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EDITORIAL

In Memory of Professor Robert E. Slavin

Alan C. K. Cheung

ROBERT E. SLAVIN, a world-recognized education researcher, passed away on April 24, 2021. The unfortunate death of Professor Slavin was a great loss for the global educational research, especially for our journal.

Holding positions as a research scientist, the first-ever Distinguished Professor at the Johns Hopkins School of Education, and director of the Johns Hopkins Center for Research, and Reform in Education, Dr. Slavin sought to translate the science of learning into effective teaching practices (Myers, 2021). Professor Slavin was among the earliest researchers working on cooperative learning, an approach through which small teams of students with different academic abilities work together (Roberts, 2021). These are now used throughout the world

As the preeminent researcher in the field of education, he always concentrated on the up-to-date education issues, devoting himself to the journey of promoting better education to the students in need. "What most studies show is that mixed-ability grouping doesn't hurt high-achieving students and in fact helps those of lower achievement levels," Dr. Slavin told *The New York Times* in 1990 (Smothers, 1990).

Professor Slavin was the chief expert of the School of Education at Johns Hopkins University. He led the College of Education and achieved first place in the National Education College Rankings (2014-2016). Professor Slavin was the top-ten influential scholar in the field of education research in the United States. He has published more than 300 articles and two dozen books, exploring topics including classroom organization, school desegregation, cooperative learning, and evidence-based reform, and has made outstanding contributions to educational research and public service (Smith, 2021).

Professor Slavin is perhaps the world's most effective advocate for using evidence as a basis for educational policy and practice. He has published dozens of reviews of research on effective practices in elementary and sec-

ondary reading, writing, mathematics, science, and early childhood education (see www.bestevidence.org), and has written widely on methodology for research review. To make evidence on educational effectiveness available to all, he founded two free websites for educators and researchers, the Best Evidence Encyclopedia (www.evidenceforessa.org) (mostly for researchers) and Evidence for ESSA (www.evidenceforessa.org) (mostly for educators). He also wrote weekly blogs on evidence-based reform in education, and distributed a bi-weekly online summary of recent research and policy developments, i.e., *Best Evidence in Brief (BEiB)*.

Meanwhile, Professor Slavin also contributed to the establishment of the corresponding platform supported by the Institute for Effective Education (IEE) at the University of York in the U.K. (http://www.beib.org.uk/), and the Centre for University & School Partnership at the Chinese University of Hong Kong in China (https://cuspbeb.com/). During his visit to China in 2018, he signed cooperation with the School of Education of Nanjing Normal University to establish the simplified Chinese version of the education evidence-based research "Best Evidence in Brief" and served as the director of the editorial board (http://www.cnbeb.org.cn:81/en/). In the form of a "newsletter", it has built a bridge for the exchanges between the world and China in the field of evidence-based research in education (Li & Yao, 2018). These platforms provide convenient results of the optimum evidence-based research results, so as to help worldwide educational scholars with professional support better improve the current evidence-based education (Slavin et al., 2021).

The educational research achievements of Professor Slavin were the valuable fortune of the world educational research, in memory of his remarkable achievements, in order to inherit his research results, and for the further development of the evidence-based research, we hereby published the "*Professor Slavin and the development of evidence-based education in China*" and "*Success for All: Professor Slavin and the improvement of evidence-based schools and its enlightenment to China*" written by the editorial board members (Yao, 2021) and (Zhou & Gu, 2021), respectively. Affected by the limitations such as time, these articles could be insufficient in structure and methods, but it will not have any impact on the memory of Professor Slavin or lower the quality of the journal.

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ORIGINAL ARTICLE

Professor Slavin and the Development of Evidence-Based Education in China

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Abstract. *In the new century, the quantity and quality of empirical education research in China have been greatly improved, and more people are paying attention to and engaging in evidence-based research and practice in education. In this context, Professor Robert Slavin, a well-known expert in evidence-based education at Johns Hopkins University in the United States, contributed greatly to the guidance and assistance to the development of evidence-based education in China. He clarified some vague understandings of Chinese scholars on the research and reform of evidence-based education, trained and instructed Chinese scholars and students, and built a platform for exchanges between Chinese and foreign scholars, which has played an inestimable role in promoting the development of evidence-based education in China.*

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The *Status Quo* of the Development of Evidence-Based Education in China

FOR a long time, education research in China has focused on qualitative research, especially speculative research. This situation leads to a single academic research paradigm, insufficient scientific characteristics, and disconnection between theory and practice. Meanwhile, China's educational practice and reform are mainly based on experience rather than scientific evidence, which make decision-making and practice often biased. It is difficult for principals and teachers to get the guidance of policies and research based on scientific evidence to effectively improve the efficiency of management and teaching.

Since the beginning of the new century, this situation has been greatly improved. On the one hand, educational decision-making departments have paid more and more attention to the role of scientific research in the process of educational reform and development, and vigorously promoted educational scientific research from the system and management level. In October 2019, the Ministry of Education of China promulgated the "*Opinions of the Ministry of Education on Strengthening Educational Scientific Research in the New Era*" (The Policy and Regulations Department, the Ministry of Education, China, [2019] No. 16). It is required to further innovate the scientific research paradigms and methods, with particular emphasis on the requirement of "strengthening empirical research, insisting on facts and evidence as the basis, and continuously tracking major issues, focusing on long-term and systematic research". This reflects a strong sense of evidence at the national level. On the other hand, in terms of the transformation of China's education research, it has become a consensus in China's education field to vigorously strengthen empirical research in recent years. In 2015, East China Normal University held the first *National Education Empirical Research Forum*, which has been held for six consecutive sessions so far. The forum has grown from the initial participation of more than 600 people to the participation of dozens of journals and universities today; it is a grand event for China's education empirical research with thousands of offline participants and more than 100,000 online participants. It has greatly promoted the development of empirical research on education in China. As a landmark event, on January 14, 2017, deans of education faculty (department) of 14 universities in China including East China Normal University, the chief editors of 32 educational research journals, the leaders of the National Educational Science Planning Office, and the Education Research Center of the People's Daily issued the "*East China Normal University Action Declaration to Strengthen Empirical Research in Education and Promote the Transformation of Research Paradigm*" in Shanghai. The release of this "*Declaration of Action*" indicated that vigorously promoting empirical research in education has become a consensus and unified action in the entire Chinese education field.

In this context, the empirical research in Chinese education research in recent years has shown a greater degree of improvement in both quantity and quality. The con-

tinuous emergence of high-quality educational scientific research results has played a more significant role in promoting educational reform and development. But it goes without saying that the foundation of China's education research is relatively weak, and there is still room for improvement. Studies have found that on the basis of comparing the top domestic and abroad educational journals, although the proportion of empirical research results on education in China was on the rise, the proportion was still relatively low. The methods used by them still focused on statistical description, the application of cutting-edge analysis methods was less, and the overall research level was not high (Zhu & Ma, 2020).

In the past two decades, the development of evidence-based education research and reform has been the most exciting thing in the education field in European and American countries. Such progress has also attracted the attention of Chinese researchers and policy makers. In recent years, Chinese researchers have noticed the development of evidence-based education in the West, but most of them were concentrated in the field of comparative education. They mainly focused on the tracking and introduction of western research trends, and research and practical exploration based on local evidence-based education were still lacking (Deng et al., 2019; Li & Cheng, 2019). In this process, no matter in terms of theoretical research, method application or practical exploration, the development of domestic evidence-based education in China has many areas that need to be clarified and improved. This situation has changed slightly in recent years, but as a whole, the development of evidence-based education in China still has a long way to go.

The Impact of Professor Slavin's Team on the Development of Evidence-Based Education in China

As a leading researcher in the research and reform of evidence-based education, Professor Slavin has made outstanding contributions to its development. In 2018, Professor Slavin and his wife, Professor Madden Nancy, were invited by the School of Educational Science of Nanjing Normal University, accompanied by Professor Alan Cheung of the School of Education of the Chinese University of Hong Kong, to visit mainland China for the first time. Since then, Professor Slavin has paid great attention to the development of evidence-based education in China. He has repeatedly participated in related academic activities organized by universities in mainland China and did his best to help Chinese universities and scholars carry out related research. He has made indelible contributions to accelerating the development of evidence-based education in China.

He Clarified Some Vague Understandings of Chinese Scholars about Evidence-Based Education

Although there have been some preliminary explorations, the research and practice of evidence-based education is still a new thing for researchers in mainland China, and their understanding of it is still vague or even inaccurate. In response to this, professor

Slavin accepted the invitation of Science Insight Education Frontiers to specially write an article in response to the questions and criticisms on the reform of evidence-based education from the Chinese scholars. In this paper, Professor Slavin responded to the following questions at length: Does evidence-based research rely too much on experimental research to narrow education research? Why can't high-quality qualitative research, case studies, and experience become "evidence" in evidence-based research? How should evidence-based research be promoted in developing countries? etc. He believed that in developing countries like China, exploring rigorous and valuable evidence is an effective way to efficiently promote educational research, practice, and reform. In this process, it is equally critical to vigorously promote local evidence-based research and learn from foreign experience (Slavin & Cheung, 2019). In 2020, invited by the journal East China Normal University Education Review, Professor Slavin published a paper entitled "How could evidence-based reform advance education?" in the journal, in which he once again discussed the importance of evidence-based reforms to the development of pedagogy (Slavin et al., 2021). These discussions clarified the vague understanding of some key issues of evidence-based research in education in mainland China, and further pointed out the direction of related research while deepening the relevant understanding.

He Made More Mainland Researchers Pay Attention to the Development of Evidence-Based Education

In recent years, Professor Slavin has come to China to participate in academic conferences and lectures. In 2018, Professor Slavin and his wife were invited by the School of Educational Science of Nanjing Normal University to visit Chinese university for the first time. During the period, they gave a number of lectures to teachers and students of Nanjing Normal University, and systematically introduced the latest development of evidence-based education reform in European and the USA. In 2019, Professor Slavin and his wife visited China again. Together with experts from all over the world, they participated in the "*International Forum on Ideas and Actions in Pursuing Educational Excellence*" hosted by Nanjing Normal University and gave keynote speeches. They discussed with Chinese evidence-based researchers on ways and paths to promote evidence-based reforms in education. Following this, Professor Slavin went to Shanghai to participate in the "*Fifth National Educational Empirical Research Forum*" hosted by East China Normal University. The keynote speeches made by Professor Slavin and his entourage at these conferences further expanded the influence of evidence-based research among Chinese researchers. It has effectively promoted more researchers and practitioners to pay attention to and participate in the research and practice of evidence-based education.

