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COMMENTARY

Teachers' Roles in Evidence-based Educational Reform in China

Alan C.K. Cheung

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> *"Education reform has as its main purpose to make sure that the education delivered is of quality."*
>
> *–Enrique Pena Nieto*

THE evidence-based educational reform was initiated in the field of medicine and now has become a cutting-edge reform wave in the world. As a new pattern of educational reform, it aims to optimize educational decision-making and practice and promote the improvement of education quality, using scientific research evidence. Contrary to experience-based traditional education practice, evidence-based education emphasizes scientific support and data collection, transforms the individual experience into replicable regional experience, and provides scientific basis for implementation of educational policies, strategies and programs.

Evidence-based educational reform involves personnel from multiple agencies including academic researchers, think tank experts, primary and secondary school practitioners, government and school decision makers. Among them, teachers are the key force of evidence-based educational research and educational reform. Zhu and Zhu (2020) suggest that teachers' accumulation of practical knowledge and keen insights, the prerequisites of educational reform, provide theoretical support for the development of evidence-based research. Some scholars believe that evidence-based educational reform is not system reconstruction, but rather a process of improvement firmly rooted in school situations and teachers' practice (Pei et al., 2020).

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China's teaching research system is a special organization in teachers' professional development, differing from other teacher bodies like teacher union. It not only organizes teachers' educational and teaching research, but also undertakes certain administrative functions. In this system, Chinese teachers receive vocational training compulsory for their teaching career, conduct research on teaching methods and strategies, and cultivate abilities to examine teaching from the perspective of learners (Darling-Hammond, 2000). It is an important link between classroom teaching and teaching reform. Based on the real teaching situations at school, teachers, under the guidance of this system, reflect regularly on teaching practice, discuss with their colleagues, and hold exchanges with higher-level teaching experts. In this way, teachers are self-motivated to gain a more comprehensive and profound understanding of teaching and their internal enthusiasm for learning and internal needs for professional progress are stimulated (Liu, 2021). Therefore, some scholars commented that teaching research in China is the result of teachers' professional competence and professional pursuit (Cheng, 2021).

With deepened basic educational reform in China, especially the curriculum reform, teaching research has also undergone a comprehensive transformation. The transition from experience to evidence has become a consensus in the development of teaching research reform. Teachers use standardized evidence and personal knowledge in implementing evidence-based teaching reform according to teaching objectives, students' practical situations and teaching conditions, aiming to improve teaching quality and teaching methods. In the issue of the journal, *The Role of China's Teaching Research System in Promoting Evidence-based Reform in Education: A Case Study of Jiangsu Province* by Zhou (2021) analyzed the patterns, characteristics and results of China's evidence-based reform in education and examined the roles of China's teaching research system in this reform, using a 15-year exploration of evidence-based educational reform from Jiangsu Province as a case study.

This paper indicates that China's teaching research system, a large and stable teaching research organization, has played a vital part in the follow-up evidence-based reform based on education quality survey, represented by Jiangsu Province. Its strengths in organization and execution and more importantly its application of accurate and scientific data contribute to the outcomes of educational reform. The transitions from experience to data and from mere knowledge impartment to comprehensive education mark outstanding achievements of China's evidence-based reform in education.

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ORIGINAL ARTICLE

The Role of China's Teaching Research System in Promoting Evidence-based Reform in Education: A Case Study of Jiangsu Province

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Abstract. *Teaching research system is a unique professional community of education and teaching research in China. It is an important driving and leading force in promoting evidence-based reform in education in China. Using fifteen-year exploration of evidence-based reform in education in Jiangsu Province as a case, this paper presents the ways and characteristics of evidence-based reform in education in China, with a focused analysis of the role of teaching research system in the reform. Despite its uniqueness, China's evidence-based reform in education can still contribute experience to its world counterpart.*

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Introduction

"*THE 4th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of Long-term Objectives for 2035*" emphasizes the orientation and objectives for the policy "building a high-quality education system". Promoting education reform through assessment mechanisms and building a high-quality education system are one of the important paths to drive high-quality development during the 14th Five Year Plan period. However, in the practical reform, there are still some problems, such as backward assessment concepts, unscientific assessment tools, inaccurate analysis and diagnosis, and unremarkable effects. To prevent subjective or even emotional judgements and stimulate sound and reasonable educational reform is essential in improving the quality of education and teaching and in building a powerful education system.

In fact, how to make educational decision-making more rational and effective has not only been an issue faced by China, but also by the whole world. Amidst this situation, the evidence-based reform came into being in the 1980s, providing a possible way to address this issue. Being "evidence-based" refers to the concept that any decision, opinion, or conclusion must be based on solid evidence drawn from scientific research. The evidence-based reform was meant to reduce the randomness in educational development, ensure that educational reform complies with scientific logic, and achieves the goal of educational development in a more efficient and steady way. Up till now, the evidence-based reform, as an important driver in global educational reform and development, has made remarkable achievements (Slavin & Cheung, 2019; Slavin et al., 2021).

In this context, the importance of acquisition and use of scientific evidence has been increasing in China's educational reform and development. Jiangsu, as a province with a high level of socio-economic and educational development, started the survey of student academic quality in basic education in 2006. Since then, following the principles of evidence-based reform, Jiangsu has made great efforts in pursuing effective and rational surveys and attaining a large amount of scientific evidence in improving the efficiency and quality of education and teaching. In driving the evidence-based reform of regional education, the unique teaching research system has played an important part. Teaching research institutions at all levels contribute to the search for laws of effective education and teaching, summarize and promote typical experience and effective practice through research results feedback, evidence-based reform projects and multi-party cooperation. As a result, Jiangsu succeeds in finding the path for evidence-based reform in education with Chinese characteristics.

As part of the global wave of evidence-based reform in education, China started relatively late, but has been making rapid progress. By taking Jiangsu as a case and analyzing its evidence-based reform process, this study presents the patterns and characteristics of China's evidence-based reform in education and examines the roles of China's teaching research system in this reform. Although China's mode of promoting evidence-based reform through its unique teaching research system cannot be used by

other countries directly, considering China's huge volume and the important role of the teaching research system in promoting the development of high-quality education, we believe the general laws inferred from its exploration can be used as references for global educational development.

China Teaching Research System

China's basic education is stereotyped as a process in which rigid, intensive and authoritative exercises and training are emphasized by teachers in pursuit of academic achievements. In this process, educational outcomes depend mainly on the investment of time, energy and even money, while cultivation of students' independent inquiry ability and teacher's search for education and teaching methods are ignored. It is believed that when bringing excellent academic performance to Chinese students, the current practice also causes problems such as heavy academic burden and unfavorable development of high order thinking abilities. For this reason, Zhao (2014) believes that China may have the best and at the same time the worst education system in the world. In such an education system, students may be able to cope well with standardized examinations and obtain better exam results but have difficulty in developing other important skills based on individual talent.

We believe that such stereotyped ideas are biased in that they fail to cover the other side of China's basic education. In fact, in the basic education area, China has established a complete and powerful teaching research system. Some people held the view this system is a simulation of the teaching research organizations of the former Soviet Union. In recent years, more researchers come to believe that China's teaching research system is the result of domestic practice and exploration (Liu, 2021). It is thought to have originated in the late Qing Dynasty when the then-education department began the trial to build teaching research institutions and implement teaching research policies to meet the demands for school system reform. After the National Government was set up in 1912, it strengthened the guidance and survey of school teaching through a series of organizational construction, which laid the foundation for the establishment of China's education system. After the founding of the People's Republic of China in 1949, a complete teaching research system covering the whole country has been gradually established. It started with learning from the teaching research system of the former Soviet Union, and then built up China's own system with Chinese characteristics based on domestic practice, which is not only the result of inheritance and development of the previous systems, but also that of exploration under the new historical background (Li, 2014).

To date, China has built up a teaching research team of nearly 100,000 staff and a five-level working system. In 2019, the State Council issued the document named "Opinions on How to Deepen Education and Teaching Reform and Comprehensively Improve the Quality of Compulsory Education,"[1] which not only fully affirmed the professional and supportive role of teaching research in basic education, but also put forward a series of tasks and requirements on how to strengthen teaching research in the next stage, further reinforcing the role and status of the teaching research system. Chi-

na's teaching research system has become a professional community for the growth of Chinese teachers and the improvement of education and teaching quality. Its functions include training and guiding teachers, engaging teachers in teaching research and directing teaching reform. Some scholars believe that emphasis on teaching research is advantageous to Chinese teachers, and the research itself is far superior to the general in-service training received by foreign teachers (Chen, 2021). Given that, simply attributing the excellent academic achievements of Chinese students to highly intensive learning is somewhat biased. What worth noticing is the significant positive impact of China's teaching research system on the educational reform.

Furthermore, China's teaching research system is not only a conglomerate of professional research institutions, but also undertakes certain administrative functions. In terms of organizational structure, it mainly consists of teaching research offices at all levels, from the central to local. The system exerts vertical and centralized management to implement the national policies on education through all kinds of teaching research programs. In addition, teaching research offices at each level can also set up their own teaching research projects and reform measures according to the specific needs of regional education reform and development. Therefore, the system is run with a management mode combining centralization and decentralization. Moreover, although China's teaching research offices at all levels exist in the form of "research institutions", they are also responsible for formulating educational and teaching policies, managing scientific research projects and funds, assessing and displaying teaching scientific research outcomes, etc. Because these roles are closely related to the development of schools and teachers, the "instructions" issued by teaching and research offices are normally highly valued and seriously implemented by schools at all levels. Compared with Western teaching research institutions and professional bodies of teachers, China's teaching research system has stronger resource allocation and administrative power. Such power enables China's teaching research system a strong capacity to organize and implement broad, highly intensive and targeted reforms and experiments (Liang et al., 2010; Lu & Shen, 2010).

In the 21st century, Chinese educators have significantly increased awareness of scientific evidence acquisition, and accordingly, made great progress in the improvement of teaching quality and effectiveness. With the expansion of the influence of evidence-based reform, how to promote evidence-based reform with Chinese characteristics has become an important topic in China's education community. Early this century, Jiangsu established a provincial academic survey system for the purpose of accurate assessment of student academic performance and exploration of teaching effectiveness, and on that basis, vigorously promoted evidence-based reform in education. In this process, the teaching research offices in primary and secondary schools in the provincial teaching research system played an important role in the reform and in harnessing the direction of the reform. Citing Jiangsu as a case, this article will further explain the progress of evidence-based reform in China and how the unique teaching research system works in this momentous reform.

Fifteen-Year Evidence-Based Reform in Jiangsu Province

In 2006, Jiangsu initiated the follow-up evidence-based reform, based on the provincial survey of basic education quality. In the initial phase of the reform, Jiangsu relied on the survey of academic performance to obtain promising evidence from relevant research. After further accumulation of such evidence, the Provincial Teaching research Office arranged a series of follow-up reforms through the teaching research system, so as to obtain more stable evidence and reform experience. The fifteen-year reform can be divided into four stages.

Preliminary Stage of Exploration (2006-2012): Systematic Study and Team Building Jiangsu

In 2008, the Provincial Basic Education Quality Survey Center of Jiangsu was established, the first of its kind in China. Efforts were made in improving the survey rules and methods and building a stronger team with expertise. Through cooperation with the national project team and participation in survey projects, the Center accumulated surveying experience, and formed work specifications and relevant supporting systems. After that, three rounds of survey of compulsory education quality were carried out in Jiangsu Province, which help build up practical experience and laid a foundation for follow-up work.

Practical Stage of Reform (2012-2016): Tool Innovation and System Construction

A team of experts in academic quality survey were built in Jiangsu Province to study and create academic quality standards in line with the teaching situation of the province. They were engaged in research and development of assessment frameworks and tools for students' core skills and key abilities, in establishing the comprehensive index assessment system of student academic quality in compulsory education in Jiangsu Province, and in creating a feedback system of survey result. Xishan District and Binhu District of Wuxi City and Hongze District of Huai'an City were chosen to carry out the follow-up reform based on the analysis at the city district and county levels and the cooperative research on how to improve the quality of regional compulsory education. The pilot reform of improving the teaching management level based on the assessment and analysis was conducted in Nanjing foreign language school Xianlin Campus.

Follow-Up Stage of Implementation (2015-2018): Model Construction and Project Promotion

Under the guidance of evidence-based reform theory, the follow-up reform projects were implemented, and the working model of regional education quality improvement put forward. In 2015, the Provincial Department of Education set up "the Major Follow-up Reform Program Based on the Assessment and Analysis ". Twenty-nine key follow-up projects were launched at the levels of city, county, and school to promote the practical application of survey results of academic quality. A number of role models of the follow-up reform emerged, such as Suzhou Industrial Park, Nanjing Qinhuai District and Nanjing Foreign Language School Xianlin Branch. In 2017, the Provincial Teaching research Office, in cooperation with Nanjing Pukou District Government and other Institutions, carry out an evidence-based experimental intervention research to improve the quality and practical effectiveness of evidence-based reform.

