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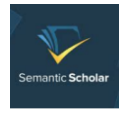


Best Evidence in Chinese Education

EDITORS

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COMMENTARY

Parent Time Input in Teenager Education Matters More Than Shadow Education

Xiaoqiao Cheng

Nanjing Normal University, Nanjing, Jiangsu, China

> *"Education is what survives when what has been learned is forgotten."*
>
> *–BF Skinner*

IN recent years, shadow education—paid private supplementary tutoring providing additional educational assistance for students who are preparing for a variety of examinations—has become one of the fastest growing industries in a number of countries around the world, causing concern among governments and education policymakers, who believe that shadow education exacerbates the financial burden on poor families and exacerbates education inequality (Yu & Zhang, 2022). The growing significance of educational accomplishments for students' future careers, combined with the immense pressure schools face to maintain their ranking, may lead the majority of parents to seek out private tutoring as the most effective means of enhancing their children's academic competitiveness. However, the opportunities for children from various socioeconomic backgrounds to participate in exam-focused shadow education are frequently mediated by their home economic strengths; as a result, children from low-income households face barriers to accessing shadow education. For instance, Byun (2019) found in his analysis that Seoul families often spend more than twice as much on shadow education as their rural counterparts. There is a widespread belief among global researchers that the substantial investment by families of superior economic

status in shadow education has resulted in higher educational attainment and consequently exacerbated the imbalanced gap between students from different social strata that is "taken for granted". Although the government and relevant education policymakers have attempted to implement some reforms to address these issues, such as providing financial assistance to poor families, they have failed to adequately respond to the extraordinary expansion of educational aspirations resulting from the existing position of the consolidated upper and middle classes. Entrich (2015) suggested that highly ranked public high schools in metropolitan areas would attract a greater proportion of students from affluent families who view extracurricular tutoring as a necessity during their high school years. This may encourage them to enroll in the most prestigious universities, thereby ensuring their social standing remains above average. This provides a plausible explanation for the rise in popularity of shadow education. Therefore, numerous types of evidence indicate that students' participation in shadow schooling is significantly influenced by their social origins and family incomes.

In this issue, *Family Time and Money Inputs in Education and Teenager Development: Interpretation of Social Capital, Cultural Capital, and Shadow Education* by Li and He (2022) examined the connection between family financial and time investments in education and adolescent development. This study integrates home time and money inputs in education and reveals: there are class differences in family time and money investments in education; family time investment in education is the most influential factor on adolescent academic performance; social capital (parental participation) and cultural capital account for score gaps among students far more than shadow education. This article suggests that the influence of shadow education on the academic achievement of adolescents is not as great as previously believed. In addition to spending more money on off-campus supplemental tutoring for their children, parents from middle-class or higher socioeconomic backgrounds also devote more time to accompanying their children. In addition, extracurricular tutoring on weekdays (Monday through Friday) has a considerable detrimental influence on adolescents' academic performance, whereas weekend tutoring has a significant favorable effect. The most important result of this study is that parents' direct time investment in their children, like parent-child contact and parental companionship, has the biggest effect on adolescent academic success.

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Correspondence to:
Xiaoqiao Cheng, Ph.D.
Nanjing Normal University
Nanjing 211200
Jiangsu
China
E-mail: xqcheng2008@vip.163.com

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ORIGINAL ARTICLE

Who Teaches in Rural Schools in Underdeveloped Areas? An Investigation Based on a Survey of 5,554 Teachers from 117 Towns in H Province in Wuling Mountains Zone, China

Tianjiao Zhang,[1] Weiping Wang,[2] Li Yi[3]

1. *Party School of Shanghai Xuhui District Committee of C. P. C., Shanghai 200030, China*
2. *Jingxiangyi Education Institute, Hangzhou Normal University, Hangzhou 310000, Zhejiang, China*
3. *Hunan First Normal University, Changsha 410000, Hunan, China*

Abstract. *Teacher shortage is a major hindrance to China's rural education growth in underdeveloped areas, as well as one of the main causes of educational injustice. We conducted a survey of 5,554 teachers from 117 towns in H province in the Wuling Mountains Zone to investigate the issue of rural school teacher supply. From geographical, emotional, and institutional perspectives, we used a polynomial logit model to examine the validity of the "hometown effects" hypothesis. The findings showed that hometown effects exist in China in all three dimensions. The institutional hometown effects are the most pronounced; when compared to open recruitment, teachers sourced through teacher supply augmentation programs (such as the Secondary Normal Graduates Program, Special Position Program, and Targeted Position Program) are more likely to teach in rural schools, particularly more disadvantaged village primary schools or teaching sites. China's policy of increasing teacher supply has had a considerable positive influence on rural school staffing. Students from rural areas make better teacher candidates; feelings for hometowns should be encouraged among normal school or university students in pre-service education; and the implementation of teacher support policies should be emphasized to retain rural teachers and improve their teaching quality.*

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***Keywords**: Rural Teachers, Hometown Effects, Teacher Supply Augmentation Policy, Teacher Shortage*

***About the Authors:** Weiping Wang, Hangzhou Normal University, Hangzhou 310000, China. E-mail: weipingzhang@hznu.edu.cn*

Li Yi, Hunan First Normal University, Changsha 410000, China. E-mail: lily_yi2011@163.com

***Correspondence to:** Tianjiao Zhang, Party School of Shanghai Xuhui District Committee of C. P. C., Shanghai 200030, China. E-mail: tjzhang17@fudan.edu.cn*

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Introduction

As per the teacher-to-class ratios in compulsory education schools released in the Report on China's Rural Education Development 2019, China's rural schools are experiencing a serious teacher shortage (Wu & Qin, 2019). *South Reviews* (2021) published a report entitled "*China Needs More Rural Teachers*" in 2021, which emphasized the critical issue of rural teacher shortage. It was widely shared on social media sites like Phoenix and Tencent, and it drew a lot of attention and discussion. Rural teachers face a variety of issues, including low pay, insufficient social support, limited professional development, a lack of incentive mechanisms, a higher number of problem students, difficult class management, low social status, poor living conditions, potential cultural conflicts, and so on (Neeshatlen, 1985; Yarrow, 1999). These disadvantages in rural school working and living situations make teacher recruitment and retention challenging in the growth of rural education in impoverished areas around the world. As a result, the question of "who teaches in rural schools" has become a hot topic in academia.

Since its foundation, the People's Republic of China has implemented a number of teacher supply augmentation measures to alleviate the rural teacher shortage. The central government began implementing the Secondary Normal Graduates Program in several provinces in the early 1980s, in which graduates from junior colleges and secondary normal schools were selected and assigned to teach in local rural schools. For the next two decades, and until the early 21st century, this initiative was a major source of rural teachers.

The influence of urbanization on the countryside as well as the structural changes in rural schools has made it more difficult to recruit and retain rural teachers, as well as to improve the quality of rural education at the turn of the 21st century. The Ministries of Education and the Finance collaborated in 2006 to develop the *Special Position Program*, which used central government financing to hire college graduates to work in rural compulsory education institutions (Ministry of Education, 2006). The initiative began in western China and was eventually expanded to the central and eastern parts of the country. In the meantime, the State Council issued the Measures for the Implementation of *Free Education for Students of Normal Universities Affiliated to the Ministry of Education* (Ministry of Education, 2007), requiring the six normal universities affiliated to the Ministry of Education to provide free education to their students. In 2013 and 2015, Jiangxi Normal University and Fujian Normal University, both joint establishments of provincial governments and the Ministry of Education, joined the Free Education Program. The *Measures to Implement Public-funded Education for Students of Normal Universities Affiliated to the Ministry of Education* were published by the State Council in 2018, and the "*Free Education Program*" was renamed the "*Public-funded Teacher Education Program*" (also known as the *Targeted Position Program*).

The *Special Position Program* and the *Public-funded Teacher Education Program* have gained widespread acclaim in society for significantly reducing staffing shortages in rural parts of western China, and also for helping to attract and retain rural teachers and improve compulsory education quality (Pu et al., 2019). Preferential policies such as the *Particular Position Program and the Public-funded Teacher Education*

Program were first adopted in the western regions due to regional special demands and the state's limited financial capability. However, there are impoverished and underdeveloped areas in the central provinces that confront similar issues, such as local budget deficits, poverty-stricken rural areas, stymied rural school growth, and a rural teacher shortage. Despite little funding from the central government, several provinces strive to address staffing issues in rural schools by increasing teacher labor supply, improving teacher quality, and reducing structural human resource imbalances. Hunan Province in central China, for example, drafted the *Opinions on Strengthening Primary and Secondary Teacher Education* in 2005 and pioneered the *Targeted Position Program* for village primary teacher education in China. The provincial government and lower levels of government contribute to the funding of this initiative. The provincial department of education uses the joint money to commission local normal institutions and universities to train suitable teachers for specific rural schools.

As a result, open recruitment, the *Secondary Normal Graduates Program*, the *Targeted Position Program, the Special Position Program*, temporary teachers, and other sources of rural teacher supply exist in present China. This study applied a polynomial logit model to assess the validity of the "hometown impacts" hypothesis in the geographical, emotional, and institutional dimensions, based on the findings of a survey of 5,554 teachers from 117 towns in H Province in the Wuling Mountain Zone.