He Guided and Helped Chinese Researchers Grow

Professor Slavin was very concerned about the talent training and professional construction of evidence-based education. In addition to providing up-to-date information for

researchers, he also led his team to contributed to the development of evidence-based education in China. During his two visits to China, Professor Slavin gladly accepted the invitation of Nanjing Normal University and was successively appointed as a foreign consultant expert of the School of Educational Science of Nanjing Normal University and the "Hongguo Chair Professor" of Nanjing Normal University. In addition, the Center for Research and Reform in Education of Johns Hopkins University led by Professor Slavin has also received visiting students from China many times. Under the guidance of Professor Slavin's team, these students have been greatly improved in their research vision and abilities. It has laid a solid foundation for the sustainable development of China's Evidence-based Education at a higher level in the future.

He Actively Promoted the Research Results of Evidence-Based Education in China

During his first visit to the mainland China, Professor Slavin signed a cooperation agreement with the School of Educational Science of Nanjing Normal University to cofound the "*Best Evidence in Brief (BEiB)*" project in the mainland. The *BEiB* project is a global evidence-based research and reform public welfare project led by Professor Slavin and participated by several universities and research institutions. It compiles the most cutting-edge, most effective, and most interesting evidence-based research results, so that researchers and first-line practitioners can obtain timely first-hand information, thereby promoting the development of evidence-based education. After intense preparations, the *BEiB* project in mainland China was launched in November 2018. Professor Slavin also introduced and shared the website link on his blog. This project has not only received extensive attention from domestic education colleagues in China, but has also become an important window for international evidence-based education researchers to understand the research dynamics in China. So far, *BEiE* in mainland China has nearly 10,000 subscriptions and is read hundreds of times every day, and its influence is gradually expanding.

On this basis, in order to further expand the influence of Evidence-based education research in China, after discussion with Professor Slavin, the Chinese *BEiE* project team decided to launch an academic journal dedicated to the achievements of evidence-based education in China. In 2019, *Best Evidence in Chinese Education (BECE)* was officially launched, and Professor Slavin personally served as the chairman of the editorial board. During the development of the journal, Professor Slavin has given strong professional support. In 2020, with the global spread of Covid-19 pandemic, how to maintain the operation of the education system under the premise of pandemic prevention and control has become a key issue for global educators. In this context, Professor Slavin was invited by the journal *BECE* to publish a COVID-19 themed paper. Together with scholars from many other countries, they discussed the international anti-pandemic experience in education. Once this group of papers was published, it attracted widespread attention and the journal's influence increased rapidly. So far, *BECE* has

been abstracted or indexed in more than ten important databases including EBSCO, ERIC, SSRN, etc., showing a good momentum of development.

Professor Slavin's Prospects for the Development of Evidence-Based Education in China

Professor Slavin has expressed his expectations for the future development of evidence-based education in China on many occasions. During his first visit to China, Professor Slavin expressed his view in the lecture exchange session that China, as a big country different from the West, has different national conditions and educational conditions from the West. However, in terms of evidence-based reform, both East and West should be consistent in promoting education reform through the acquisition of scientific evidence. In this regard, China, as the most populous country, has its own advantages, and its development prospects for Evidence-based Education are promising.

Professor Slavin has also expressed his views on how to accelerate the development of evidence-based education in China. In 2019, during Professor Slavin's participation in the conference in Nanjing, a participant ever asked him as: China's current evidence-based education research foundation is still relatively weak, and many decision makers have not formed the consciousness of making decisions based on evidence. Therefore, in this situation, how should we overcome difficulties and advance the development of Evidence-based Education research and practice? Professor Slavin's response to this issue was that even in Europe and the United States, evidence-based education reform would be questioned and criticized, which was normal. For a country like China, it is in the initial stage of evidence-based education, the first task was to start it first. In the initial stage, it might be difficult for researchers to obtain excellent and sufficient experimental research conditions. In this case, even doing some research that reduced the rigorous requirements was better than doing nothing. Researchers should work closely with front-line teachers and decision makers to make evidence serve the reform and practice of education. In this process, try to gradually improve the quality of research and people's sense of identification with evidence-based reforms, and subsequently and gradually the research and reforms would be easier to carry out. Such a deep and pragmatic insight is not only a suggestion for the research and practice of evidence-based education in China, but also a great encouragement to researchers and practitioners who are interested in it.

Professor Slavin hoped that China's evidence-based education research and reform can run its own way. When the author accompanied Professor Slavin and his wife in 2018, I once proposed an idea to use the resources of "Success for All (SFA)" and apply its implementation model to carry out related work in China. Professor Slavin did not approve of this. In addition to SFA's resources are not suitable for China, he believed that China has its own unique national and education conditions, and therefore also has its own problems that need to be solved. He even advocated that Chinese researchers should use evidence-based reform ideas and methods to solve China's own problems based on the experience of other countries. Such a view is obviously very en-

lightening and should be the development direction of evidence-based education in China.

Professor Slavin has always paid close attention to the development of Evidence-based Education in China. In recent years, the progress of China's evidence-based research in education and reform has also made him very pleased. Due to the pandemic, many planned exchange activities have been suspended, but we have been planning to invite him to visit China again to answer questions and guide Chinese scholars again. Professor Slavin also said in his last letter to the author that he hoped to work with me again after the pandemic was over. But what I never expected was that this had become a wish that Professor Slavin could never realize. On April 25, 2021, Professor Slavin left us forever. When the news came, many scholars in the Chinese education field who were familiar with him were quite grieving. Even if Professor Slavin has passed away, we believe that the tree of evidence-based education in China will continue to take root and sprout until it flourishes. This is perhaps what Professor Slavin would like to see most.

I would like to deeply in memory of Professor Slavin with this article!

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ORIGINAL ARTICLE

Success for All: Professor Slavin and the Improvement of Evidence-Based Schools and Its Enlightenment to China

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Abstract*. Success for All (SFA) is a school improvement project promoted by the team of Professor Robert Slavin of Johns Hopkins University. This paper reviewed the development process of SFA and analyzed its characteristics. By comparing with China's "New Basic Education" project, we summarized the reference value of SFA for China, and further discussed the possible path of China's evidence-based school improvement.*

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HELPING schools, especially weak schools, improve the efficiency of education and teaching, and promote the quality of teaching is an important theme in educational research and practice. Over the years, with the joint efforts of researchers and practitioners, the improvement projects of some schools have achieved remarkable results. This includes "Success for All" (SFA) led by Robert Slavin of Johns Hopkins University, "Direct Instruction" (DI) of Siegfried Engelmann of the University of Illinois, and "The Accelerated Schools" of Henry Levin of Stanford University. They are all helping students, especially those with disadvantaged family backgrounds and poor grades, through which they have achieved remarkable results in improving students' reading, math, and language skills. However, researchers have noticed that what works well in some schools may not be applicable in others (Borman et. al., 2002). In order to avoid the bias of results caused by a single independent research, and to achieve the best plan for the evaluation of student ability, a non-profit social science research institution operated by the American Institutions for Research (AR) funded by the Office of Elementary and Secondary Education of the US Department of Education - Comprehensive School Reform Quality (CSRQ) evaluated and compared the effectiveness and quality of 22 comprehensive school reforms. It was found that SFA relied on the wide coverage of schools (1,200) and applicable age (preschool-7th grade), the most research designs (41), the most valid conclusions (34), and a clear effect size (d = 0.18), thus getting the best evaluation (Slavin, 2007).

Chinese educators have also contributed greatly to the school improvement. As a successful school improvement project, SFA was the most important educational research and practice legacy of Professor Slavin. It undoubtedly provided an important reference for the work of Chinese colleagues. This paper will discuss the path of China's evidence-based school improvement on the basis of reviewing and summarizing the experience of SFA, hoping to find some new ideas for the reform and development of Chinese education.

Success for All: How Professor Slavin Promoted School Improvement Based on Evidence

Since 1986, Professor Slavin's team has been invited by Baltimore City Public Schools to develop a project that can ensure the success of all poor children, which became the origin of the SFA project. Professor Slavin and his team believed that a good school can

develop more "adversity-resistant students", thereby helping those students with poor family backgrounds to obtain "counter-attack" in performance. However, helping students to read is an early key factor for students to achieve academic success. Therefore, the research team started from Cooperative Reading and gradually developed a school improvement plan that can provide comprehensive guidance for students from preschool to 7th-grade. Early interventions include ability grouping in the form of teaching organization-aka Joplin Plan (Slavin, 1987; Gutierrez & Slavin, 1992), classroom management strategies (Evertson et al, 2000), and one-to-one student reading improvement program (Pinnell et al., 1988; Pinnell et al., 1994), teacher professional development path (Perry et. al., 1999); etc. These actions were integrated into the early SFA plan.

The early intervention has achieved obvious results. Since then, the research team has turned its attention to a wider range of areas. On the one hand, the SFA plan began to pay attention to the impact of related interventions on second language acquisition. Because when teaching children from poor families, a large number of students come from families whose mother tongue is not English, it has partially demonstrated the positive effect of the SFA program on bilingual learning. At the same time, when teaching reading, learning phonics & phonological awareness, which is an important part of English learning like Chinese phonetic alphabet (Pin Yin in Chinese), is extremely conducive to the rapid grasp of English pronunciation and writing. Studies have found that this has a significant positive impact on the English learning of Spanish, Colombian, Mexican and Chinese students (Calderon et al., 1998; Cheung & Slavin, 2005; Slavin & Madden, 1999; Ross et al., 1996). In addition, Borman et al. also conducted a longitudinal follow-up survey of Baltimore school students and found that by the eighth grade, these students' performance in standardized reading was still significantly better than the early control students (Borman et al., 2003). On the other hand, the SFA project team also explored the auxiliary teaching and evaluation of electronic software. The research team used Reading Reel and Alphie's Alley. The former is software that helps students to learn vocabulary in the form of animation, and the latter is software that helps teachers to plan lessons and evaluate students. After three sets of comparative experiments, it was found that the students who used Reading Reel and Alphie's Alley performed better than those who only participated in the SFA program and only participated in the SFA tutor guidance (Chambers et al., 2007; Chambers et al., 2005a; Chambers et al. al., 2005b). So far, SFA has achieved great success. It has become one of the most effective and evidence-based education-based school improvement programs in the United States.

