

# Research on the Influence of Internet Development Level on Community Education in China based on the Panel Data Analysis of Beijing and Shanghai From 2009 to 2016

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**Abstract**—The rapid development of information technology has a far-reaching impact on China's education industry. This paper attempts to clarify the impact of informatization on China's community education, so as to further analyze the impact of Internet development on the development of education industry characterized by the upgrading of community education. Using stochastic effect model to analyze the panel data of 32 districts in Beijing and Shanghai, while taking certain effects such as time effect and urban effect into consideration, the research found that the improvement of Internet development level has a significant positive effect on the number of students and teachers in common middle schools in cities, which fully illustrates the positive impact of Internet development on community education. We suggest to carry out top-level design, increase financial investment, encourage the government and enterprises to share resources, and promote the use of information technology for construction of excellent model on community education, in order to further promote the development of community education.

**Keywords:** *Internet development, community education, panel data, impact*

## I. RESEARCH BACKGROUND AND IDEAS

The continuous development of information technology has played a revolutionary role in the adjustment of China's economic structure and the transformation of economic system, and has become the most important growth force in China's economic ecology.[1] In the era of "Internet Plus", the mode of economic development has gradually shifted from mainly relying on capital and material to science and technology, and information technology is the main source of scientific and technological progress.

Information technology is also driving the constant change of education mode. In the context of "Internet Plus ", informatization has broken the boundaries of education, and online education has broken the limits of classroom size, place, time and space; Multimedia teaching is also changing the traditional teaching mode. Online tutoring, APP homework, data analysis of learning situation and other information modes are introduced into education, which improves the teaching efficiency. [2] At the same time, informatization promotes the innovation and development of education. The popularization of informatization educational equipment ensures the sharing of scarce and high-quality educational resources, becoming an effective way to promote the balanced development of urban and rural education, general education and vocational education.

This research hopes to clarify the impact of informatization on China's economic development, especially on community education, so as to further analyze the impact of Internet development on the development of education industry characterized by the upgrading of community education, and to provide suggestions and guidance for further promoting China's overall economic development and structural optimization. In order to analyze the impact of Internet development on community education, a multi-dimensional description has been chosen to illustrate the impact of Internet development level on community education. Firstly, we select the number of common middle school teachers to represent the development level of community education, and explore how the development level of the Internet affects community education when considering the time effect and urban effect. At the same time, we use the number of common middle school students to represent the level of community development to further analyze the impact of Internet development level on

community education. The research framework is shown in Fig. 1 below.

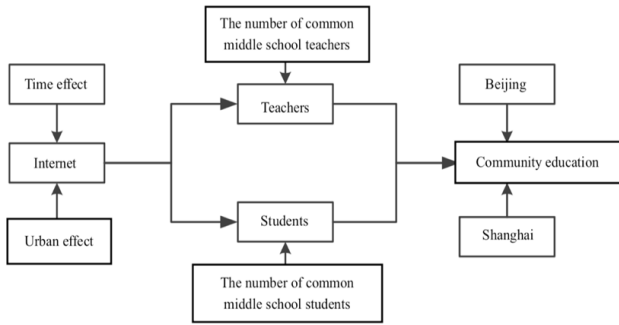


Fig. 1. Research framework.

II. LITERATURE REVIEW AND HYPOTHESIS PRESENTATION

Daowei ZHANG (2011) demonstrated that the regional informatization level can promote the growth of per capita education level. Since the popularity of higher education is based on good grassroots education which reflects the improvement of education level, the increasing informatization level also promotes the development of community grassroots education. [3]

Wei CHEN and Yue YANG (2018) expound the positive impact of information technology on education ecology through quantitative analysis and empirical research. The optimized ecological function of education finally promotes the educational effect. The author analyzes three education models based on information technology: mooc, flipped classroom and Mak-er. These three models promote the fairness of learners' resource utilization, the display of students' personality and the spirit of cooperation. The application of these functions of information technology in the field of community grassroots education can improve the quality of students, thus promoting the development of the education industry. [4]

Yunlin LI (2013) interpreted that "information technology has a revolutionary impact on the development of education". He analyzed the revolutionary impact of information technology on the development of education. The Internet promotes modern education and has a positive impact on the theory and practice of educational informatization. Community grassroots education is an indispensable part of the education industry, and its development is also driven by the Internet. [5]

Geshua HU and Mingfei FU (2011) elaborated that the mobile Internet caters more appropriately to learners' needs, that the new market of the Internet provides opportunities for community education to seek funds, and that community education is supported by the Internet and database, thus demonstrating that the change of the development mode of the Internet would promote the development of community education. [6]

