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Modern Distance Teacher Training in Narrowing the Gap on the Dual Structure Basic Education

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Abstract: With the development of technology, distance education has become an important tool to achieve educational equity. This paper aims to analyze the impact mechanism of modern distance teacher training on narrowing the gap between urban and rural education of China, and put forward a new path to improve the basic education. The research takes the China Education Panel Survey (CEPS) as the data source for analysis and find that the gap between urban and rural basic education does exist, but the academic achievement gap reflected by students at different quantiles is different; Distance teacher training is conducive to improving urban and rural students with different academic performance levels, and it has a higher promotion effect on students with better academic performance in rural areas; Different distance teacher training methods have different effects on students' academic performance, and the effects on mathematics and English subjects are more significant than those on Chinese subjects. Finally, this paper put forward some suggestions for the improvement of modern distance teacher training from the aspects of organization and management, training content, so as to provide a valuable reference for the balanced development of urban and rural education.

Keywords: Distance training; Narrow the gap between urban and rural education; Basic education; Influence mechanism

1. INTRODUCTION

At the beginning of 2019, "China Education Modernization 2035" drew a blueprint for the development of smart campus, digital education resources and artificial intelligence teaching combination based on the development picture of education informatization, which fully reflected the implementation logic from the macro-level education informatization policy to the micro-level to narrow the gap between urban and rural education, and provided a feasible solution to solve the problem of rural education resources [1]. However, how to examine the comprehensive impact brought by the application of information technology based on the practical problems from the microscopic perspective has become a key proposition to be solved urgently at this stage.

At this stage, the academic circles have fully studied the influencing factors related to the differentiation of basic education. Some scholars have calculated the performance of urban and rural basic education in 29 provinces of China through DEA dynamic and static models, and made a prediction before actual intervention to evaluate the basic gap. The results show that this gap does exist, mainly in technological progress and scale efficiency, and the influencing factors involve economic development level, financial freedom, urbanization rate, and poverty level of residents (Yu Xinghou et al., 2019)[2]. Some scholars believe that this gap can be alleviated by improving the distribution of educational resources. Combining distance learning and teaching information technology, we can provide rural teachers with the same educational resources as urban teachers, so that both teachers and students can benefit from the shared educational resources and focus on improving their academic level and educational governance from two aspects: individual internal factors and external environmental factors (Danie, 2021)[3]. At present, there are many ways of distance teacher training, such as online open courses, social network collaborative learning and mobile distance training. These forms have great potential in promoting teachers' quality, improving the quality of learning content, supporting curriculum teaching and improving learning satisfaction. For example, some scholars reported the enthusiasm and application of MOOC in rural areas (Mower, 2016)[4]. Some scholars have pointed out that mobile distance training has the potential to improve academic level, but there is no evidence that this measure can help narrow the gap between urban and rural basic education and provide equal educational opportunities for all (Syahida et al, 2022)[5].

Despite the surging interest in the role of ICT on reforming education, only limited attention has been given on the influence of modern distance teacher training and lack data support. Therefore, this paper uses CEPS data to explore the impact mechanism of on-site distance teacher training on narrowing this gap.

2. The research design and data sources

2.1 The data sources

The research data comes from the benchmark data of "China Education Panel Survey" (CEPS). This survey collected 19,487 students from 28 counties (districts), 112 schools and 438 classes nationwide, and collected information on family and school resources, teacher training status, students' academic achievements and basic characteristics, families and schools, which met the research needs.

2.2 The research methods

Uqr (unconditional quantile regression). In order to explore the influence mechanism of distance teacher training on students with different academic achievements, this paper adopts UQR regression analysis method to carry out research. UQR mainly uses RIF function to transform data, and divides students with different academic achievements into several points, so that we can analyze the differences in the influence of distance teacher training on students at different points. The main formula is as follows:

$$RIF(S, Q_\tau) = Q_\tau + \frac{\tau - I(S \le Q_\tau)}{F_S(Q_\tau)}$$

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In the formula, RIF is the reconcentration influence function of distribution statistics, S is academic achievement, Q is unconditional quantile, and I is indicative function.

3. The research results and statistics

According to the research hypothesis and CEPS baseline data, the data results are statistically analyzed, and three research questions are answered: the gap between urban and rural basic education; the influence of distance teacher training on narrowing the gap between urban and rural basic education; and the differential influence of different distance teacher training methods on narrowing the gap between urban and rural basic education.