Finalizing Stage of Promotion (2018-2021): Results Refinement and Application Implementation

Cooperating with academic institutions like Nanjing Normal University, the Provincial Teaching research Office strengthened scientific research and reinforced application of survey results. As a result, the evidence-based reform model of Jiangsu's education was formed, which effectively integrates the academic research, teaching research management and the teaching practice of the front-line teachers and facilitates scientific decision-making and scientific ways of teaching. It solved the problems of over reliance on experience and lack of rationality and effectiveness in the process of educational reform and development. The popularization and application of this model in the whole province has greatly improved the quality of education and teaching and promoted the all-round development of students.

Evidence-Based Reform in Education Led by the Teaching Research System in Terms of Organization, Method, and Model

To date, the survey of basic education quality has become a powerful driver to Jiangsu's educational experiment and reform. With the joint efforts of multiple departments and institutions, Jiangsu Province has built organizational, back-up and working systems for evidence-based reform based on the survey of education quality, with scientific research as major duties and practice improvement as the objective.

Academic Survey System

At present, Jiangsu's survey of basic education quality covers all the main subjects at the compulsory education stage and all cities and counties in the province. Teaching research offices at all levels make contributions to the wide-coverage and completeness of this survey system (see **Table 1**). Jiangsu province attaches great importance to the construction of a professional survey team, and continuously raises the academic level

Table 1. Survey Sample Size in Jiangsu Province over the Years (2006-2020).

Year	2006	2008	2010	2012	2014	2016	2018	2020	Total
Number of students	113,438	174,747	194,675	197,586	213,585	224,763	262,245	375,086	1,756125
Number of students	28,473	35,759	31,458	33,636	34,971	37,484	40,407	54,744	296,932
Number of principals	3,314	4,563	4,182	4,441	4,590	5,121	5,354	5,607	37,172
Number of schools	1,762	2,290	2,109	2,260	2,453	2,695	2,808	2,917	19,294

of the survey team by introducing professionals and strengthening personnel training. A full-time survey and analysis team of more than 150 staff has been built and made an important force in promoting evidence-based reform.

Scientific and Accurate Assessment Tools

The lack of scientific and accurate assessment tools has always been a factor restricting China's evidence-based reform in education. To solve this problem, the Provincial Teaching research Office not only hires experts to participate in the preparation of questionnaires, but also organizes special personnel to analyze the assessment tools of PISA and other international projects, so as to absorb the theories, experience and methods of those classic assessment projects. Focusing on assessing student core skills and key abilities, the Provincial Teaching research Office first developed complete assessment tools and investigation tools for Chinese, mathematics, English of primary school and Chinese, mathematics, English, physics, biology, geography of junior middle school and produced more than 15,000 survey and analysis reports on education quality in 11 categories. Cutting-edge and innovative, the assessment tools not only have good reliability and validity and high accuracy, but also solve the assessment problems in non-cognitive factors, high order thinking dispositions and other correlative factor scales, in the context of national conditions and teaching conditions, (see **Figure 1**).

Furthermore, Jiangsu Province has developed a comprehensive index system for survey of basic education quality in Jiangsu Province by taking reference from research results of other surveys of education quality at home and abroad (see **Figure 2**). This index system can not only survey students' learning, but also comprehensively analyze correlative factors, processes, mechanisms, and results, respond to the key, difficult and hot issues of educational reform and development, and evaluate the implementation effect of educational policies and measures. Based on these tools and indicators, a complete and accurate survey information system for Jiangsu learning and teaching is created. Being comprehensive, practical and scientific, this system is in the leading position in China, providing accurate and high-quality evidence for the improvement of education quality in Jiangsu.

Follow-Up Educational Experiments and Evidence-Based Reform

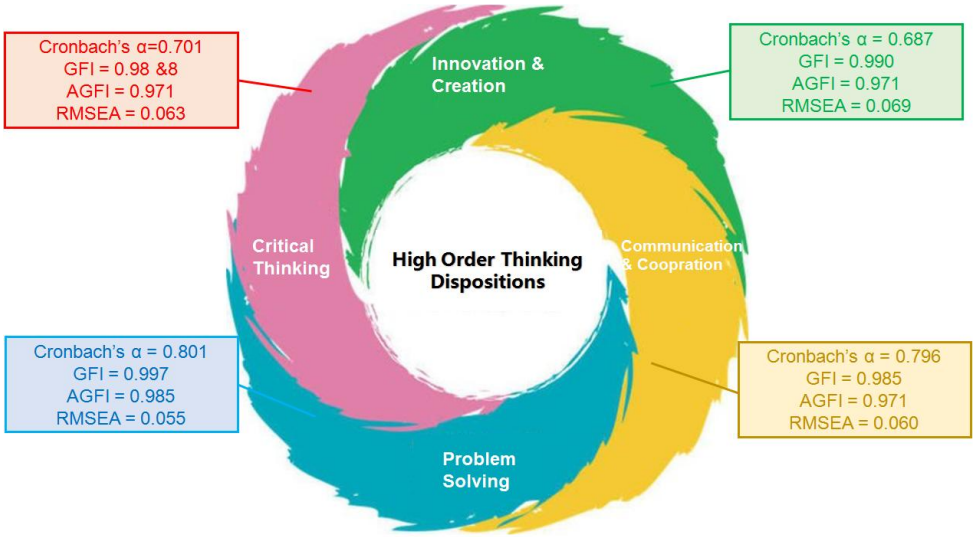

Figure 1. Test Results of Measurement Dimension, Reliability and Validity of High-Order Thinking Disposition Scale for Primary and Middle School Students.

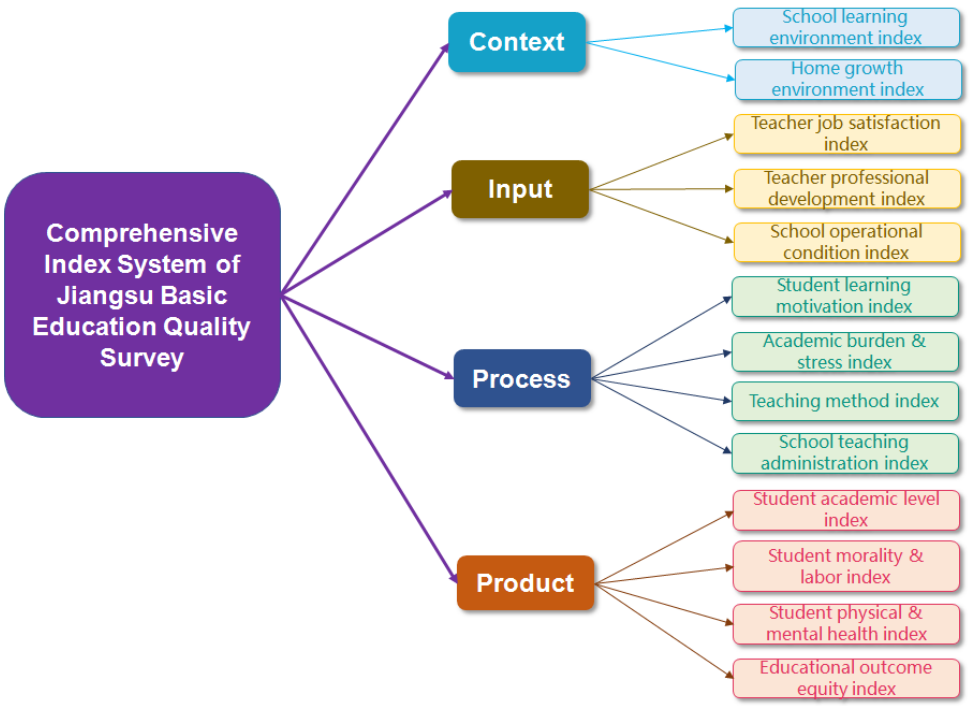

Figure 2. Comprehensive Index System of Basic Education Quality Survey in Jiangsu Province.

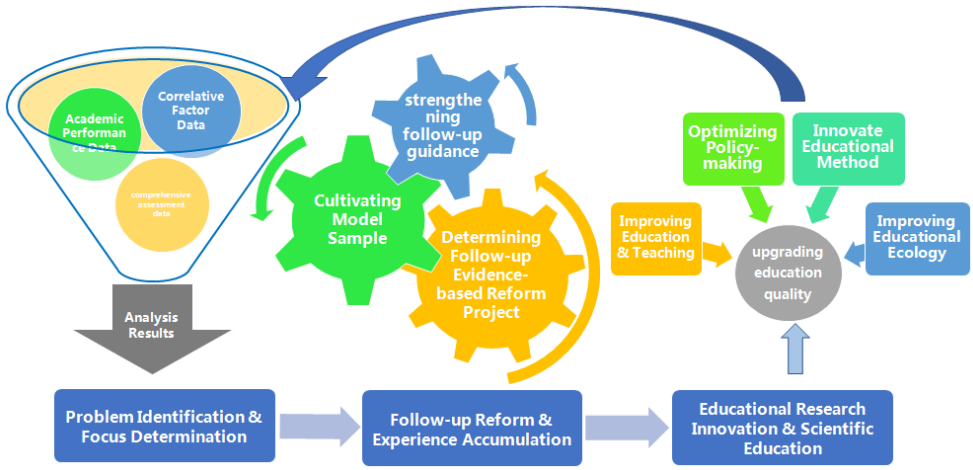

Figure 3. Implementation Model of Follow-Up Evidence-Based Reform.

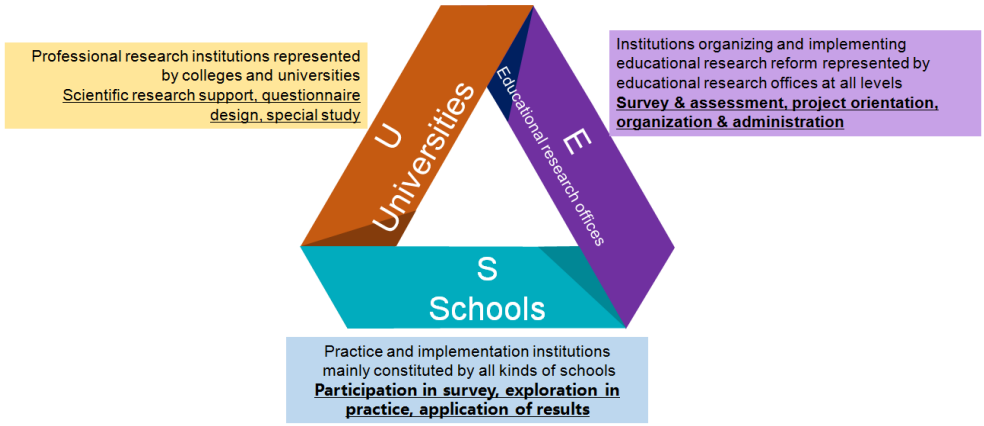

Figure 4. Multi-Party Cooperative Reform Community.

The evidence-based education reform in Jiangsu Province proceeded after the completion of survey. The Provincial Teaching research Office started to address the relevant research findings and to promote their application in the front-line teaching practice, with the purpose of improving the education and teaching quality based on scientific evidence. In this regard, Jiangsu's teaching research system creatively organized and implemented the "follow-up reform" using the academic survey data analysis. The "Follow-up Reform Program Based on Assessment and Analysis" involved 29 projects in the whole province, including 2 entrusted projects by colleges and universities, and 9 projects at each level of district, city, county and school. From 2017, to integrate survey, teaching research and scientific research, follow-up reform projects were included in

the subject research projects of primary and secondary schools in Jiangsu Province for the first time. 15 provincial key projects were granted, which were supported and complemented by projects at all levels. A total of 700 projects were set up to encourage and promote all localities and schools to carry on follow-up evidence-based reform. Under the guidance of the Provincial Teaching research Office, Suzhou, Changzhou and other places achieved remarkable outcomes through local academic surveys and follow-up reforms. The Provincial Teaching research Office allocated special funds to support relevant research and reform projects, and invested 22.5 million yuan in recent five years, which effectively guaranteed the smooth progress of the reform (see **Figure 3**). In recent years, the follow-up evidence-based reform in Jiangsu has emphasized the importance of the stability of evidence and the mining of causality and carried out educational intervention experiments of different scales in many places. Further efforts will be made to explore the laws of education and teaching more steadily and deeply and improve the effectiveness and quality of education by adopting the cutting-edge methods and technologies of international evidence-based research.

Multi Party Cooperative Reform Community

In the long-term exploration, Jiangsu has evolved a reform community consisting of professional researchers from colleges and universities, governmental administrative departments and teaching research institutions, and primary and secondary schools, which complement one another with each party's advantages and share a collaborative relationship (see **Figure 4**). This community takes the improvement of education quality as the first priority, and implements the relevant research results and policy measures, to make sure that research results can really play a part in upgrading the quality of education and teaching. Under the condition of data security, Jiangsu Teaching research Office opens data resources, decentralizes the design authority of survey projects and research topics, and tries to introduce multiple intellectual resources to improve the quality of survey and the effectiveness of the reform.

