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TABLE OF CONTENTS

BECE, Vol. 12, No. 2, November 2022

Commentary

Review

Article

Newsletter

COMMENTARY

Evidenced-based Educational Reform Supported by Education Quality Monitoring: China's Exploration and Experience

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> *"Every child should have the opportunity to receive a quality education."*
>
> *–Bill Frist*

IN China's educational community, there is a consensus that any decision-making or advance in reform must be based on scientific evidence. It has been realized that the traditional instruction modalities that draw on educators' personal experience have become ineffective in accomplishing better education in the new era. In this context, China's educational administrators have been committed to constructing an evidence-based system to enable reform in education.

In the *Construction and Application of Regional Education Quality Monitoring Databases: A Case Study of Suzhou's Education Quality Monitoring* in this issue of the journal (Shen & Luo, 2022), Suzhou's education quality monitoring (EQM) research team presents their city's experiences in developing EQM databases. Suzhou, a city with a high level of socio-economic development, has made successful experiments in evidence-based educational reform. It has created a citywide EQM system, which can provide comprehensive evaluation of student academic performance as well as useful information about school operation, teachers' instruction behavior, students' learning behavior, and home education, etc. As a result, ample data are available for systematic analyses of teaching and learning processes and

outcomes. Technically, Suzhou's EQM system has incorporated big data analytics and AI assessment technologies; it also enables longitudinal research on student long-term development. Such educational database design is original and cutting-edge in China.

The significance of Suzhou's exploration in EQM database construction is remarkable. First, there are big gaps in social development level among regions in China. Attitudes towards evidence-based educational reform vary in different areas. It necessitates pioneers and successful stories from relatively developed regions which can serve as role models for less developed ones by sharing valuable experience. Suzhou proves to be a good example in this regard. Second, Suzhou's practice provides a useful reference for global evidence-based educational reform. Its EQM database architecture is top-notch in operational procedure and technological application, and has many advantages in supporting educational decision-making and practice. Although each country has its own national circumstances and educational conditions, we believe that Suzhou's technical innovation in EQM can go beyond regional and national boundaries and has the potential of universal application. Third, Suzhou's evidence-based educational reform focuses on issues of Chinese features. Chinese society tends to overemphasize student academic achievements. This has caused a series of problems, but also offers a chance to achieve the breakthrough in educational reform. For its regional EQM, Suzhou has established a complete feature database system focused on student academic performance, which is a reasonable and effective strategy under China's circumstances. This pathway can not only assist in responding to the most pronounced and critical issues, but also ignite a larger scale of educational reform and make it a successful change.

As the evidence-based educational reform is still in its infancy in China, the exploration in this area, including Suzhou's, is undergoing progressive improvement. Despite the remarkable achievements that have been made in Suzhou's EQM, there is still room for improvement in obtaining more reliable and robust evidence. We believe that over time, with the continuous efforts of researchers and practitioners, China's, including Suzhou's, educational reform based on empirical evidence will surely generate more salient results and provide valuable insights to its counterparts worldwide.

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Shen, J. & Luo, Q. (2022). The construction and application of regional education quality monitoring databases: A case study of Suzhou's education quality monitoring. *Best Evidence in Chinese Education*, 2022; 12(2):1613-1628. DOI: https://doi.org/10.15354/bece.22.re031

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***Conflict of Interests:** None.*

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REVIEW

The Construction and Application of Regional Education Quality Monitoring Databases: A Case Study of Suzhou's Education Quality Monitoring

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***Abstract**: The development of school education depends on the quality of the education provided, and it is a key metric for assessing the effectiveness of schools in developing talent. Building specialized, intelligent education quality monitoring (EQM) databases is crucial for speeding EQM progress in the big data era. This article examines the development of regional EQM databases in the areas of operational procedure and logical structure based on the idea of data lakes by using the development of databases for the EQM data analysis system (DAS) in Suzhou City as a case study. The goal of this study is to assist in addressing the current issues with regional EQM data processing and ensuring EQM's successful implementation.*