A Literature Review and Research Hypotheses

Some studies claimed that "hometown effects" (also known as "draw of home") exist in the teacher labor market, which are not common in other professions (Reininger, 2012; Cannata, 2010; Goff & Bruecker, 2017; Engel et al. 2014). According to the "hometown effects" hypothesis, teachers prefer to teach in the place where they grew up or in an area that is similar to their home environment. In their research of teacher distribution at New York State, Boyd et al. (2005; 2013) find that 61% of teachers start their careers in schools within 15 miles of their homes, and more than 80% in schools within 40 miles. In a survey conducted in Gansu Province, China, Wei (2016) discovered that 93% of teachers begin their careers in native countries, 51% in native towns, and 23% in native villages. Furthermore, Wei et al. (2020) find that rural teachers who start their careers in the same region as their birthplace have much lower employment mobility than those who start their careers in a different region. A survey of 40 rural schools in Guangdong and other provinces found that localization is an important geographical aspect of rural teacher employment, with many teachers working in their hometowns (Liu, 2019). According to Monk (2007), people who are interested in rural education and have strong feelings about rural living will opt to teach in rural areas, despite the fact that interests and feelings are vulnerable to spatial linkages.

As a result, hometown effects, which are a distinctive feature of the teacher labor market in China and other countries, are universal. Governments all over the world are forming rural teacher education and selection programs based on the localization tendency of the teacher labor market, such as the Grow-your-Own Program in the United States, the Indigenous Teacher Education Program in Australia, and the Public-funded Teacher Education Program in China, to name a few.

Localized selection of teachers in rural or distant locations is the most successful strategy to attract and retain rural teachers, according to academia and governments. Teachers with local "registered residences" (also referred to as "huji" or "huko" in China) are more likely to work in local town schools or in more remote rural schools and teaching sites in China, according to a well-known occurrence. There are discrepancies in how Chinese researchers and their international colleagues define the variable "returning to hometown". When assessing the variable "returning to hometown," foreign scholars typically mention the distance between the school and the home or calculate the distance using the school's and home's zip codes (Boyd et al, 2013). In China, "returning to hometown" refers to returning to work in the area of one's registered residence or birthplace; Scholars commonly utilize the county-level division of administrative regions (in China, a county is a lower-level administrative unit than a city) as a criterion to separate natives and foreigners, i.e., people from outside a certain county (Liu, 2019). As a result, we suggest the first hypothesis (H1): Teachers with a local registered residency are more likely to teach in rural schools, implying that rural teachers have geographical hometown effects.

Researchers also pointed out that many front-line teachers in rural areas spent part of their childhood or schooling in the area (Monk, 2007). According to surveys, 72.3% of teachers who have worked in rural schools for a long time were raised in rural areas, and 60% acquired their education in rural schools. In contrast, Chinese research focuses on geographic hometown preferences associated with registered residence, but there is little talk about emotional hometown impacts deriving from teachers' early life or education experiences in local places. Our second hypothesis (H2) is that: Based on geographical hometown effects related to the registered household, there is an emotional hometown preference based on teachers' rural life experience, i.e., teachers who grew up in rural areas or attended rural schools are more likely to teach in rural schools.

China's education administration system differs from that of various Western countries. In China, the county-level government is primarily responsible for funding primary and secondary schools in towns and villages. As a result, the county-level government is also responsible for teacher recruitment and appointment based on the staffing needs reported by the towns and villages under its jurisdiction. Government policies have a greater impact on teachers recruited through teacher supply augmentation initiatives. The Targeted Position Program in H Province requires program participants to agree to teach in the areas of their registered residency for 5-7 years after graduation, and the county bureau of education sets their compensation and other perks, such as Bianzhi membership (a system of officially budgeted posts in China). The county government may take into account teachers' preferred working locations as well as their registered residences when making teacher appointments. Teachers, on the other hand, are typically assigned to areas where teaching staff is in limited supply throughout the year (Wei, 2016). As a result, while examining teachers' hometown preferences within a county region, we must consider this institutional aspect. The third hypothesis (H3) we propose is that: after accounting for geographical and emotional hometown effects, institutional hometown effects exist, as evidenced by the fact that students educated through teacher supply augmentation programs are more likely to teach in rural schools.

Research Design

Sample Summary

The Wuling Mountains Zone is a theoretical economic notion employed in the state's efforts to alleviate poverty, and it spans most of the Wuling Mountains. The Wuling Mountains Zone is economically poor and has a large underprivileged population due to its physical location. It is one of the most important beneficiaries in the country's poverty alleviation program. The participants in this study are rural teachers from 117 towns in seven counties in H province in central China's Wuling Mountains Zone. The following factors influenced the sample selection: (i) According to national criteria, the seven counties studied are destitute. The Wuling Mountains Zone is one of China's 14 most impoverished areas, with insufficient basic public services, severely outdated infrastructure in education, culture, health, and sports, and per capita education and health spending of only 51% of the national average. Recruiting and keeping talented rural teachers in this area is a common problem in socioeconomically underdeveloped areas. (ii) H Province was one of China's first provinces to adopt the Targeted Position Program. In 2006, H Province launched a special program to recruit junior secondary school graduates for 6-year pre-service education in order to provide targeted training of multi-disciplinary primary school teachers for towns and villages, one year ahead of the Ministry of Education's and its six affiliated normal universities' *Free Teacher Education Program* (Hunan First Normal University, 2017). H Province has acquired a large number of teachers as a result of various sorts of teacher supply augmentation schemes during the last 10 or more years, ensuring the sample's representativeness.

The Wuling Mountains Zone encompasses the counties and cities of H Province's western, northwestern, and central regions, with the western half of the province having the most counties. We chose four counties at random from the province's west, two from the northwest, and one from the central region based on geographical distribution, and conducted a two-month field study in each of the seven counties in 2020. The seven counties have a total of 117 towns and nearly 15,000 primary and secondary school teachers, as shown in **Table 1**. A total of 5,554 questionnaires were obtained for this study, all of which were legitimate.

Variables and Measurement

The Dependent Variable

The school type, which is a categorical variable, is the study's dependent variable. County-level schools (referring to primary and secondary schools in the county's metropolitan areas), town-level nine- and 12-year schools, town junior secondary schools, town primary schools, village primary schools, and teaching sites are all covered. This paper groups town-level nine- and 12-year schools, town junior secondary schools, and town primary schools into one category in the regression model for statistical convenience, making school type a categorical variable with three categories: county-level schools, town primary and secondary schools, and village primary schools and teaching sites, which are coded as 0, 1, and 2, respectively.

Independent Variables

Table 1. Sampled Counties.

Sampled Counties	Numbers of Towns Under Jurisdiction	Numbers of Teachers	Retrieved Questionnaires	Valid Questionnaires	Validity Rate
A	12	1,641	718	718	100%
B	19	2,244	1,005	1,005	100%
C	17	3,417	1,358	1,358	100%
D	26	3,405	1,832	1,832	100%
E	20	5,730	596	596	100%
F	23	n/a	0	0	n/a
Total	117		5554	5554	100%

Notes: 1. Respondents are grades 1-9 teachers (no secondary vocational and high school teachers surveyed); 2. Due to some emergencies, the investigation team failed to distribute the questionnaires in F County, and only conducted interviews in this county.

The teacher's registered residence, rural living and education experience, and teacher supply sources are the three independent factors in this study. For the teacher's registered residence, the inquiry provides five options: the town or village where the school is located; other towns or villages within the local county; the local county's urban region; other counties within the province; and other provinces. There is just one option for this question. We combine "other counties within the province" and "other provinces" into one category: registered residence outside the local county, and come up with a variable with four categories of registered residence, with 1, 2, 3, and 4 representing registered residence in the town or village where the school is located, other towns or villages within the local county, the local county's urban area, and outside the local county, respectively. Furthermore, we collect information about teachers' birthplaces, determine whether the teacher is a local based on their response to the question "Whether your birthplace is the same as the location of the current school" in the questionnaire, and create a dummy variable for teachers' birthplaces, with 0 indicating "no" and 1 indicating "yes".

In addition, with the variable of five or more years of early rural life or education experience, the questionnaire evaluates emotional hometown impacts. Teachers' rural experience or schooling experience is treated as a dummy variable, with 0 indicating "no" and 1 indicating "yes." The source of teacher supply is a categorical variable, with 0, 1, 2, 3, 4, 5 representing open recruitment, temporary teachers, the Targeted Position Program, the Special Position Program, the Secondary Normal Graduates Program, and other supply sources (such as inter-school teacher rotation), respectively.

Control Variables

Individual characteristics of teachers, such as gender, age, ethnicity, and proximity to the school, serve as control variables in this study. Gender is a dummy variable (0 = female, 1 = male); age is a continuous variable; proximity to the school is a dummy variable (0 = no, 1 = yes); and ethnicity is a categorical variable (0 = Han nationality, 1 = Miao nationality, 2 = Tujia nationality, 3 = other ethnic minorities).

The Model and Analytical Approach

This study employs polynomial logit regression to analyze the dependent variable "school type," which is a multi-category variable. The model is as follows:

$$\ln\left(\frac{\pi_{ij}}{\pi_{ib}}\right)=\ln\left(\frac{P\left(y_i=j\left|x\right.\right)}{P\left(y_i=b\left|x\right.\right)}\right)=x_i'\beta_j$$

where b signifies the baseline group and j specifies the number of school types in the categorical variable, i.e., j =1, 2, 3... The anticipated probability of each category can be computed by solving the equation below (Yang & Zhang, 2020):

$$\pi_{ij}=P\left(y_i=j\left|x\right.\right)=\frac{\exp\left(x_i'\beta_j\right)}{\sum_{m=1}^{J}\exp\left(x_i'\beta_m\right)}$$

Thus, we obtain the frequency ratio of each category relative to the baseline group. In the examination of regression findings, the odds ratio is utilized to calculate and evaluate the model's regression coefficients. To further address the research issue, the study employs stepwise regression to examine the hometown effects of rural China's teachers.