Therefore, while enhancing the education quality of Jiangsu to a new level, the model of evidence-based reform in education led by teaching research system helps integrate multi party strength in research and practice, enabling quick and effective responses to difficult and hot issues in the process of education reform and development. Before each assessment session, the Provincial Teaching research Office will adjust the methods and contents of assessment and investigation according to the previous research findings and the new problems, new situation and new needs faced by Jiangsu Province. A task force is delegated by the Office to analyze the contents of Pisa and other international authoritative assessment projects, so as to follow the latest progress in the area of international education assessment in terms of student skills, assessment methods, correlative factors and research topics, to better understand and judge the direction of global education reform and development. At the same time, more analysis of Jiangsu educational situation is made to confirm the urgent needs and common concerns of the public. In recent years, to make the survey of basic education quality more targeted and practical, the Office have focused on issues like student burden reduction, effective teaching strategy, educational equity for the underprivileged, student stress

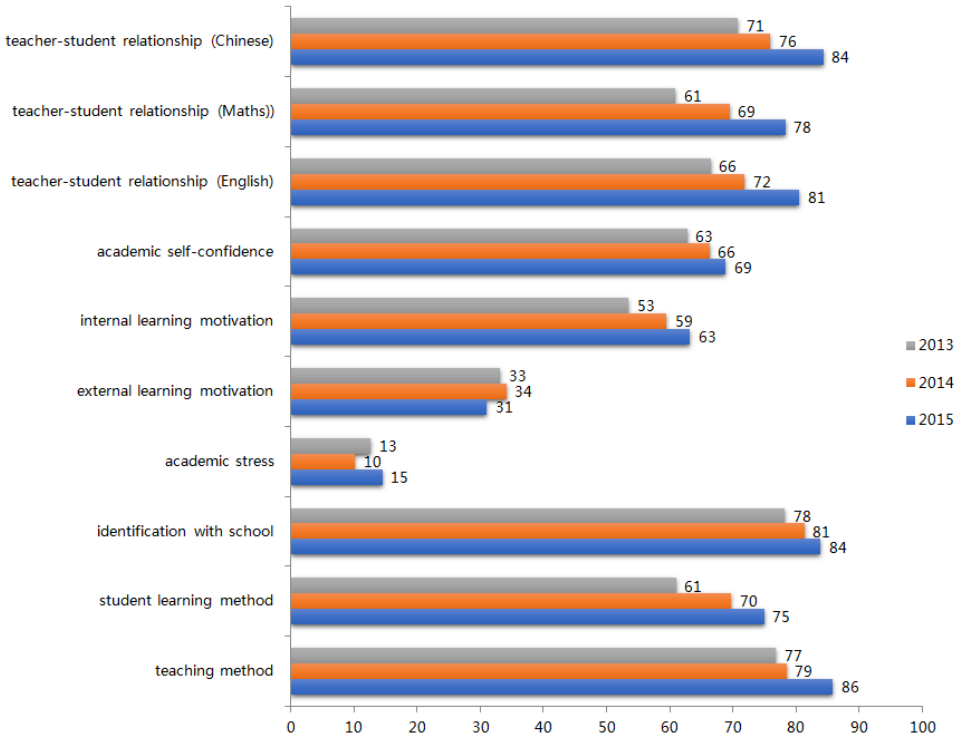

Figure 5. Follow-Up Reform Outcomes at the School Level: Taking Nanjing Foreign Language School Xianlin Campus as a Case.

resistance, teacher job satisfaction, student high-order cognitive ability development, educational resources allocation.

Outcomes of Evidence-Based Reform in Education

After 15 years of exploration, Jiangsu has made remarkable achievements in evidence-based reform in education. The concept and mode of "scientific evidence-based and follow-up reform" have been integrated into all aspects of school teaching reform, and fruitful results have been attained in practice.

Firstly, the quality of basic education is significantly improved, and student all-round development is promoted.

At the school level, through survey and assessment, comprehensive and accurate diagnosis of school teaching problems has been made, and remarkable results have been achieved in the follow-up reform in experimental schools such as Nanjing Foreign Language School Xianlin Campus (see **Figure 5**). At the local level, follow-up reform projects are taken seriously in seeking for effective ways to improve the education quality and promote student all-round development. At the provincial level, Jiangsu has made remarkable achievements in previous PISA and relevant national surveys, with continu-

ous improvement of various indicators and steady progress in high-quality and balanced development, which fully indicates that the reform has achieved significant results.

Secondly, the integration of evidence-based reform into normal teaching and research drives the quality improvement and transformation of grass-roots teaching and research in the province.

Under the guidance of the Provincial Teaching research Office, all localities carry out evidence-based teaching diagnosis in teaching and research, reform teaching methods, constantly improve teachers' professional skills and teaching quality. Various models of classroom reform have emerged throughout the province, such as Nantong's "Learning-centered Classroom", Xuzhou's "Learning and Presentation Classroom", Yancheng's "Critical Learning Classroom", Suzhou's "Suzhou-style Classroom", Huai'an's "Integrated Learning Classroom", Taizhou's "Micro Classroom", Zhenjiang's "Integrated Classroom".

Thirdly, the assessment tools of student core skills and key abilities, question designing technology and investigation by questionnaires have been widely used in the whole province.

Directed by the Provincial Teaching research Office, Changzhou, Yangzhou, Suzhou and other places deepened follow-up reforms by using provincial assessment tools and technologies. After several rounds of training, their standardized framework of survey of academic quality, and question designing skills have become an important reference for academic assessment for all cities in the province and made an important contribution to the improvement of exam question quality in the middle school entrance examination in our province. The popularization of these tools and technologies has greatly improved the quality of educational assessment and reform in Jiangsu, and the relevant exploration and achievements are in the leading position in the country.

Finally, aimed to improve education quality by survey, the evidence-based reform model of Jiangsu makes a big difference in the country.

Jiangsu's evidence-based reform in education has attracted extensive attention. Fujian, Hainan, Xinjiang, Sichuan, Qinghai and other provinces have sent personnel to Jiangsu to study and transplant Jiangsu experience to the survey and teaching reform in their own provinces. In recent years, the teaching research staff have published more than 30 papers in authoritative journals at home and abroad, and relevant personnel have been invited to make theme reports at important conferences over the world for many times. China Education Daily and Xinhua news agency reported on Jiangsu's achievements in education reform and interviewed leading research personnel, which was well received. A project team created the "Best Evidence in Brief" website (http://www.cnbeb.org.cn:81/). Its official account of WeChat has registered nearly 20 thousand subscribers both at home and abroad and become an important channel for obtaining information on evidence-based research and reform results in education.

Discussion: Uniqueness and Universality of China Evidence-Based Education Reform

Jiangsu, as one of the regions of high socio-economic and educational development levels in China, takes the lead in evidence-based reform in education, in which China's unique teaching research system plays an important role. In the case of Jiangsu, its strong teaching research system has always been the director and motivator of the provincial evidence-based reform in education. Decision-makers' determination to transform the traditional experience-dependent teaching modes to scientific evidence-based education models is the prerequisite for the role of the teaching research system in the reform. Moreover, the strong capacity of resource mobilization, organization and coordination of China's teaching research system lays a solid organizational and institutional foundation for the rapid progress and remarkable effectiveness of this reform.

As mentioned earlier, China's teaching research system is not only a conglomerate of research institutions, but also performs the administrative and organizational function in teaching and scientific research. In the process of evidence-based reform in education in Jiangsu, massive human and financial resources are required in both organizing large-scale provincial academic survey and setting up follow-up reform projects. The establishment of an academic survey system covering the whole province, the compilation of a complete package of scientific assessment tools, the promotion of large-scale intervention experiments within the province, and the formation of evidence-based education policymaking and implementation mechanisms, within just 15 years, depend entirely on the strong force of such a system. Local educational departments, whether they support evidence-based reform in education or not, must keep in line with the overall arrangement under this system, which ensures the effective promotion of reform. Once the effect of the reform at the initial stage is confirmed, such a system can help carry out large-scale verifying experiments and then further deepen the reform.

In fact, China teaching research system as a whole has always had such a powerful capacity, yet undoubtedly, some of the reforms it initiated previously could not reach the goals as expected or be verified of their effects. The success of Jiangsu's evidence-based education reform is attributed to the strong organization and coordination abilities of its teaching research system, yet more to the value orientation and action path determined by the teaching research system led by the Provincial Teaching research Office. During the 15 years of exploration, the reform has consistently been based on solid scientific research, to ensure the correctness of reform direction and the effectiveness of reform measures.

Jiangsu's education reform and experiment are of great significance to the promotion of China's evidence-based reform in education and innovation of teaching research approach, in that the follow-up evidence-based reform in Jiangsu takes scientific evidence as the basis of reform and practice, through which long-standing problems with China's education reform such as lack of scientific approach and poor effectiveness can be solved. The survey of basic education quality in Jiangsu and the relevant analysis provide the reform with full support of scientific research. Directed by laws of education, the reform can overcome blindness and achieve the expected results.

Moreover, the follow-up evidence-based reform uses reform experimental projects as media in applying survey results fully into practical work, thereby dissolving the separation between professional research and practical work. Such follow-up reforms start with scientific research, and then apply it to practical work, and in turn draw research subject matter from practical work, thereby to form a promotion path of reform combining theory with practice, resulting in the pertinence and effectiveness of scientific research, and the strengthened guidance on practical work.

It should be noted that the great achievements made in the Jiangsu evidence-based reform in education is significantly conditioned by China's unique teaching research system and its powerful strength. In a sense, the path of China's evidence-based reform in education can hardly be replicated by other countries. However, emphasis on scientific survey tools, multi-party cooperation in reform and gradual expansion of reform scope from pilot experiments to popularization are universal experience in line with laws of educational development.

Challenges and Prospects

Despite the remarkable results achieved by the follow-up evidence-based reform of Jiangsu supported by the survey of educational quality, the reform is still facing several challenges and has a long way to go when looking into the future.

Firstly, data conditions need to be further improved and vertical tracking data covering more subjects are to be built.

The lack of vertical tracking data has been constraints to China teaching research and the progress of evidence-based reform in education. A comprehensive and scientific vertical tracking database is essential infrastructure in further push for such reform.

Secondly, the progress of global evidence-based research should be followed, and more cutting-edge and scientific analysis technology be introduced.

With the technological and scientifically advancement, more cutting-edge technology and methodology have been applied to the educational survey and the evidence-based reform. China's evidence-based reform in education should draw more investment of energy and effort in the future, keep pace with global cutting-edge technology and localize educational innovation, in the push for intelligence-oriented development in this field.

Lastly, the follow-up reform should be reinforced, and closer combination of scientific evidence and practical work be advocated.

In the future, more flexible and innovative follow-up measures are needed to further strengthen the promotion, publicity and application of evidence and improve the effectiveness of evidence use.

Note:

1. *The project team began to develop the high order thinking disposition scale for primary and middle school students in 2016. Referring to similar studies at home and abroad, after testing trials of nearly 100,000 samples in more than 2 years, an assessment tool with high reliability and validity was obtained and applied to the provincial survey in 2018. The assessment results are good. The above figure shows the confirmatory factor assessment results. The assessment tool takes the lead in solving the technical problem of high order thinking disposition assessment in provincial survey and has high academic value and practical application value.*

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ARTICLE

Does Teacher Training Narrow the Educational Gap between Urban and Rural Students? Empirical Evidence from CEPS Baseline Data

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Abstract*. Based on the baseline data of the China Education Panel Survey, this paper explored the relationship between teacher training and academic performance in urban and rural samples respectively and the impact of teacher training on the urban-rural gap of students' academic performance. The results showed that: firstly, there was a significant urban-rural gap in academic performance, and the gap in high quantiles and language subjects were even larger. Secondly, the results of unconditional quantile regression showed that teacher training could improve the performance of urban students with different academic levels and rural students with intermediate or above academic levels, but it cannot improve the performance of rural students with lower academic levels. In addition, the overall effect of teacher training in urban areas is significantly higher than that in rural areas. Thirdly, different quantiles of Oaxaca-Blinder decomposition found that the endowment effect and the coefficient effect of teacher training were the important causes of the urban-rural performance gap, but the relative sizes of the two were different according to the different grades and different quantiles of performance distribution. Therefore, to increase the training opportunities and improve the training quality of rural teachers as well as enhance the resource conversion rate of rural students are of great practical significance for narrowing the urban-rural performance gap.*

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***Keywords**: Teacher Training, Urban-Rural Gap, Unconditional Quantile Regression, Oaxaca-Blinder Decomposition*

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Introduction

THE development of China's compulsory education has achieved remarkable results. However, the academic development of rural students still lags behind that of urban students (Zhu, Li & Song, 2017; Peng, 2014; Qi & Zheng, 2019). Access to education is dependent on the path (Chen, 2008). The gap in the compulsory education stage will cause huge differences in the enrollment rate and academic development of urban and rural students in the subsequent learning stage (Zheng, Sun & Lu, 2019; Zhang, 2019), and ultimately affect the overall level of social human capital accumulation (Wang et al., 2018). Therefore, it is crucial to reveal the reasons behind the gap in academic development of urban and rural students in the compulsory education stage. Studies have pointed out that the quality of rural teachers is much lower than that of urban teachers is the key reason for the gap between urban and rural students' academic development (Qi & Zheng, 2019; Zong et al., 2018). Therefore, the Chinese government has invested a lot of resources in extensive teacher training programs to improve the overall quality of rural teachers. So, does rural teacher training really improve the quality of rural education and thereby narrow the gap with urban education development? In this paper, based on the CEPS baseline survey data, we used unconditional quantile regression and Oaxaca-Blinder decomposition technology to explore the above problems.

