety of Internet activities in the school				
Searching for learning materials	48.7	52.3	45.2	52
Searching for other useful materials	28.8	26.6	24.9	28.6
Playing games	33.0	37.9	34.6	35.9
Reading domestic news	19.9	19.4	17.6	20.5
Reading world news	19.0	19.5	16.1	20.2
Reading entertainment news	35.0	31.4	29.0	34.5
Chatting with friends	33.8	31.6	26.4	34.6
Chatting with strangers	9.1	6.6	6.7	8.5
Reading/Sending Emails	9.4	12.5	6.2	12.1
Downloading Music, Movies or Software	25.6	22.4	22.3	25.0
Reading posts or stories	14.5	16.3	12.3	15.9
Posting on websites	5.7	11.1	6.2	8.6

Students were asked to report the activities for which they used the Internet for in school. They were allowed to choose multiple activities. In comparing the non-home Internet group and home Internet group, we found that both groups engaged in similar Internet activities in school, with small differences in *Searching for learning materials* (48.7% *vs.* 52.3%), *Reading entertainment news* (35.0% *vs.* 31.4%), *Posting on websites* (5.7% *vs.* 11.1%). When comparing the no parental support group and parental support group, one interesting theme emerged: there was a higher percentage of parental-support-students than of non-parental-support-students engaging in each activity. That means, students with parental support engaged in a wider range of online activities in school than those without parental support.

4.3. Computer and Internet Self-Efficacy, Attitudes towards Technology and Developmental Characteristics

We performed independent-samples T-tests to compare the means of scores on *Computer and Internet Self-Efficacy*, *Attitudes towards Technology and Developmental characteristics* between non-home-Internet group and home-Internet-group, and between non-parental-support-group and parent-support-group. The results (see Table 2) showed that students who had access to the Internet at home reported higher scores than those without home Internet on all three dimensions. All differences were statistically significant. We also provided the Cohen's d results as the measure of magnitude for reference. Similarly, the group whose parents supported their Internet use also reported significant higher scores than their counterparts did on all three dimensions.

Table 2. Results of T-tests on the Relationship Between Home Internet Access and Parental Support and Student Outcomes.

Independent-Samples T-Test	W/O Home Internet Access V.S. W/ Access		W/O Parental Support V.S. W/ Parental Support	
	T-Test	Cohen's d	T-Test	Cohen's d
Computer and Internet Self-Efficacy				
Computer Self-Efficacy	−11.432**	0.59	−6.603**	0.34
Internet Self-Efficacy	−10.479**	0.54	−7.132**	0.36
Attitudes towards technology				
Interest in Computer	−4.591**	0.23	−4.279**	0.22
Importance of the Internet	−4.478**	0.23	−4.221**	0.22
Impact of the Internet on learning Performance	−3.388**	0.17	−2.989**	0.15
Impact of the Internet on development of Interest	−6.576**	0.33	−5.001**	0.26
Developmental Characteristics				
Collaboration skills	−2.572**	0.13	−2.439*	0.13
Problem solving skills	−3.699**	0.19	−2.935**	0.15
Self-esteem	−4.254**	0.22	−3.184**	0.16
Interest in Different Cultures	−4.997**	0.26	−1.985*	0.10

* $p < 0.05$, ** $p < 0.01$.

Regression analyses were used to predict dependent variables *Computer and Internet Self-Efficacy*, *Attitudes* towards *Technology and Developmental characteristics* from home Internet access and parental support. Time spent on the Internet and school Internet access were controlled for in the analyses for two reasons: (1) they were found to have an effect on student technology skills [9,10]; (2) in this study, we found strong bivariate correlations between these two variables and dependent variables, respectively.

Table 3 summarizes results from the multiple regression analysis. Parental Support and Home Internet Access remained significant predictors of most of the variables.

Table 3. Multiple Regression Results on the Relationship Between Home Internet Access and Parental Support and Student Outcomes.