After CSQR integrated 41 SFA experiments, it is found that the effect size of SFA on students is $d = 0.18$. Although 0.18 was a small effect size, in the field of education, large-scale random intervention programs such as SFA could achieve an effect size of about 0.2 was already a very exciting result. This showed that the effect of SFA was significant, and its actions could provide strong evidence for the formulation of education policies. The success of SFA is largely due to the design, implementation and improvement of each of its interventions based on scientific evidence; and in the process of continuous iteration, a robust, systematic, high promotion value, and effective

intervention method has been formed. In this way, more schools will benefit in a larger scale. These proven methods include:

Flexible Class Schedule and Class Placement Mode

Based on the research of Evertson et al. (2000), the SFA plan uses 90 minutes as a course unit to make the classroom rhythm compact and efficient. What teachers have to do is to improve class management strategies and use time efficiently. However, due to the large differences in the abilities of students in a class, efficient teaching is challenged. Therefore, students in the SFA program should pass a test before participating in the reading program and be reclassified. This type of teaching has the following advantages: First, teachers can better teach per their aptitude to meet the different learning needs of students with different abilities. Second, teachers do not need to group in class for separate guidance when teaching, which not only improves the rhythm of the course, but also increases the efficiency of the class. Third, the class size after re-grouped is smaller than the original class size, which helps teachers pay more attention to students and accumulate teaching experience and skills.

Rich and Diverse Teaching Resources

In order to meet the different reading needs of students from preschool to seventh grade, SFA has designed different curriculum plans. In the teaching materials book provided by SFA, these activities will be integrated according to the physical and mental laws of student development, and the key points, goals, and maxims of teaching will be put forward. It provides teachers with a set of teaching systemic materials for almost all the ability development needs of students. In the pre-school stage, these materials were called Curiosity Corner and Kinder Corner by the SFA research team; after that, SFA provided Reading Roots, Reading Wings and Reading Edge course materials for the beginner, intermediate and middle school students, respectively. In addition to providing teaching materials and books, SFA also provides comprehensive guidance on activities corresponding to the development needs of students, student evaluation record sheets after teaching, evaluation methods and evaluation questions, which provide teachers with direction guidance.

Professional "Coordinator" Guidance

In order to realize the smooth development of the project, SFA has set up a project "coordinator", which mainly includes two roles: one is the facilitator for the entire project operation; the other is the tutor for coordinating courses, teachers, students, and equipment. A school generally has a facilitator, whose main job is to organize periodic student assessments, lectures and lectures, and teacher training, select the appropriate learning stage for students, and help teachers improve their work; etc. In this process, the coordinator is not an evaluator, supervisor or vice-principal, but a supporter of teacher development. Therefore, many coordinators themselves are excellent and ex-

tremely experienced teachers. A school can have multiple tutors. When instructing students, they often adopt one-to-one guidance, assess students' progress, determine priority development abilities and teaching materials, combine class teaching, learn to read by reading, and actively communicate with class instructors.

Emphasize Fairness and Full Participation

According to the original purpose of the SFA plan, in order to promote educational equity, helping students from poor families to develop better. First of all, SFA plans to conduct school selection before officially introducing schools. It generally selects disadvantaged schools that are dominated by non-white students such as Latino or African descent. Secondly, before the school is ready to accept the plan, teachers will vote to decide whether to participate. It will only be introduced when more than 90% of school teachers show a positive attitude towards this plan. Finally, the school will inform the parents of the rules of the plan and sign an agreement to protect the parents' right to know the plan; if the parents refuse to participate, the children will not be included in the school improvement plan. These three steps ensure that all participants initially have a positive attitude to promote the complete operation of the entire program. After the plan is launched, SFA will also obtain parental support and participation through various methods such as home visits, sending text messages to parents, parent-child reading, and family-school activities.

What Can We Learn? Enlightenment of Evidence-Based School Improvement in a Comparative Perspective

In the process of China's education reform and development, school improvement is also a task that all parties attach great importance to. In the process of long-term exploration, Chinese educators have also discovered some ways to improve schools with Chinese characteristics.

Among the many local school reforms in China, the most influential one with the most complete system and the longest continuous practice is undoubtedly the "new basic education" reform. For a long time, excessive emphasis on test scores has made it difficult to cultivate the talents China needs. This is the main problem that China's basic education has been widely criticized. In this regard, Professor Lan Ye from East China Normal University put forward the basic education reform idea of "new basic education" and put it into practice (Feng & Xiang, 2018). In 1994, Professor Lan Ye began to construct the theory of "new basic education"; by 1999, it entered the stage of promotion and developmental research; so far, it has entered a stage of gradual enrichment and vigorous growth in theory and practice. The research and experiment of "new basic education" have gone through nearly 30 years. It has become a model of school improvement with far-reaching influence and Chinese characteristics.

This project, starting from the full and complete development of "life", highlights the dominant position of learners, and builds a complete system of classroom teaching, teacher development, class construction, and school management. Its ultimate goal is to promote the healthy and comprehensive development of students. It is an educational reform that is jointly promoted by Chinese local researchers and front-line workers, combines educational theory and practical exploration, and meets the needs of cultivating new talents in the 21st century (Ye, 1999). Such a change has impacted the traditional educational concepts and strengthened the student-centered view of teaching in a considerable range, through which a distinctive, flexible and effective teaching mode and curriculum system have formed. Eventually it became a representative project for the improvement of Chinese local schools in the new era (Liu, 2003). Similar to SFA, the experiments of "New Basic Education" are all educational reform projects based on school improvement. There are many similarities between the two in terms of value pursuit, implementation methods and research drive.

First of all, both uphold the student-centered teaching concept, and make every student fully developed as the value pursuit.

In terms of curriculum, SFA always focuses on the development of students, and strives to solve the reading problems of students in weak schools, so that students can increase students' enthusiasm and autonomy through group cooperation, thereby improving students' reading ability. Meanwhile, the SFA program will also set up different reading courses for students at different levels to achieve personalized reading teaching as much as possible. China's "New Basic Education" experiment also has a lot of measures focusing on individualized learning of students and helping disadvantaged schools and students. Both of them embody a strong value trend of emphasizing educational equity.

Second, both have adopted a comprehensive reform approach to advance, and attach importance to the participation of multiple subjects.

The reform of the SFA model was originally intended to improve the reading level of the students in the lower grades of weak schools. However, with the advancement of experimental reforms, the SFA model not only includes reading teaching, but also involves the psychological aspects of students, and finally developed into an effective teaching paradigm for bilingual teaching and non-native English teaching. In order to promote school reform and ensure the effect of intervention, SFA has also formed a package plan including research support, teaching optimization, leadership improvement, and home-school cooperation. It has fully mobilized the power and resources of schools, families and communities. At the same time, with the support of the government and enterprises and other social forces, the participants have realized diversifica-

tion. The "New Basic Education" experiment also showed such characteristics in the process of organization and implementation. Researchers in the theory of education system ecology represented by the American psychologist Bronfenbrenner (1979) believed that the development of human beings is affected by multiple environmental factors. Through mutual restriction and mutual connection among various elements, children's development and understanding will be enriched continuously. Both of these projects have achieved the joint participation of schools, families and communities, and the joint efforts of multiple parties have contributed to success.

Third, both are based on full cooperation between scholars and schools, and school improvements implemented with the support of academic research.

As mentioned earlier, during the implementation of SFA, Professor Slavin and his team provided solid research support for the reform of the school. This support is not only reflected in the provision of relevant teaching resources and teaching models for the implementation of reforms, but also in the implementation of recommendations and interventions based on research evidence. This ensures that relevant reforms can be carried out in the right direction, while also being able to adjust specific measures in a timely manner based on feedback. The "new basic education" was initiated by scholars when it was implemented. Starting from theoretical research and then promoting practical improvement, throughout the implementation process, a research-driven, theory-practice-combined approach was adopted. From this perspective, these two school improvement projects are different from the reform efforts carried out by the schools themselves, and both reflect obvious research-leading characteristics.

Although the two projects have the same characteristics as above, it is undeniable that there are also differences between the two. Although the "New Basic Education" is a far-reaching school improvement project in China, it has also made outstanding contributions to the reform of China's education. But so far, such efforts still suffer from insufficient scientific evidence, improper grasp of the model, unclear interpretation of the rules, and difficulty in popularizing experience. The reason for this is largely due to the fact that many Chinese school improvement projects, including "new basic education", are not based on scientific evidence, but rely more on experience and feelings. For a long time, in China's education reforms, the gradual empiricist reform model is often emphasized, that is, reforms are carried out in accordance with past experience and subjective wishes while ignoring scientific evidence (Zhang, 2007).

This makes it difficult for people to objectively judge the actual effect of a certain reform. Furthermore, due to the lack of scientific evidence, even if a certain reform achieves the expected results, we still cannot know exactly what factors have led to such a success under what conditions. Therefore, it is even more difficult to know to what extent such success reveals the scientific laws of education and teaching, and to what extent can it be promoted and valued. As a representative project of evidence-based school improvement, SFA may be able to provide us with reference to solve this

problem in China. As an outstanding scholar of evidence-based education research and reform, Professor Slavin has spent his life exploring the methods and paths of evidence-based education. In the implementation of the SFA project, on the one hand, any intervention is based on the evidence of previous studies.

On the other hand, during the implementation of the project, rigorous experimental interventions were also implemented. So that researchers and practitioners can accurately grasp and evaluate the effect of project implementation and its mechanism of action. In this way, we can get rid of the chronic problem of empirical school improvement projects and help find more targeted and effective school reform measures. This is probably the most worthy place for Chinese schools to learn from.

What Can We Do? Possible Approaches to China's Evidence-Based School Improvement

From the perspective of the advancement and improvement process of SFA, research methodology based on educational experiments and quasi-experiments has become an important support for the reform of the program. In the reform, the use of evidence as the basis for selected programs will enable education to enter a virtuous circle of innovation, evaluation, and gradual improvement (Slavin, 2013). But it needs to be pointed out that due to the differences in national conditions and teaching conditions, when we learn from the experience of SFA, we first need to demonstrate the possibility of learning.

First, as far as the overall policy environment is concerned, China has issued a series of policy documents and emphasizes the application of evidence in the educational decision-making and reform process. However, we are not like the United States, requiring all important education reforms at the national level to be based on evidence and educational scientific research. As a result, many of the current decisions and reforms in China are still based on feelings, experience and even the consciousness of officials. Therefore, the scientific awareness and quality of educators need to be greatly improved.

Second, in terms of the implementation conditions of evidence-based school improvement, Chinese schools need to implement teaching in accordance with the national curriculum standards and syllabus during the teaching process. Therefore, the teaching autonomy of schools and teachers is greatly restricted. This makes the selection and implementation of intervention measures face more restrictions and difficulties in the process of promoting school improvement.

Third, because of the evidence-based research and reform of education, it is still a new thing for China. Therefore, there are deficiencies in the research staff and research level. There is also a lack of accurate and effective measurement tools suitable for the local area, which makes us have more difficulties in measurement and analysis to deal with in the process of carrying out evidence-based education reform.

This means that China must do something and not do something in the process of promoting evidence-based school improvement. In other words, it is necessary to

explore the evidence-based school improvement road with Chinese characteristics based on the national conditions and education of the country.