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***Keywords**: Education Quality Monitoring, Data Analysis System, Data Lake, Database*

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Conflict of Interests*: None.*

Introduction

Education quality is crucial to the advancement of school education because it is an indicator of school performance, educational development, and talent training. Building a system to monitor the quality of compulsory education is an essential step in deepening the reform of educational evaluation in the new era and changing the unscientific orientation of educational evaluation. The State Council's Overall Plan for Deepening Educational Evaluation Reform in the New Era, released in October 2020, proposes the use of innovative evaluation tools as well as the application of artificial intelligence, big data, and other modern information technologies to develop a longitudinal evaluation system for the entire process of students' learning in all grades as well as a transversal system to comprehensively evaluate the results of moral, intellectual, physical, and social development (State Council, 2020).

A database is a warehouse that organizes, stores, and manages data in accordance with a data structure; it can connect and interact with data through tools such as data collection, organization, analysis, and visualization to provide evidence for scientific research and decision-making processes.

Education quality encompasses, among other things, the outcomes of school operation, teacher instruction, student learning, and family education. The education quality monitoring (EQM) database collects information about participating schools, teachers, students, and parents and stores and analyzes it using information technology, computer technology, and analytical data mining.

The domestic study on Compulsory Education Quality Monitoring (CEQM) focuses mostly on two topics. One is to examine its implementation measures and support mechanisms, such as the research and development of monitoring tools (Wang, 2016), the establishment and operation of monitoring institutions (Zhang, 2010), the application of monitoring results (Yang, 2019; Guo & Wang, 2016), and IT support for monitoring (Wang, 2016; Zhang et al., 2016). The second field of research focuses on EQM's implementing actors and the development of a monitoring system that includes EQM at the national, provincial, municipal, and district levels (Li & Chen, 2020; Xin & Zhao, 2020; Li et al., 2017; Zhou, 2016). These two interrelated topics are the primary focus of CEQM research. However, there is a paucity of research on how to leverage big data technology and appropriate theories to generate an EQM database and build a data analysis system (DAS) for EQM, which has impeded the development of education quality monitoring.

The purpose of this study is to examine the building of the regional EQM database using the construction of the EQM database in Suzhou as an example in order to address the difficulties in data analysis.

The Status Quo of EQM Development in Suzhou

Massive amounts of data are involved in EQM. Suzhou's CEQM 2021, for example, generated more than 67.15 million data records during the data collection stage, each of which is made up of data of various types and structures. It is necessary to retrieve relevant data from previous years for follow-up analysis during the data analysis stage. Every year, hundreds of millions of raw monitoring data points must be processed. With such a large amount of data and complex structures, the planning and construction of an EQM database is an urgent task that must be completed.

The "*Compulsory Education Academic Quality Monitoring Project*" was launched in Suzhou City, Jiangsu Province, in 2015, and the Suzhou Education Quality Monitoring Center (hereinafter referred to as the Suzhou EQM Center) has been tracking and monitoring junior secondary school students ever since. More than 1.3 million students had been tested by 2021, more than 180 million pieces of monitoring data been collected, and more than 14,000 monitoring reports been issued (Song & Luo, 2021). The Suzhou EQM Center strengthens the application of intelligent technology in monitoring practices in response to educational evaluation reform in the artificial intelligence era and builds a regional EQM database with Suzhou characteristics. It has also established a data analysis system and made incremental technological advances in standardized data governance, intelligent data analysis, and visualized data presentation.

Suzhou EQM Center created the DAS framework based on its own needs (**Figure 1**), which divides the data analysis procedure into six processes involving 12 functional modules.

The DAS provides data assistance for the data presentation step after the data gathering stage. Data import, data cleaning, quality analysis, project establishment, calculation analysis, and data push are the six steps that make up the data analysis process.

Based on the aforementioned structure, two additional structural layers - algorithm support and Data Lake - are added to the data analysis system to create a full analysis system design. To be exact, the data lake contains six databases, including raw data, virtual hierarchical data, user rights control, desensitized project data, algorithm rule resources, and result presentation data. The algorithm support layer also contains four algorithm libraries (**Figure 2**).