Literature Review

The Relationship between Teacher Training and Student Academic Development

Studies have found that on-the-job training can help teachers improve their teaching practice (Ross & Bruce, 2007), and enhance their sense of self-efficacy (Liu, Ma & Kang, 2020), thereby improving their professional development level and students' academic performance. For example, Angrist and Lavy (2001) pointed out that in 1995 several public schools in Jerusalem received an education and training fund dedicated to improving teachers' reading, math, and English teaching skills, while teachers in other schools were not subject to this project. Based on this, they used the technique of double difference to find that teacher training could improve the mathematics and reading performance of elementary school students. In addition, the authors believed that teacher training is more cost-effective for improving student performance than adjusting class size or teaching hours. Zhou and Yang (2019) used CEPS data to find that China's rural teacher training improves students' academic performance, and the above-mentioned positive effects were more pronounced among boys and lower-grade students.

Nevertheless, some studies based on randomized controlled trials, quasi-experimental design, and training program evaluation have found that teacher training

has no significant effect on student performance. For example, Jacob and Lefgren (2004) used the breakpoint regression method for the educational reform implemented by the Chicago Public School System in 1996[1] and found that teacher training had no obvious effect on improving the mathematics and reading performance of primary school students. Moreover, this result exists steadily among students of different abilities, genders, races, and family incomes. However, the authors believed that the target group of this educational reform was schools with high levels of poverty and extremely backward student academic development, and the lack of structure and poor quality of training activities may be the reasons for the ineffectiveness of training. Zhang, Lai and Pang (2013) conducted a randomized controlled trial of training intervention for English teachers in schools for children of migrant workers in Beijing. The results showed that short-term and high-intensity on-the-job training had no significant impact on the teaching level of English teachers and the English performance of students. By evaluating the effectiveness of large-scale rural teacher training programs in China, Loyalka et al. (2019) found that teachers' knowledge and teaching habits, students' academic performance, psychological factors in specific subjects, or dropout behavior are not affected by this training project.

Furthermore, most of the existing studies reveal the relationship between teacher training and student academic development in an average sense. The key assumption is that there is no difference in the effect of teacher training for students with better and poorer grades in the class (Lounkeaw, 2013). However, students with poor grades tend to learn passively, while students with excellent grades learn more actively (Qing, 2009). Then when participating in training squeezes the time allocation of teachers in teaching, preparing lessons, and tutoring students (Zhou & Yang, 2019), the performance of students with poor grades may further decline and it is more difficult to benefit from teacher training, while students with good grades are more likely to benefit from teacher training. May be undisturbed and benefit from teacher training. Therefore, in the sense of super-average, it is still worth in-depth to reveal the relationship between teacher training and student academic development more accurately.

The Training Status of Urban and Rural Teachers

Since the 21st century, China's teacher training has made great progress (Pang et al., 2020). However, practical problems still exist in the training of rural teachers, such as lack of training funds and opportunities, formalized training process and low quality of training (Zhao & Xie, 2019).

On the one hand, a large number of rural schools are experiencing inadequate implementation of teacher training funding guarantee policies, which to a certain extent limits the training opportunities for rural teachers. For example, a number of national and regional surveys have shown that many rural schools have not fully implemented the requirement that 5% of the public funds for elementary and middle school teachers should be used for teacher training (Wu & Qin, 2020; Ministry of Education of China, 2019). On the other hand, the training activities received by rural teachers may be of poor quality, lack of appropriate training content, difficult to meet the characteristics of

rural schools, and out of touch with their professional development needs (Pang et al., 2020; Chen & Wang, 2013). Therefore, the training opportunities and quality of rural teachers may not be as good as urban teachers. If it can be proved that teacher training has a boosting effect on students' academic development, we have reason to speculate that the gap in training opportunities and training quality between urban and rural teachers may be an important reason for the gap in the academic development of Chinese urban and rural students.

Based on the above literature review, we proposed the following hypotheses to be verified:

Hypothesis 1: The academic development of rural students lags behind that of urban students significantly.

Hypothesis 2: Teacher training has a boosting effect on students' academic development, but this effect is heterogeneous among students with different academic foundations.

Hypothesis 3: The gap in teacher training between urban and rural areas is an important reason for the differences in student performance between urban and rural areas.

Research Design

Data Sources

The data comes from the China Education Panel Survey (CEPS) implemented by the China Survey and Data Center of Renmin University of China from 2013 to 2014. The CEPS was a large-scale follow-up survey project with national representativeness. Taking the two cohorts of the seventh and ninth grades as the starting point for the survey, 28 counties (districts), 112 schools, 438 classes, and 19,487 students were randomly selected across China as the survey subjects. It collected information on family and school resources, teacher training status, students' academic performance, and basic characteristics of students, families and schools, which meet our research needs. After deleting a small number of invalid samples and samples with missing values in key variables, the subsequent analysis of the student sample size is 10,628, including 5,743 urban samples and 4,885 rural samples.

Variable Selection

- ***Urban-Rural Variables***

Based on the information provided by the principal's questionnaire, we defined schools located in the central city, fringe urban areas, and urban-rural junctions of cities/counties as "urban schools", and schools located in towns and rural areas as "rural schools". In **Table 1**, there are 3,065, 2,487, 2,678, and 2,398 students in seventh grade urban students, seventh grade rural students, ninth grade urban students, and ninth grade rural students, respectively.

Table 1. Descriptive Statistics of Main Variables.

		Seventh Grade			Ninth Grade		
Dimension	**Variable Name**	**City Sample**	**Rural Sample**	**Mean Difference**	**City Sample**	**Rural Sample**	**Mean Difference**
Independent variable	Teacher training frequency	22.973	15.545	7.428***	20.501	15.844	4.658***
Dependent variable	Cognitive performance weighted language performance	45.535	35.754	9.781***	45.254	35.595	9.659***
	Cognitive performance weighted mathematics performance	39.418	31.922	7.496***	39.245	31.624	7.620***
	Cognitive performance weighted English performance	46.946	38.241	8.705***	46.644	38.617	8.027***
Student level Face variable	Student gender	0.528	0.532	0.004	0.502	0.490	0.012
	Is it an only child	0.524	0.263	0.261***	0.549	0.271	0.278***
	Have you received preschool education	0.843	0.743	0.100***	0.816	0.727	0.089***
	Cognitive performance	44.021	39.069	4.952***	45.719	37.743	7.976***
Family layer Face variable	Family financial situation-Poor	16.25%	28.31%	/	15.23%	25.38%	/
	Family financial status-Average	76.74%	67.42%	/	77.91%	70.41%	/
	Family financial status-Rich	7.00%	4.27%	/	6.86%	4.20%	/
	Maximum years of education for parents	11.563	9.689	1.874***	11.414	9.344	2.070***
School level Face variable	School Ranking-Medium and below	15.08%	29.25%	/	13.00%	28.78%	/
	School Ranking-Upper Middle	50.70%	70.75%	/	48.59%	71.22%	/
	School Ranking-Best	34.22%	0	/	38.41%	0	/
	Proportion of undergraduate teachers	0.808	0.668	0.139***	0.813	0.648	0.165***
	Proportion of teachers graduated from normal majors or colleges	0.897	0.875	0.022***	0.897	0.857	0.040***
Sample size		3,065	2,487	/	2,678	2,398	/

*Note: *p < 0.1, **p < 0.05, ***p < 0.01. Except for the variables of "family economic status" and "school ranking" which are in percentage form, other variables are in mean value form.*

- ***Student Performance***

The dependent variables were the students' Chinese, math, and English scores. In order to increase the comparability of academic performance in different schools and regions, we used the regional and school-comparable student cognitive performance data collected by the CEPS project team. First, generate the school-level average cognitive performance index, then weight the students' performance in the school, and finally obtain the variables of the three science achievements. In **Table 1**, in the sample of students in the two grades, the average scores of rural students were significantly lower than those

of urban students; in terms of subject, the gap was the largest in Chinese, followed by English, and the smallest in mathematics.

- ***Teacher Training***

The core explanatory variable was teacher training. It came from the frequency information of various teacher training conducted by schools provided by the principal questionnaire, which was a continuous variable. **Table 1** shows that the frequency of teacher training in rural areas was significantly lower than that in urban areas.

- ***Control Variable***

This study contains three groups of control variables at the student level, family level and school level. Student-level variables included gender (0 = female, 1 = male), only child (0 = no, 1 = yes), preschool education (0 = no, 1 = yes), and student cognitive test scores. Family-level variables included family economic status (1 = poverty, 2 = average, 3 = abundant) and the parent's highest level of education. School-level variables included school rankings (1 = medium and below, 2 = upper-middle, 3 = best), the proportion of teachers with a bachelor's degree, and the proportion of teachers who graduated from teachers' colleges or majors. **Table 1** shows that compared with urban students, the proportion of only-children, the proportion of preschool education and cognitive performance among rural students were significantly lower; parents' educational level was significantly lower; family economic conditions were generally worse; schools ranked lower; the proportion of teachers with a bachelor's degree and the proportion of teachers who graduated from teachers' majors or colleges were significantly lower.

Research Methodology

Unconditional Quantile Regression

To investigate the impact of teacher training on the performance of urban and rural students at different points of student performance distribution, we adopted Unconditional Quantile Regression (UQR) to conduct research. Following is an example of Chinese score. UQR mainly uses the re-centered influence function (RIF) of distribution statistics for data conversion (Firpo, Fortin & Lemieux, 2009). For the unconditional quantile (Q_τ) of the dependent variable student's Chinese score, $F_{Score}(Q_\tau)=\tau_0 f_{Score}(Q_\tau)$ is the marginal density function of the student's score distribution, and I(•) is the indicator function. Its RIF can be recorded as:

$$RIF(Score, Q_\tau) = Q_\tau + \frac{\tau - I(Score \leq Q_\tau)}{f_{Score}(Q_\tau)} \qquad (1)$$

The average value of RIF is equal to the corresponding target statistic, namely E[RIF(Score,Qτ)|X]=Qτ(Score). Then the marginal effect of UQR is expressed as:

$$UQPE(\tau) = \int \frac{\partial E(RIF(Score,Q_\tau)|X)}{\partial X} d\, F_X \qquad (2)$$

UQR can be regressed on any quantile. Due to space limitations, the follow-up analysis only presents the estimated results of the effect of teacher training on urban and rural student performance at the 30th, 50th, and 70th points of the student performance distribution.

Oaxaca-Blinder Decomposition

With the help of OB decomposition (Blinder, 1973; Oaxaca, 1973), we focused on the decomposition of the performance gap between urban and rural students in teacher training. We take the Chinese score as an example to detail the decomposition process. Δ is the urban-rural gap of students' language performance, and its OB decomposition form is as follows:

$$\Delta = E(Score|Urban) - E(Score|Rural) = (\bar{X}_u - \bar{X}_r) \cdot \hat{\beta}_r + \left(\hat{\beta}_u - \hat{\beta}_r\right) \cdot \bar{X}_u \qquad (3)$$

$\overline{X}_u$ and $\overline{X}_r$ represent the average level of teacher training frequency in the urban sample and the rural sample, respectively, $\hat{\beta}_u$ and $\hat{\beta}_r$ represent the estimated value of the coefficient when the urban sample and the rural sample are used to estimate the influence of teacher training on student performance. Therefore, the difference in the average Chinese performance of urban and rural students can be attributed to two parts: one part is due to the difference in the mean of teacher training frequency between urban and rural students, namely $(\overline{X}_u\text{-}\overline{X}_r)\bullet\hat{\beta}_r$, also known as the endowment effect; the other part The difference between the estimated coefficients derived from teacher training affecting the performance of urban and rural students, namely $(\hat{\beta}_u\text{-}\hat{\beta}_r)\bullet\,\overline{X}_u$, is also called the coefficient effect.

The endowment effect and coefficient effect of teacher training correspond to different policy improvement ideas. The significant endowment effect indicates that the urban-rural gap in teacher training opportunities is an important reason for the urban-rural gap in student performance; then follow-up policies need to increase the training opportunities for rural teachers in order to narrow the urban-rural education gap. A significant coefficient effect indicates that the urban-rural gap between teacher training quality and student resource conversion rate is an important reason for the urban-rural gap in student performance; then follow-up policies need to improve the quality of rural teacher training and the resource conversion rate of rural students to achieve educational balance.