(i) Whether they are policy makers, researchers, principals or frontline teachers, they all need to firmly establish a scientific outlook on development. In the reform and development of education, it is necessary to strengthen the awareness of evidence and truly achieve decision-making and teaching based on evidence. To achieve this, the government not only needs to further strengthen the requirements for evidence at the institutional level, but also requires researchers to change the style of study and vigorously strengthen empirical research; further, schools need to pay more attention to the acquisition and use of evidence in the reform process.

(ii) It is necessary to vigorously strengthen and promote educational experimental research in China. As far as the current research status of domestic school improvement is concerned, most of the research is still speculative research, and a small amount of empirical research is mostly statistical description and correlation analysis. Although this type of research can help understand the status quo and influencing factors of specific educational phenomena, it is difficult to conduct causal analysis. In education empirical studies without a control group, there would be a risk of biased estimation of the intervention effect (Cheung & Slavin, 2016). To solve this problem, technically, the best way is to carry out rigorously designed experimental research. Only in this way can we provide more robust scientific evidence for school improvement based on more empirical research.

(iii) Efforts should be made to solve the problem of measurement methods and tools. In the process of school improvement in China, they are often good at reforming teaching and management models. However, due to the lack of authoritative and scientific measurement tools suitable for China conditions, many school improvement plans are unable to accurately report actual effects, influencing factors, and mechanism of action, so it is difficult to summarize their truly effective scientific laws. To solve this problem, the only way to increase scientific research is to develop measuring tools suitable for China's national and teachings conditions, and truly solve the problem of "can be measured and measured more accurately".

(iv) As mentioned earlier, successful evidence-based school improvement projects are the result of the cooperation of multiple parties. From the current reality of China's education reform and development, it can be known that the transformation of school improvement from experience-based to evidence-based cannot be accomplished with the efforts of one party alone. In terms of education evidence-based research and reform itself, it also requires close cooperation between researchers and practical work. It is impossible to obtain effective and robust evidence only by speculative "rocking chair" research, let alone evidence-based school improvement. Therefore, this must be a process from cooperation to win-win. In other words, the road of evidence-based

school improvement must be the road of mutual dependence and promotion between theory and practice.

Professor Slavin and his team have presented a successful evidence-based school improvement path for educators around the world through the SFA project. Although the situation in different countries is not the same, the idea and path of evidence-based school improvement based on scientific research to promote the achievement of reform goals has shown its universal value. This is especially important for a country like China that has long been accustomed to advancing reforms through experience. After decades of rapid economic development in China, its education reform, like reforms in other fields, has entered the "deep water zone." Under such circumstances, reforms based solely on experience have increasingly shown its risks. Relying on scientific evidence to promote reforms steadily has become the only way for China's education reform and development. This road is not easy, but it is full of hope. In this process, Professor Slavin's outstanding work in the field of evidence-based research will continue to guide the researchers and practitioners to move forward like a lighthouse!

We would like to commemorate the respected Professor Slavin with this article.

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ARTICLE

The Impact of Higher Education and Human Capital Quality on "Local-Neighborhood" Economic Growth

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Abstract. *Based on China's provincial panel data from 1990 to 2017 and the improved Lucas, Nelson & Phelps model, the Spatial Dubin Model is used to test the spatial effects of higher education and human capital quality. The results showed that high-level human capital, characterized by higher education and urban labor income index, indirectly promoted local economic growth through technological innovation. There was also a "local-neighborhood" synergy effect. The neighborhood effect was manifested in that it affected the economic development of neighbors by promoting technological catch-up. After considering the quality factor, both the local and neighborhood effects were enhanced. From a regional perspective, higher education in the Yangtze River Delta, where the level of economic development is relatively high, was manifested as a spatial spillover effect of technological innovation and the neighborhood effect in the northeastern Bohai Rim and the Pearl River Delta was manifested as a technological catch-up.*

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Introduction

FROM 1978 to 2010, the Chinese economy maintained an average annual growth rate of more than 10%, creating a growth miracle that attracted worldwide attention. After 2010, the growth rate has gradually slowed down, and the GDP growth rate from 2017 to 2019 was below 7%. The economy has transformed from high-speed growth in the past to medium- and high-speed growth. China's "demographic dividend" advantage is gradually diminishing. Labor shortage and population aging have gradually become key factors restricting economic growth. As a comprehensive indicator to measure population size, structure, and quality, human capital determines national and regional economic development speed and quality. From 1982 to 2017, the proportion of the population with an associate degree education and above in the Chinese labor force showed a significant upward trend increased from 0.9% in 1982 to 18% in 2017. The decline in the number of labor forces will not be conducive to economic growth, but can the improvement in labor quality make up for the growing gap caused by the decline in the number of labor forces?

What is the mechanism and realization path of higher education's influence on regional economic growth? Does this impact show spatial dependence characteristics among regions with significant differences in population size, education quality, and economic development? Previous studies adopted the average years of education or the total years of education, which could not reflect the change in the quality of the labor force. Our study used the revised Lucas and Nelson & Phelps models for spatial econometric analysis by constructing two data sets of labor income index human capital and education human capital (Lucas, 1988); Nelson & Phelps, 1965). This helps to understand the spatial mechanism of higher education and human capital quality from a deeper level and provides a decision-making reference for implementing the coordinated development of China's higher education and regional economy to a certain extent.

Literature Review

The Mechanism and Direction of Human Capital in Economic Growth

Research under the macro-framework mainly focuses on the mechanism of education and human capital in economic growth and the direction and significance of human capital in economic growth. There are primarily the following views on the mechanism: Firstly, human capital directly participates in the production process as a production factor that improves the quality of labor, and the accumulation of specialized human capital is the decisive factor in promoting sustained economic growth (Lucas, 1988). Secondly, human capital promotes the indirect effects of economic growth by fostering technological innovation and technological catch-up, emphasizing that the stock of human capital is a critical factor in economic growth (Romer, 1990; Ding & Knight, 2011;

Li et al., 2016). Thirdly, human capital directly affects output as a factor and indirectly promotes a joint mechanism of economic growth by promoting technological innovation and imitating absorption (Engelbrecht, 2003; Du et al., 2014). Fourthly, from a regional perspective, some studies have confirmed that education and human capital have positive spatial externalities (Chang & Zhao, 2017; Deng & Ke, 2020), but some studies have reached the opposite conclusion (Fischer et al., 2009). It can be seen that the mechanism of different levels of education and human capital in space still needs to be further tested.

"Stock" and "Quality" in Human Capital Measurement

In the research on the relationship between education, human capital, and economic growth, a vital issue is distinguishing between "stock" and "quality" in human capital. The more mature human capital measurement methods mainly include cost method, income method, and education characteristic method. The main idea of the cost method is to compare the method of measuring physical capital. Most scholars estimate the stock of human capital in various countries or different periods based on perpetual inventory technology (Schultz, 1961; Kendrick, 1976; Qian, 2012; Meng & Wang, 2014). Previous studies on the impact of education on economic growth have focused more on quantitative educational indicators. The commonly used proxy variables include the average years of workers' education (Psacharopoulos & Patrinos, 2004; Barro & Lee, 1993) and the adult literacy rate (Cai & Du, 2000). Studies have also shown that once the factors of education quality (international test scores, etc.) are considered, the influence of the quantity of education becomes insignificant. In contrast, the quality of education has a strong positive effect on economic growth (Jamison et al., 2007; Hanushek & Woessmann, 2011). Still, the use of international test scores cannot directly measure the human capital level of the working-age population (Graham & Webb, 1979). There are two ways to use the income method to calculate human capital: one is to use the sum of the present value of future income to measure human capital (Jorgenson & Fraumeni, 1989; Li & Tang, 2015; Dong, 2017). However, it is impossible to eliminate the influence of the annual increase in physical capital on the stock of human capital. The other is to estimate human capital by using the present value income of workers. The most representative is LIHK (Labor-Income-Based Human Capital) labor income method (Mulligan & Sala-i-Martin, 1997). It reflects the difference of different education levels, the change of education quality over time, and factors such as work experience on human capital accumulation. Simultaneously, it effectively eliminates the influence of physical capital on the measurement, which is more reasonable for analyzing economic growth (Zhu & Xu, 2007; Liang et al., 2015).

Based on the concept of unit human capital in the income method, this research constructs two types of panel data: human capital index and educational human capital, including scale, structure, and quality. By establishing a spatial measurement model, the spatial effect mechanism of higher education and human capital quality in economic growth is tested under the premise of fully considering spatial and geographical factors.

Human Capital Measurement Based on LIHK Income Method

According to China's primary data, we first need to estimate the annual population data according to gender, age, urban and rural areas, and education level. Secondly, we need to evaluate the income of each part of the group. Using the method of the China Human Capital and Labor Economics Research Center (CHLR), we estimated the expanded Mincer income equation (1):

$$ln(wage) = \alpha + \beta_1 Sch + \beta_2 Exp + \beta_3 Exp^2 + \beta_4 Sch \cdot ave\_gdp + \beta_5 Sch \cdot indus\_gdp + \beta_6 ave\_wage + \beta_7 male + \beta_8 urban \quad (1)$$

Where ln(wage) is the natural logarithm of income. Sch represents the number of years of education. Exp is an individual's work experience. ave_gdp represents the per capita GDP of the province. indus_gdp indicates the proportion of tertiary industry output value in GDP in the province where it is located. ave_wage represents the average wage level in the province. According to the two databases of CHNS (China Health and Nutrition Survey, 1989-2015) and CFPS (China Family Panel Studies, 2010-2016), the weighted results based on the sample size yield the intercept term, Sch, Exp, and the coefficient of Exp^2. Then, the linear fitting of the variable to the time trend is made, and the fitting value of the missing year is obtained. Then the human capital index of the individual by sex, age, urban and rural, and education level was calculated. The total human capital stock is obtained by adding up the number of labor forces in each group.

Construction of Spatial Panel Data Measurement Model

Research Method

The two basic setting methods for spatial interaction are: one is Spatial Lag Model (SLM) (Lagged Dependent Variable), and the other is Spatial Error Model (SEM) (The error term contains a Spatial Autoregression process). Spatial Dubin Model (SDM) is a general form of the spatial measurement model and a broader SLM and SEM measurement model. Among them, y_{it} is the explained variable, x_{it} is the explanatory variable, and the primary expression of the model is:

SLM:

$$y_{it} = \mu_i + \alpha_t + \eta \sum_{j=1}^{N} w_{ij} y_{it} + \lambda x_{it} + \varepsilon_{it} \quad (2)$$

SEM:

$$y_{it} = \mu_i + \alpha_t + \lambda x_{it} + \varepsilon_{it}$$
$$\varepsilon_{it} = \rho \sum_{j=1}^{N} w_{ij}\varepsilon_{ij} + v_{it}$$
(3)

SDM:

$$y_{it} = \mu_i + \alpha_t + \eta \sum_{j=1}^{N} w_{ij}y_{it} + \lambda \sum_{j=1}^{N} w_{ij}x_{it} + \varepsilon_{it}$$
(4)

This study draws on the model of Lucas and Nelson & Phelps (Lucas, 1988; Nelson & Phelps, 1965), combined with the improved research framework of Yuhong Du et al. (Du & Zhao, 2018), to test the spatial effect mechanism of higher education and human capital quality on economic growth. We hypothesized that different levels of human capital have different growth paths: basic human capital influences growth by increasing factor accumulation. In contrast, advanced human capital promotes growth by promoting technological innovation and imitating catch-up. We set the production function to the following form:

$$Y = A(Ha)K^{\alpha}Hb^{\beta}L^{\gamma}$$
(5)

Y represents output, K represents capital, Ha represents high-level human capital, Hb represents basic human capital, L represents labor force. A means technological progress rate or total factor productivity.

