

The Impact of Home Computer and Internet Device on Students' Academic Performance in the Digital Age

Yue Liu^{1,*} and Jiacheng Gao¹

¹ School of Finance and Public Administration, Harbin University of Commerce, Harbin, Heilongjiang, 150028, China

*Corresponding author. Email: 847686104@qq.com

ABSTRACT

In order to study the impact of home computers and the Internet on students' academic performance in the current era of rapid Internet development, this paper is based on the China Education Panel Survey (CEPS) 2014-2015 academic year data, using quantile regression estimation methods, the research finds under the background of the digital age, students' home computers and Internet device have a significant positive effect on students' academic performance. Therefore, in the current digital age, home computers and Internet devices are essential for students.

Keywords: home computer and Internet device; student academic achievement; quantile regression; the digital age

(Datu, 2018; Whelan, 2020; Kirschner, Karpinski, 2010; Sulinsen, 2018).

1. INTRODUCTION

With the widespread application of the Internet in the current digital age, especially the continuous innovation and integration of the development of Internet-related technologies are profoundly changing the way of thinking, production, life and learning of human beings. Under the background of the digital age, the continuous popularization of the Internet can provide more students with massive information resources and educational resources. According to the Statistical Report on China's Internet Development (2020), by June 2020, China had 940 million Internet users, and the Internet penetration rate had reached 67.0%, up 12.7% from 54.3% in June 2017. Combining the proportion of netizens using the Internet for related activities, it can be found that 5.9% of netizens use the Internet for online education, 4.7% for browsing online news, 4.6% for reading online literature, 13.7% for instant messaging, and 12.8% for watching online videos, 7.3% watched live webcasts, 8.8% watched short videos, and 10.9% listened to online audio. These activities all indicate that the Internet can provide its users with massive information resources and massive educational resources. At the same time, combining with the current age structure of Chinese netizens, it can be found that netizens aged between 10 and 19 account for 14.8%, indicating that students are a "main force" among netizens and have good opportunities to use the Internet to obtain massive information resources and educational resources. Studies have found that compared with students who do not use the Internet, using the Internet can improve students' academic performance[1-3] (Willoughby, 2018; Peter, 2005; Chengjianwei, 2018). Studies have also found that excessive use of the Internet will reduce students' concentration, which will lead to a decline in students' academic performance[4-7]

2. EMPIRICAL RESEARCH DESIGN

2.1. Data Source

The data in this paper are from the China Education Panel Survey (CEPS) in the 2014-2015 academic year, which was recently released by the China Survey and Data Center of Renmin University of China.

2.2. Variable Setting

This paper mainly studies the influence of home computer and Internet device on students' academic performance under the background of the digital era. Firstly, the variables in this paper are set.

Dependent variables: students' Chinese, mathematics, and English scores. Since the China Education Tracking Survey is a survey of 112 schools across the country, there are inconsistencies in the full scores of Chinese, mathematics, and English exams between schools, and direct comparisons cannot be made. In order to conduct a more accurate empirical analysis, the Chinese, mathematics, and English scores of all student samples are converted into a 100-point system. The corresponding assignments are shown in Table 1.

Core explanatory variable: whether the student's home is equipped with a computer and Internet. In the digital era, it is very important for students to have the opportunity to surf the Internet after school. Using computers to connect to the Internet can not only enable students to continue to acquire learning resources after school, but also enable students to

communicate with like-minded groups online, which can make students relax and broaden their knowledge. The corresponding assignments are shown in Table 1.

Control variables: with reference to the relevant literature, this article further added in the process of demonstration whether there is a separate desk in the student's home,

whether the student is participated in out-of-school tutoring, the student's physical health, the student's father's education years, the student's mother's education years, the student's family economy conditions and whether the student's family is receiving the minimum living guarantee. The corresponding assignments are shown in Table 1.