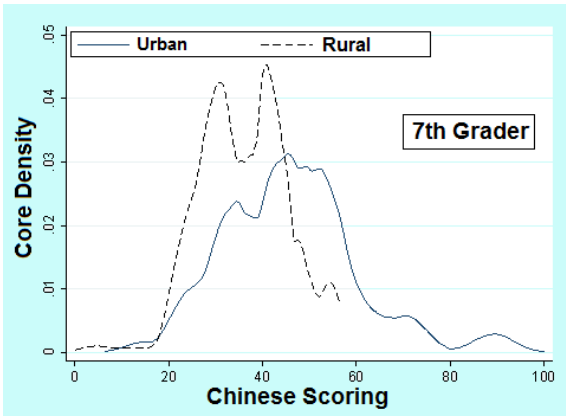

Figure 1. The Distribution of Chinese Scores of Urban and Rural Students in Seventh Graders.

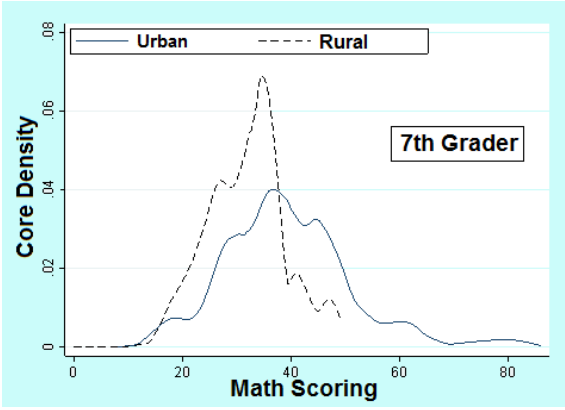

Figure 2. Distribution of Mathematics Scores of Urban and Rural Students in Seventh Graders.

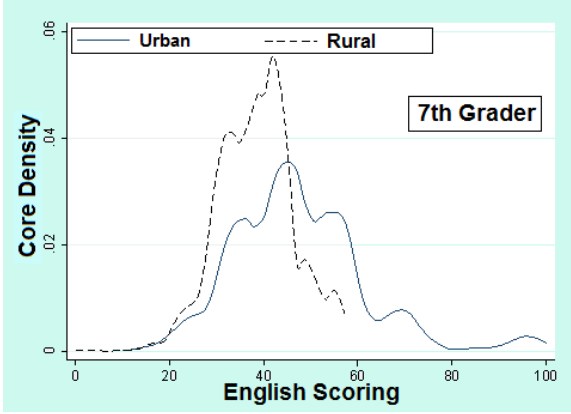

Figure 3. Distribution of English Scores of Urban and Rural Students in Seventh Graders.

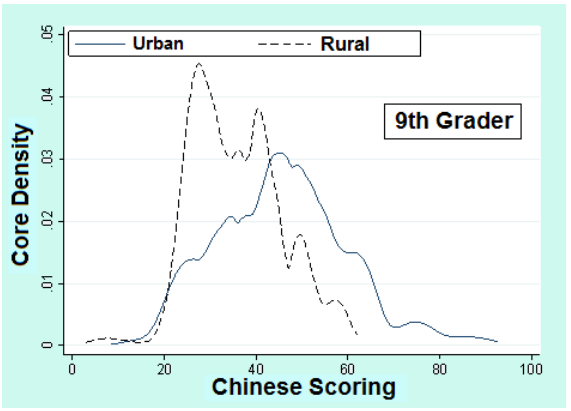

Figure 4. The Distribution of Chinese Scores of Ninth Grade Urban and Rural Students.

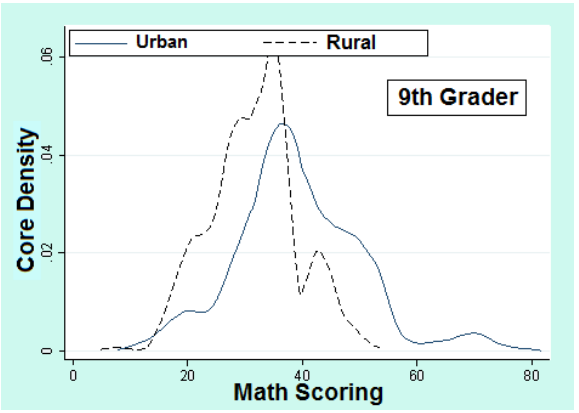

Figure 5. Distribution of Mathematics Scores of Urban and Rural Students in Ninth Graders.

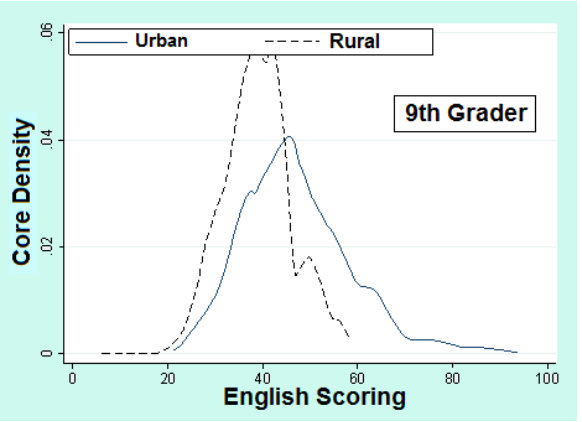

Figure 6. The Distribution of English Scores of Ninth Grade Urban and Rural Students.

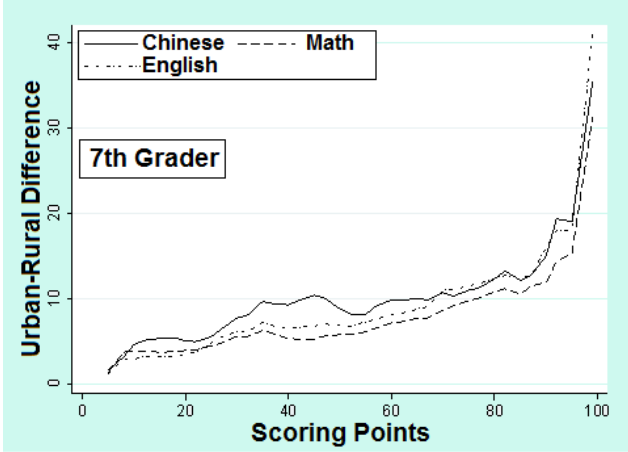

Figure 7. The Urban-Rural Gap in the Performance of Seventh Grade Students at Different Quantile.

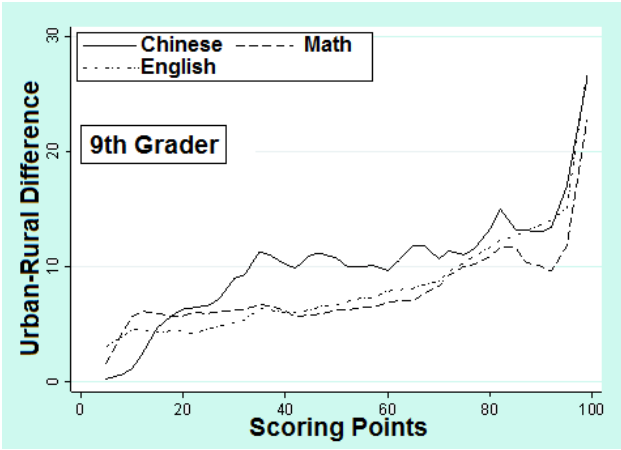

Figure 8. The Urban-Rural Gap between Grade Nine Students at Different Quantile.

Results

The Status Quo of the Gap between Urban and Rural Students' Performance

This section reveals the performance distribution of urban and rural students (**Figures 1 to 6**) and the performance gap between urban and rural students at different points of

the performance distribution (**Figures 7 and 8**). The data shows that in the two grades, compared with urban students, the distribution of the three subjects of rural students is significantly leftward, indicating those rural students' performance in Chinese, mathematics, and English lags behind that of urban students as a whole. So, the hypothesis 1 was confirmed.

At the same time, the urban-rural gap in student performance at different quantile showed similar characteristics in both grades. As follows: First, urban students at different quantile have significantly higher scores in Chinese, mathematics, and English than the corresponding rural students. Second, the performance gap between urban and rural students presents a "ceiling effect", that is, with the increase of the quintile, the urban and rural gaps in the three subject performances of students have shown a significant expansion trend. Third, there is subject heterogeneity in the degree of the urban-rural gap in student performance; the gap between urban and rural students in different quantile in language subjects (Chinese and English) is generally greater than the gap in mathematics. These findings indicated that the performance gap between urban and rural students is more mainly reflected in the student groups with good performance and language subjects. Therefore, it is extremely important to examine the differences in the impact of teacher training on urban and rural student performance in different disciplines and different points of student performance distribution.

The Influence of Teacher Training on Student Performance in Urban and Rural Areas

This section used UQR technology to estimate the effect of teacher training on students' Chinese, mathematics, and English performance at different points of the score distribution in samples of all students, urban students, and rural students. The results are shown in **Table 2**.

Based on the full sample, the following results appeared robustly in different grades and different subjects: Students with different quantile of performance distribution have improved their academic performance due to teacher training, and with the increase of quantile, the effect of teacher training on student performance continued to increase. The possible reason is that, compared with students with poor performance, those with good performance generally performed better in learning habits and abilities characterized by learning initiative, participation, and interest. Moreover, the resource conversion rate of the various element inputs they face was higher (Jiang, 2017). When being taught by teacher training at the same time, students with good performance are better able to absorb and internalize the teaching improvement obtained through training into higher academic performance, and thus get more benefits from teacher training.

Next, we subdivided the sample of urban and rural students. The results showed that among urban students, teacher training benefited all students, but the degree of benefit varied with the difference in student performance. Specifically, compared with students with lower-middle grades, students with middle and above grades have achieved a greater degree of improvement in performance due to teacher training.

Table 2. UQR Estimation Results of the Effect of Teacher Training on Student Performance.

		Full Sample			Urban Sample			Rural Sample		
		Q30	Q50	Q70	Q30	Q50	Q70	Q30	Q50	Q70
Chinese	7th Grader	0.042***	0.111***	0.159***	0.117***	0.205***	0.147***	0.012	0.168***	0.122***
		(9.23)	(25.90)	(18.48)	(16.95)	(32.01)	(13.75)	(0.80)	(9.54)	(8.58)
	9th Grader	0.022***	0.123***	0.177***	0.134***	0.203***	0.233***	-0.063***	0.119***	0.123***
		(3.76)	(22.91)	(17.96)	(13.49)	(22.64)	(19.23)	(-4.76)	(7.22)	(7.79)
Math	7th Grader	0.044***	0.075***	0.133***	0.082***	0.155***	0.137***	-0.012	0.068***	0.056***
		(11.35)	(25.99)	(18.10)	(16.85)	(28.53)	(14.32)	(-0.82)	(6.37)	(6.39)
	9th Grader	0.032***	0.068***	0.131***	0.080***	0.143***	0.192***	-0.045***	0.057***	0.056***
		(7.27)	(22.67)	(16.16)	(15.37)	(20.59)	(15.23)	(-3.41)	(5.25)	(6.43)
English	7th Grader	0.049***	0.090***	0.143***	0.094***	0.157***	0.167***	-0.046***	0.087***	0.075***
		(11.17)	(26.02)	(18.39)	(16.06)	(24.93)	(14.68)	(-3.06)	(7.36)	(6.69)
	9th Grader	0.023***	0.080***	0.145***	0.087***	0.165***	0.167***	-0.031**	0.046***	0.060***
		(5.75)	(22.72)	(18.75)	(13.90)	(23.51)	(12.58)	(-2.41)	(4.99)	(6.29)

*Note: * p < 0.1, ** p < 0.05, *** p < 0.01. The T value is in parentheses. Each coefficient in the table comes from an independent model. Due to space limitations, the estimated results of the control variables are not presented in the table.*

The above results robustly exist in different grades and different subjects, and are similar to the estimated results based on the sample of all students.

In the sample of rural students, teacher training can only benefit students with intermediate and above grades. Students with intermediate and lower grades cannot be improved by teacher training. What's more, students with poor grades in the ninth grade will have a significant decline in all three subjects due to teacher training. This is because rural students with low-to-middle grades are the worst-developed group in China's entire education system. They generally lack learning initiative, and the learning process is more dependent on the teacher's constant supervision (Qing, 2009). However, training may bring conflicts between working and teaching to teachers, reduce the time allocation for teaching and class preparation, and the attention and urge to students. In the end, the academic performance of students with low grades is difficult to benefit from teacher training. For urban students at the lower-middle level, their academic performance, learning ability and habits are generally better than those of the correspondingly ranked students in rural areas; in addition, the parents of urban students are more likely to have higher education levels and educational participation levels; and therefore, the children can be guided after class, and ultimately they have not been negatively affected by teacher training. Therefore, the negative relationship between teacher training and student performance is mainly reflected in the rural student groups with poor per-

formance. In fact, Jacob and Lefgren (2004) based on data from USA schools that are highly impoverished and whose student performance was extremely low, found that teacher training could not improve student performance, and the results would not change due to differences in students' previous academic foundation. This finding better supports the reliability of the conclusions of this study for rural student groups with poor performance.