Drawing on the study of Nelson & Phelps (Nelson & Phelps, 1965), Ha represents technological innovation and $Ha * \frac{y_{max}-y}{y}$ means technological imitation and catch-up, as shown in equation (6):

$$A(Ha) = A_0 exp\left(c + g * Ha + \delta Ha * \frac{y_{max} - y}{y}\right)$$
(6)

Take the per capita form and digitize both sides of equation (5) at the same time, and add the spatial effect after substituting equation (6) to obtain the spatial panel model (7):

$$ln(y_{it}) = c + \beta\, ln(k_{it}) + \gamma\, ln(hb_{it}) + \theta\, ln(L_{it}) + ha + \delta ha\,(y_{max} - y_{i0})/y_{i0} + \varphi Z_{it} + \alpha_i + \sigma \sum_{j=1}^{N} w_{ij}\, ln(k_{it}) + \varsigma \sum_{j=1}^{N} w_{ij}\, ln(hb_{it}) + \tau \sum_{j=1}^{N} w_{ij}\, ln(L_{it}) + \upsilon \sum_{j=1}^{N} w_{ij} ha_{it} + \psi \sum_{j=1}^{N} w_{ij} ha_{it}\,(y_{max} - y_{i0})/y_{i0} + \varepsilon_{it}$$

(7)

Among them, the explained variable is represented by GDP per capita, and the explanatory variables include physical capital (k), number of laborers (L), basic human capital (hb), advanced human capital (ha), technological imitation, and catch-up (Catch), representing a series of Control variables include foreign trade dependence (open), industrial structure (indus), and government support (gov). c, α_i, and ε_{it} represent a constant term, a regional fixed effect, and a random error term, respectively. w_{ij} represents the elements of the spatial weight matrix. This study uses three types of matrices for analysis.

The adjacency weight matrix W1 is constructed by studying whether the variables are adjacent to each other by assigning values of 0 or 1. If i = j, it means that province i and j are adjacent; if i ≠ j, it means that province i and j are not adjacent.

$$w_{ij} = \begin{cases} 0, i = j \\ 1, i \neq j \end{cases}$$

(8)

Besides, in order to test the robustness of the estimation results, we also consider the attenuation of the spatial effect as the distance increases and construct the geographical distance weight matrix W2:

$$w_{ij} = \begin{cases} 0, i = j \\ 1/d_{ij}^2, i \neq j \end{cases}$$

(9)

At the same time, to objectively express the spatial correlation of the economic development level of the spatial unit, we also construct the economic distance weight matrix W3, where $\bar{y}_i$ is the average GDP of the region i over the years, and $\bar{y}$ is the average GDP of the full sample.

$$w_3 = w_2 \times diag(\bar{y}_1/\bar{y}, \bar{y}_2/\bar{y}, \cdots, \bar{y}_n/\bar{y})$$

$$\bar{y}_i = \frac{1}{t_1 - t_0 + 1}\sum_{t=t_0}^{t_1} y_{it}\,, \bar{y} = \frac{1}{n(t_1 - t_0 + 1)}\sum_{i=1}^{n}\sum_{t=t_0}^{t_1} y_{it} \tag{10}$$

Data Sources and Variables

According to the availability of samples, this paper selects the panel data of 30 provinces from 1990 to 2017 as the research sample (the Tibet Autonomous Region has been eliminated due to excessive data missing). The data we used to measure LIHK's human capital came from "China's 1982 Census", "China's 1990 Census", "China's 2000 Census", "China's 2010 Census", "China Demographic Yearbook (1991-2018)", the provincial census data and statistical yearbooks, the China Nutrition and Health Survey (CHNS, 1989-2015) and the Chinese Family Panel Studies (CFPS, 2010-2016) microdatabase; the original data of other variables were from the "China Statistical Yearbook" (1991-2018)", "China Labor Statistics Yearbook (1991-2018)" and statistical yearbook of each province.

- Output Level (Y/y)

The output level reflects the economic development status of a province and is expressed by the province's gross regional product (Y) and per capita gross regional product (y).

- Capital Stock (K) / Capital Stock per Capita (k)

As there are currently no official statistics on annual physical capital stock data, the most commonly used calculation method is the Perpetual Inventory Method. The interprovincial material capital stock data used in this article came from Holz and Dr. Sun Yue (Holz & Sun, 2018).

- Human Capital

We measured human capital in two forms: years of education and LIHK Human Capital Index. Advanced human capital (ha) is equal to the sum of years of education of all workers with higher education, and basic human capital (hb) is equal to the sum of years of education of all workers with elementary, middle, and high school education. This study also measured the human capital index based on the LIHK labor income method, reflecting the comprehensive effect of labor force size and quality. Considering the conditions in rural areas in China, they usually only have limited opportunities for higher education, and it is difficult for them to have the opportunity to obtain advanced skills from their jobs. Therefore, the main reason for the urban-rural income gap can be attributed to the difference in advanced human capital levels. The measured rural labor income index and urban labor income index were used as substitute variables for basic (hb_LIHK) and advanced human capital (ha_LIHK).

- Other Control Variables

Foreign trade dependence (open), industrial structure (indus), and government support (gov) respectively used the proportion of total regional imports and exports to GDP, the ratio of the added value of the tertiary industry to GDP, and the balance of government public budget fiscal expenditures in GDP.

Empirical Result Analysis

Preliminary Test of Spatial Effect Model

Before estimating the model, it was necessary to test whether there was a spatial effect between the quality of higher education and human capital and economic growth (shown in **Table 1**). Both the Lagrange multiplier test and robust test results rejected the null hypothesis that there was no spatial lag effect or spatial error effect. It showed that there was a significant spatial dependence characteristic between higher education, human capital quality, and economic growth in various regions. The Wald statistics of spatial lag and spatial error were both significant at the 1% statistical level, indicating that the Spatial Dubin Model's null hypothesis could be transformed into a spatial lag or error model should be rejected, so it was more appropriate to establish the Spatial Dubin Model. Simultaneously, the Hausman test result passes the 1% significance test, and a fixed-effect Spatial Dubin Model (SDM-FE) should be established. Considering that China's education, human capital level, and economic growth all present significant imbalanced characteristics, the mixed effects and time fixed effects ignore regional structural economic differences. In contrast, the space-time double fixed-effect model can simultaneously consider regional spatial differences and period effects, further effectively distinguish the role of spatial dependence from the impact of spatial heterogeneity and omitted variables. Studies have pointed out that the parameters obtained using Maximum Likelihood Estimation (MLE) were asymptotically effective (Chen, 2014). Therefore, we used the Spatial Dubin Model with dual fixed MLE time and space.

Model Estimation Results

The estimation results obtained under the three spatial weight matrices of the national adjacency matrix, inverse distance matrix, and economic distance matrix were relatively stable (shown in **Table 2**). Most of the coefficient estimates had not changed significantly, indicating the robustness of the estimated results. Simultaneously, the best fit of the model was assessed under the economic distance matrix, indicating that the spatial effect of education and human capital quality on economic growth was more reflected in economic spatial connections. Therefore, in the following, we mainly analyzed the economic distance matrix W3. The estimated values of advanced human capital (variables ha and ha_LIHK) were both positive at the 1% significance level, indicating that advanced human capital represented by higher education (ha) could significantly pro mote regional economic growth through technological innovation effects and urban

Table 1. The Spatial Effect Test of Higher Education and Human Capital Quality in Economic Growth.

Test	W1	W2	W3
Lagrange Multiplier Test (Spatial Lag)	7.857*** (0.005)	9.529*** (0.002)	4.279** (0.039)
Robust Lagrange multiplier test (Spatial Lag)	7.047*** (0.008)	8.746*** (0.003)	4.052** (0.044)
Lagrange Multiplier Test (Spatial Error)	16.072*** (0.005)	8.031*** (0.005)	3.231* (0.072)
Robust Lagrange multiplier test (Spatial Error)	15.262*** (0.005)	7.248*** (0.007)	3.004* (0.082)
Wald Test (Spatial Lag)	83.06*** (0.000)	240.39*** (0.000)	100.24*** (0.000)
Wald Test (Spatial Error)	82.52*** (0.000)	154.71*** (0.000)	53.03*** (0.000)
Hausman Test	346.48*** (0.000)	34.81*** (0.000)	95.33*** (0.000)

****, **, * Represent significant at the statistical level of 1%, 5%, and 10%, respectively. The P value of the coefficient is in parentheses.*

Table 2. Robust Estimation Results of Spatial Dubin Model (SDM).