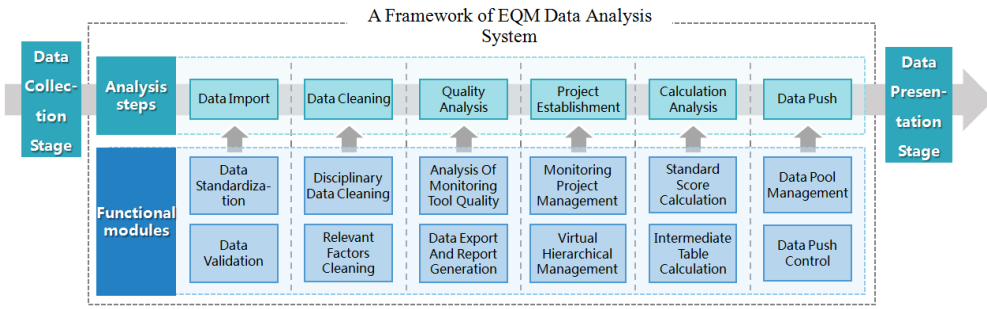

Figure 1. Procedure and Architecture of Data Analysis System for Suzhou EQM.

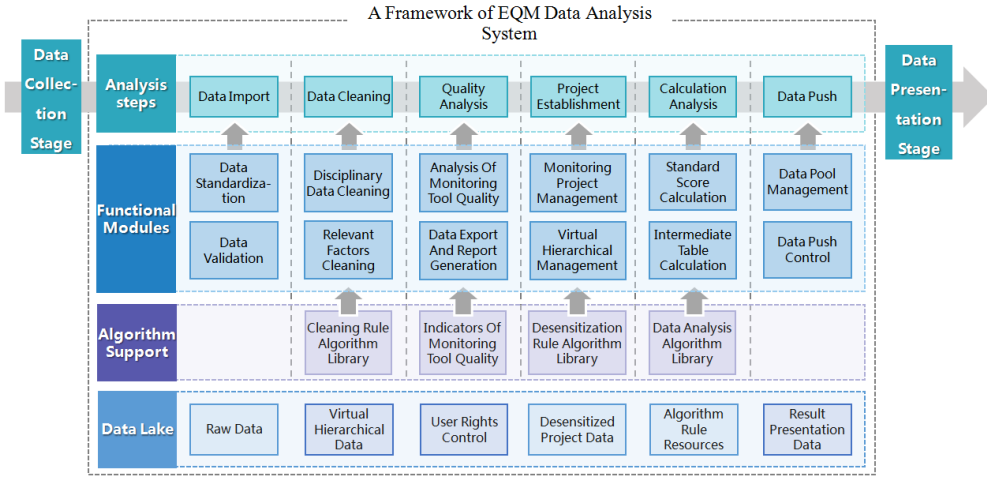

Figure 2. A Plan of Suzhou EQM Data Analysis Databases.

The Construction Paths of Regional EQM Databases

In the new era of big data and data science, having a centralized data architecture that is consistent with operational processes is critical. This is also true in EQM. Good database architecture should be able to grow with the monitoring scale and evolve with technological advancements.

Suzhou EQM Center creates databases for EQM data analysis based on the "data lake" concept. The data lake unifies the storage of all organizational data, including both the original data in the source system and the converted data (Campbell, 2017). It has become an important tool for organ-

izations wishing to make use of big data. Structured data (relational database data), semi-structured data (CSV, XML, JSON, etc.), unstructured data (emails, documents, PDFs), and binary data (images, audio, and video) are all stored in the data lake, forming a centralized data storage that holds all types of data. It aggregates and stores streams from various data sources, much like a large lake in nature, and outputs valuable data based on specific needs. In terms of monitoring data, the data lake contains not only data from various platforms, such as a question bank system, an examination service system, a scanning and marking system, and so on, but also a wide range of files, such as spreadsheets, scanned images, databases, and so on. It also saves process and result data from various data analysis processes. Its inclusiveness enables the cross-analysis of diverse data information and the use of large capacity and high-speed data pipelines, as well as the management of the entire data lifecycle to make data flow processes such as access, storage, processing, and application traceable (**Figure 3**).