Independent Variables	**Multiple Regression** (Standardized Regression Coefficient)				
	Computer Self-Efficacy	Internet Self-Efficacy	Importance of the Internet	Impact of the Internet on Learning Performance	Interest in Computer
Time	0.089**	0.068*	0.121**	−0.017	0.009
Parental Support (had support = 1)	0.182**	0.256**	0.212**	0.135*	0.227**
Home Internet (had access = 1)	0.522**	0.495**	0.130*	0.176* *	0.200**
School Internet (had access = 1)	0.070**	0.112**	0.036	0.130**	0.085**
DF	1492	1476	1478	1488	1488
F	38.26**	36.09**	11.47**	7.910**	9.90**
R squared	0.093	0.089	0.027	0.021	0.026

In regards to Computer Self-Efficacy and Internet Self-Efficacy, the results showed that both prediction models were statistically significant ($R^2 = 0.093$, F(4, 1492) = 38.26, p < 0.01; $R^2 = 0.089$, F(4, 1476) = 36.09, p < 0.01). It was found that students who had parental support and had home Internet access tended to report higher computer self-efficacy and Internet self-efficacy than their peers did after controlling for time spent on the Internet and school Internet access. When we compared the standardized regression coefficients, we found that home Internet access and parental support had significantly larger association with Computer and Internet Self-Efficacy than time spent on the Internet and school Internet access did.

As for students' *Interest in Computer*, *Perceived Importance of the Internet* and *Perceived Impact of the Internet on Learning*, the prediction models only explained a small variance of these variables (R^2 was 0.026, 0.027 and 0.021, respectively). Time spent on the Internet was only predictive of Importance of the Internet. Still, parental support and home Internet access were significant predictors. Higher Interest in Computer, Perceived Importance of the Internet and Perceived Impact of the Internet on Learning were reported by the students who had parental support and had home Internet access after controlling for school Internet access and time spent on the Internet.

5. Discussions and Conclusion

This study examines the impact of home Internet access and parental support on several student outcomes. Results indicate that students who have home Internet access reported higher scores than those without home Internet on all three dimensions: Computer and Internet Self-Efficacy, Attitudes towards Technology and Developmental outcomes, and home Internet access and parental support have significantly positive association with technology self-efficacy, interest in technology, perceived importance of the Internet, and perceived impact of the Internet of learning. Findings from this study have significant implications for research and practice on how to narrow down the digital divide at home. As discussed at the beginning of the paper, despite the huge investment in and rapid growth of information technology in both the society in general and schools in particular, the digital divide is still a serious challenge, particularly in terms of home technology access. The access issues not only include who can afford a computer and get the Internet connection, but also who can use the Internet and operate the software. Users who cannot participate effectively across the full range of opportunities and the information technologies provided cannot be said to have "access" [24]. Therefore, much more attention must be paid to narrowing the gap in student technology access outside of school.

In addition, more attention is needed on the quality of technology access because the disparity in the quality of access further widens the digital divide. More advanced technology hardware and software always cost more, and therefore is out of reach of children from the less economically advanced families and communities [25]. As the gap between the information haves and have-nots is related to the tremendous political, social, economic, educational and career opportunities created by the digital revolution [26], the digital divide not only affects education opportunities, but also is intricately intertwined with a nation's economic prosperity, stability, security and survival.

Findings from this study also shed some light on future research. First, future study should explore how parental support and home Internet access are associated with students' academic performance in school, and with other constructs that can be objectively measured, such as objectively measured computer skills and problem solving ability, in addition to their self-reported skills. Second, future study should focus on parental support in more detail to examine how the quality and the nature of parental support could be associated with student outcome. Answers to these questions could provide some practical suggestions for parents and educators.

References

1. Tien, F.F.; Fu, T.T. The correlates of the digital divide and their impact on college student learning. *Comput. Educ.* **2008**, *50*, 421-436.
2. Mehra, B.; Merkel, C.; Bishop, A.P. Internet for empowerment of minority and marginalized communities. *New. Media. Soc*. **2004**, *6*, 781-802.
3. Wells, J.; Lewis, L. *Internet Access in U.S. Public Schools and Classrooms: 1994–2005 (NCES 2007-020)*; US Department of Education: Washington, DC, USA, 2006.
4. Aslanidou, S.; Menexes, G. Youth and the internet: Uses and practices in the home. *Comput. Educ.* **2008**, *51*, 1375-1391.