Table 1. Assignment of variables

Variable	Assignment
Dependent variables:	
Chinese Score	The student's mid-term exam Chinese score directly provided by the student's school in the fall semester of 2014
Math Score	The student's mid-term exam math score directly provided by the student's school in the fall semester of 2014
English scores	The student's mid-term exam English score directly provided by the student's school in the fall semester of 2014
Core explanatory variables:	
Do students have computers and Internet at home	None of them =0; Have a computer without network =1; With computers and Internet =2
Control variables:	
Is there a separate desk in home	No desk =0; Have a desk = 1
Whether the student attended outside school tutoring	Did not attend after-school tutoring =0; Attendance at after-school tutoring =1
Student's physical health status	Very bad, not so good, average =0; Good and very good =1
The education level of the student's father	Have no education =0; Primary school = 1; Junior school = 2; Technical secondary school/technical school =3; Vocational high School =4; High school = 5; Junior college =6; Undergraduate =7; Postgraduate and above =8
Years of education of the student's mother	Have no education =0; Primary school = 1; Junior high school = 2; Technical secondary school/technical school =3; Vocational High School =4; High school = 5; Junior college =6; Undergraduate =7; Postgraduate and above =8
Economic conditions of students' families	Very difficult =1; Difficult =2; Medium = 3; Better off =4; Very rich = 5
Whether the student's family receives subsistence allowance	No=0; Yes=1

equipped with computers as a whole. Still, the network connection rate is relatively low.

2.3. Descriptive Statistics

The descriptive statistics of the mean values of the dependent variables, core explanatory variables and control variables in this paper are summarized in Table 2. The results in the table show that the average score of students' Chinese scores is 68.912 points, math scores are 64.209 points, and English scores are 62.504 points. This shows that the average scores of current students in Chinese, mathematics and English have just reached the passing standards, and there is a large room for improvement. At the same time, it can be found whether there is a computer in the student's home and the average value of the network is around 1.393, indicating that the student's family has been

Table 2. Descriptive statistics of each variable

Variable	Average	Standard deviation	Minimum	Maximum
Dependent variables:				
Chinese results	68.912	14.736	0	98.333
Math results	64.209	25.665	0	100
English results	62.504	24.051	0	100
Core explanatory variables:				
Does the student have a computer and the Internet at home	1.393	0.875	0	2
Control variables:				
Is there a separate desk in the student's home	0.789	0.408	0	1
Whether the student attended outside school tutoring?	0.349	0.477	0	1
Student's physical health status	0.789	0.408	0	1
The education level of the student's father	3.277	2.004	0	8
Education level of the student's mother	2.995	1.998	0	8
Economic conditions of students' families	2.812	0.609	1	5
Whether the student's family receives subsistence allowance	0.110	0.312	0	1
Sample size	8537			

Note: Data were collected from China Education Panel Survey (CEPS) in the academic year 2014-2015.

By observing the kernel density map of Chinese, mathematics and English scores of the students who have gone through hundred differentiation, it can be found that the scores of Chinese, mathematics and English are

distributed from 60 to 80 on the whole, which indicates that the majority of the students in the sample have middle scores or so.

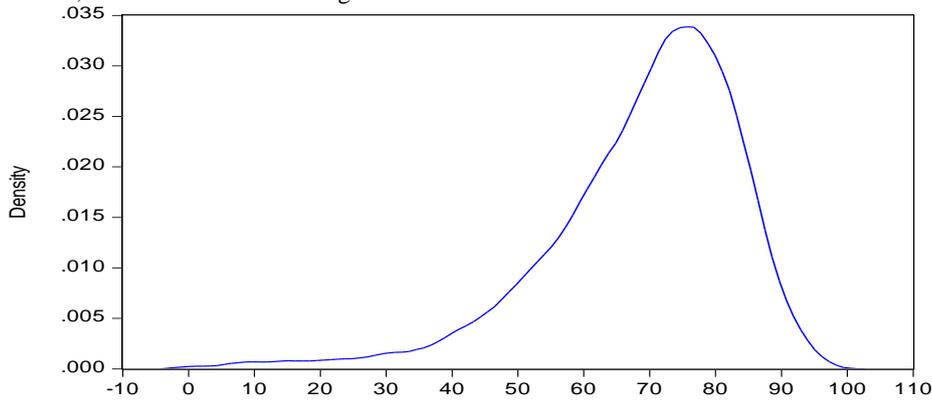


Figure 1. Kernel density map of Chinese scores of well-differentiated students in 2014-2015 school year