The logical structure design that stresses the security, integrity, and efficiency of all databases is also a crucial issue since the database must be constructed to support the monitoring procedure, making the design based on data analysis procedures the most significant component. The location of various storage types can only be determined by a database architecture that takes into account the two factors mentioned above. This architecture can also guarantee that data is safeguarded, effectively stored, and accurately processed.

Database Design Based on Analytical Processes

Separation of Raw Data and Project Data

Importing different types of data from various platforms is frequently necessary for EQM data analysis. Examples include participant, school, and regional information from the examination system; monitoring tool information, dimensional information, scoring instructions, and other data from the question bank system; and original response records, scoring records, scanned images, and other data from the scanning and marking system. The raw databases for EQM are made up of all this data.

Different logical principles must be called upon and applied to the raw data in accordance with the demands of monitoring programs. In the Regional School Quality Analysis Project, data must be retrieved on a regional basis, and in the Private School Project, data must be based on the classification of private schools for children of migrant workers or non-migrant workers. As an example, it is necessary to include the monitoring

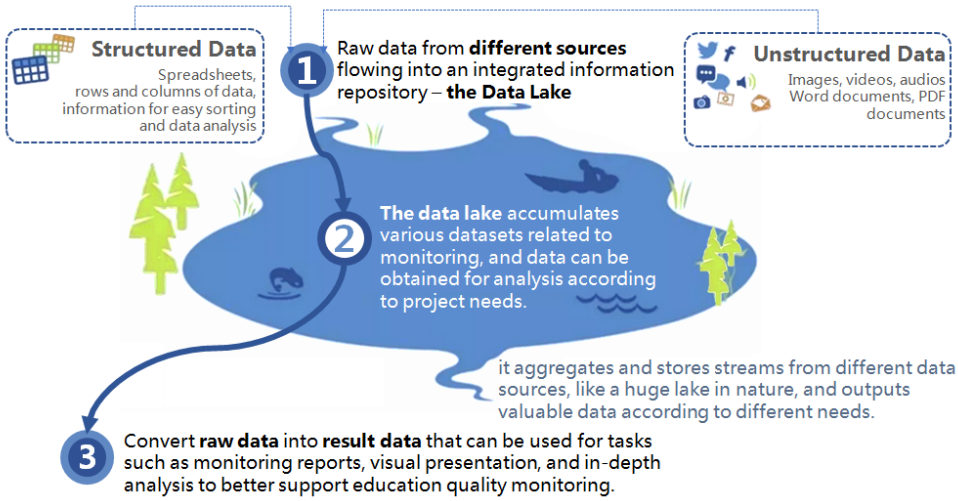

Figure 3. A Schematic Diagram of the Data Lake of Suzhou EQM Data Analysis System.

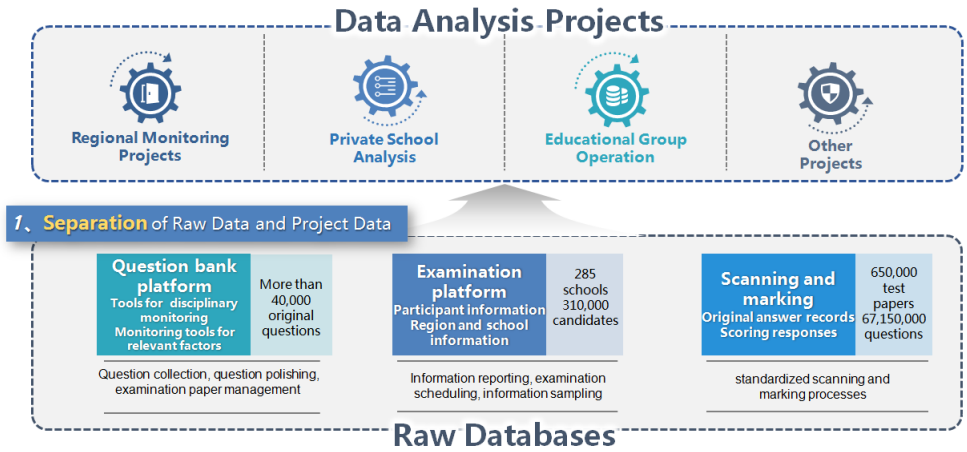

Figure 4. A Schematic Diagram of Raw Databases and Data Analysis Projects of Suzhou EQM 2021.