Yuan ZENG and Linan YANG (2010) proposed that the Internet has entered a period of rapid development and a large number of "community websites" have emerged. The Internet has played a significant positive role in the construction of community culture. Good community culture construction can

promote the living standard of community residents and also promote the development of community education. [7]

Wenjing TAO (2013) proposed that the role of community network in promoting community life focuses on three aspects: community participation, community cohesion and community belonging. These social capitals are the foundation of community education construction, so the development of community network can promote community education. [8]

To sum up, we put forward the hypothesis that community education, as an important part of the education industry, can benefit from the rapid progress of the Internet, and the development of the Internet can promote the progress of community education. In order to measure the level of community education, we take the number of common middle school students and teachers in Beijing and Shanghai as the indicators. On this basis, the relationship between the development level of Internet and the development level of community education needs to be further verified by panel data.

III. EMPIRICAL ANALYSIS OF THE INFLUENCE OF INTERNET DEVELOPMENT LEVEL ON COMMUNITY EDUCATION LEVEL

A. Samples and Data Sources

The research period of this paper is from 2009 to 2016, with 32 urban districts in Beijing and Shanghai as the research objects. The 16 districts of Beijing include Dongcheng, Xicheng, Chaoyang, Fengtai, Shijingshan, Haidian, Mentougou, Fangshan, Tongzhou, Shunyi, Changping, Daxing, Huairou, Pinggu, Miyun, Yanqing. The caliber of Dongcheng district is calculated according to the combination of chongwen district and old dongcheng district. The caliber of Xicheng district is calculated according to the combination of xuanwu district and old xicheng district. The 16 districts of Shanghai include Huangpu, Xuhui, Changning, Jing 'an, Putuo, Hongkou, Yangpu, Minhang, Baoshan, Jiading, Pudong, Jinshan, Songjiang, Qingpu, Fengxian and Chongming. The caliber of Huangpu district is calculated according to the combination of Luwan district and old huangpu district. The caliber of Jing 'an area is calculated according to the combination of Zhabei area and old Jing 'an area. The data were obtained from Beijing urban statistical yearbook, Beijing regional statistical yearbook, Shanghai urban statistical yearbook, national economic and social statistical bulletin of all urban districts in Shanghai over the years, Hongkou yearbook, etc.

B. Model Setting of the Influence of Internet Development Level on Community Education Level

Due to the lack of data at the urban level, And the level of Internet development is difficult to quantify. Considering the high degree of synergy between economic development and Internet driven development this year, we selected the proportion of regional GDP as the proxy variable of Internet development level (Int). Taking the Internet development level of Haidian district of Beijing as an example, the calculation formula is the total regional GDP of Haidian district / the total regional GDP of each urban area of Beijing in that year. The level of Internet development should be taken as an explanatory variable in the model. We describe the level of

community education from two dimensions. From the level of teachers, we use the number of teachers in common middle school (tea\_num) as the explained variable. From the student level, we use the number of students in common middle school (stu\_num) as the explained variable.

In order to avoid "pseudo-regression", we use the unit root to test the stationarity of panel data. Through F test and robust Hausman test, we determined to establish a random effect model to analyze the panel data. By testing the joint significance of all annual dummy variables, we judged that time effect should be added. Therefore, the following model is constructed:

$$tea\_num_{i,t} = \alpha + \beta Int_{i,t} + city + \eta_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

$$stu\_num_{i,t} = \alpha + \beta Int_{i,t} + city + \eta_i + \gamma_t + \varepsilon_{i,t} \quad (2)$$

$i = 1, 2, \dots, 32; t = 2009, 2010, \dots, 2016$

In the model, the subscript  $i$  refers to the city, city is a dummy variable, including two values of Beijing and Shanghai. Subscript  $t$  refers to the year, said intercept.  $\eta_i$  reflect the individual effects in different city.  $\gamma_t$  reflects the influence of time-point effect in different years.  $\varepsilon_{i,t}$  is the random error independent of the variable.

**C. Analysis on the Influence of Internet Development Level on Community Education Level**

Table I is the regression result of formula (1):

TABLE I. FORMULA (1) ESTIMATION RESULTS OF MODEL PARAMETERS

tea_num <sub>i,t</sub> = 2193.8 + 37053Int <sub>i,t</sub> + city + η <sub>i</sub> + γ <sub>t</sub> + ε <sub>i,t</sub>			
R-sq: overall=0.8836 between = 0.8544 within = 0.2217			
Number of common middle school teachers	Coef	z	P> z
<i>Int</i>	37053.0	14.02	0
<b>Time effect</b>			
<i>2010</i>	62.9	1.46	0.145
<i>2011</i>	469.3	4.72	0
<i>2012</i>	508.9	4.27	0
<i>2013</i>	414.4	2.93	0.003
<i>2014</i>	510.4	3	0.003
<i>2015</i>	624.4	2.86	0.004
<i>2016</i>	728.0	3.03	0.002
<b>City</b>			
<i>Shanghai</i>	-510.5	-1.7	0.089
<i>_cons</i>	2193.8	7.34	0