3.1 The descriptive statistics of related variables

In the two samples of urban schools and rural schools, the frequency of distance teacher training in urban schools is significantly higher than that in rural schools, and the scores of three sciences are also significantly higher than that in rural schools, especially the gap in English academic performance. Compared with urban schools in academic and family levels, the proportion of only children in rural schools and the average educational years of parents are significantly lower, and the proportion of family financial difficulties is higher. At the school level, compared with urban schools, the proportion of teachers with bachelor's degree and teachers who graduated from normal schools is lower, and the proportion of top schools is even 0.

Table 1 Descriptive statistics of related variables

Variable dimension	Variable name	City school	Rural schools	Mean difference
independent variable	Distance teacher training frequency	25.606	14.771	10.835
dependent variable	Weighted Chinese academic achievement	48.443	34.871	13.572
	Weighted mathematics academic achievement	41.779	31.628	10.151
	Weighted English academic performance	49.403	30.395	19.008
Control variable	Student-gender	0.548	0.369	0.179
	Student-Is it an only child?	0.652	0.275	0.377
	Family-economic difficulties	18.20%	30.15%	-11.95%
	Family-economic medium	60.83%	53.50%	7.33%
	Family-economic prosperity	20.98%	16.35%	4.63%
	Family-parent average years of education	12.600	9.492	3.108
	Proportion of school-undergraduate teachers	0.865	0.649	0.216
	Proportion of school-teacher graduates	0.899	0.667	0.232
	School-backward in ranking	16.42%	29.91%	-13.49%
	School-ranked medium	54.16%	70.09%	-15.93%
	Schools-Top ranked	29.42%	0.00%	

Source: The benchmark data of China Education Tracking Survey (CEPS) project;

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Note: Student-sex (male -1, female-0); Student-Is it an only child (Yes -1, No -0)

3.2 The gap between urban and rural basic education

This paper explains the gap between urban and rural students at different points through the distribution of their academic achievements. Descriptive statistical results show that compared with urban students, rural students' weighted academic achievements in Chinese, mathematics and English lag behind urban students as a whole, which is similar to previous research results.

3.3 The impact of distance teacher training on narrowing the gap between urban and rural basic education

In this paper, UQR regression analysis is used to measure the influence mechanism of distance teacher training on the academic achievement gap between urban and rural students at different points, as shown in Table 2.

Table 2 UQR measurement results of distance teacher training in narrowing the gap between urban and rural basic education

subjectUrban studentsRural studentquantile; fractileQ30Q60Q90Q30Q60Q90Chinese0.164*0.443**0.533*0.859***0.144*0.445**mathematics0.173**0.314**0.520**0.126*0.424**0.597*English0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.				Urban studentsRural studentquantile; fractileQ30Q60Q90Q30Q60Q90Chinese0.164*0.443**0.533*0.859***0.144*0.445**mathematics0.173**0.314**0.520**0.126*0.424**0.597*English0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.		Rural studentquantile; fractileQ30Q60Q90Q30Q60Q90Chinese0.164*0.443**0.533*0.859***0.144*0.445**mathematics0.173**0.314**0.520**0.126*0.424**0.597*English0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.
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thematics0.173**0.314**0.520**0.126*0.424**0.597*English0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.	thematics0.173**0.314**0.520**0.126*0.424**	tics0.173**0.314**0.520**0.126*0.424**0.597*English0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.		.314**0.520**		
mathematics0.173**0.314**0.520**	0.173**0.314**	0.314**0.520**	0.520**0.126*0.424**0.597*English0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.	0.126*0.424**	0.424**0.597*	0.597*English0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.
English0.291**0.544*0.437*0.749**	0.291**0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.	0.544*0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.	0.437*0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.	0.749**0.580**0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.	0.580**0.982*	0.982*Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.

Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.

From Table 2, it can be seen that students' academic achievements are distributed in three quantiles, namely Q30, Q60 and Q90, which can all be improved through distance teacher training, and with the improvement of quantiles, the promotion of distance teacher training to students' academic achievements is gradually enhanced. In other words, distance teacher training can improve students' academic performance, but it does not mean that the gap between urban and rural education can be narrowed under the same distance training frequency. In addition, distance teacher training has a stronger promotion effect on students with good academic performance, but not on students with poor academic performance.

3.4 The differentiated effects of different distance teacher training methods on narrowing the gap between urban and rural basic education

This paper sorts out different distance teacher training methods, and divides them into three categories: open courses, social networks and mobile internet, and reveals the explanatory power of different distance teacher training methods in narrowing the gap between urban and rural basic education, as shown in Table 3.