data of the same subject for consecutive years in the tracking analysis. Therefore, the raw database and the project database should be maintained separately in the data lake to meet the various calling logics of various data analysis projects (**Figure 4**).

Virtual Stratification in a Project-Based Database

The data is frequently converged and displayed by various school attributes in various data analysis initiatives. For instance, a three-level structure of "Suzhou city, district, and school" is necessary for calculation and report creation in the regional analysis project, whereas a three-level structure of "District, Group, and School" is necessary in the educational group project.

A distinct virtual stratification module is added to the system function module to construct a different database for each project based on the logic of virtual stratification to satisfy the needs of the project. According to the specifications of the data analysis project, a three-tier structure based on school attributes can be created, as illustrated in **Figure 5**, supporting a range of monitoring reports.

Database Design Based on Logical Structure

Hierarchical Management of Classified Databases

The database faces more internal security concerns because of its growing value and accessibility. For instance, unlawful overstepping operations and hostile infiltration result in the theft and disclosure of confidential information, but it is unable to adequately trace and audit the events that caused these events. Strengthening data security management is especially crucial for databases that contain a lot of personal data. Information leakage must be prevented at all costs, in addition to rapid improvements and effective vulnerability management. Database security protection techniques that are flexible and targeted are the most effective way to do this.

A crucial security measure for databases is database access control, and Suzhou EQM Center now mostly uses role-based access control (RBAC). Users and operation rights are intertwined with the idea of roles. To achieve hierarchical management, various roles are first developed in accordance with the organizational functions, each of which corresponds to a distinct level of operation privileges. RBAC must assign the user's account a role and associated rights in accordance with the information in the role rights database, in addition to verifying the user's identity and password when they log in to the system (**Figure 6**). The application system can be modified to meet the new access control requirements in the case of a functional shift in the organization by merely reassigning permissions to the roles.

Suzhou EQM Center has also implemented four different types of security protection measures for the database. In order to prevent operational paralysis in advance and ensure the ongoing availability of operational sys-

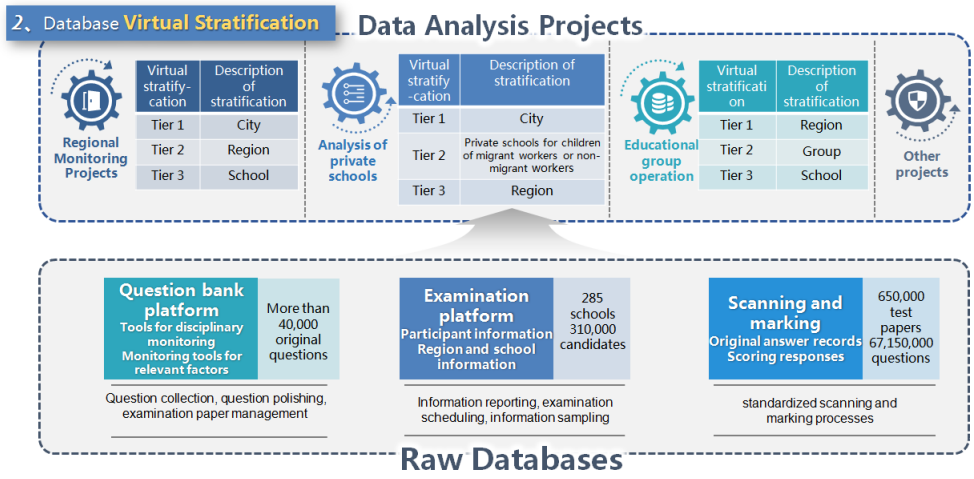

Figure 5. A Schematic Diagram of the Data Virtual Stratification Logic in Data Analysis Projects.