Research Results

Sample Descriptions

Table 2 provides a summary of the subjects. (i) Female teachers account for 16.46% more than their male counterparts, which is in line with China's current gender structure in elementary and secondary schools. (ii) The proportions of young and older teachers are greater than those of middle-aged teachers, according to the age distribution pattern. (iii) Currently, 72.04% live within walking distance of a school. (iv) The ethnicity of the subjects in the sample is quite diverse. More than half of the subjects are Miao and Tujia ethnic groups, which corresponds to the existing population situation in the Wuling Mountains Zone). (v) In terms of professional titles, the teaching staff is primarily made up of first- and second-rank teachers, with senior teachers accounting for approximately 11.76%. (vi) Pre-service education was provided to over 60% of teachers through teacher supply augmentation initiatives. (vii) The vast majority of study participants were students from rural elementary and secondary schools. Therefore, sample distribution is consistent with general features of participants, indicating that the sample is ideal and representative.

Localization of Rural School Staffing

Table 2. A Sample Summary.

Variable	Sample Classification	Frequency	Percentage (%)
Gender	Female	3,234	58.23
	Male	2,320	41.77
Age	18-27	1,485	26.74
	28-38	1,295	23.32
	39-55	2,311	41.61
	56-77	435	7.83
	others	28	0.50
Living around School Locations or Not	Yes	1,553	27.96
	No	4,001	72.04
Nationality	Han	2,066	37.39
	Miao	1,763	31.91
	Tujia	1,567	28.36
	Other ethnic minorities	129	8.19
Professional Title	The third-rank teacher and others	1,240	22.32
	The second-rank teacher	1,503	27.06
	The first-rank teacher	2,158	38.85
	Senior teacher	653	11.76
Sources of Teacher Supply	Open recruitment	1,158	20.85
	Targeted Position Program	1,078	19.41
	Special Position Program	1,076	19.37
	Secondary Normal Graduates Program	956	17.21
	Temporary teachers	470	8.46
	Others	816	14.69
School Type	Village primary schools and teaching sites	949	17.09
	Town-level 9- and 12- year schools	667	12.01
	Town primary and secondary schools	2,644	47.61
	County-level schools	1,294	23.30

Notes: 1. Percentiles 1/4, 1/2, and 3/4 are employed to divide age groups 2. The Targeted Position Program includes the Ministry of Education's public-funded teacher education Program and local level targeted position programs. 3. The Special Position Program includes nation level and local level programs.

The data in **Table 3** show that rural teachers in the county's territory have a high rate of localized employment. More than half of the teachers working in rural primary schools or teaching sites (475/949 = 50.5%) have a registered residence in the local towns or villages. Teachers, who live in other towns or villages in the county, or beyond the county, are less likely to work at rural primary schools or teaching sites; instead, they prefer to teach in town primary and secondary schools, or at the county level. Furthermore, teachers who live in the county's urban areas are the least likely to work in village primary schools or teaching sites. A close link exists between rural teachers' registered residence and their school category ($p < 0.001$), indicating that teachers with local registered residency are more likely to accept work in rural schools. As a result, H1 has been certified.

Table 3. School Types of Teachers with Different Registered Residence.

Variable Names	# of Teachers from the Local Town and Village	# of Teachers From Other Towns or Villages of the Local County.	# of Teaches From Urban Areas of the County	# of Teachers from Outside the County	Total
Village Primary Schools and Teaching Sites	475	193	112	169	949
Town Primary and Secondary Schools	1460	856	447	548	3,311
County-Level Schools	225	394	548	127	1,294
Total	2,160	1,443	1,107	844	5,554
chi^2	688.2650				
P-value	0.000 (***)				

*Note: Levels of significance: ***p < 0.001, **p < 0.01, *p < 0.05, +p < 0.1*

Table 4. School Types of Teachers from Different Teacher Supply Sources.

Variable	Open Recruitment	Temporary Teachers	Targeted Position Program	Special Position Program	Normal College or University Student Program	Other Sources	Total
Village Primary Schools and Teaching Sites	178	158	155	221	133	104	949
Town Primary and Secondary Schools	595	287	704	719	593	413	3,311
County-Level Schools	385	25	219	136	230	299	1,294
Total	1,158	470	1,078	1,076	956	816	5,554
chi^2	378.1099						
P-value	0.000						

*Note: levels of significance: ***p < 0.001, **p < 0.01, *p < 0.05, +p < 0.1*

The Influence of Teacher Supply Augmentation Programs on Rural School Staffing

As mentioned before in this study, due to China's unique educational administration system, rural teachers may experience local effects as a result of institutional arrange-

ments. So, how do different teacher supply programs affect teachers' hometown preferences? There are substantial disparities in school categories among teachers produced by different programs ($p < 0.001$), according to data from **Table 4**. Teachers in village primary schools or teaching sites are mostly from the Special Position Program (221 teachers), which is part of the policy to increase teacher supply. The majority of Targeted Position Program and Special Position Program teachers (704 and 719, respectively) chose to work in town primary and secondary schools, which offer superior working conditions, accounting for about half of the entire staff.

The study results from 117 towns in H Province suggest that educational policies may have a significant impact on the hometown effects of rural China teachers. Due to the fact that the Special Position Program recruits teachers based on the staffing needs of local schools as opposed to the distribution plan of county-level educational authorities, the influence of teachers' independent decisions on hometown effects cannot be neglected. Therefore, additional research is required to explore institutional hometown impacts.

The Effects of Geographical Influence, Emotional Preference, and Policy Guidance on Rural Teachers' Employment

The results of a regression study of the impacts of geographical influence, emotional preference, and policy advice on teachers' choice of school types are presented in **Table 5**. The registered residence of teachers is used to assess geographical hometown impacts, whereas their early rural life or schooling experiences are utilized to measure emotional hometown effects. The scope of Model 1 is limited to evaluating the effect of teachers' registered residence on their employment and school kinds. In Model 2, the early rural life or education experience of teachers is included in Model 1. The source of teacher supply is added as a variable in Model 3. Due to the inability to conduct direct comparisons between the Mlogit model's regression coefficients, we must convert them into odds ratios in order to evaluate and present the results of the analysis (Hong, 2015).

The Relationship between Geographical Hometown Effects and Teachers' Choice of School Types

Using teachers employed by county-level schools as the baseline group, Model 1 demonstrated that after controlling for variables such as gender, age, ethnicity, and whether or not they live around the school location or not, teachers from the local town or village are more likely to work in village primary schools or teaching sites than teachers with registered residence outside the county, with a 2.147 times higher odds ratio ($e^{1.147}$-1), which is statistically significant ($p < 0.001$) than teachers with registered residence within the county. In a related manner, teachers who were native to the town in which the school is located were 1.254% more likely to teach in the town's primary and secondary schools than teachers whose registered residences were outside of the county ($e^{1.006}$-1, $p < 0.001$). In a fundamental sense, this is in line with the statistical descriptions made in the past.

Table 5. Results of the Regression Analysis of Hometown Effects on Rural Teachers' Employment.

	(1)	(2)	(3)	(4)	(5)	(6)
	Model 1		Model 2		Model 3	
	School types (County-level schools as the baseline group)					
Variable	I	II	I	II	I	II
Gender	0.747***	0.813***	0.747***	0.811***	0.808***	0.843***
	(0.108)	(0.085)	(0.109)	(0.085)	(0.111)	(0.086)
Age	-0.035***	-0.039***	-0.036***	-0.041***	-0.046***	-0.042***
	(0.005)	(0.004)	(0.005)	(0.004)	(0.006)	(0.005)
Living around the School location or not	-0.838***	-0.654***	-0.843***	-0.700***	-0.836***	-0.711***
	(0.115)	(0.092)	(0.119)	(0.095)	(0.121)	(0.096)
Nationality (Han nationality as the baseline group)						
Miao	-0.723***	-0.508***	-0.727***	-0.510***	-0.748***	-0.539***
	(0.112)	(0.088)	(0.112)	(0.088)	(0.115)	(0.090)
Tujia	-0.506***	-0.254**	-0.512***	-0.261**	-0.552***	-0.301**
	(0.115)	(0.092)	(0.115)	(0.092)	(0.119)	(0.094)
Other ethnic minorities	-1.582***	-0.516*	-1.589***	-0.521*	-1.631***	-0.564*
	(0.383)	(0.235)	(0.383)	(0.235)	(0.389)	(0.240)
Registered Residence (Registered residence outside the local county as the baseline group)						
Local town Or village	1.147***	1.006***	1.149***	0.999***	1.137***	0.886***
	(0.163)	(0.137)	(0.164)	(0.137)	(0.172)	(0.142)
Other towns or Villages in the Local county	-0.610***	-0.349**	-0.610***	-0.363**	-0.482**	-0.332**
	(0.156)	(0.124)	(0.156)	(0.124)	(0.162)	(0.129)
Urban areas of the Local county	-1.318***	-1.166***	-1.318***	-1.156***	-1.137***	-1.108***
	(0.168)	(0.127)	(0.168)	(0.127)	(0.173)	(0.132)
Early rural life or Education experience			0.035	0.230*	0.168	0.311**
			(0.135)	(0.108)	(0.138)	(0.111)
Teacher Supply Sources (Open recruitment as the baseline group)						
Temporary teachers					2.656***	2.039***
					(0.264)	(0.240)
Targeted Position Program					0.308*	0.646***
					(0.154)	(0.114)
Special Position Program					1.032***	0.988***
					(0.155)	(0.126)
Secondary Normal Graduates Program					0.363*	0.604***
					(0.168)	(0.123)
Other sources					-0.105	-0.015
					(0.162)	(0.116)
Constant terms	1.918***	2.971***	1.915***	2.917***	1.649***	2.434***
	(0.195)	(0.162)	(0.197)	(0.164)	-0.242	-0.194
Pseudo R^2	0.092		0.093		0.118	
Log likelihood	-4746.895		-4743.728		-4610.350	
AIC	1.739		1.740		1.697	
BIC	-37564.929		-3754543		-37657.16	
Sample size	5,500	5,500	5,500	5,500	5,500	5,500

*Notes: I: Village Primary Schools & Teaching Sites; II: Town Primary & Secondary Schools. 1. Values in parentheses are standard errors. 2. Levels of significance: ***p<0.001, **p<0.01, *p<0.05, +p<0.1*

In the meantime, we observed that teachers with registered residences in other towns or villages within the county do not demonstrate a positive hometown preference for the local rural schools compared to teachers with registered residences outside the county, and the likelihood is even significantly reduced (the coefficients in Model 1 are -0.610, and -0.349, respectively, and the p-values are both less than 0.001). As a result, we can conclude that the geographical characteristic of hometown effects is not positively correlated with teachers' registered residence in the local county (as was assumed in prior research), but rather with teachers' registered residence in the local town, a smaller administrative area. This cautions us that, in the context of China, a more comprehensive examination of the consequences of geographical hometown is required. The survey results from Hubei, Jiangsu, and Henan confirmed that teachers from local towns had the lowest turnover rates (Liu, 2019).