Further, horizontally compare the urban-rural gap in the effect of teacher training on the improvement of student performance. The results found that in different grades and different disciplines, the effect of improving the performance of rural students due to teacher training was significantly smaller than that of urban students; this phenomenon steadily exists at different quantile of the distribution of student performance. There are two possible explanations for this. (i) The training opportunities and quality of rural teachers are not as good as that of urban teachers. (ii) Compared with urban students, rural students have a poorer academic foundation and ability; therefore, the resource conversion rate is lower. These all may limit the effectiveness of teacher training in rural areas.

In sum, teacher training could help improve the academic performance of urban students with different performance levels and rural students with middle and above performance levels. However, it could not bring a positive impact on rural students with lower-middle performance levels. In addition, the performance improvement effect of urban teacher training was higher than the corresponding effect of rural teachers. So far, Hypothesis 2 has been confirmed. Therefore, it can be speculated that the urban-rural gap in teacher training will cause the gap in academic performance of urban and rural students.

The Influence of Teacher Training on the Achievement Gap between Urban and Rural Students

This section used both UQR and OB decomposition techniques. Decomposes the performance gap between urban and rural students, and mainly presents the explanation strength of the urban-rural gap in teacher training. The results are shown in **Table 3**.

The decomposition results of the seventh grade showed that in different subjects and different quantile, teacher training could explain the urban-rural gap in student performance to a certain extent. As the quantile increases, the explanatory power of the endowment effect of teacher training showed a trend of first increasing and then decreasing, but the fluctuation range was relatively slow and always maintained above 10%. At the same time, the explanatory power of the coefficient effect of teacher training decreased rapidly from more than 20% of the low quantile to less than 10% of the high quantile.

Furthermore, comparing the relative importance of the two effects of teacher training at different quantile of performance distribution, it is found that: (i) For urban and rural students whose performance is below average, the performance gap could easily be explained by the coefficient effect of teacher training; (ii) For urban and rural

Table 3. Decomposition Results of Teacher Training on the Urban-Rural Gap in Student Performance.

			Seventh Grade			Ninth Grade		
			Q30	**Q50**	**Q70**	**Q30**	**Q50**	**Q70**
Chinese	Endowment effect	Estimated Value	0.935***	1.629***	1.101***	0.636***	0.958***	1.060***
		Percentage	12.05%	18.49%	10.25%	7.08%	8.91%	9.90%
	Coefficient effect	Estimated Value	1.724***	0.948***	0.380	3.098***	1.497***	1.760***
		Percentage	22.21%	10.76%	3.54%	34.48%	13.92%	16.44%
Math	Endowment effect	Estimated Value	0.641***	1.147***	1.041***	0.387***	0.647***	0.893***
		Percentage	11.42%	19.75%	12.00%	6.18%	10.35%	10.71%
	Coefficient effect	Estimated Value	1.531***	1.336***	0.877***	1.963***	1.363***	1.949***
		Percentage	27.28%	23.00%	10.11%	31.33%	21.81%	23.38%
English	Endowment effect	Estimated Value	0.742***	1.201***	1.252***	0.425***	0.758***	0.778***
		Percentage	12.02%	17.49%	11.36%	8.28%	11.30%	8.86%
	Coefficient effect	Estimated Value	2.239***	1.104***	1.014***	1.945***	1.873***	1.422***
		Percentage	36.28%	16.08%	9.20%	37.88%	27.92%	16.20%

Notes: (1) the above decomposition process also control the variables at the school level, the family level variables and school level variables, space is limited, the results are not eleven out . (2) The endowment effect percentage in the table refers to the ratio of the explanatory strength of the endowment effect of teacher training to the explanatory strength of the endowment effect of all variables included in the model, and the coefficient effect percentage refers to the explanatory strength of the coefficient effect of teacher training and the model includes The ratio of explanatory strengths of the coefficient effects of all variables.

students with intermediate and above grades, their performance gap was suitable to be explained by the endowment effect of teacher training. Similarly, the decomposition results of the ninth grade showed that both endowment and coefficient effect of teacher training in different subjects and different quantile could explain the urban-rural gap in student performance to a certain extent. But relatively, the explanatory strength of the coefficient effect always dominated at different quantile. Therefore, Hypothesis 3 is confirmed.

In addition, comparing the results of the seventh and ninth grades, we found that the greater urban-rural gap in the performance of ninth grade students was explained by the coefficient effect of teacher training, and the explanatory effect of the endowment effect of teacher training was relatively small. If the coefficient effect of teacher training was understood as the difference in the efficiency of urban and rural students' conversion of the positive effects of teacher training into their own performance improvement, it meant that the resource conversion rate of rural students was lower than that of urban students. The possible explanation is that capacity formation is cumulative. As the grade increases, the differences in the accumulation of learning foundation in the early stage are gradually showed up, and will affect the subsequent academic development.

The above results indicated that the training frequency of rural teachers was significantly lower than that of urban teachers; the efficiency of transforming rural teacher training into student performance was not as efficient as the corresponding situation in the city; these were the potential reasons why rural students' academic performance significantly lags behind urban students. In fact, the training frequency of urban teachers in grade seven (22.973 times) was significantly higher than that of rural teachers (15.545 times). The training frequency of urban teachers in grade 9 (20.501 times) was significantly higher than that of rural teachers (15.844 times). Moreover, the conversion rate of teacher training was comprehensively affected by the quality of training and the ability of students. Therefore, in order to reduce the performance gap between urban and rural students, it is necessary to increase the training opportunities for rural teachers, improve the quality of rural teacher training, and improve the early learning ability of rural students. In order to achieve a balanced development of urban and rural education and ensure the quality of teachers' inputs, the family's inputs, which are closely related to the formation of students' abilities, cannot be ignored.

Conclusion and Suggestion

Based on CEPS data, this study examined the relationship between teacher training and student performance and its impact on the urban-rural gap in student performance. We found that: First, in the entire academic performance distribution, rural students lagged behind that of urban students, and this gap was more obvious at high quantile and in language subjects. Second, teacher training helped improve the performance of students with different academic levels in cities and rural students with middle and above levels, but it could not improve the performance of rural students with middle and below levels. In addition, the overall effect of teacher training on urban students was significantly higher than that of rural students. Third, the urban-rural gap in teacher training explained the urban-rural gap in student performance distribution to a certain extent. The endowment effect and coefficient effect of teacher training were both important reasons for the urban-rural gap in student performance, but the relative size of the two varied with grades and academic performance. Therefore, the findings of this study have enlightenment to formulate education policies that narrow the development gap between urban and rural students.

First, innovate and improve rural teacher training policies and systems, and provide rural teachers with more high-quality training activities. This study found that only when rural teachers obtain the "dual guarantee" of training opportunities and quality, can they contribute to the balanced development of urban and rural education. However, in reality, many rural schools had not fully implemented the teacher training funding guarantee policy, which limited the frequency of rural teacher training (Chen & Wang, 2013). Some rural teachers reported that the training content was too theoretical, the teaching format was superficial, and the guiding role was very limited (Pang, et al., 2020). Therefore, it is necessary to fully implement the provisions on the proportion of rural school teacher training funds to public funds; increase financial support for rural teacher training projects; and provide rural teachers with more training opportunities.

Meanwhile, training activities should effectively address the characteristics of rural schools and teachers, and increase the training of local knowledge and the psychological problems of rural left-behind children and their ability to improve the applicability of training.

Second, effectively strengthen parental participation and popularize rural preschool education to help rural students lay a solid academic foundation and increase their resource conversion rate. We found that the coefficient effect of teacher training could significantly explain the performance gap between urban and rural students at different quantile of the distribution of student performance in different grades. To a certain extent, it reflected that the resource conversion rate of rural students was significantly behind that of urban students, which was an essential reason why they have been behind urban students for a long time. The disadvantage of rural students in the resource conversion rate is caused by the students' poor academic foundation, lack of family resources and low level of parental participation. Therefore, in the short term, school administrators should encourage "family and pre-school education together", especially emphasizing, accepting and guiding the participation of parents of students with poor academic performance. In the long run, education reform needs to pay attention to the importance of early education for rural students. Popularize rural preschool education, extend the period of rural preschool education, improve the quality of care and education, and ensure that rural students have a solid knowledge reserve to improve the efficiency of their resource input conversion.

Finally, for student groups with different characteristics, differentiated teacher training intervention programs need to be adopted to more effectively narrow the urban-rural education gap. This study found that for students with middle and above levels in the lower grades, the part of the performance gap explained by the teacher training endowment effect was greater than the explanatory power of the coefficient effect. The opposite was true for senior students and students whose grades are below average. Therefore, for the former type of rural students, teachers can directly provide more high-quality training opportunities, and at the same time, gradually increase the student's resource conversion rate. For the latter type of rural students, before increasing the frequency of high-quality teacher training, it is more necessary to focus on improving the student's resource conversion rate. The above-mentioned differentiated teacher training intervention programs can bring more obvious effects to improving the education gap between urban and rural areas. In addition, senior rural students with poor performance may be negatively affected by teacher training, which reduces teaching time or loses teacher supervision. And they are at the critical stage of the entrance examination, so they can make full use of the network platform and innovate training models under the current background of "Internet + education" to improve the time efficiency of these teachers' participation in training.

Note:

1. *In 1996, according to the standard that the proportion of students meeting the national reading standard in schools was less than 15%, CPS selected 71 elementary schools out of 489 elementary schools for intervention. Its main purpose is to provide these schools with professional funds*

for teacher training and enhancement of teacher professional development.

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ARTICLE

The Influence of School Loose-Tight Culture on Bullying of Middle School Students: The Mediating Role of Collective Moral Disengagement and Collective Efficacy

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Abstract*. To explore the relationship and mechanism of school loose-tight culture to middle school bullying, a total of 808 students were selected from three middle schools in Dehong Prefecture, Yunnan Province of China, to conduct a questionnaire survey. The study used the school loose-tight culture scale, the collective moral disengagement scale, the collective efficacy scale, and the bullying scale for middle school students. The results showed that (i) school loose-tight culture significantly predicted the occurrence of school bullying; (ii) school loose-tight culture was significantly negatively correlated with collective moral disengagement and school bullying but positively correlated with collective efficacy. Further, collective moral disengagement was significantly positively correlated with school bullying, but collective efficacy was significantly negatively correlated with school bullying; (iii) school loose-tight culture inhibited school bullying through the dual mediating effects of collective moral disengagement and collective efficacy at the same time.*

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Question

SCHOOL bullying is considered a widespread form of school violence, which has a long-term negative impact on young people's healthy personalities and development (Hu, 2017). Studies have shown that students with externalized behavior problems react negatively to the external environment (Cai, 2006). First, according to the ternary interaction theory, an individual's behavior is strongly governed by motivation and beliefs and adversely affects the subject's thinking and emotions. Secondly, behavior is not only governed by individual needs but also restricted by the environment. Schools and classes are the environments that middle school students are exposed to most frequently, directly impacting their behavior. Studies have shown that bullying behaviors of middle school students are related to factors such as moral disengagement, self-efficacy, and class environment (Wang et al., 2018). Still, there is no research on the influencing factors of campus bullying from the collective level. According to the ecological system theory, the development of middle school students is in a complex environmental system, and each layer of the system interacts with other systems and individuals, which affects the development of students. School culture is the core force that promotes the development of the school and the internal mechanism that affects students' behavior. Therefore, it is feasible and significant to discuss the impact of school culture on campus bullying from the collective level.

Tight-loose culture is a new dimension of cross-cultural psychology research, which refers to the social norm culture of punishment and intensity of deviant behaviors (Lu et al., 2017). The "loose" in tight-loose culture refers to weak norms and a high tolerance for deviant behaviors (inadequate punishment), and "tight" refers to solid norms and a low tolerance for deviant behaviors (intense punishment) (Gelfand, Li & Gordon, 2017). Social norms under different cultural backgrounds reflect the difference between looseness and tightness, which helps to enhance our understanding and prediction of differences in human psychology and behavior. Under different school cultural backgrounds, students perceive different school loose-tight cultures, and their self-control, self-regulation, and self-monitoring abilities for bullying behavior are also quite different. Studies have shown that students are prone to frequent skipping classes in schools with relatively loose rules and regulations. Students cannot be better integrated into the class environment, leading to increased bullying behavior (Zeng et al., 2019). As a result, school loose-tight culture directly impacts campus bullying, and this impact will play a role indirectly through the class atmosphere.

Studies have shown that moral disengagement has a significant positive predictive effect on adolescent verbal bullying, relationship bullying, and physical bullying (Yang & Wang, 2012). Bandura (2002) put forward the concept of collective moral disengagement, which refers to the common belief of the group that defends negative behaviors morally, and it reflects the degree of recognition or opposition of the class to certain irregular behaviors. As a collective consensus, collective moral disengagement is more likely to transfer responsibility, which in turn increases the possibility of campus bullying. The lower the middle school students' perception of the school atmos-

phere, the higher their level of moral disengagement. Collective efficacy is proposed by Bandura based on self-efficacy and defines it as to whether people feel that they can solve problems through joint efforts in a group, organization, or country, and increase the strength of belief in life. Studies have shown a negative correlation between individual self-efficacy and bullying behavior, and individuals with low self-efficacy are more likely to have bullying behavior (Valois et al., 2017). Studies have pointed out that student problem behaviors are significantly related to class collective efficacy, and students with lower collective efficacy levels are bullied more frequently (Sapouna, 2010). Social norms run through the entire human culture and are a collective consensus of human beings on acceptable behavior. Collective moral disengagement and collective efficacy, as a collective consensus of class environment and school belonging, may affect students' bullying behavior.