Through the random effect model, we found that the overall determination coefficient R2 was 0.8836, indicating that the model had a relatively large degree of interpretation for the

panel data. To be specific, for every 1% increase in the level of Internet development, the number of common middle school teachers in a single urban area increased by about 370. The time effect is also significant in this model. With the growth of time, the number of ordinary middle school teachers is also gradually increasing, with an annual increase of about 100 teachers. This is in line with the fact that budget spending on education is increasing. At the same time, we found that compared with Shanghai, the districts in Beijing are more abundant in the allocation of teachers' resources in common middle schools, with an average of more than 500 more teachers.

The regional differences reflected in the model are influenced by profound social and environmental factors. For example, as the political center of Beijing, highly inclined financial support cannot be ignored. Secondly, Beijing itself has abundant and high-quality educational resources, and the influx of students from all over the country is also an important reason for the significant large number of teachers in Beijing. In addition, as a national center of higher education, Beijing can give full play to the compound advantages of science and technology and talents, and the influence of the Internet in various fields in Beijing is also growing. Due to the particularity of science and technology and education in summary, Beijing has shown remarkable discrimination effect in samples.

Table II is the regression result of formula (2):

TABLE II. FORMULA (2) ESTIMATION RESULTS OF MODEL PARAMETERS

stu_num <sub>i,t</sub> = 18604 + 214991Int <sub>i,t</sub> + city + η <sub>i</sub> + γ <sub>t</sub> + ε <sub>i,t</sub>			
R-sq: overall=0.8478			
Number of common middle school students	Coef	z	P> z
<i>Int</i>	214990.9	3.06	0.002
<b>Time effect</b>			
<i>2010</i>	-669.7	-3.69	0
<i>2011</i>	-1037.1	-2.28	0.023
<i>2012</i>	-1272.1	-2.42	0.015
<i>2013</i>	-1125.4	-1.6	0.11
<i>2014</i>	-1796.0	-2.34	0.019
<i>2015</i>	-3209.3	-4	0
<i>2016</i>	-3859.8	-4.06	0
<b>City</b>			
<i>Shanghai</i>	6294.7	1.36	0.174
<i>_cons</i>	18603.9	4.22	0

In the model, the overall determination coefficient R2 reaches 0.8478, indicating that the model has a relatively high

degree of interpretation of panel data. Specifically, for every 1% increase in Internet development level, the number of ordinary middle school students in a single urban area increases by about 2200. The time effect cannot be ignored in this model. As time goes on, the number of students gradually decreases, which corresponds to the situation that the peak of China's demographic dividend has passed.

#### IV. CONCLUSIONS AND POLICY SUGGESTIONS ON THE INFLUENCE OF INTERNET DEVELOPMENT LEVEL ON COMMUNITY EDUCATION LEVEL

From the construction of the above model, we find that for the number of common middle school students, the Internet development level is significant when the P value is 0.001 and has a positive promoting effect. Apart from the perspective of common middle school teachers in the model 1 to verify the level of Internet development on the level of community education, we found that in the case of common middle school teachers, the internet development level is significant and continues to grow when the P value is 0.005. That is to say model 2 from the dimension of students shows that the Internet development level promotes the community education level. Hence, it can be fully demonstrated that the higher the level of Internet development, the higher the level of community education.

Based on the above conclusions on the impact of Internet development level on community education level, we give the following policy suggestions: (1) Strengthen the top-level design of central and local governments. Improve relevant laws on informatization infrastructure construction at the central level and formulate relevant laws and regulations on informatization infrastructure construction at the local level according to local conditions. Plan the development of online education in community education and create a good environment for online community education. (2) Increase the investment in community education, the government should increase the financial support for community education in the fiscal budget, especially for the central and western regions. The government can change the traditional teaching methods through information technology investment to make up for the shortage of educational resources in the above areas. (3) Strengthen resource sharing between the government and enterprises. Through the support of the government to the

community education, more enterprises will be involved in the development of Internet education. The PPP mode can also be taken into consideration so as to promote the community education. (4) Publicize excellent models, select excellent cases of using information technology to promote community education from foreign perspectives, conduct extensive research and discussion and summarize replicable models, and then combine with the actual situation of the community education construction.[9]

With the rapid development of Internet, the backstage support of community education is Internet and information technology. The proposal of the development strategy of "Internet + community education" gives full play to the characteristics of interactivity, timeliness, openness and convenience in the Internet era, demonstrates the advantages of the Internet in community education, and enables the development and improvement of community education.

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