The Relation between Emotional Hometown Effects and Teachers' Choice of School Types

The coefficient of determination of Model 2 is improved, and the model's significance is maintained, when the variable of early rural life or teacher education experience is introduced. Teachers with five or more years of early rural life or education experience are more likely to work in village primary schools or teaching sites (with a positive coefficient) than in county-level schools after controlling for variables such as gender, age, ethnicity, registered residence, and whether or not they live near the school location, though the difference is not statistically significant. Nonetheless, compared to those with no such experience, teachers with five or more years of early rural life or education experience had a 26% greater odd ratio of working in town primary and secondary schools ($e^{0.230}$-1), which is statistically significant ($p < 0.01$). The findings of Stiut (2010) and Boylan (2010), who both believed that teachers' prior rural living or job experience had a beneficial effect on their extended stay at rural schools. As a result, H2 is only partially accepted.

The Relationship between Policy-guided Hometown Effects and Teachers' Choice of School Types

In order to investigate the impact that the teacher supply augmentation programs have on hometown effects, Model 3 contains the variable of teacher supply sources as an independent variable. As a consequence of this, the model's coefficient of determination rose from 0.093 to 0.118, which indicates that the model's explanatory power has improved and that this improvement is statistically significant. Taking teachers employed at county-level schools as the baseline group, Model 3 demonstrates that after controlling for the variables of gender, age, ethnicity, registered address, and whether or not the teacher lives near the school location, teachers produced through the Targeted Position Program by the Ministry of Education and local governments have a 36.10% higher odds ratio ($e^{0.308}$-1) of working in village primary schools and teaching sites, and a 90.81% higher odds ratio ($e^{0.646}$-1) of working in town primary and secondary schools, compared to those recruited through open recruitment, and these differences are statistically significant ($p < 0.1$ and $p < 0.001$, respectively).

There is no question that the hometown effects associated with the Targeted Position Program are partially attributable to the rigorous and forceful implementation of pertinent policies, which state that graduates who benefit from the program must return to work in their original region of residence. Moreover, the majority of students trained under local targeted position programs come from towns or villages. This substantially increases the likelihood of teachers returning to the town or village. Then, what about graduates of the Specific Position Program, which does not restrict the supply of students but instead creates special posts based on the needs of local schools?

Under the same control conditions, in comparison to the baseline group (consisting teachers from county-level schools), teachers recruited through the Special Position Program are much more likely to work in village primary schools and town schools than those recruited through open recruitment. The odds ratios are 1.801 times ($e^{1.032}$-1) and 1.689 times ($e^{0.988}$-1) higher, respectively, which is statistically significant at the 0.001 level.

Similarly, teachers recruited through the Secondary Normal Graduates Program in the early stages are far more likely to work in rural primary schools and urban schools than those recruited through open recruitment (with positive coefficients, significant at levels of 0.05 and 0.001, respectively).

Since the 1980s, the implementation of teacher supply augmentation programs in China has significantly reduced the teacher shortage in rural schools, particularly in remote and disadvantaged village primary schools and teaching sites, as indicated by the data presented above. Effective educational policy direction generates considerable institutional impacts in the local community. As such, H3 is confirmed.

In addition to this, the impact of the control factors should not be disregarded. When compared to the baseline group of county-level school teachers, the likelihood that male teachers will work in town primary and secondary schools, as well as village primary schools and teaching sites, is significantly higher than the likelihood that female teachers will do the same ($p < 0.001$) in Models 1, 2, and 3. The likelihood of a teacher working in a rural school decreases significantly with the teacher's age (with negative coefficients, $p < 0.001$). Teachers who live in close proximity to schools are less likely to work in town schools and village primary schools (with negative coefficients, $p < 0.001$). It is statistically significant that teachers of Han nationality are more likely to work in town schools and village primary schools than teachers of ethnic minority backgrounds (such as Miao, Tujia, and other ethnic minorities). This suggests that Han educators have a greater propensity to work in rural schools.

Robustness Check

In the robustness test, teachers' registered residence is replaced by birthplace, sources of teacher supply are by means of joining Bianzhi, and the Mlogit model is used for regression analysis. As shown in **Table 6**, the model's analytical results remain significant despite slightly reduced values of coefficients of determination, suggesting the model's remarkable robustness. In this study, the impacts of control variables such as gender, age, ethnicity, and proximity to the school are consistent with previous analytical findings.

Table 6. Robustness Check on Hometown Effects on Rural Teachers' Employment.

	(7)	(8)	(9)	(10)	(11)	(12)
	Model 1		Model 2		Model 3	
	School Types (County-level schools as the baseline group)					
Variable	I	II	I	II	I	II
Gender	0.862***	0.933***	0.862***	0.930***	0.972***	0.954***
	(0.105)	(0.081)	(0.105)	(0.081)	(0.116)	(0.087)
Age	-0.029***	-0.035***	-0.032***	-0.039***	-0.043***	-0.044***
	(0.004)	(0.003)	(0.005)	(0.004)	(0.008)	(0.006)
Living around the school location or not	-0.895***	-0.669***	-0.944***	-0.758***	-0.912***	-0.686***
	(0.113)	(0.090)	(0.117)	(0.093)	(0.131)	(0.101)
Nationality (Han nationality as the baseline group)						
Miao	-0.811***	-0.576***	-0.815***	-0.581***	-0.825***	-0.640***
	(0.107)	(0.083)	(0.107)	(0.083)	(0.120)	(0.091)
Tujia	-0.554***	-0.295***	-0.560***	-0.304***	-0.561***	-0.363***
	(0.111)	(0.087)	(0.111)	(0.087)	(0.125)	(0.095)
Other ethnic minorities	-1.432***	-0.403+	-1.437***	-0.407+	-1.395**	-0.212
	(0.373)	(0.222)	(0.373)	(0.222)	(0.445)	(0.253)
Birthplace	0.848***	0.593***	0.852***	0.603***	0.718***	0.535***
	(0.096)	(0.074)	(0.096)	(0.074)	(0.109)	(0.081)
Early rural life or education experience			0.239+	0.414***	0.377*	0.505***
			(0.130)	(0.103)	(0.153)	(0.116)
Ways of Joining Bianzhi (Joining Bianzhi through examinations as the baseline group)						
From temporary positions					2.127***	1.730***
					(0.240)	(0.202)
From Targeted Position Program					0.285	0.539***
					(0.179)	(0.136)
From Special Position Program					-0.198	-0.081
					(0.159)	(0.118)
From Secondary Normal Graduates Program					-0.115	0.202+
					(0.150)	(0.106)
Constant terms	1.259***	2.474***	1.198***	2.364***	1.222***	2.157***
	(0.173)	(0.140)	(0.175)	(0.141)	(0.282)	(0.215)
Pseudo R^2	0.040		0.041		0.052	
Log likelihood	-5020.523		-5012.341		-4066.613	
AIC	1.835		1.834		1.805	
BIC	-37095.184		-37085.711		-29858.928	
Sample size	5,500	5,500	5,500	5,500	5,500	5,500

Notes: *I: Village Primary Schools & Teaching Sites; II: Town Primary & Secondary Schools.* 1. Values in parentheses are standard errors. 2. Levels of significance: ***p<0.001, **p<0.01, *p<0.05, +p<0.1

The key explanatory variable, birthplace, is a dummy variable with a value of 0/1 (0 = non-local birth, 1 = local birth). It has a positive regression coefficient of p0.001, indicating that, after controlling for variables such as gender, teachers born locally are more likely to work in village primary schools and teaching sites, or town primary and secondary schools (than county-level schools), and the difference is statistically significant. The findings of the emotional hometown effects tests also show that the impact of teachers' early years of rural living or education is favorable (all coefficients were positive) and statistically significant ($p < 0.05$). As a result, the geographical and emotional influences of home are still present. The impact of the variable "the way of joining Bianzhi" confirms that institutional hometown impacts are also significantly good. Teachers who join Bianzhi as temporary teachers are more likely to work at village primary schools and town schools than at county-level schools, compared to the baseline group (teachers who join Bianzhi through examinations). Joining Bianzhi from the Targeted Position Program and the Secondary Normal Graduates Program had both positive and statistically significant regression coefficients. Nonetheless, there is no statistically significant difference ($p > 0.1$) in rural school employment between teachers who join Bianzhi through the Special Position Program and those who join through examinations.

After substituting teachers' registered location and sources of teacher supply with other key explanatory variables, the impact of geographical, emotional, and institutional hometown effects on rural teachers' employment remains significant, according to the results of the robustness test. The modified model yields essentially identical analytical results to the original model. Consequently, we believe the model estimation results of this study to be reliable.

Conclusions and Suggestions

This study applies the polynomial logit model to assess hometown effects from geographical, emotional, and institutional aspects based on a survey of 5,554 teachers from 117 towns in H province in the Wuling Mountains Zone. The conclusions are as follows.