School culture has a particular influence on campus bullying. In addition, collective moral disengagement and collective efficacy, as an individual's perception of class atmosphere, also impact campus bullying behavior. According to ecosystem theory, school loose-tight culture will affect the class atmosphere, and the class atmosphere will further affect campus bullying. Therefore, the relationship between school loose-tight culture, collective moral disengagement, collective efficacy, and the occurrence of campus bullying is worthy of attention. This study aims to test the relationship between these variables to provide a reference for the prevention and intervention of school bullying.

Methodology

Survey Object

Using the convenient sampling method, a total of 850 middle school students were selected from three middle schools in Dehong Prefecture, Yunnan Province of China. After excluding 42 invalid data, 808 valid data were finally obtained, with an effective rate of 95.1%. Among them, there are 353 boys (43.7%) and 455 girls (56.3%); there are 276 (34.2%) students in the 7th grade, 238 (29.5%) in the 8th grade, and 294 (36.3%) in the 9th grade.

Research Tools

- **School Loose-Tight Culture Scale**

This study used the school loose-tight culture scale compiled by Gelfand et al. (2011), with a total of 6 items. A Likert 6-point scoring is used, from 1 for "completely disagree" to 6 for "completely agree. The higher the score, the "tighter" the school loose-tight culture perceived by the students. The Cronbach's α coefficient of the scale in this study was 0.86.

- **School Bullying Moral Disengagement Scale**

This study used the Moral Disengagement Scale of Campus Bullying compiled by Thornberg et al. The Chinese version was revised by Wang, Yan & Qiu (2019). There are 30 items in the scale divided into eight dimensions: moral defense, distorted results, dehumanization, responsibility transfer, scattered responsibility, euphemistic labeling, favorable comparison, and blame attribution. Use a 5-point scale of 1-5. The higher is the score, and the higher is the level of campus bullying moral disengagement. The Cronbach's α coefficient of the scale in this study was 0.91.

- **Collective Efficacy Scale**

This study used the collective efficacy scale compiled by Goddard (2002), with 12 tems in total. It is divided into two factors: task analysis and group structure. Using a 5-point scale of 1-5, and the higher is the score; the higher is the students' collective efficacy. The Cronbach's α coefficient of the scale in this study was 0.87.

- **Bullying Scale for Middle School Students**

Using Yang's (2014) bullying scale for middle school students, there are 14 items in total, divided into two subscales: bullying and being bullied. The scale uses a 5-point scale of 1-5. The Bullying Scale has seven items, and the higher the score, the higher the frequency of bullying; the Bullied Scale has seven items and the higher the score, the higher the degree of being bullied. The Cronbach's α coefficient of the bullying subscale and the being bullied subscale in this study were 0.89 and 0.85, respectively.

Data Processing and Collection

Use SPSS25.0 for reliability test, single factor common method deviation test, descriptive statistics, and correlation analysis. In addition, Mplus7.4 established the structural equation model, and the mediation effect test of the percentile Bootstrap method with deviation correction was carried out.

Results and Analysis

Common Method Deviation Test

Harman's single factor test method was used to perform unrotated EFA on all the original items of the main variables in this study. The test results found that the explanatory rate of the first common factor was 14.28%, which did not exceed the critical value of 40%. Therefore, this result indicated that no serious common method deviation existed in this study.

Descriptive Statistics

Descriptive statistics and Pearson correlation analysis were performed on school loose-tight culture, collective moral disengagement, collective efficacy, and school bullying (**Table 1**). The results showed that school bullying was significantly negatively corre-

Table 1. Correlation Analysis of School Bullying and School Loose-Tight Culture, Collective Moral Disengagement, and Collective Efficacy.

Variable	*M±SD*	School Loose-Tight Culture	Collective Moral Disengagement	Collective Efficacy	Bullying
School Loose-Tight Culture	4.52±0.93	1			
Collective Moral Disengagement	2.09±0.65	-0.17**	1		
Collective Efficacy	3.58±0.58	0.31**	-0.28**	1	
Bullying	1.71±0.81	-0.21**	0.28**	-0.33**	1
Being Bullied	1.34±0.65	-0.15**	0.31**	-0.28**	0.53**

*Note: **p<0.01, ***p<0.001.*

Table 2. Analysis of the mediating effect of collective moral disengagement and collective efficacy.

	Effect Size	Boot SE	Z	p	95% CI	
					Upper Limit	Lower Limit
Overall Effect	-0.25	0.04	-5.53	< 0.001	-0.34	-0.16
Indirect Effect	-0.22	0.03	-5.90	< 0.001	-0.30	-0.16
School Loose-Tight Culture → Collective Moral Disengagement → School Bullying	-0.07	0.02	-3.55	< 0.001	-0.11	-0.03
School Loose-Tight Culture → Collective Efficacy → School Bullying	-0.15	0.03	-4.84	< 0.001	-0.23	-0.10
Direct Effect	-0.03	0.02	-0.52	0.61	-0.13	0.08

lated with school loose-tight culture, significantly positively correlated with collective moral disengagement, and significantly negatively correlated with collective efficacy. School loose-tight culture has a significant negative correlation with collective moral disengagement and a significant positive correlation with collective efficacy. Furthermore, bullying is positively associated with being bullied. This showed that school bullying is obviously affected by school loose-tight culture perception, collective moral disengagement, and collective efficacy.

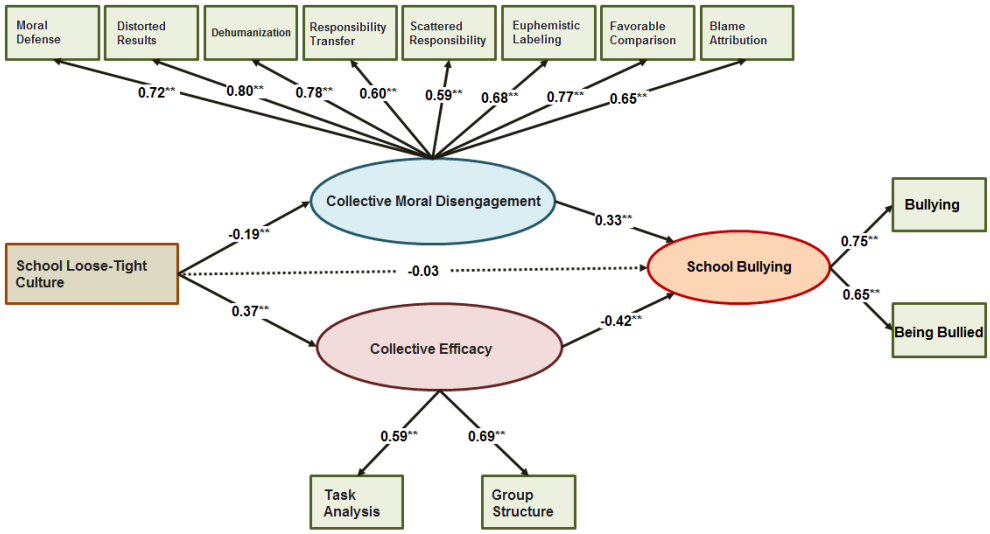

Figure 1. The Mediation Model of School Loose-Tight Culture Affecting School Bullying.

The Mediating Role of Collective Moral Disengagement and Collective Efficacy in the Relationship between School Loose-Tight Culture and School Bullying

Structural equation modeling was used to analyze the multiple mediating effects of collective moral disengagement and collective efficacy between school loose-tight culture and campus bullying (**Figure 1**). Each fitting index of the model reached a critical value (χ^2/df = 3.64, CFI = 0.95, TLI = 0.94, RMSEA = 0.06). According to the Bootstrap method recommended by Wen and Ye (2014) to further test the significance of the mediation effect. The results show that the mediating effects of collective moral disengagement and collective efficacy are both significant, and the parallel mediating effects of collective moral disengagement and collective efficacy in school loosening culture and campus bullying are significant.

The total effect of school loose-tight culture on school bullying was -0.25. After the model introduces collective moral disengagement and collective efficacy, the direct effect changed to -0.03; the indirect effect of collective moral disengagement and collective efficacy in the impact of school bullying on school loose-tight culture was -0.22, and the effect amount (that is, the mediation effect accounts for the total effect percentage) was 88%. School loose-tight culture had an indirect effect on campus bullying through collective moral disengagement, with a size of -0.07, accounting for 28% of the total effect. School loose-tight culture could also indirectly affect bullying behavior

through collective efficacy, with a size of -0.15, accounting for 60% of the overall effect (**Table 2**).

Discussion

This study aimed to explore the impact of school loose-tight culture on campus bullying, and the mediating mechanism of collective moral disengagement and collective efficacy. Correlation analysis showed that school loose-tight culture is significantly negatively correlated with school bullying; further structural equations showed that school loose-tight culture negatively predicts school bullying. The finding is consistent with previous research results (Wang et al., 2017) and further proved the negative predictive effect of school loose-tight culture on campus bullying. Collective moral disengagement is significantly positively correlated with campus bullying; collective efficacy is significantly negatively correlated with campus bullying. This result validates our hypothesis and is also in line with the moral disengagement theory. When individuals have externalized behavior problems, they will first reduce psychological guilt and self-blame through the mechanism of moral disengagement (Gutzwiller-Helfenfinger, 2015). According to social cognition theory, when individuals pursue goals, self-efficacy affects behavior changes through physical arousal and is cultivated by individuals in the social environment. In the same way, collective efficacy is a way of cognition cultivated by individuals in a group environment and affects their bullying behavior.

Our results showed that collective moral disengagement plays a completely mediating role between school loose-tight culture and campus bullying. On the one hand, moral disengagement is a crucial internal mechanism for psychological abuse and neglect to affect adolescent bullying behavior. On the other hand, school culture is the norms, rules, atmosphere, and way of thinking jointly created by teachers, students, and school administrators in the long-term educational and teaching activities through the interaction between the school members. School culture provides students with ethical requirements, lists clear rules and regulations, and determines what behaviors students can do and what is out of school management treaties. These can effectively reduce the occurrence of collective moral disengagement. On the other hand, when the level of moral disengagement is higher, the collective will transfer more responsibility, thereby perceiving less attribution of blame and lowering the victim's painful perception, which ultimately leads to campus bullying, consistent with previous studies (Sun et al., 2017). Therefore, we must not only pay attention to the cultivation of the school cultural environment, but also prevent the negative effect of collective moral disengagement in the class environment.

Collective efficacy plays a completely intermediary role between school loose-tight culture and campus bullying. In collective cognition development, group identity, collective efficacy, and group emotions will change with social situations and group conditions. When students perceive the "tight" school culture atmosphere, the level of collective efficacy will increase, and group members are more willing to participate in joint actions. Students have improved their interpersonal relationships through cooperation and communication, and the intervention on campus bullying will also increase,

which has a certain inhibitory effect on bullying. Therefore, improving the level of collective effectiveness can effectively reduce the probability of school bullying incidents.

The research results showed that there is a significant negative correlation between collective moral disengagement and collective efficacy. Collective moral disengagement and collective efficacy, as a collective consciousness, as the class environment and atmosphere, are closely linked to the school culture, forming an ecological environment system that connects the school and the class and profoundly impacts the bullying behavior of students.

The study results confirmed that the school loose-tight culture reduces school bullying by reducing collective moral disengagement and enhancing collective efficacy. Thus, introducing the loose-tight cultural dimension in cross-cultural psychology has practical significance for advancing the localization of campus bullying. Therefore, in the future, we can pay attention to campus bullying and the level of students' mental health from the overall ecosystem level of individual-collective, home-school connection, and so on.

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NEWSLETTER

Can Programming Really Promote Individual Development of Children? A Meta-analysis on 28 Experimental and Quasi-experimental Studies

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AS a basic skill of children facing the future, adapting to the future, and transforming the future, programming has continuously received attention from all walks of life. Scholars have carried out a great deal of experimental and quasi-experimental research, but the results of the research differ. To respond to the topic "whether children's programming promotes children's individual development", a study from *Journal of East China Normal University (Education Science Edition)* adopted a meta-analysis method to conduct empirical research on the influence of programming on individual development by reviewing 28 independent studies and 74 effect sizes that can be used for analysis. The research results were evaluated to summarize the degree of influence of programming on the individual development of children. In addition, the study further analyzed the differences in the influence of programming on the individual development of children by different stages, programming styles, sample sizes, and experimental cycles, to obtain scientific and reasonable conclusions and provide a feasible reference for the subsequent progress in children's programming education research and practice.

The important findings of the study are as follows:

- In this study, the combined effect size of the overall impact of programming on children's individual development is SMD = 0.61 > 0.5, which shows that programming has a positive effect on children's individual development.
- This study further measured the specific effects of programming on children's individual development from three dimensions: cognition, behavior and emotion.