Variable	Educational Human Capital			LIHK Human Capital		
	SDM-FE	SDM-FE	SDM-FE	SDM-FE	SDM-FE	SDM-FE
	Adjacency Weight Matrix	Geographic Distance Matrix	Economic Distance Matrix	Adjacency Weight Matrix	Geographic Distance Matrix	Economic Distance Matrix
Capital Stock	0.3169*** (0.0107)	0.3090*** (0.0112)	0.3364*** (0.0113)	0.2983*** (0.0113)	0.2926*** (0.0122)	0.3059*** (0.0119)
Number of Labor	-0.7215*** (0.0314)	-0.7326*** (0.0291)	-0.6796*** (0.0297)	-1.0331*** (0.0461)	-0.9616*** (0.0437)	-0.8552*** (0.0393)
Basic Human Capital	0.5145*** (0.0929)	0.3112*** (0.0856)	0.5216*** (0.0855)	0.1160*** (0.0195)	0.0444** (0.0187)	0.0407** (0.0187)
Advanced Human Capital	0.1196*** (0.0156)	0.0832*** (0.0143)	0.1461*** (0.0140)	0.4696*** (0.0580)	0.4945*** (0.0462)	0.5389*** (0.0537)
Technology Catch-up	-0.0383*** (0.0042)	-0.0335*** (0.0037)	-0.0394*** (0.0044)	-0.1411*** (0.0306)	-0.1667*** (0.0219)	-0.2120*** (0.0261)
Spatial effect of Capital Stock	0.0036 (0.0239)	0.0613** (0.0310)	0.1187** (0.0466)	-0.0328 (0.0247)	0.0036 (0.0333)	0.2024*** (0.0505)
Spatial effect of Labor Number	0.4491*** (0.0566)	0.6311*** (0.0922)	0.1447 (0.1304)	0.8156*** (0.1055)	0.9434*** (0.0994)	0.4077** (0.1333)
Spatial Effect of Basic Human Capital	-0.3800** (0.1619)	0.6952*** (0.1904)	-0.7506** (0.2837)	-0.2086*** (0.0382)	-0.1922*** (0.0487)	-0.1422** (0.0659)
Spatial Effect of Advanced Human Capital	-0.0658** (0.0297)	0.0785** (0.0322)	-0.1696*** (0.0509)	-0.4810*** (0.1240)	-0.1513 (0.1273)	-0.2338 (0.1957)
Spatial Effect of Technology Catch-up	0.0483*** (0.0080)	0.0492*** (0.0088)	0.1105*** (0.0121)	0.1479** (0.0564)	0.2158*** (0.0528)	0.2922*** (0.0744)
Sample Size	840	840	840	840	840	840
R^2	0.311	0.366	0.470	0.164	0.294	0.367

****, **, * Represent significant at the statistical level of 1%, 5%, and 10%, respectively. This table only reports the estimated results of the core explanatory variables, and the complete results can be obtained from the author.*

labor quality factor (ha_LIHK) included in the income index had a more substantial impact on local economic growth. The estimated value of the spatial effect of advanced human capital is negative, and it is only significant under the human capital index measured by education level. The estimated value of the spatial impact of technological catch-up is positive at the 1% significance level, indicating that although the flow of technology and personnel and other factor resources have produced spatial spillover effects, the spillover effects of high-level human capital are mainly realized as technological imitation and catch-up. Since the estimation results of the SDM model cannot fully reflect the relationship between the explained variables and the explanatory variables, according to the research of Lesage and Pace (LeSage & Pace, 2009) , the use of partial differential methods could better deal with the error of spatial spillover effect estimation. The partial differentiation method decomposed the Spatial Dubin Model (SDM) total spatial spillover effects into direct and indirect effects. The total effect was the sum of the immediate impact and the indirect effect.

Table 3 reports the estimated results of the local direct effects, the indirect impact of neighbors, and the total effects of higher education and human capital quality under the economic distance matrix. Different levels of human capital have other spatial mechanisms for economic growth. Among them, essential human capital directly affects local economic growth through the production of final products, but it will inhibit the economic growth of neighboring provinces. The local effect coefficient of high-level human capital, characterized by higher education and urban labor income index, which promotes economic growth through technological innovation, is significantly positive, confirming the mechanism of high-level human capital indirectly promoting regional economic growth through technological innovation. And for every year of higher education years, the growth effect brought by technological innovation in the region will increase by 0.15%. The level of high-level human capital, including quality factors, will increase by one unit. The economic growth brought by technological innovation in the region will increase by 0.55%. It shows that compared with the quantity of education, quality factors can promote economic growth in the region. The spillover effect of advanced human capital through technological innovation in promoting the growth of neighboring areas was not significant or significantly negative, which may be due to the "Matthew effect" existing in the advanced human capital level of different provinces, which makes it impossible to form the spillover effect of technological innovation. The spatial spillover effect of advanced human capital was mainly manifested in improving the economic growth level of neighboring regions through the promotion of technological imitation and catch-up. The impact of technological catch-up to promote the growth of neighboring areas was 0.11%-0.29%. Therefore, to realize the leapfrog transformation of the spatial spillover effect of higher education from technological imitation and absorption to high-end technological innovation, it is also necessary to rely on higher levels of education and human capital. Improving the quality of education is the key to promoting the coordinated development of higher education and the regional economy.

Table 3. Decomposition of the Spatial Effect of Higher Education and Human Capital Quality in Promoting Regional Economic Growth.

Variable	Local Effect		Neighborhood Effect		Overall Effect	
	Education Level	LIHK	Education Level	LIHK	Education Level	LIHK
Capital Stock	0.3355*** (0.0115)	0.3033*** (0.0123)	0.0716** (0.0358)	0.1299*** (0.0388)	0.4070*** (0.0365)	0.4332*** (0.0403)
Number of Labor	-0.6850*** (0.0269)	-0.8687*** (0.0358)	0.2061* (0.1179)	0.4841*** (0.1162)	-0.4790*** (0.1133)	-0.3846*** (0.1153)
Basic Human Capital	0.5351*** (0.0925)	0.0456** (0.0186)	-0.7291** (0.3054)	-0.1265** (0.0611)	-0.1940 (0.2830)	-0.0809 (0.0630)
Advanced Human Capital	0.1499*** (0.0152)	0.5493*** (0.0578)	-0.1715** (0.0528)	-0.2953 (0.1848)	-0.0216 (0.0487)	0.2540 (0.1878)
Technology Catch-up	-0.0416*** (0.0050)	-0.2212*** (0.0295)	0.1058*** (0.0129)	0.2934*** (0.0752)	0.0642*** (0.0115)	0.0722 (0.0674)
Foreign Trade Degree of Dependence	0.0436** (0.0144)	-0.0028 (0.0159)	0.0455 (0.0386)	-0.0781* (0.0449)	0.0891** (0.0382)	-0.0808* (0.0477)
Industrial Structure	-0.3621*** (0.0639)	-0.3022*** (0.0623)	-0.0902 (0.2330)	0.0419 (0.2219)	-0.4523* (0.2402)	-0.2604 (0.2352)
Government Support	-0.4233*** (0.0623)	-0.3146*** (0.0692)	-0.3324* (0.1833)	0.3758** (0.1828)	-0.7558*** (0.1774)	0.0612 (0.1710)

****, **, * Represent significant at the statistical level of 1%, 5%, and 10%, respectively.*

Table 4. Estimation of the Spatial Effect of Higher Education by Dividing Economic Zones.

	Bohai Sea Economic Belt and Northeast China		Yangtze River Triangle Economic Belt		Pearl River Delta Economic Belt	
	Local	Neighborhood	Local	Neighborhood	Local	Neighborhood
Capital Stock	0.4932*** (0.0212)	-0.1160* (0.0687)	0.1341*** (0.0190)	-0.0904** (0.0416)	0.2900*** (0.0261)	-0.0411 (0.0845)
Number of Labor	0.0311 (0.0800)	-0.2317 (0.2230)	-0.1039*** (0.0063)	0.0439** (0.0181)	-0.0426*** (0.0050)	-0.0841*** (0.0240)
Basic Human Capital	0.1777*** (0.0211)	0.1016* (0.0537)	-0.0480* (0.0248)	0.2370*** (0.0574)	0.0499** (0.0242)	-0.1249*** (0.0369)
Advanced Human Capital	0.1624*** (0.0290)	-0.1099 (0.0753)	-0.0239 (0.0358)	0.1607** (0.0591)	0.1853*** (0.0553)	-0.1323 (0.0850)
Technology Catch-up	-0.0674*** (0.0075)	0.1659*** (0.0292)	0.0471** (0.0201)	0.0575 (0.0369)	0.0161 (0.0255)	0.1584** (0.0575)
Sample Size	252		112		168	
R^2	0.883		0.362		0.658	

**This table only reports the spatial direct and indirect effects of using W3 matrix and education human capital to estimate core explanatory variables. The complete results can be obtained from the author. In terms of regional division, this article draws on the division method of Tongbin Zhang (2016). Among them, the Bohai Sea Economic Belt and Northeast China include 9 provinces (cities, autonomous regions), including Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, and Shandong; the Yangtze River triangle economic belt includes 4 provinces (cities) of Shanghai, Jiangsu, Zhejiang, and Anhui; the Pearl River Delta economic belt includes 6 provinces of Fujian, Jiangxi, Hunan, Guangdong, Guangxi, and Hainan.*

Further Discussion on the Spatial Spillover Effect of Higher Education

About 70% of the world's entire economy is from the economic output of more than 40 major urban agglomerations globally. In recent years, China's three major urban agglomerations, the Yangtze River Delta, the Pearl River Delta, and Beijing-Tianjin-Hebei have become the three growth poles of China's economic development and have produced more than 40% of GDP. We refer to the classification standard of Zhang et al. (Zhang, 2016) to further estimate the sub-samples of the Northeast, Yangtze River Delta, and Pearl River Delta Economic Belts in the Bohai Rim Economic Zone, observe the spatial effects of higher education within the region and make regional comparisons (**Table 4**). In terms of regional differences, the Yangtze River Delta has the highest per capita GDP during the sample period. The Bohai Rim Economic Belt has a higher per capita GDP than the Pearl River Delta. The technological innovation spillover effect of advanced human capital represented by higher education is significantly positive in the Yangtze River Delta region, indicating that the "agglomeration effect" of the economic belt has brought new momentum to regional economic growth. The neighborhood effect is not significant in the northeastern Bohai Rim region and the Pearl River Delta region. The neighborhood effect of higher education in the northeastern Bohai Rim and the Pearl River Delta is mainly manifested in technology catch-up and imitation. Complying with the "Guangdong-Hong Kong-Macao Greater Bay Area" policy, along with the flow of talents and technologies, higher education has enhanced the ability to absorb and imitate technology in the Pearl River Delta region, promoted the economic growth of neighboring areas, and strengthened the economic growth of higher education throughout the region.

Conclusions and Suggestions

Using panel data from China's provinces and municipalities from 1990 to 2017, combined with microdata, two human capital measurement data were constructed using the education stock and labor income index method. And learn from the improved Lucas and Nelson & Phelps models to clarify the mechanism of higher education and human capital quality from the spatial dimension. The results found: (i) Higher education indirectly promotes local economic growth through technological innovation, but the spatial spillover effect is mainly manifested in promoting economic growth in neighboring areas through technological catch-up and imitation. After considering quality factors, the local and neighboring growth effects of advanced human capital are both enhanced. (ii) Basic human capital directly acts on output to promote regional economic growth, but it will inhibit the economic growth of other neighboring provinces and cities. (iii) Higher education exhibits different effects in regions with different economic development levels, and it can, even more, exert a technological innovation spillover effect on economic growth in areas with high economic development levels.

Based on the above research conclusions, the policy implications are as follows:

Firstly, give full play to the spatial coordination mechanism of higher education that promotes local-neighborhood growth through technological innovation and technological imitation and enhances the contribution of higher education to regional economic growth. When formulating regional development policies, spatial factors should be included. Continuously improve the level and quality of human capital, amplify the agglomeration effect and scale effect, ensure the full use of human capital externalities, and constantly increase the contribution of higher education and human capital to regional economic growth.