5. Judge, S.; Puckett, K.; Bell, S. Closing the digital divide: An update from the early childhood longitudinal study. *J. Educ. Res*. **2006**, *100*, 52-60.

6. Mason, C.Y.; Dobbs, R. Bridging the digital divide. *Principal* **2005**, *84*, 24-30.

7. Trotter, A. Minorities still face digital divide. *Education Week*, 13 September 2006; Editorial Projects in Education: Bethesda, MD, USA, 2006.

8. Warschauer, M.; Knobel, M.; Stone, L. Technology and equity in schooling: Deconstructing the digital divide. *Educ. Policy*. **2004**, *18*, 562-588.

9. Hohlfeld, T.N.; Ritzhaupt, A.D.; Barron, A.E.; Kemker, K. Examining the digital divide in K-12 public schools: Four-year trends for supporting ICT literacy in Florida. *Comput. Educ*. **2008**, *51*, 1648-1663.

10. Kuhlemeier, H.; Hemker, B. The impact of computer use at home on students' internet skills. *Comput. Educ*. **2007**, *49*, 460-480.

11. Wang, Y.M. Children's internet uses at home. *J. Educ. Technol. Sys*. **2003**, *32*, 269-281.

12. Gibson, S.; Oberg, D. Visions and realities of internet use in schools: Canadian perspectives. *Brit. J. Educ. Technol*. **2004**, *35*, 569-585.

13. Volman, M.; van Eck, E.; Heemskerk, I.; Kuiper, E. New technologies, new differences. Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Comput. Educ*. **2005**, *45*, 35-55.

14. Jakson, L.; von Eye, A.; Biocca, F.A.; Barbatsis, G.; Zhao, Y.; Fitzgerald, H.E. Does home internet use influence the academic performance of low-income children? *Dev. Psychol*. **2006**, *42*, 429-435.

15. Goolsbee, A.; Guryan, J. The impact of internet subsidies in public schools. *Rev. Econ. Stat*. **2006**, *88*, 336-347.

16. Jorgenson, D.; Ho, M.; Stiroh, K. *Productivity: Information Technology and the American Growth Resurgence*; MIT Press: Cambridge, MA, 2005; Volume 3.

17. Zhao, Y.; Lei, J. New technology. In *AERA Handbook on Educational Policy Research*; Plank, D., Sykes, G., Schneider, B., Eds.; Routledge: New York, NY, USA, 2009; pp. 671-693.

18. Dennis, J.M.; Phinney, J.S.; Chuateco, L.I. The role of motivation, parental support, and peer support in the academic success of ethnic minority first-generation college students. *J. Coll. Stud. Dev*. **2005**, *46*, 223–236.

19. Kef, S.; Dekovic, M. The role of parental and peer support in adolescents well-being: A comparison of adolescents with and without a visual impairment. *J. Adolesc*. **2004**, *27*, 453-466.

20. Espinosa, L.M.; Laffey, J.M.; Whittaker, T.; Sheng, Y.Y. Technology in the home and the achievement of young children: Findings from the early childhood longitudinal study. *Early. Educ. Dev*. **2006**, *17*, 421-441.

21. Whelan, D.L. Parents: Internet is a double-edged sword. *Sch. Libr. J*. **2006**, *52*, 15-15.

22. Bushone, S. Parenting the internet. *Teach. Libr*. **2002**, *29*, 12-16.

23. Minkel, W. National report: Internet filters can't replace parents. *Sch. Libr. J*. **2002**, *48*, 16-16.

24. Burbules, N.C.; Callister, T.A. Universities in transition: The promise and the challenge of new technologies. *Teach. Coll. Rec*. **2000**, *102*, 271-293.

25. Warschauer, M. Technology and social inclusion: Rethinking the digital divide; MIT Press: Cambridge, MA, USA, 2003.

26. Yu, P.K. Bridging the digital divide: Equality in the information age. *Cardozo Arts Entertain. Law J.* **2002**, *20*, 1–52.