Table 3 UQR measurement results of different distance teacher training methods to narrow the gap between urban and rural basic education

			Urban studentsRural studentQ30Q60Q90Q30Q60Q90ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%8.11%			Rural studentQ30Q60Q90Q30Q60Q90ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%8.11%		
subjectTraining categoryestimated value	Training categoryestimated value	estimated value/explanatory powerUrban studentsRural studentQ30	Q30Q60Q90Q30Q60Q90ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	Q60Q90Q30Q60Q90ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	Q90Q30Q60Q90ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	Q30Q60Q90ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	Q60Q90ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	Q90Chinese
ChineseOpen courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	Open courseestimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	estimated value1.271**1.355*1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	1.271**1.355*1.042**	1.355*1.042**1.013**	1.042**1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	1.013**1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	1.267***1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	1.034**Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%
		Explanatory power12.14%14.99%5.02%5.72%3.29%6.78%	12.14%14.99%5.02%5.72%3.29%6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	14.99%5.02%5.72%3.29%6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	5.02%5.72%3.29%6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	5.72%3.29%6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	3.29%6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	6.78%Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%
	Social networkestimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	estimated value1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	1.038**1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	1.563**2.955**1.832**1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	2.955**1.832**1.327*	1.832**1.327*1.830**	1.327*1.830**Explanatory power15.04%11.15%12.98%7.45%	1.830**Explanatory power15.04%11.15%12.98%7.45%
		Explanatory power15.04%11.15%12.98%7.45%	15.04%11.15%12.98%7.45%8.11%	11.15%12.98%7.45%8.11%6.91%	12.98%7.45%8.11%6.91%Mobile Internetestimated	7.45%8.11%6.91%Mobile Internetestimated	8.11%6.91%Mobile Internetestimated value2.0701	6.91%Mobile Internetestimated value2.0701

value2.0701	value2.0701	.8731.5962.	.8731.5962.
.8731.5962.	.8731.5962.	1931.5051.	1931.5051.
1931.5051.	1931.5051.	874**Expla	874**Expla
874**Expla	874**Expla	natory	natory
natory	natory	power20.23	power20.23
power20.23	power20.23	%15.54%23	%15.54%23
%15.54%23	%15.54%23	.02%10.07	.02%10.07
.02%10.07	.02%10.07	%9.24%5.1	%9.24%5.1
%9.24%5.1	%9.24%5.1	1%mathem	1%mathem
1%mathem	1%mathem	aticsOpen	aticsOpen
aticsOpen	aticsOpen	courseestim	courseestim
courseestim	courseestim	ated	ated
ated	ated	value1.424*	value1.424*
value1.424*	value1.424*	*2.858**2.	*2.858**2.
*2.858**2.	*2.858**2.	211**1.865	211**1.865
211**1.865	211**1.865	**2.518**2	**2.518**2
2.5182	**2.518**2	.466**Expl	.466**Expl
.466**Expl	.466**Expl	anatory	anatory
anatory	anatory	power10.22	power10.22
power10.22	power10.22	%18.61%20	%18.61%20
%18.61%20	%18.61%20	.50%15.71	.50%15.71
.50%15.71	.50%15.71	%17.05%25	%17.05%25
%17.05%25	%17.05%25	.93%Social	.93%Social
.93%Social	.93%Social	networkesti	networkesti
networkesti	networkesti	mated	mated
mated	mated	value2.435*	value2.435*
value2.435*	value2.435*	*1.944*0.9	*1.944*0.9
*1.944*0.9	*1.944*0.9	96***1.797	96***1.797
96***1.797	96***1.797	**1.078**2	**1.078**2
1.0782	**1.078**2	.125*Expla	.125*Expla
.125*Expla	.125*Expla	natory	natory
natory	natory	power15.48	power15.48
power15.48	power15.48	%17.92%20	%17.92%20
%17.92%20	%17.92%20	.98%16.80	.98%16.80
.98%16.80	.98%16.80	%15.97%12	%15.97%12
%15.97%12	%15.97%12	.10%Mobil	.10%Mobil
.10%Mobil	.10%Mobil	e	e
e	e	Internetesti	Internetesti
Internetesti	Internetesti	mated	mated
mated	mated	value1.615*	value1.615*
value1.615*	value1.615*	*1.224*2.3	*1.224*2.3
*1.224*2.3	*1.224*2.3	21**2.198*	21**2.198*
21**2.198*	21**2.198*	*1.540**0.	*1.540**0.
*1.540**0.	*1.540**0.	941**Expla	941**Expla
941**Expla	941**Expla	natory	natory
natory	natory	power14.74	power14.74
power14.74	power14.74	%20.33%10	%20.33%10
%20.33%10	%20.33%10	.18%21.89	.18%21.89
.18%21.89	.18%21.89	%25.35%18	%25.35%18
%25.35%18	%25.35%18	.88%Englis	.88%Englis
.88%Englis	.88%Englis	hOpen	hOpen
hOpen	hOpen	courseestim	courseestim
courseestim	courseestim	ated	ated
ated	ated	value2.484*	value2.484*
value2.484*	value2.484*	*1.685*1.1	*1.685*1.1
*1.685*1.1	*1.685*1.1	24*1.613*1	24*1.613*1
24*1.613*1	24*1.613*1	.969*1.430	.969*1.430
.969*1.430	.969*1.430	***Explana	***Explana
***Explana	***Explana	tory	tory
tory	tory	power12.50	power12.50
power12.50	power12.50	%20.31%18	%20.31%18
%20.31%18	%20.31%18	.28%19.14	.28%19.14
.28%19.14	.28%19.14	%31.56%34	%31.56%34
%31.56%34	%31.56%34	.86%Social	.86%Social
.86%Social	.86%Social	networkesti	networkesti
networkesti	networkesti	mated	mated
mated	mated	value1.624*	value1.624*