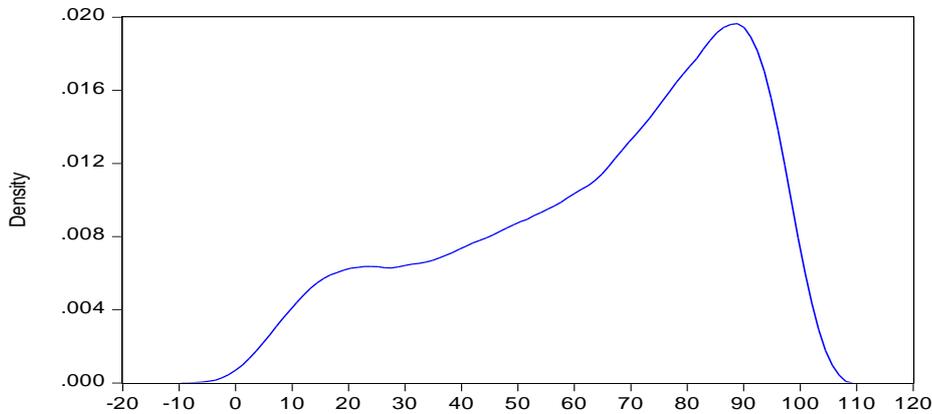


Figure 2. Kernel density map of mathematics scores of well-differentiated students in 2014-2015 school year

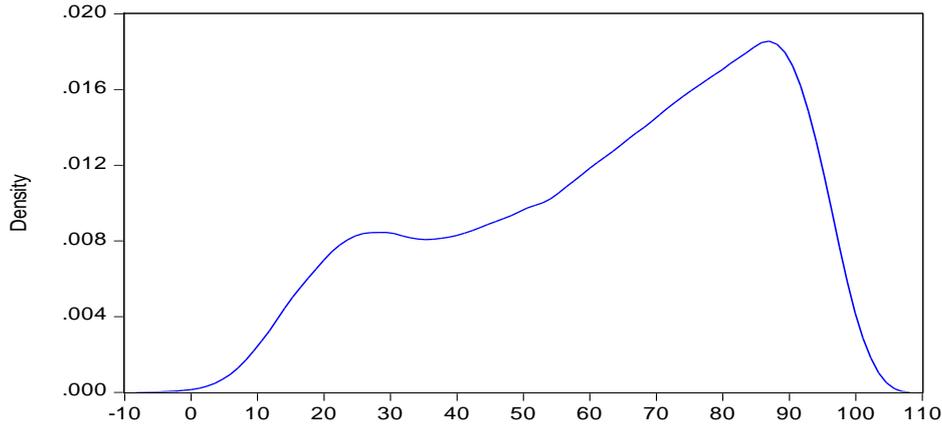


Figure 3. Kernel density map of English scores of well-differentiated students in 2014-2015 school year

Therefore, it is very appropriate to use quantile regression method to analyze the causal relationship between students' home computer and Internet configuration and students' Chinese, mathematics and English scores from different quantiles.

2.4. Model Setting

In order to study the influence of computer and Internet device in students' home on their academic performance in the digital era, a linear model was selected in this paper. The linear model was chosen for better marginal analysis of explanatory variables. The linear model is as follows:

$$\begin{aligned} \text{Examination Performance}_i &= C_i + \beta_1 \text{Home Computers And The Internet}_i \\ &+ \gamma_i \sum X_i + \mu_i \end{aligned}$$

The dependent variable *Examination Performance_i* represents the scores of students in Chinese, math and English after differentiation.

Core explanatory variable *Home Computers And The Internet_i* is for whether students have computers and Internet at home. X_i is a series of control variables. C_i is the intercept term. The reason why quantile regression method is used is that it is not easy to be affected by extreme values, it can be used to analyze different quantile sites, and the results are more robust.

3. EMPIRICAL RESULTS and ANALYSIS

In this paper, Eviews10.0 is used for empirical analysis. Before estimating the model, in order to prevent serious multicollinearity among the explanatory variables, the multicollinearity test is carried out in the first step. The average variance inflation factors of each explanatory variable is 1.401, and the variance Inflation factors among the explanatory variables is far less than 10, so there is no serious multicollinearity problem in the model. Table 3 presents the results of the empirical analysis based on the quantile regression method.

Table 3. Quantile regression results of the influence of home computer and Internet on students' academic performance

	(1) Chn	(2) Mat	(3) Eng
Home computers and the internet	1.394*** (0.248)	3.185*** (0.508)	3.619*** (0.479)
Independent desk	1.824*** (0.515)	4.863*** (1.055)	9.810*** (0.995)
Outside tutoring	1.125** (0.415)	4.357*** (0.850)	5.524*** (0.802)
Child health	0.440 (0.458)	1.262 (0.937)	1.143 (0.884)
Father's educational level	0.370** (0.127)	1.333*** (0.261)	1.810*** (0.246)
Mother's educational level	0.639*** (0.129)	1.363*** (0.265)	1.238*** (0.250)
Family economic conditions	0.366 (0.333)	0.113 (0.681)	0.524 (0.643)
Subsistence allowance	-2.384***	-6.869***	-5.810***