Secondly, realize the complementary advantages of provincial education and human capital, and form a regional economic layout with high-quality development. It is necessary to strengthen further the positive spillover effect of human capital in promoting technology imitation and absorption in the region and at the same time enhance the technology assimilation and absorption capacity of neighboring areas. Creating an environment conducive to sharing knowledge within the region and stimulating imitation, absorption, and independent innovation in neighboring areas and the quality of economic development in the entire area are ultimately improved.

Thirdly, implement differentiated policies for regions with different development levels, and build an innovative system for the coordinated development of regional higher education and economy. The external environment for technological innovation and economic growth should be continuously optimized to enable the spillover of the talent innovation effect to break through the limitations of geographical proximity. Open up the path of high-level talent knowledge spillover, improve regional connectivity, realize the matching interaction between high-level innovative talents and the upgrading of regional industrial structure, and form a talent layout conducive to regional coordinated development.

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NEWSLETTER

How Family Environment Influences Pupils' Learning Performance?

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RECENTLY, a study published in *Journal of East China Normal University (Educational Sciences)* used the methods such as structural equation model and multiple linear regression to analyze the data collected from 770 pupils who engaged in "home-school co-education" in New Educational Experiment and setting 726 pupils as the control group. The results of the paired-sample analysis show that:

The indirect effect of family environment on pupils' learning performance through mediating variables such as the students' learning engagement and school environment was significant. School environment had a significantly positive effect on pupils' learning engagement and learning performance, and home-school interaction could also significantly improve students' learning performance.

The home collections of pupils who engaged in New Education Experiment schools were significantly higher than those in the Non-new Education Experiment schools.

The longer the schools participated in the "home-school co-education" of the New Educational Experiment, the better the students' reading performance and mathematics performance were.

Research recommendations:

- Create a family learning environment for parents and children to read, write and live together.
- Establish a scholarly campus and develop new courses that refer to the integrity of life.
- Strengthen students' learning engagement and develop learning habits through achieving a goal once a month.
- Optimize home-school cooperation and realize the ecological co-governance of education modernization.

Source: Journal of East China Normal University (Educational Sciences), 2021; 39(3):71-83.

NEWSLETTER

Is Media Multitask Bound to Negatively Affect Online Learning?

By Chen, J., Lin, H., & Liao, X.
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MEDIA multitasking is generally considered to be one of the main negative factors affecting online learning, and this negative impact could be relatively complicated. A study published in *Modern Educational* Technology conducted empirical research on instant message interference in students' mathematics video learning, and researchers compared the learning effects of 54 eighth-grade students under different interference conditions. The study adopted the incoordinate control group, setting one of the groups with insufficient media multitasking experience as the control group (LMM=14), and considering the other three groups with rich experience as the treatment group (HMM1=14, HMM2=14, HMM3=12). Using the One-way Repeated Measures Anova, with the interference amount of instant message as the independent variables and the post-test results of mathematics video learning, the main outcomes are concluded as follows:

- Within the limited learning period, even students with rich media multitasking experience the learning effects of them will be affected by the negative impacts of the frequency increasing of dealing with multitasks, which is the "frequency effect";
- For students with rich experience, the instant messaging interference does not affect the learning effect within certain limits, and the learning effects gradually decline when the limit went beyond.

This study proposes the following suggestions:

On the one hand, educators can optimize the media multitask through training students' ability, so as to reduce the interference of multitasking on online learning. On the other hand, it is more realistic to guide learners to control irrelevant multitasking in the process of online learning within a certain frequency range than to try to prevent teenagers from taking on media multitasking.

Source: Modern Educational Technology, 2021; 31(3):50-56.

NEWSLETTER

The Situation of "School's Out, But Class's On" under the Epidemic

By Wang J., Wei Y., & Zong M.
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CONFRONTED with the COVID-19 outbreak, online education has become the main way of teaching at all kinds of schools since the Ministry of Education of P. R. China proposed the "School's Out, But Class's On" policy. An empirical article published in *China Educational Technology* took 59,156 primary and secondary school teachers in Hubei Province (the worst-hit area of the epidemic), as research objects, analyzing their online teaching behaviors, teaching modes, and acceptability through questionnaire survey and interview.

The research findings are as follows:

In terms of teaching behavior and teaching mode: the smartphone has become the most commonly used teaching terminal for teachers. However, from the perspective of its functions, the function supporting the teaching process is slightly single, and the screen is too small, which will affect the effect of teachers' online teaching.

In terms of the use of teaching resources, teachers' own resources made the most, accounting for 51.79%; in addition, public education resources play an important role in this online teaching.

Considering the online teaching contents, teachers can carry out flexible teaching according to local conditions. On the basis of the spring schedule, 78.84% of the teachers began to teach basic cultural courses and carried out epidemic prevention education, life and safety education, and other themed education. They also guided students to operate home-based labor, physical exercise, and other activities, which combining education with talent cultivation.

As to the teaching mode and activities: live online classroom and centralized tutoring and Q&A are the teaching modes generally adopted by teachers; in addition, more than half of the teachers assigned and corrected homework (80.46%), answered questions online, and provided tutoring (76.32%) and sent digital learning resources (65.11%), which ensured the learning of students' cultural foundation courses. What's more, 62.66 percent

of teachers communicate with students' parents to encourage them to supervise the students' learning.

In terms of teachers' acceptability: teachers have a strong willingness to use online teaching. The perceived usefulness and willingness of rural teachers were significantly higher than those of urban teachers, and the acceptability of junior middle school teachers was the lowest.

There are some problems in online teaching: the network environment and hardware equipment still need to be improved; teachers lack the ability to design online teaching; teachers' information literacy is uneven, and they cannot accurately analyze the learning situation.

Therefore, the author considered that the hardware facilities and software resources should be improved to provide a good environment for online teaching; the teaching concept should be changed from "teaching for teaching" to "teaching by learning"; the way of teacher training and teaching research should be innovated to improve teachers' ability of online teaching design; data-driven, individualized instruction should be realized based on learning analysis technology.

Source: China Educational Technology, 2020; 2020 (5):15-21.

NEWSLETTER

How do Learning and Teaching Strategies Improve Students' Academic Performance?

By Tang, Y., Wang, C., & Hu, Y.
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A STUDY published in *Journal of East China Normal University (Educational Science)* analyzed the three questions, including which teaching strategies are more effective, which learning strategies are more effective, and whether the teaching strategies can improve learning strategies. Teaching strategies can be divided into individualized teaching strategies (ITS), participatory teaching strategies (PTS), and guided inquiry teaching strategies (GTS). Meanwhile, learning strategies are consisting of cognitive strategies (CS), metacognitive strategies (MS), and inquiry strategies (IS). Researchers used the Hierarchical Linear Regression Model and the Coarsened Exact Matching (CEM) to design the quasi-experimental and then adding variables of teaching strategies and learning strategies to compare the results through effect size calculation. The research results are as follows:

- The results of the hierarchical linear model show that the cognitive strategy has the most significant influence among the three learning strategies, which means it is necessary for students to master the methods of information processing, in this way can information be efficiently accessed in memory.
- Among the three teaching strategies, the guided inquiry strategy turned out to be the most significant. To be specific, when teachers guide students to discuss a certain problem, it is suggested that teachers could connect the teaching content with daily life, guiding students to think and put forward their own views, and encouraging students to solve problems in different ways, as a result, to effectively promote students' academic performance.
- The results prove teaching strategies can significantly promote various students' learning strategies. But there was a significant difference between elementary and middle school. Cognition and inquiry strategies were significantly affected by teachers' teaching strategies in elementary school, while metacognitive strategies were significantly affected by teachers' teaching strategies in junior middle school.

In summary, researchers suggest that parents and teachers should have a deep understanding of the impact of learning strategies and teaching strategies on elementary and middle school students' learning, focusing on improving students' academic performance through more effective strategy guidance. At the same time, it is necessary to follow the tendency of international education evaluation and drive the reform of basic education examination assignment in China more innovative and cooperative.

Source: Journal of East China Normal University (Educational Science), 2020; 38(3):93-105.

NEWSLETTER

Effects of Parental Academic Involvement and Academic Pressure on Early Adolescents' Academic Engagement

By Zhang, Y., Chen, J., Yang, M., Ren, P., & Liu, S.
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HOW can parents actively involved in children's academic engagement while avoiding negative influences, for the purpose of students' better adjustment to the requirements of junior high school and forming a benign development? A study published in *Psychological Development and Education*, with 2,487 first-year junior students as research objects, respectively analyzed the effects of parental academic involvement and academic pressure on early academic engagement of adolescents, which provides certain assistance for improving the academic engagement level of adolescents from the perspective of family.

The results are as follow:

- Parents' influences on children's academic development generate from cultivating children's learning motivation. Parental academic involvement can help the adolescents stimulate internal motivation, so as to put more effort into learning. Under this circumstance, students are involved, interested, and aiming for self-improvement.
- Parental academic pressure leads to adolescents' academic burnout and even disengaging from the learning situation. In order to make the adolescents more focused on learning, parents could actively participate in their children's study, providing their children with learning tools and emotional support, and also paying attention to avoid putting pressure on their children.
- When parents participate in the education of their children, especially for those with good grades, it is suggested that they reduce compulsory or negative behavioral intervention to release students' burden. As for students with poor grades, parents' help and support should concentrate on personally practice on children's education process, in this way can they help their children cultivate suitable achievement goal orientation, enhancing intrinsic motivation, and promoting academic engagement.

Source: Psychological Development and Education, 2021; 37(2):211-221.

NEWSLETTER

The Effects of Teacher Professional Development on Student Achievement

By Wei, Y.
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MOST of the previous empirical studies on teacher professional development mainly focused on the impacts of professional development activities on teachers themselves, while fewer analyzed the impacts on students. Based on the standardized test scores of more than 40,000 high school students in Beijing from 2016 to 2019 and the questionnaire survey data collected from about 2,000 teachers, researchers used a value-added model to examine the value-added effects of teachers on students' academic achievement, and further analyzed the effects of teachers' participation in district-level and school-based teaching research activities on students' academic achievement. The results of the study are as follows:

- The degree of participation in regular teaching and researching activities district-level on average, feathered teaching and researching activities, and activities related to effective professional development elements have a significant positive relationship with the value-added of students' achievement.
- Generally speaking, the average degree of participation in school-based teaching and researching activities, formal and informal exchanges among teachers, and the value-added of students' performance have a significant positive relationship.