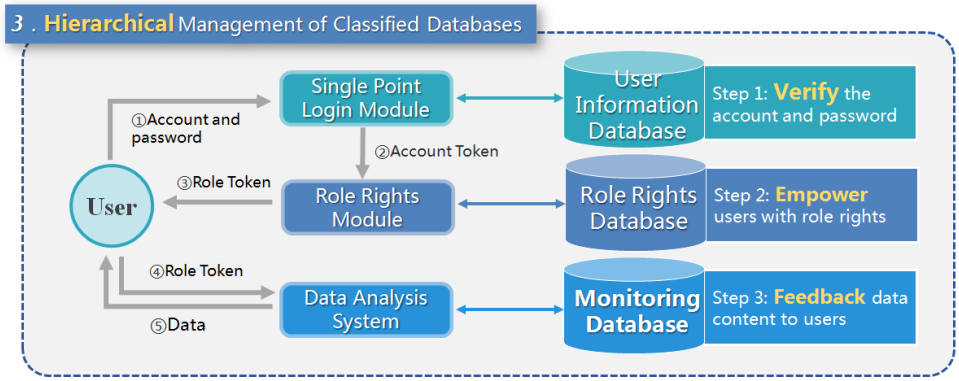

Figure 6. The Process of Account Authentication.

tems, it must be able to monitor the database operation state in real time and provide early warning when the condition is abnormal. The second is to be able to evaluate the database system's risk, including weak password detection, system vulnerability, configuration risk, etc., to identify user and system access behavior patterns to the data and produce access rules with various levels of strength. Thirdly, it must be able to keep track of data activities in real time, create data access models, assess access risks promptly, find and prevent unauthorized access, and encrypt sensitive data to improve data se-

curity protection. The fourth is to use audit logs to carry out thorough user access behavior monitoring. Finding the risk source at the outset and following the individual responsible for the risk become required actions to close the security gap once the security risk has materialized. Using the audit log query tool, this issue can be fixed.

Desensitization and Recovery of Sensitive Data

For the purpose of scheduling exams, information on the monitoring subjects, such as student, teacher, and other personnel personal identifying information, must be gathered during the EQM process. A desensitization and recovery module should be set up in the system to centrally desensitize, encode, and save sensitive information in basic data in order to guarantee data security.

It is also necessary to establish an administrator position for the desensitization module, whose primary responsibility is to grant permissions to data in the desensitization and restoration module, because data analysis is a collaborative task that requires the participation of numerous people. This functional module and any associated forms and fields are not accessible to other roles in the system.

The coding rules for the desensitization and recovery of each datum are mostly stored in the desensitization rule algorithm library in the Suzhou EQM databases. These guidelines are used to desensitize the sensitive database used for data collection in order to obtain code-version basic data. To create the analysis result database with real names, the calculation and analysis module recovers the code-version result database. In order to offer data support for later data presentation and report creation, the desensitized code-version result database and the recovered name-version result database are finally pushed to the data presentation link through a data interface (see **Figure 7**).

Establishment of an Algorithm Rule Repository

The term “algorithm rule repository” primarily refers to the storage of data analysis algorithms as a new type of data asset and the formulation of pertinent specification processes in accordance with the guidelines and specifications of data asset management.