(i) Teachers with local registered residences are more likely to work in rural schools in China, proving the importance of geographical hometown effects. However, based on the subdivisions of registered residence, we find that the scope of local registered residence pertaining to this topic is limited to the local town, a smaller administrative division, as opposed to the local county (assumed by preview studies). Wei's (2016) research in Gansu Province and Liu's (2019) research in Guangdong, Zhejiang, Shanxi, Sichuan, and Guizhou Provinces supports the conclusion.

(ii) Teachers with at least five years of rural life or education experience are more likely to work in village schools or teaching sites, demonstrating a favorable effect of teachers' hometown attachments on their employment in rural schools. In recruiting and educating rural teachers, consideration should be given to the motivational effect of teachers' attachment to their hometown. Existing studies have also indicated that it is difficult to attract a sufficient number of qualified teachers using only market-based strategies in underdeveloped regions. Incorporating spiritual components such as emotions, wills, and beliefs into teacher

education and recruiting is not only helpful in enhancing the retention rate of competent employees, but also in instilling a feeling of civic responsibility in teachers towards their hometowns (Li, 2020).

(iii) The results of regression analysis show strong institutional hometown effects after controlling for geographical and emotional hometown preferences. Those educated by teacher supply augmentation programs are more likely to work in rural schools, notably village primary schools and teaching sites in more backward conditions, than those employed through open recruiting. It demonstrates how educational programs have aided in the expansion of China's rural workforce. Preliminary studies have not paid enough attention to the policy-induced local consequences.

Because of the severe lack of available human resources in rural schools, both the central and local governments have been making efforts to increase the number of available teachers (Wang & Wu, 2019). The central and local authorities have come to the conclusion that selecting, training, and recruiting students of local origins as rural teacher candidates under the logic of hometown effects is an effective way to ensure a sufficient supply of rural teaching staff. This conclusion has led to the formation of a consensus among the central and local authorities. However, an excessive reliance on institutional hometown effects may lead to some negative consequences, such as a high rate of default on the part of normal school students educated under the *Free Teacher Education Program* (Ren & Chen, 2020), and a high turnover rate of teachers produced by the Special Position Program who only use rural school positions as a transition in their careers (Wang & Feng, 2020).

On the basis of this study's empirical findings and results from prior research, we provide some policy recommendations for attracting and keeping rural teachers.

First, the geographical quality of hometown effects is most prominent within a constrained administrative region, i.e., the local town. Its conclusion for policymakers is that more students from native towns should be recruited into future rural teacher education programs, and that when staffing rural schools, graduates should be encouraged to teach in their native towns' rural schools. It is important to note that this recommendation may be more applicable in developing countries and regions, particularly those with large disparities in educational resources between urban and rural areas or with distinct racial or ethnic cultural characteristics, where teachers have stronger ties to their native lands and are obligated to care for their families and relatives, and where working close to home helps them achieve work-life balance (An & Cao, 2017).

Second, in the pre-service education of rural teachers, their attachment to their hometowns should be fostered (Zheng & Hu, 2018). According to existing research, 72.3% of teachers with extensive experience in rural schools were raised in rural areas, and 60% have schooling experience in rural settings (Boylan & McSwan, 1998). In a longitudinal research study, Hernan (2018) evaluates the effects of two distinct approaches to rural teacher training. The first program engaged pre-service teachers in a variety of classroom-, school-, and/or community-based professional activities; the second program directly recruits and trains students from rural backgrounds. It is determined that the second strategy is superior to the first because those with a background in rural life are better able to comprehend rural culture and integrate into rural life.

Third, to maintain an appropriate supply of skilled rural teachers, it is crucial to invest more in the Targeted Position Program through partnerships with secondary normal schools, normal junior colleges, and normal universities, and to improve the educational quality of the program. However, strengthening the execution of rural teacher support policies is more crucial. According to Merrow (1999), addressing the teacher shortage solely through recruitment is a "wrong diagnosis" and a "phony cure." Increasing rural teachers' compensation, elevating their social status, and providing them with more accolades may be more effective solutions to the rural school staffing issue.

In conclusion, the present study attempts to experimentally answer the question, "Who teaches in rural schools?" based on the hometown effects hypothesis. It has broadened the scope and dimensions of the concept by sparking discussion on the institutional aspect of hometown effects. However, the limitations of this study should be acknowledged. First, there are significant gaps between central and western China, as well as between poor regions in various provinces. This study focused on the origins of rural teachers in the Wuling Mountains Zone in central China, and the sample is somewhat unrepresentative, which hinders the generalizability of the findings. Second, the hometown effects hypothesis is a Western academic theory. To confirm the explanatory power and scope of applicability of the theory in China, it is necessary to conduct additional empirical studies based on evidence. Furthermore, this study identified the institutional impact of hometown effects on rural teachers in China, but the influence mechanism of pertinent policies on rural teachers' employment decisions remains to be investigated.

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ARTICLE

Can Educational Robots Improve Student Creativity: A Meta-analysis based on 48 Experimental and Quasi-experimental Studies

Haoxiang Hou,[1] Xianyi Zhang,[2] Dan Wang[2]

1. *Faculty of Education, Jiangnan University, Wuxi 214000, Jiangsu, China*
2. *Wuxi Teacher Development College, Wuxi 214000, Jiangsu, China*

Cultivating innovative talents has become a critical strategy for building China into a strong country in science and technology. Catering to the trend of educational reform in the intelligent era, the use of robotics in developing student creativity proves to be of greater practical value. The findings of this study are that: first, the overall effect of educational robotics on student creativity reaches above-moderate level; second, educational robotics has more significant effects on creativity of primary and junior secondary students; third, in terms of subjects, robotics courses can most effectively promote student creativity; fourth, among various teaching topics, prototype creation has the most substantial impact on student creativity; fifth, in terms of instruction methods, inquiry-driven teaching can best stimulate student creativity; sixth, compared with ordinary classrooms, the laboratory environment is more favorable for the development of student creativity. The paper also offers recommendations for popularizing robotics curriculum at different education levels.

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About the Authors: *Xianyi Zhang, Wuxi Teacher Development College, Jiangsu Wuxi, 214000, China*
Dan Wang, Wuxi Teacher Development College, Jiangsu Wuxi, 214000, China
Correspondence to: *Haoxiang Hou, Faculty of Education, Jiangnan University, Jiangsu Wuxi, 214000, China. E-mail: 1296910644@qq.com*
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This paper uses meta-analysis to code and analyze experimental research on robotics education in China and other countries and combines field research to investigate the effect of robotics education on student creativity, aiming to provide useful references for the implementation of robotics curriculum in schools. In this study, three teaching methods are discussed to utilize educational robots to develop student creativity: the robotics-based inquiry-driven method; the robot design-based teaching method; the robotic application project-based teaching method.

Research Design

Methods and Instruments

The present study uses meta-analysis to examine the sample data in existing research to systematically evaluate the results of numerous studies by quantitative synthesis. Samples and parameters such as the mean values and standard deviations of the experimental and control groups are extracted from the experimental studies to calculate standardized mean differences (SMD) which are treated as effect sizes. Hedges' g value is one of the estimated values of SMD, a computation result combining the SMD with the mixed variance of the control group and the experimental group. Compared with Cohen's d and Glass' values, it is more suitable for the meta-analysis of effect sizes based on relatively small sample sizes and limited number of studies. Hence, Hedges's g value is used as the final effect size to demonstrate the effect of robotics education on student creativity.

Data Selection and Coding

The present study searched Chinese and foreign literature databases for journal articles, dissertations, academic conference papers, etc. to acquire as many samples as possible. A total of 852 pieces of literature addressing the relationship between educational robots and student creativity and published between 2001 and 2020 were obtained. All of them adopt randomized experimental or quasi-experimental methods and encompass experimental and control groups, sample sizes in statistical results, means, standard deviations, experimental periods, and other data. The following criteria were used to decide whether to include the study in the analysis: i) applying robotics in educational and teaching activities, including the cases wherein the experimental group employs robots in teaching while the control group adopts conventional teaching methods; ii) treating student creativity as the dependent variable in both the experimental and the control group; iii) providing sufficient data for the computation of the average effect size (the data resulting from the experimental and control group analysis must include sample sizes, means, standard deviations, etc.). After several rounds of screening, 48 papers were selected, and 6,057 samples extracted for this meta-analysis. The included literature covers all the education levels ranging from kindergarten to university; subjects such as mathematics, geography, science, and robotics; teaching programs like prototype creation, engineering production, scientific inquiry, and result verification; teaching methods including inquiry-driven, design-based, and project-based instruction; teaching locations including experiment rooms and classrooms. This paper classifies

student creativity into three categories: A-creative thinking (critical thinking, logical thinking, divergent thinking, imagination, spatial thinking ability, etc.), B-practical innovation ability (practical operation, problem solving, engineering, scientific inquiry, etc.), and C-creative personality and psychology (personality traits, perseverance, teamwork, interest in learning, etc.)

Results

The Test of Overall Effect

The test results demonstrate that Hedges' s g-values of both the fixed effects model and the random effects model are greater than 0, and the P-value in the two-tailed test is less than 0.001, indicating that robotics education has a significant positive impact on student creativity. Compared with fixed-effects models, random-effects models are more useful in addressing the measurement discrepancy between various study results and the overall effect size. According to the theory of SMD statistics, when $0.51 \leqslant SMD \leqslant 1$, it is considered an effect size of above-moderate level. Thus, the analysis results of summary effect size (SMD = 0.576) in this study demonstrate that robotics education exerts an above-moderate positive impact on student creativity.