				value1.624*	value1.624*		
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means P<0.05; * * * means P<0.01.	* means P<0.01.	* means P<0.01.	P<0.01.

Source: The benchmark data of China Education Tracking Survey (CEPS) project; Note: * means P<0.1; * * means P<0.05; * * * means P<0.01.

From Table 3, it can be seen that the frequency of distance training for rural teachers is significantly lower than that of urban teachers, and the efficiency of transforming students' academic performance into improvement is not as good as that of urban students. Specifically, there are significant differences in the effects of different distance training methods on the academic performance of urban and rural students, and this difference is also heterogeneous in different disciplines and different points. For example, in the Q90 scores of urban students, the explanation of open courses, social networks and mobile internet for the improvement of students' academic performance in mathematics and English is significantly higher than that for the improvement of Chinese academic performance.

4. CONCLUSIONS

First, the gap between urban and rural basic education does exist, but the academic achievement gap reflected by students at different quantiles is different. First of all, urban students' scores in Chinese, mathematics and English at any score point are significantly higher than their corresponding rural students; Secondly, the gap between urban and rural students' academic performance has gradually widened with the increase of the scores; Finally, the academic gap between urban and rural students is heterogeneous in different disciplines, that is, the academic performance of English is generally greater than that of Chinese and mathematics. It can be concluded that the academic achievement gap between urban and rural students is particularly prominent among those with better academic achievements, and it is mostly reflected in English subjects.

Secondly, distance teacher training is beneficial to improve urban and rural students with different academic performance levels, and it has a higher promotion effect on students with better academic performance in rural areas, rather than those with poor academic performance in rural areas. On the one hand, the influence of distance teacher training on the gap between urban and rural students is consistent, and the same training frequency is helpful to improve students' academic performance; On the other hand, in the academic performance of rural students, the positive effect of distance teacher training on students in Q90 is significantly higher than that of students in Q30 and Q60, that is, distance teacher training can not bring significant positive effects to rural students with lower academic performance. It can be concluded that distance teacher training can promote the academic performance of urban and rural students, and the effect on urban students is significantly higher than that on rural students at the same training frequency, so it cannot be directly explained that distance teacher training can narrow the gap between urban and rural education, and further research is needed to verify this conclusion.

Thirdly, the effects of different distance teacher training methods on students' academic performance are different, and the effects on mathematics and English subjects are more significant than those on Chinese subjects. First of all, according to the different characteristics of urban and rural student groups, we should adopt differentiated distance teacher training methods, so as to achieve better results; Secondly, for teachers of different disciplines, we should also adopt differentiated distance teacher training methods. On the whole, the training effect of open courses is significantly higher than that of social networks and mobile internet; Finally, at different points, different distance teacher training methods have different explanations for improving students' academic performance, so different training methods should be adopted according to students' academic level. From this, we can draw a conclusion: when developing distance teacher training, we should dynamically apply open courses, social networks and mobile internet training methods according to students' academic level and different subject categories.

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