By building unique algorithm repositories for each functional module, the data analysis system controls them. Data production, data processing, data analysis, data preservation, data access, and data reuse are the six nodes that make up the loop structure model that the UK Data Achieve (UKDA) uses to characterize the cycle of research data (UK Data Service, n. d.). Su

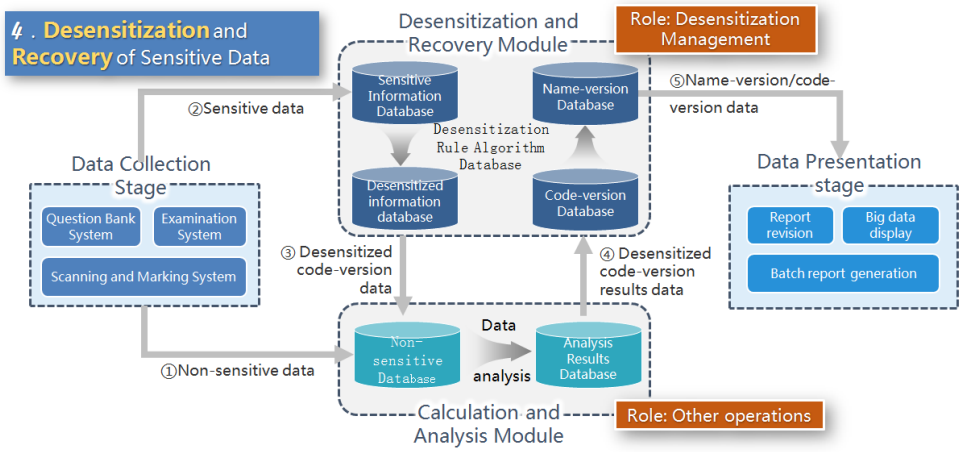

Figure 7. A Schematic Diagram of Data Flow in the Desensitization and Recovery Module.

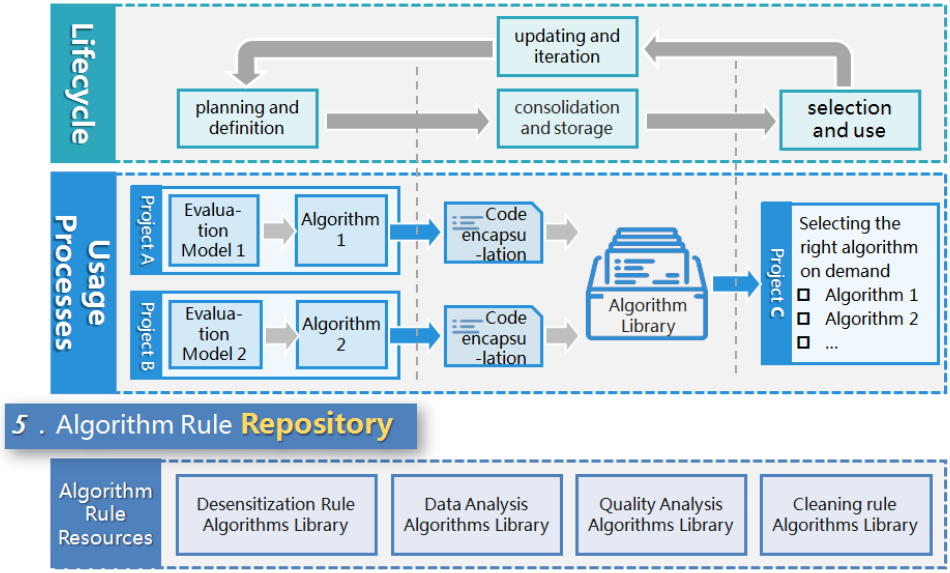

Figure 8. A Schematic Diagram of the Algorithm Repository Application Process and the Algorithm Asset Lifecycle.

zhou EQM Center splits the life cycle of data analysis algorithms into four stages based on this model: planning and definition, condensing and storing, choice and use, and updating and iteration (**Figure 8**). To meet the unique

and creative demands of data analysis for various monitoring projects, applicable analysis algorithms can be chosen from the algorithm library during the process of specific application for various monitoring projects. Additionally, new data analysis algorithms, various indicators, and charts can be customized in accordance with various analysis models.