The Test of Effects on Different Categories of Student Creativity

Robotics education has significant effects on student creativity in different categories and in various combinations of these categories. Specifically, student practical innovation ability (B category) is most significantly enhanced (SMD = 0.453, $P < 0.001$) by robotics education, followed by student creative thinking (A category) (SMD = 0.386, $P < 0.001$), while student creative personality and psychology (C category) is moderately improved (SMD = 0.283, $P < 0.001$, $0.21 \leq SMD \leq 0.50$). In terms of student creativity in different category combinations, the configuration of A and B categories is most substantially and positively affected by educational robotics (SMD = 0.757, $P < 0.001$), indicating that the robotics curriculum significantly bolsters student creative thinking and practical innovation ability.

Tests of Various Mediating Effects

i. Robotics education engenders differential effects on student creativity at different education levels. Due to the limited sample size of kindergartens and universities, the comparison is focused on the different effects on the creativity of primary, junior secondary, and senior secondary students. The creativity of junior secondary students is most significantly boosted by robotics education (SMD = 0.607, $P < 0.001$), followed by that of primary students (SMD = 0.435, $P < 0.001$), but it has no significant effect on the creativity of senior secondary students.

ii. There are subject differences in the effects of robotics curriculum on student creativity. In the robotics course, the boosting effect on student creativity is the

most remarkable, reaching the above-moderate level (SMD= 0.606, P< 0.001), followed by the mathematics course (SMD = 0.466, P < 0.001). The sample sizes of geography and science courses are too small to represent significant effect.

iii. Mediating effects diverge among various teaching programs in robotics curriculum, while all of them can significantly promote student creativity. Programs such as hands-on creation, experimental verification, process participation are exceptionally effective in enhancing student innovation ability.

iv. In terms of the mediation of different teaching methods, the influence of inquiry-driven teaching on student creativity is extremely significant (SMD = 0.927, P < 0.001), followed by that of design-based teaching (SMD = 0.598, P < 0.001) and project-based teaching (SMD = 0.529, P < 0.001), which implies that robotics curriculum can maximize its effect on the cultivation of student creativity through project exploration, high student participation, hands-on learning and other methods.

v. Robotics education at various teaching locations can all contribute to the development of student creativity. In the ordinary classroom, robotics teaching yields a significant effect on the advancement of student creativity (SMD = 0.485, P < 0.001). In the laboratory environment, the creation of learning situations and interaction with educational robots significantly improve the effect of robotics education on student creativity (SMD = 0.578, P < 0.001), highlighting the relevance of strengthening laboratory environment construction.

Conclusions and Discussion

Popularizing the Robotics Education Curriculum

The positive effect of robotics curriculum on student creativity reflects the substantial benefits of intelligent education for student creativity development. Therefore, it is of vital importance to incorporate the education of intelligent robots into the school curriculum to improve students' literacy in programming control, human-computer interaction, algorithm programs, neural networks, and intelligent ethics.

Emphasizing the Cultivation of Student Creativity at Basic Education Levels

It is recommended to invest more in promoting student creativity by robotics education at the primary and secondary stages. The secondary school level is particularly critical to the comprehensive development of student innovation ability.

Constructing a Robot Maker Teaching Model Suitable for Student Innovation Capability

The effects of various teaching programs and methods on student creativity in robotics education suggest that teaching modes that assist in prototype creation and inquiry-driven learning is most beneficial to enhancing student creativity.

Strengthening the Construction of the Laboratory's Tangible and Soft Conditions

Tangible conditions cover the following facilities that enable students to experience robotic learning: equipment for conception, such as multimedia devices, drawing tools, and electronic whiteboards; designing equipment, including modeling software, robot making software, online robot simulation platform, etc.; operation facilities, such as LEGO robots, Arduino robots, and assembly welding equipment; presentation facilities, providing students with display platforms to test the performance of their robots. Soft conditions involve teaching program making, case demonstration, information resources, cognitive tools, dialogue and collaboration instruments, and social network support. The effective integration of tangible and soft conditions creates an environment facilitating robotic experimental teaching and promoting student innovation thinking, hands-on creation, and teamwork skills.

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ARTICLE

Family Time and Money Inputs in Education and Teenager Development: Interpretation of Social Capital, Cultural Capital, and Shadow Education

Jiali Li,[1] Ruizhu He[2]

1. *School of Education, Shanghai Normal University, Shanghai 200030, China*
2. *Faculty of Education, the Chinese University of Hong Kong, Hong Kong, China*

This paper utilizes data from the China Education Panel Survey 2013-2015 to examine the effects of family time and money inputs in education on adolescent academic performance from the perspectives of home social capital, cultural capital, and shadow education. Home time input in education is more vital to teenager academic progress than money input. Domestic social capital and cultural capital as well as weekend shadow education positively impact child academic results. Home-based parental participation as a key component of domestic social capital has the most significant influence on teenager academic improvement, while weekend supplementary tutoring generates the weakest effect; workday extracurricular tutoring even negatively affects student academic achievement. School-based parental involvement differs among families of different classes, with a significant negative effect on academic results of teenagers from disadvantaged backgrounds. Due to the absence of heterogeneity effects of home time input in education on academic progress of students from various social backgrounds, parental time investment should be taken as the most effective means to improve academic performance of adolescents from underprivileged classes.

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About the Author: *Jiali Li, School of Education, Shanghai Normal University, Shanghai 200030, China*

Correspondence to: *Ruizhu He, Faculty of Education, the Chinese University of Hong Kong, Hong Kong, China.*
E-mail: estherho@cuhk.edu.hk

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Previous studies on family educational investment mostly focus on one single dimension such as parental participation, cultural capital, or shadow education. Few of them integrate home time and money inputs in education in one discussion, despite that the two are generally concurrent. The differences in home time and money investment in child education among families of different classes as well as the impact of the inputs on teenagers and its power are worth exploration. Based on data from the China Education Panel Survey 2013-2015, we discuss the social stratification of home educational investment and the effects of differential family inputs on adolescent development. To be specific, this paper addresses the following topics: 1) the current state of time and money inputs in education by families of different social status and disparities in social capital, cultural capital, and access to shadow education among differentiated family backgrounds (such as the family economic status, parental education level, parents' professional status); 2) the impact of social capital, cultural capital, and shadow education on teenager academic performance and its power; 3) the impact of time and money investment in education by families of different social strata on child academic achievement and heterogeneity effects of social capital, cultural capital and extracurricular tutoring on the development of students with different family backgrounds.

Research Data and Variables

This study uses data from CEPS 2013-2014 and 2014-2015 to investigate the impact of home time and money inputs in education on teenager academic achievement. CEPS 2013-2014 randomly selected 438 classes (roughly 20,000 students) from 112 schools in 28 county-level administrative regions in China. In the academic year of 2014-2015, it succeeded in following up 9449 students who were the 7th graders in 2013-2014. Their average score of Mathematics, Chinese, and English is treated as the dependent variable. Core explanatory variables include social capital, cultural capital, and shadow education. Social capital consists of domestic activities such as parental company, parent-child communication, parental supervision and external events like school-parent communication, parents' meetings, inter-parent interactions. Cultural capital includes parents' time input in reading (reading habit) and money input (book collection). Shadow education refers to both Monday-Friday and weekend extracurricular tutoring. Individual attributes, family backgrounds, and school features are used as control variables. Individual attributes include gender, hukou, the only child of the family or not, early ability, parental and self-education expectations, and parents' expectations of child academic performance; Family backgrounds refer to home economic status, parents' highest education level and occupational position; School features cover the regional level of the school location, school type, and school ranking.

Methodology

This study adopts descriptive statistical methods such as chi-square test and F test to analyze the status quo of and differences in social capital, cultural capital, and shadow education among families with different backgrounds. Moreover, ordinary OLS regression is used to investigate the effect of different family educational inputs such as parental participation, cultural capital and shadow education on adolescent academic performance, and Shapley decomposition is used to analyze the influence of family money

and time investment in education on the gap in adolescent academic performance. Furthermore, the interaction terms of parameters such as family backgrounds (family economic status, parents' occupational position and education level), social capital, cultural capital and shadow education are incorporated into the analysis to ascertain the heterogeneity of impact of home time and money investment in education on the academic achievement of adolescents from different social classes.

Research Results

Descriptive Statistics

The average academic results of children from socioeconomically advantaged families (with high economic status and high parental education level and occupational position) are significantly superior to those of children from disadvantaged families (with impoverished or manual-worker parents of education background below senior secondary level); the former score 10 points higher than the latter in Mathematics, Chinese, and English tests on average. There are substantial differences in time and money inputs in education among families of different backgrounds. Socioeconomically advantaged Families from the middle and above classes have significantly higher economic and time investment in education than their disadvantaged counterparts. Nonetheless, there is no remarkable difference in parental company between them.

The Differentiated Effects of Home Educational Inputs on Adolescent Academic Performance

Extracurricular tutoring on workdays (from Monday to Friday) imposes a significant negative effect on adolescent academic results, while that on weekends has significant positive impact. Cultural capital such as the family book collection and parental reading habit affects adolescent academic achievement positively. Domestic social capital such as parental company and parent-child communication has a significant positive impact on adolescent academic performance; the higher the frequency of parental participation, the better the child academic performance; parental supervision has a significant negative influence on adolescent academic results. External social capital such as parents' meeting and inter-parent communication is not correlated with adolescent academic performance; the higher the frequency of home-school communication, the lower the student academic performance. Differentiation of effects of social capital, cultural capital, and extracurricular tutoring on adolescent academic achievement by the Shapley decomposition method shows that social capital and cultural capital account for average score gaps among students (6.94% and 6.10%, respectively) more than extracurricular tutoring (2.58%). To be more specific, domestic social capital has a significantly higher accountability rate (5.82%) than the external social capital (1.43%); parent-child communication has the greatest impact, with an accountability rate of 3.82%. In terms of cultural capital, weekend extracurricular tutoring accounts for average score disparities among students (1.86%) more than weekday tutoring (0.38%), but significantly less than parent-child communication, book collection size and parental reading habits.