	(0.610)	(1.250)	(1.179)
Constant	63.17***	49.93***	40.05***
	(0.941)	(1.926)	(1.817)
N	8537	8537	8537
R ²	3.79%	6.40%	10.83%

Standard errors in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001

The regression results in table 3 shows that in students home if there have a computer and the Internet, whether students Chinese scores or math scores or English scores were extremely significant, and the direction for positive influence, its value on each ascending one unit will bring the students' Chinese scores rise 1.394 points, 3.185 points in math scores, and 3.619 points in English scores. This shows that in the current digital era, students can gain more information through computers and the Internet after school, including the acquisition of learning resources and the

communication with the like-minded people to broaden their knowledge, which enable students to synchronize study with relaxation and to make learning more efficient.

Since students' scores in Chinese, math and English are all distributed from 60 to 80, it is necessary to make an empirical study on students' academic achievements at different scores. In this paper, every 25 deciles are stratified, and then the influence of students' home computer and Internet device on students' academic performance is studied. The actual results are shown in Table 4.

Table 4. Quantile regression results of the influence of home computer and Internet on students' academic performance at 25-point, 50-point and 75-point

	(4) Chinese25	(5) Math25	(6) English25	(7) Chinese50	(8) Math50	(9) English50	(10) Chinese75	(11) Math75	(12) English75
Home computers and the Internet	2.000***	2.917**	2.386***	2.000***	2.917**	3.619***	1.184***	1.743***	2.958***
	(0.286)	(0.544)	(0.416)	(0.221)	(0.637)	(0.395)	(0.195)	(0.453)	2.958***
Control variable	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	8537	8537	8537	8537	8537	8537	8537	8537	8537
R ²	6.36%	7.56%	10.62%	3.79%	6.40%	10.83%	2.57%	3.02%	8.95%

Standard errors in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001

From the regression results of the 25th, 50th and 75th percentiles, it can be seen that whether there is a computer and the Internet at home has a positive and significant influence on students' academic performance, whether they have poor academic performance, moderate academic performance or excellent academic performance. Every unit increase in its value will increase the Chinese scores of students with poor academic performance by 2 points, the math scores by 2.917 points and the English scores by 2.386 points. The Chinese scores of middle school students increased by 1.394 points, math scores increased by 3.185 points, and English scores increased by 3.619 points; The results of Chinese, math and English increased by 1.184, 1.743 and 2.958 respectively. This shows that the device of students' home computers and Internet can significantly improve students' academic performance.

4. CONCLUSION

In the context of the digital age, this article uses the China Education Panel Survey (CEPS) 2014-2015 academic year data, uses quantile regression method and examines the effects of students' home computers and Internet devices on students' academic performance from different quantiles. The study found that in a student home whether has a

computer and the Internet both has a significant positive impact on the academic performance of students with poor academic performance, students with intermediate academic performance, and students with better academic performance. Therefore, in the current digital age, the device of students' home computers and the Internet is very necessary.

REFERENCES

- [1] Peter J, Valkenburg P M, Schouten A P. Developing a model of adolescent friendship formation on the Internet.[J]. *CyberPsychology & Behavior*. 2005, 8(5): 423-430.
- [2] Willoughby, Teena. A short-term longitudinal study of Internet and computer game use by adolescent boys and girls: prevalence, frequency of use, and psychosocial predictors.[J]. *Developmental Psychology*. 2008, 44(1): 195-204.
- [3] Cheng Jianwei, Yan Jianxiong, Gao Lei. Study on the Relationship between Internet Preference and Academic Achievement of Primary and Secondary School Students

[J]. *China Health Education*.2018,034 (004): 347-351.(In Chinese)

[4] Datu J A D, Yang W, Valdez J P M, et al. Is facebook involvement associated with academic engagement among Filipino university students? A cross-sectional study[J]. *Computers & Education*. 2018, 125(OCT.): 246-253.

[5] Karpinski K. Facebook® and academic performance[J]. *Computers in Human Behavior*. 2010.

[6] Whelan E, Brooks S, Islam A. Applying the SOBC paradigm to explain how social media overload affects academic performance[J]. *Computers & Education*. 2019, 143: 103692.

[7] Su Linsen, Liu Xiaoyan. Study on the Relationship between Children's Internet Access and Academic Achievement [J]. *Youth Research*. 2020, No.435(06): 17-27. (In Chinese)