This research also has certain limitations. In order to accurately evaluate the impact of teachers' professional development activities on students' academic performance, and revealing the mechanism and influence path of which, hence further study should focus on specific teachers' professional development activities and relevant design considerations. In addition, students' achievement and teachers' effectiveness are affected by various factors, therefore, it is also important to combine quantitative and qualitative researches, collecting multi-dimensional teacher data, so as to more objectively evaluate the effects of teachers' participation in professional development activities on students' achievement.

Source: Education & Economy, 2021; 37(1):74-82+96.

NEWSLETTER

How Can Interdisciplinary Collaborative Learning be Effective?

By Ma, Z., Li, H., Wang, W., & Li, Y.
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IN order to explore the application effects of Computer Supported Collaborative Learning (CSCL) in STEM education, this study used the method of meta-analysis to quantitatively analyze 142 pieces of empirical research literature in relevant fields, so as to examine the effects of CSCL on different learning types, as well as the differences in the effects of STEM education supported by CSCL in the dimensions like discipline, learning stage, technology, and teaching strategy.

The results of the study are as follows:

The application of CSCL in STEM education can help improve students' learning effects, but there exist differences in the effect degree of various learning effects, in particular, the effects on cognitive learning are the most significant.

The effects of CSCL on STEM education on different disciplines are different. The impact on Science, Engineering, and Pedagogy is relatively large, while the impact on Health Education and Computer Education is relatively small. CSCL has an impact on the effects of STEM education in different learning stages, comparatively speaking, it has a greater impact on graduate and elementary stages.

Communication Technology, Dynamic Presentation Technology, and Sharing and Co-construction Technology have a more significant impact on the effects of STEM education, while the Multi-technical Combination may not significantly improve the effects of STEM education.

Teaching Strategy has moderately influenced the STEM education effects. Among all the strategies, case-based, game-based, knowledge-constructing and inquiry-based teaching methods are the more effective.

The researchers suggested that it is important to pay attention to using CSCL to achieve emotional goals, strengthening the design of emotional goals; adopting co-construction and sharing technology to support interdisciplinary collaborative learning, focusing on the application of co-construction and sharing technology in knowledge visualization representation and

knowledge tracking; integrating various teaching strategies to promote collaborative inquiry learning.

Source: Modern Distance Education Research, 2021; 33(1): 97-104.

NEWSLETTER

Can Investment in Vocational Education Increase the Income of the Rural Labor Force?

By Qi, Z., & Xie, J.
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PREVIOUS researches prove that vocational education is highly coupled with the development of the economy and society in rural areas. However, the rate of returns in vocational education on rural labor force with various income levels still requires further investigation. On the basis of data from China Family Panel Studies (CFPS) 2018, recently a study published in *Educational Research* explored the validity of vocational education in promoting the increase of different income level of the rural labor force, through the counterfactual estimation based on Propensity Score Matching (PSM) and the expanded Mincer Equation.

The results are as follows:

- To some extent, vocational education indeed played the role of promoting the increment of the rural labor force, which shows a significant effect on the economic benefits of rural labor.
- Secondary vocational education has effectively promoted the increase of rural labor income, but the marginal rate of returns of relative income has gradually reduced.
- Regarding higher education, the positive effects of investments in higher vocational education are generally lower than those of undergraduate education.
- The rural labor force cultivated by vocational education is more in line with the demand of the employment market.

This study showed that vocational education can promote the increase of the rural labor force, but the potential of income increase needs to be further improved. This requires thinking outside the box, other than trapped in the economic model of whether the rural labor income increase and investment vocational education are cost-effective, but to consider the two-way coupling between the benign interaction and symbiotic development from the perspective of symbiosis. To be specific, suggestions have been put up as follows: broaden the appeal for rural educators on vocational education; consolidate the foundational status of secondary vocational education; reasonably

arrange higher vocational education; give full play to the advantages of effective linking vocational education with the labor market.

Source: Educational Research, 2021; 42(2):97-111.

NEWSLETTER

Can Augmented Reality Improve Learning?

By Nie, Y., & Wan, W.
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ON the basis of 40 effective experimental and quasi-experimental studies from home and abroad, the article recently published in *Modern Educational Technology* explored the issue of whether augmented reality technology can improve learning effectiveness through the usage of Review Manager.

The main research results are as follows:

This study provides strong evidence for the education and teaching effects of AR technology and confirms that AR technology does have a moderate (d = 0.57) effect on student's learning effects. The AR technology has a moderate influence on student's cognitive ability and non-cognitive ability.

- AR technology has a moderate influence on the learning effectiveness of different learning stages, with the most significant effects on the preschool stage, followed by a primary school, and the least effects on the college stage.
- Combined with different teaching methods, AR technology can always greatly improve the practical learning effects, but moderating effects vary in different interventions.
- The effect size of AR application in different scenarios ranging from high to low in turns is: off-campus venues (d = 0.73), classroom (d = 0.63), and campus laboratory (d = 0.48). Moreover, there exist differences in the moderating effects on learning effectiveness under different scenarios.

Based on the findings above, this study also provides some practical recommendations, such as improving the role of technology on learning effectiveness, flexibly choosing the situation according to the teaching contents, and carefully selecting the original teaching methods in the application of AR technology.

Source: Modern Educational Technology, 2021; 31(2):40-47.

NEWSLETTER

Healthy Context Paradox of Being Bullied and Externalizing Problems among Adolescents

By Liu, X., Pan, B., Chen, L., Li, T., Ji, L., & Zhang, W.
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HEALTHY Context Paradox mainly refers to the situation where the bullied adolescents tend to show more psychological problems, such as depression and anxiety, while the surroundings are relatively low in bullying level. A study published in *Acta Psychologica Sinica* further conducted in-depth research exploring this counterintuitive psychological phenomenon, analyzing the relationship between being bullied and externalizing problems. Specifically, students' externalizing problems represent explicit misbehaviors.

In terms of model construction, researchers set the average level of being bullied within a class as moderating variables and taking hostile attribution bias as mediating variables. The results are as follows:

- Between the level of individual being bullied and externalizing problems, the former can significantly positively predict externalizing problems, while the level in the class did not predict externalizing problems directly, which adjusted the correlations, the lower the level, the higher the frequency of individual externalizing problems, as a result, presenting the "Healthy Context Paradox" phenomenon.
- After the inclusion of mediating variables, the average level of bullying in the class significantly negatively predicted the relationship between the experience of being bullied and the hostile attribution bias. As for the class with a higher average level of bullying, the relationship between the experience of being bullied and the hostile attribution bias was relatively weak.

These results suggest that hostile attribution bias plays a mediating role in the Healthy Context Paradox. Although the classroom environment is relatively positive, the students tend to become more "incompatible" as long as they are bullied, and then their hostile attribution bias will increase, and more externalization problems will occur.

The researchers suggest that after a bullying incident, teachers should help the victim by forming the proper attributional pattern. In addition, in the

daily teaching work, teachers can design games and activities aimed at promoting positive interaction between classmates to help students build good peer beliefs and reduce the hostile attribution bias of bullied individuals.

Source: Acta Psychologica Sinica, 2021; 53(2):170-181.

NEWSLETTER

The Impact of Boarding on the Children's Health in Rural China

By Jiang, N., & Xu, J.
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THIS article is based on the data from the China Health and Nutrition Survey in the year 2009, 2011, and 2015, which covers a total of 12 provinces in the east-central-west regions of China, using the Propensity Score Matching Method (PSM), and adopted the Rosenbaum boundary estimation and instrumental variable methods for robustness testing to confirm the credibility of the research conclusions. The research results are as follows:

- Indicators and method introduction: Using the anthropometric parameters (height, weight, etc.) to measure children's health status, and use HAZ score (height for age Z-score) to evaluate children's long-term nutritional health status, BAZ score (BMI for age Z-score) to reflect children's recent or short-term nutritional health status. From the descriptive statistics of the data, it is known that there are certain characteristics differences between boarding students and non-boarding students. The propensity score matching method (PSM) needs to be used to control the differences in characteristics besides children's health status, and it is necessary to further adopt the robustness test of Rosenbaum boundary estimation and instrumental variable method to confirm the reliability of the research conclusions.
- Analysis of the results: boarding at school has a certain negative impact on children's health, and rural children from central west regions, especially the western areas were strongly affected, while the situation of that in the eastern region is not significant; The negative impact of school boarding on the health of rural boarding students mainly occurs at the elementary school level.
- Countermeasures and Suggestions: First, it is necessary to contribute to the reinforcement of financial support for rural boarding schools in the central west regions, especially in the western regions. Meanwhile, the special fund for the nutrition improvement plan for boarding schools requires strict management. Second, great importance should be attached to children's health

problems caused by low-age boarding. It is strongly recommended to provide nutrition and health courses and strengthening home-school interaction to help low-age boarding children develop healthy eating habits; Third, refine the rural boarding schools' management, carry out some nutrition knowledge training, concentrate on meal collocation, ensure the diversified food and balanced nutrition structure, and improve the food taste, so as to provide a good learning and living condition for rural boarding children.

Source: Education & Economy, 2020; 36(4):21-29.

NEWSLETTER

Impact of STEM Education on Students' Academic Achievement

By Zeng, Z., & Yao, J.
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A RECENT study published in *Journal of East China Normal University (Educational Sciences)*, analyzing the impact of STEM education on students' academic achievement as an example of how to use meta-analysis to synthesize existing empirical research.

Results show that:

The study provides firm evidence of the effects for STEM education, which proves that STEM education is conducive to students' academic achievements (d = 0.410), and factors like educational methods, students' educational stage, location, and sample all have notable affection on the effects.

In terms of the methods, this study explores how to obtain reliable evidence through a literature review to support educational reform, and demonstrates that "meta-analysis" can be more effective, objective, and normative than traditional subjective literature review methods, as a result of "meta-analysis", which enjoys many advantages like sorting out general and regular conclusions from the Literature review.

Regardless of the type of research, the evidence obtained through the scientific analysis and comprehensive induction of the existing research literature conducted by the meta-analysis method is undoubtedly more general and instructive, and more in line with the requirements of "best evidence". Stronger evidence effectiveness, which helps relevant research based on a more solid foundation. To this end, the author makes the following comments and suggestions:

Vigorously strengthen and promote domestic educational experimental research. Only by carrying out strictly designed experimental research can people get general conclusions through meta-analysis and other techniques on the basis of more empirical research.

Advocate for the "evidence" awareness of literature review research. Many current types of education research have problems such as incomplete reviews, inaccurate processes, and unreliable conclusions. A subjective literature review focusing mainly on academic inquiry and opinion expression, it

is difficult to provide direct, effective, and robust "best evidence" for practical work. From this perspective, the meta-analysis method may provide an effective path for enriching the educational literature review and research, and better serving educational practice exploration.

Source: Journal of East China Normal University (Educational Sciences), 2020; 38(6):70-85.

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Note to Contributors

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