Heterogeneity Effects of Family Educational Investment on Academic Performance of Teenagers with Different Family Backgrounds

Parental supervision and home-school communication have significant heterogeneity effects on academic performance of adolescents from families with different economic status; the interaction term between parental supervision and home economic status is significantly negative, indicating that the negative impact of parental supervision on adolescent academic achievement decreases with lowered family economic status; the interaction term between home-school communication and family economic status is significantly positive, indicating that the positive effect of home-school communication on adolescent academic performance decreases with lowered family economic status. Home book collection sizes and parents' meetings have significant heterogeneity effects on academic results of adolescents with parents of different occupational positions, and the positive effects of these two variables on adolescent academic results increase with lowered parents' occupational positions. Weekend extracurricular tutoring, book collection sizes, parents' meetings, inter-parent communication have significant heterogeneity effects on academic performance of adolescents with parents of different education levels; the interaction terms between parents' education level and weekend extracurricular tutoring, the home book collection size, and the parents' meeting are significantly negative, while the interaction term between parents' education level and inter-parent communication is significantly positive, indicating that weekend extracurricular tutoring, book collection sizes, parents' meetings have a greater positive effect on academic achievement of teenagers having parents with education background of senior secondary level or below, and that inter-parent communication had a greater positive effect on academic performance of adolescents with highly educated parents.

Conclusions and Discussion

- There exist class differences in home time and money inputs in education. Parents of middle-class or above not only spend more money in acquiring off-campus educational service and resources for their children, but also spare more time to accompany their children than those in manual labor force with education backgrounds of senior secondary level or below and poor incomes. Therefore, home time and money inputs in education by the advantaged classes are significantly higher than those by the disadvantaged classes.

- Family time input in education is the primary factor affecting child academic performance. Relatively direct time input on children by parents in the form of home social capital such as parent-child communication exerts the greatest effect on adolescent academic achievement. There is timing difference in the impact of shadow education on student progress. Extracurricular tutoring between Monday and Friday fails to improve or even impairs teenager academic performance, while attending extracurricular tutoring on weekends can significantly improve adolescent academic results.

- Heterogeneity effects of home time investment in education in some specific forms are most pronounced on adolescent academic performance. The negative impact of parents' meetings on student academic results lessens with lowered parental education levels and occupational positions; there is the possibility that academic results of teenager students from working class with education background of senior secondary level or below are positively correlated with parental attendance of parents' meeting. The positive effect of parent-teacher and inter-parent communication on student academic progress increases with the elevation of family economic status and parents' education level. Economic inputs in weekend extracurricular tutoring and home book collection have a negative impact on the academic performance of adolescents from advantaged families, but a positive impact on the academic achievement of those from disadvantaged families.

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ARTICLE

General and Vocational Tracks and Equity of Higher Education Enrollment Opportunities among Classes: A Reconstruction of Indicator System for Social Class-based Differential Enrollment Opportunities and its Empirical Analysis

Yan Cao, Shanshan Tang

Institute of Higher Education, East China Normal University, Shanghai 200062, China

Based on the educational hierarchical reproduction theory and the MMI and EMI hypotheses, this paper discusses the impact of the tracking of general and vocational education at the secondary level on higher education opportunity equity among social classes. The study finds that increasing gross enrollment rates of both general high schools and secondary vocational schools can help improve the equity in admission opportunities of colleges and universities among social strata; expanding the share of general high school places by adjusting the structure of general and vocational tracks (that is, the general-vocational ratio) can effectively reduce the class disparities in college and university admission opportunities; neither the change in the scale nor in the structure of general and vocational tracks will contribute to alleviating class inequality in top university enrollment opportunities.

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***About the Author**: Shanshan Tang, Institute of Higher Education, East China Normal University, Shanghai 200062, China*

***Correspondence to**: Yan Cao, Institute of Higher Education, East China Normal University, Shanghai 200062, China. E-mail: caoyan0516@126.com*

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The tracking of general and vocational education at the secondary level is the first streaming Chinese students face in the entire educational system. To some extent, it is not only educational tracking, but also a form of hierarchical differentiation among classes. In the context of worsening social inequality and blocked social mobility, there exist huge class disparities in the acquisition of resources and capital in students' early stage of schooling. The expansion of regular college and junior college enrollment scale and the continuous upgrading of the industry also contribute to the problematic circumstances of secondary vocational education such as low returns, implicit social discrimination, and obscure development prospects. The primary issue for the tracking of general and vocational education in China is the contradiction between the need of economy and industry for vocational education development and the low public demand for vocational education. The purpose of this paper is to explore the appropriate tracking scale and structure that help reduce the gap in student access to higher education among social strata from the perspective of regional development.

Research Hypotheses

The increase in total enrollment of general schools enable those students who would otherwise be diverted to the vocational track to enter academic schools and enhance their opportunity of attaining higher education, thereby improving equity in higher education opportunity among different classes. The following hypotheses are put forward in this study. H1: Expanding the general school enrollment scale is conducive to reducing the class gap in higher education opportunity disparity, while it cannot change the inequality in high-quality tertiary education opportunity among classes; H2: The increase in the proportion of general school places helps alleviate the class inequality in student access to higher education, whereas it makes no differences to the disparity in top-level university attendance among classes.

Sources of Data

This paper sources data from the enrollment database of all regular colleges and junior colleges in China and summarizes the number of enrollments in each region from in the academic year of 2014-2015. Additionally, it consults the China Statistical Yearbooks to trace the data of those students who participate in college entrance examination in this academic year (2014-2015) in various regions and draws on the numbers of regional primary school graduates (2008-2009), junior high school graduates (2011-2012), secondary vocational enrollments (2011-2012), high school enrollments (2011-2012), and regional high school graduates (2014 and 2015) of the corresponding groups whose college entrance examination year was in 2014-2015.

Results and Discussion

The Regression Analysis of the Effect of General and Vocational Education Tracking on Class Disparities in Tertiary Education Opportunity

After controlling for other factors, the gap in places between junior and senior secondary schools in various regions significantly affects the equity of higher education. The widened gap in school places results in the increased disparities in tertiary education opportunity among classes. In terms of the effect of school places on the class disparities in access to the general tertiary education (including regular and junior colleges) and the 4-year regular college courses, the logarithmic coefficient values are 0.005 and 0.006, respectively, which means that with every 100% increase in the gap in places between junior and senior secondary school, the disparity between the middle class and the lower middle class in the access to general tertiary education will expand by 0.5%, and that in access to 4-year regular colleges will increase by 0.6%. The R-squared values mediated by the model of enrollment scale of general and vocational tracks are 0.591 and 0.541, and the R-squared value mediated by the model of enrollment structure of general and vocational tracks is 0.407-0.458, which shows that the scale and structure of general and vocational tracks can properly explain their effects on class equity of college enrollment opportunities in three years. The P values of the F test are all less than 0.01, indicating that the overall model has a significant explanatory effect.

After controlling for other variables, the coefficients of the effect of the gross enrollment rate of general high schools on class disparities in student access to general tertiary education and 4-year regular college education are -0.165 and -0.158, respectively, statistically significant at the 1% level, which means that with every 100% increase in the gross enrollment rate of general high schools, the gap in general tertiary education and regular college education opportunities between the middle class and the lower middle class will significantly decrease by 16.5% and 15.8%, respectively. The increase in the gross enrollment rate of secondary vocational schools has a relatively small influence on the class disparities in general tertiary education and regular college education opportunities with influencing coefficients being -0.125 and -0.126, respectively, statistically significant at the 5% level, which indicates that with every 100% increase in the gross enrollment rate of secondary vocational schools, the gap in general tertiary education opportunity between the middle class and the lower middle class is reduced by 12.5%, and the gap in regular college education opportunity by 12.6%. Therefore, regarding the enrollment scale, the increase in the gross enrollment rate of both general high schools and secondary vocational schools is likely to enhance class equity in higher education opportunities, while the effect of expanding enrollment scale of general education is more pronounced.

Using the ratio of general-vocational school places (or the proportion of general high school places) to represent the structure of general and vocational tracks, this study discovers that without considering the discrepancy in school places between junior and senior secondary levels, the proportion of general high school places has no significant impact on the class disparities in the general tertiary education and 4-year regular college education opportunities. After controlling for the above discrepancy in school places, the proportion of general high school places significantly affects the gaps in the general tertiary education and 4-year regular college education opportunities between the middle class and the lower middle class, with coefficients of -0.192 and -0.167, respectively, statistically significant at the 1% level, which signals that with every 100% increase in the proportion of general high school places, the class disparity in the general tertiary education opportunity is reduced by 19.2%, and that in the 4-year regular college enrollment opportunity by 16.7%. After controlling for the discrepancy

in places between junior and senior secondary schools, the higher the proportion of general high school places in the structure of general and vocational tracks, the more conducive it is to the promotion of education opportunity equity between classes. Moreover, the increased proportion yields a slightly greater positive effect on the equity in 4-year regular college education opportunity than that in the overall tertiary education opportunity.

This result provides a new perspective in examining the role of tracking. Nowadays, China's high education is more universalized than ever before, gradually weakening the "screening function" of the college entrance examination. General-vocational education tracking, as the first streaming in students' entire education course, will largely affect their access to later opportunities. From the point of view of class equity, expanding the enrollment scale of general secondary education, to a large extent, allows students from disadvantaged classes more opportunities for further academic education, and delay the time of first "educational diversion", thereby promoting inter-class mobility.