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First, at the cognitive level, the combined effect size of programming on individual children is (SMD = 0.86, $p < 0.001$), reaching a statistically significant level, indicating that programming can significantly and actively promote the cognitive development of students. Specifically, programming influences mathematical thinking (SMD = 2.68, $p < 0.001$), academic achievement (SMD = 0.61, $p < 0.001$), knowledge transfer (SMD = 0.82, $p < 0.001$) and computational thinking (SMD = 0.50, $p < 0.001$). The impacts reach a significant level.

Second, at the behavioral level, the combined effect size of programming on children's individual development is (SMD = 0.34, $p < 0.001$), indicating that programming has a significant intermediate effect on children's behavior development, specifically, in pair ranking ability (SMD = 0.65, $p < 0.001$), classification planning (SMD = 0.31, $p < 0.05$), problem solving (SMD = 0.25, $p < 0.05$) and collaborative innovation (SMD = 0.40, $p < 0.01$) The impacts are of significant levels.

Finally, at the emotional level, the combined effect size of programming on children's individual development is (SMD = 0.31, $p < 0.001$), indicating that programming has a significant intermediate effect on children's emotional development. Specifically, programming has significant impacts on learning interest (SMD = 0.51, $p < 0.01$) and children's self-efficacy (SMD = 0.22, $p < 0.05$), and the impacts on children's learning motivation (SMD = 0.19, $p > 0.05$) and learning participation (SMD = 0.20, $p > 0.05$) are not significant.

Overall, programming has significant positive effects on children's cognitive, behavioral, and emotional development, and it has the most prominent effect on cognitive development.

- From the perspective of different learning stages, there is no significant difference between the group effects ($Chi^2 = 2.67$, $p > 0.05$) of children's programming in preschools, elementary schools and middle schools. The effects of programming on the individual development of students at different school stages are ranked in order of the combined effect size: middle school (SMD = 0.77, $p < 0.001$), preschool (SMD = 0.56, $p < 0.001$) and elementary school (SMD = 0.52, $p < 0.001$)).
- From the perspective of different experimental cycles, there are significant differences in the impact of programming experiment cycles of different lengths ($Chi^2 = 24.68$, $p < 0.001$) on the individual development of children. Specifically, the short-term experiment had the highest combined effect size (SMD = 0.43, $p < 0.001$), followed by the long-term experiment (SMD = 0.26, $p < 0.001$), and the mid-term experiment had the lowest combined effect size (SMD = 0.24, $p < 0.001$).
- From the perspective of different sample sizes, the intergroup effect size shows $Chi^2 = 23.53$, $p < 0.001$, reaching a significant level, indicating that there are significant differences in the influence of programming on the individual development of large, medium, and

small-scale of student sample. Specifically, the small-scale combined effect size (SMD = 0.41, $p < 0.001$) is higher than that of the medium-scale (SMD = 0.37, $p < 0.001$) and higher than the large-scale combined effect size (SMD = 0.17, $p < 0.001$). This shows that small-scale programming activities have a more significant impact on children's individual development than medium-scale and large-scale programming activities. Moreover, there is a negative correlation between the sample size and the effect. As the sample size increases, the effect gradually decreases. This finding can provide a reference for the design and development of subsequent programming activities.

- From the perspective of different programming forms, the intergroup effect size shows $Chi^2 = 32.72$, $p < 0.001$, reaching a significant level, indicating that there are significant differences in the role of different programming forms in promoting the individual development of children. Specifically, unplugged programming has the highest combined effect size (SMD = 1.47, $p < 0.001$), followed by LOGO programming (SMD = 0.78, $p < 0.05$), other programming forms (SMD = 0.41, $p < 0.001$), and Scratch (SMD = 0.23, $p < 0.001$) with the lowest combined effect size, which indicates that unplugged programming is significantly better than other programming forms in promoting the individual development of children. However, there is a possibility that this is caused by the differences among users in different groups.

In summary, the analysis results affirm the importance of programming to children's growth and its positive role in promoting individual development. However, research results also shows that programming education will present different effects when facing different learners and learning situations. Therefore, programming teaching practice should not be carried out blindly. Instead, it should be designed and planned scientifically and reasonably according to the different elements of the teaching system.

Source: Journal of East China Normal University, Educational Sciences, 2021; 39(11):45-58.

NEWSLETTER

Does Being Left Behind Estrange the Peer Relationship? An Empirical Analysis Based on CEPS

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PEER relationships can not only reflect the intimacy and harmony in children's interaction with others, but also represent an important aspect of children's socialization and a key indicator of social adaptation. The absence of family education from parents may lead to deviations in the behavior of left-behind children, making them more likely to be rejected by their peers in the process of socialization. This paper uses the data of 2013-2014 baseline survey, China Education Panel Survey (CEPS) and adopts the propensity score matching method (PSM) to explore whether staying behind will affect children's peer interactions? Is there a causal relationship, and to what extent? Is there heterogeneity among different groups?

This study defines the peer relationship as a dependent variable, staying behind as an independent variable, and staying behind as the state with one or both parents leaving home for employment, and other control variables including age, gender, and grade are used.

First, using the least squares method, with peer relationship as the dependent variable and staying behind as the core independent variable for regression, the results show that staying behind experience has a negative impact on the construction of students' peer relationships.

Then, using staying behind as the dependent variable and the selected covariate as the independent variable, the Logit model is established. The regression results show that male students whose ethnicity is Han, being only child and in seventh grade, and with fathers of low level of education are more likely to be left behind. The results of the probability model of propensity score show that there is a non-negligible heterogeneity between the left-

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behind and the non-left-behind. In order to ensure the accuracy of the result of propensity matching scores, this study carried out a balance test, and the matching effect and estimation results were good, and at the same time, the common support hypothesis was satisfied.

After that, by matching the samples according to different left-behind status, different grades, different genders, and whether they are boarding students, this paper studied the heterogeneity of the impact of staying behind on the peer relationship of students. It is concluded that the negative impact of staying behind on the peer relationship of students is more prominent among those seventh grade non-boarding boy students (the younger ones in the sample) with fathers leaving home.

Finally, based on the use of the PSM method, the propensity score is incorporated as a new variable into the regression model, to establish a regression model that effectively controls the sample selection bias. According to the results of Sharpley value decomposition, staying behind can contribute 3.75% to the explainable variation of peer relationships, that is, left-behind students are in a "relatively disadvantaged position" in terms of peer relationship construction.

Based on above findings, this research puts forward several suggestions:

- Strengthen psychological guidance for the key development stages of the socialization of left-behind children, because schools and teachers play a guiding role in the construction of student peer relationships.
- Emphasize parents' family education responsibilities to left-behind children, and guide migrant worker parents to pay attention to the mental health, peer communication and social communication of left-behind children.
- Further reform the urban and rural household registration system, solve the problem of schooling for children living with migrant parents, turn population mobility from "individual mobility" to "family mobility", and change the state of "parent-child separation".

Source: Education and Economy, 2021;(04):48-55+80.

NEWSLETTER

Evaluation of the Effectiveness of the "Application-assessment" Admission Method in Doctoral Student Enrollment

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A STUDY published in *Degrees and Postgraduate Education* took doctoral students from a university in double-first-class construction as an analysis sample. Firstly, the Logit regression analysis method was used to investigate the differences between doctoral students admitted through "application-assessment" method and those through none "application-assessment" methods. Secondly, Tobit regression and propensity value matching methods are used to compare the difference in scientific research output between doctoral students admitted through the "application-assessment" method and those admitted through other methods. In addition, this study also analyzed the disciplinary differences in scientific research output between the two categories of doctoral students. In this study, doctoral students admitted through "application-assessment" method are set as the treatment group, and those enrolled under the MD-PhD program, through general examinations and through exemption of examination are combined to form the control group. In terms of scientific research output, considering the influence of disciplines and the level of paper publication, the scientific output is weighted according to the existing research, and the grade is averaged according to the actual situation of investigation. Other variables are divided into three dimensions: individual characteristics, college background and training process. Individual characteristics include gender and academic aspirations; college background refers to the type of college at undergraduate and postgraduate stages; the training process variables involve tutors, scientific research training, and academic level. In the Logit regression analysis, this study uses individual characteristics and academic background as covariates.

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The results of the study are as follows:

- The logit regression analysis results show that, when other variables controlled, compared with those enrolled under the MD-PhD program, through general examinations and through exemption of examination, the doctoral students admitted in "application-assessment" method have higher academic aspirations, though less advantaged in college background.
- Tobit's full-sample regression analysis results show that, under the premise of controlling other variables, compared with doctoral students admitted through other methods, doctoral students admitted through the "application-assessment" method have higher scientific research output during their PhD.
- The results of sub-sample regression analysis show that in science and engineering, the scientific research output of doctoral students admitted through the "application-assessment" method is significantly higher than that of doctoral students admitted through other methods; in the humanities and social sciences, the scientific research output of doctoral students admitted through the "application-assessment" method is higher than that of doctoral students admitted by other enrollment methods, but it is not significant at the 5% level.
- The analysis results of the control variables show that academic aspirations and relevant scientific research experience (hosting projects, participating in international conferences) can increase the scientific research output of doctoral students, but factors such as gender, whether the tutor is a returnee, whether there is an associate tutor, and college background have no significant impact on the research output of doctoral students.
- The results of the robustness test of the propensity value matching method are consistent with the results of the Tobit regression analysis, and both show that the "application-assessment" method has a positive talent selection effect, and this positive selection effect has certain disciplinary heterogeneity.

Based on the research results, the following two points are concluded: First, the doctoral students admitted through the "application-assessment" method are not advantaged in college background, but they have higher academic aspirations. Second, the research output of doctoral students admitted through the "application-assessment" method is higher them that of doctoral students admitted through non "application-assessment" methods. during the PhD period.

In view of this, the research suggests: First, colleges and universities should continue to promote the reform of the doctoral student enrollment system, further improve the "application-assessment" method, weaken the concern about the applicant's college background, and make the "application-assessment" method more scientific and efficient. The "application-assessment" method should be improved to facilitate the fair selection of

doctoral students with high comprehensive ability and research potential. Second, colleges and universities should pay attention to the differences in disciplines when selecting doctoral students through the "application-assessment" method. While intensifying the reform and development of the "application-assessment" method in science and engineering disciplines, diversified enrollment paths should be explored in the selection of doctoral candidates in humanities and social sciences. Third, this study has the following shortcomings: (i) It did not analyze the specific differences between doctoral candidates admitted through the "application-assessment" method and those enrolled under the MD-PhD program, through general examinations and through exemption of examination. (ii) The survey samples of this study come from universities in "double first-class" construction, and whether the research results can be extended to other types of universities remains to be further tested.

Source: Degree and Graduate Education, 2021; 2021(9):49-55.

NEWSLETTER

The Determinants and Impacts of Private Tutoring in and out of School in Hong Kong

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A STUDY published in the *Education & Economy* uses the datasets of PISA 2015 of Hong Kong as an analysis sample. This study attempts to identify the factors that explain the demand for on-campus and off-campus private tutoring by using two-level Bernoulli Model, and to analyze the effect of private tutoring by using Hierarchical Linear Model (HLM) and Propensity Score Matching (PSM), hoping to provide some references to the implementation of "After School Service" program in Mainland China. The results are as follows:

- After School Program in Hong Kong intended to serve poor students are mainly for poor performance students instead of poor students. According to the two-level Bernoulli Model, students with poor academic performance are more likely to attend After School Program. At the same time, combined with the results of HLM model, under the condition of controlling family ESCS background, family ESCS has no significant impact on students' scores in science, mathematics and reading. Therefore, schools provide After School Program based on students' academic performance rather than family conditions, which deviate from the original intention of serving poor families and turns into, serve poor performance students.
- The effect of on-campus and off-campus private tutoring t on students' academic performance differs in different subjects. According to the results of PSM, on-campus tutoring has a significantly negative effect on students' achievement in Science, Math, and Reading. Off-campus tutoring has a negative impact on students' Math achievement, but has no impact on reading and science achievement.

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- The After School tutoring provided by different teachers has different effects on students' academic performance. Combined with the results of HLM model, on campus tutoring are mainly provided by students' regular teachers or teachers working for a business or organization specialized in extracurricular instruction. And no matter who provide the tutoring, on-campus tutoring would damage students' achievements. Off-campus tutoring provided by regular teachers in school has significantly negative impacts on students' math and reading achievements.

The upgrading and adjustment of After School Program in Mainland China cannot do without the guidance of theory, while the After School Service study in Hong Kong provides positive and beneficial experience for it. Based on the research findings, the author pointed out that the implementation of "After School Service" program in Mainland China should pay more attention to the choice of students, selection of tutors and service methods. Specifically, After School Service should follow the selection criteria for the poor students or students with learning difficulties, allowing students to choose freely whether to participate; meanwhile, the contents, forms and methods of academic After School Service should be standardized. In addition, the After School Service mode of "school-auxiliary assistance" from schools and professional tutoring institutions should be appropriately adopted to provide services for students in Mainland China.

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