The Regression Analysis of the Effect of Tracking on Class Disparities in Top-level University Attendance

To evaluate the class-based differentials in high-quality tertiary education, this study introduces diverse college categories into the model to examine the effect of tracking on first-class university enrolment opportunity. Mediated by the model of enrollment scale of secondary schools, the R-squared values is 0.478 and 0.431; Mediated by the model of structure of general and vocational tracks, the R-squared value is 0.424-0.590, signaling that the mediation of independent variables can explain the variance (between 42.4% and 59%) of class disparities in top university attendance. After controlling for relevant factors, neither gross enrollment rates of general and vocational secondary schools nor the ratio of general-vocational school places is significantly related to the class disparities in first-class university attendance. The result of analysis validates the initial hypotheses and demonstrates the intense competitiveness and rigorous selectiveness of top universities. Increased admissions of general high schools simply mean the raised number of participants in the college entrance examination. Virtually, the tracking of general and vocational education has no effect on ordinary class students' access to top universities.

Conclusions

Scaling up the enrollment of both general and vocational tracks by increasing the gross enrollment rate of general high schools and secondary vocational schools and other means will help improve the equity of admission opportunities of colleges and universities among social strata and reduce disparities in student access to higher education between the middle and lower classes. Additionally, increasing the proportion of general high schools (i.e., the general-vocational ratio) by adjusting the structure of general and vocational tracks can effectively reduce the stratum gap in college and university admission opportunities.

Regarding superior higher education opportunities, neither the increase in the gross enrollment rate of general high schools nor secondary vocational schools nor the rise in the proportion of general high school places in the general-vocational tracking structure can contribute to alleviating class inequity.

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NEWSLETTER

The Effect of Parental Involvement on Online Learning Performance of Secondary Students: A Report on the Survey of Primary and Secondary School Online Teaching in Jiangsu Province

By Cao, M., Zhu, X., & Shen, S.
Correspondence to: Shusheng Shen, Nanjing Normal University, China. E-mail: ssshen_nj@163.com

THIS paper was published in the *Journal of East China Normal University*. Affected by the Covid-19 Pandemic, China's education system has experienced a nation-wide practice of online teaching and learning. The online learning performance of primary and secondary school students and their adaptability to the new operation has become a social concern. Families are more involved in child learning process than ever before. Based on a large-scale survey of online teaching in primary and secondary schools commissioned by the Jiangsu Provincial Department of Education, this study explores how middle school students perform in online learning and how parental involvement affects secondary school students' online learning performance. The findings of the study are as follows.

- Overall, the online learning performance of middle school students is close to good, the learning engagement is good, and their behavioral engagement and cognitive engagement have reached an above-good level. Their learning outcomes are measured by the degree of goal achievement; the outcomes are close to good; Students can quite effectively complete online learning tasks and achieve the learning objectives set by teachers. Middle school students are at a medium level in learning psychology and not very pro-active in learning. A big share of middle school students has psychological problems, such as emotional instability and anxiety, which deserves public attention.
- Parental involvement has a positive impact on student learning psychology, and a good parent-child atmosphere positively influences students' learning mentality. Homework tutoring by parents has the greatest positive effect on online learning outcomes and also positively influences learning engagement and learning psychology of students; the creation of a good learning environment can predict student learning engagement to a considerable extent and directly af-

fects online learning experience and learning psychology; excessive parental education expectations or over-rigorous learning supervision may negatively affect students' learning psychology and exacerbate students' anxiety and academic stress.

Based on the research results, this study offers several recommendations. First, in home-school collaboration, it is necessary to incorporate parent education into the teaching framework of blended learning, guide parents to renew their concepts in terms of educational expectations, parent-child communication, and online learning supervision, and teach them how to alleviate their children's anxiety through scientific parenting styles. Second, parents should be concerned about children's mental state in online learning. Different learners have distinct psychological characteristics, and thus different measures should be taken to intervene on potential risks of online learning. Finally, the interactivity, cooperativeness, and sociality of online learning need to be further strengthened.

Source: Journal of East China Normal University (Education Sciences), 2021; 2021(4):16-28.

NEWSLETTER

The Influence of Mothers' Perception of Co-parenting on Preschoolers' Behavioral Problems: A Moderated Mediation Model

By Liu, X., & Li, Y.
Correspondence to: Yan Li, Shanghai Normal University, China. E-mail: liyan@shnu.edu.cn

THIS study published in *Psychological Development and Education* undertook a one-year panel survey of 170 five-year-old children in 2 kindergartens of Shanghai and their mothers to examine the relationship of children's behavioral problems with co-parenting, parents' marital conflicts, and children's psychological resilience through questionnaire investigation. According to the research theme, the study puts forward the following hypotheses: 1. Marital conflicts mediate the relationship between co-parenting and children's behaviors. 2. Children's psychological resilience moderates the mediation role of marital conflicts in the relationship of mothers' perceived co-parenting and children's behavioral problems and moderates the second half of the mediating path. The results of the study are as follows.

- The regression analysis shows that mothers' perceived co-parenting has a significant effect on children's behavioral problems (β = -0.17, t = -2.40, 95% CI [-0.31, -0.03]); The interaction between mothers' perceived co-parenting and children's psychological resilience is not significantly correlated with children's behavioral problems (β = 0.09, t = 1.47, 95% CI [-0.03,0.21]). The direct effects of mothers' perceived co-parenting on children's behavioral problems are not mediated by children's resilience.
- The regression analysis also indicates that the direct effect of mothers' perceived co-parenting on children's behavioral problems is significant, and so is the indirect effect of mother's perceived co-parenting on children's behavior problems mediated by marital conflicts (a*b = -0.09, SE = 0.03, 95% CI [-0.16, -0.04]. This confirms that Hypothesis 1 holds, that is, marital conflicts play a mediating role between mothers' perceived co-parenting and children's behavioral problems.
- The results obtained by a moderated intermediary model: the mothers' perceived co-parenting negatively predicts marital conflicts; marital conflicts significantly and positively predict children's be-

havioral problems; children's psychological resilience has a negative effect on their behavioral problems. The interaction between parents' marital conflicts and children's psychological resilience significantly predicts children's behavioral problems. The results verify Hypothesis 2.

- Parents' marital conflicts have a significant positive predictive effect on behavioral problems of children with low psychological resilience ($b = 0.40$, $SE = 0.10$, $p < 0.001$, 95% CI [0.20, 0.59]). The fiercer the marital conflicts, the more behavioral problems the children have; the positive predictive effect of marital conflicts is not significant on behavioral problems of children with high psychological resilience ($b = 0.04$, $SE = 0.09$, $p > 0.05$, 95% CI [-0.13, 0.21]). This result suggests that high psychological resilience of children can mitigate the negative effects of marital conflicts on their behaviors.
- 5. Child psychological resilience also mediates mothers' perceived co-parenting through the indirect predictive effect of marital conflicts on children's behavioral problems. The adjusted mediation coefficient was 0.08, 95% CI [0.04, 0.13]. For children with low psychological resilience, the indirect effect of their mothers' perceived co-parenting on their behavioral problems is significant, and the coefficient is -0.14, 95% CI [- 0.24, - 0.08]; for individuals with high psychological resilience (psychological resilience of one standard deviation above the mean), the indirect effect of their mothers' perceived co-parenting on their behavioral problems is not significant, with a coefficient of 0.01, 95% CI [-0.04, 0.08].

The following implications are proposed: 1) In the family, the husband and wife should consciously coordinate with each other in parenting and improve their marital relationship to promote children's social adaptation and reduce children's behavioral problems. 2) Schools and families can utilize psychological resilience trainings to enhance children's resilient competence (such as promoting self-esteem and self-confidence to enhance children's self-efficacy, improving children's emotion regulation ability, developing children's cooperation and communication skills, improving problem-solving, etc.) and promote their self-protection capability.

Source: Psychological Development and Education, 2022; 2022(5):626-634.

NEWSLETTER

Can Teacher Participation in School Governance Improve Student Academic Performance?

By Fan, Y., & Fan, G.
Correspondence to: Guorui Fan, East China Normal University, China. E-mail: grfan@ecnu.edu.cn

THIS study published in *Modern Education Management* uses the data of 9,841 students from the Program for International Student Assessment (PISA) 2015 in four provincial administrative regions of China as sample to analyze the impact of teacher participation in school governance on student academic performance. Since there are significant differences in student academic performance among various schools, the multi-layer regression model is adopted to address the question "whether teacher participation in school governance can improve student academic performance". The findings are as follows.

- Teacher participation in school governance significantly affects student academic performance. The results of the two-layer regression model show that raising teacher participation level is conducive to improving students' overall academic results. It means that teacher participation in school governance has a positive effect on school education quality. Besides, high level of teacher competence as well as adequate school education resources and teacher supply positively affects student academic performance.
- Teacher participation in personnel and curriculum management can effectively improve student academic achievement. Descriptive statistics show that Chinese teachers engage intensively in curriculum-related decision-making but have a low participation in personnel and financial management. The results of the two-layer regression model indicate that teacher participation in both personnel and curriculum management can significantly promote student academic performance, indicating that the clarification of teachers' rights in school affair administration is beneficial to improving the quality of teacher participation, thus promoting student academic progress.
- High competence of teachers can significantly enhance student academic performance. The results of empirical research show that the regression coefficient of the interaction term between teachers' competence and teacher participation is positive (a positive coefficient of

interaction term means the effect of independent variables on dependent variables increases with strengthened moderating variables). In addition, the coefficient of interaction term between teacher competence and teacher participation in teaching administration is also significantly positive, which demonstrates that participation of high competence teachers in student assessment, student discipline, and other affairs can effectively improve student academic performance.

Based on the research results, the study suggests that schools should integrate the theory of Good Governance and the idea of co-governance into school internal administration. Besides, schools should optimize the mechanism to encourage teacher participation in school governance and implement law-abiding school governance. Meanwhile, teachers should increase their awareness of pro-active participation in school governance and place a premium on professional development in order to enhance the quality of their participation and to promote student academic progress.

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