The algorithm rule repository contains a cleaning rule algorithm library, a quality analysis index algorithm library, a desensitization rule library, and a data analysis algorithm library, which provide algorithm support for the four processes of data cleaning, quality analysis, data desensitization, and calculation of analysis, respectively. Each algorithm library has amassed a specific number of algorithms as a technological reserve and is regularly generating new algorithms as the EQM project advances. Taking the cleaning rule library as an example, to adapt to the needs of diverse projects, it has so far accumulated 106 cleaning methods for a variety of situations, such as missing tests, contradictory alternatives, contradictory logic between questions, invalid answers, etc. Also, using the data analysis algorithms library as an illustration, there are multiple algorithms for a single indicator of "percentile grade," as well as algorithms that encapsulate multidimensional characteristics of the educational ecology, such as the balance of education, ecological health, etc.

Practical Application of EQM Databases in Suzhou

Although it only makes up a small portion of Suzhou's overall EQM process, the development of databases is a key technology that underpins high-quality monitoring. Through these databases, the effective and reliable operation of each functional module of the Suzhou EQM data analysis system is ensured (**Figure 1**). This increases the effectiveness of the analysis and evaluation of monitoring data and satisfies the specific requirements of data analysis for the various Suzhou monitoring projects.

Using various quality analysis algorithms from the algorithm rule resource library, the monitoring tool quality analysis module in the data analysis system, for instance, provides quantitative indicators for analyzing test questions, improving tool quality, and improving teaching. It is based on classical measurement theory and structural equation modeling. As well as indicator algorithms used to verify the validity and reliability of each dimension of the pertinent factor instruments, there are algorithms for indicators of disciplinary tools, such as reliability, difficulty, differentiation, percentage of score bands, and ability value of score points. During the whole EQM 2021 process, this functional module offers more than 100 high-quality analysis reports for the monitoring tools at all grade levels and for all subjects,

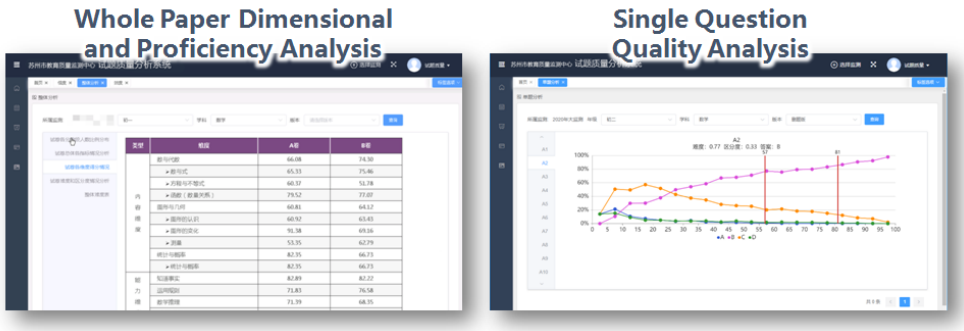

Figure 9. Screenshots of Some Functions of the Monitoring Tool Quality Analysis Module.

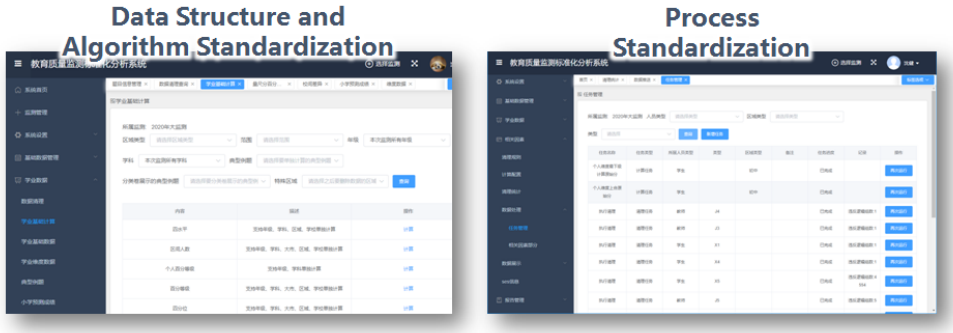

Figure 10. Screenshots of the Functions of Calculation and Analysis Related Modules.

providing a data foundation for the development and accumulation of monitoring tools (**Figure 9**).

In the "calculation and analysis" process, for instance, the virtual stratification database is utilized to ensure that the data required for each project can be reliably accessed in order to execute numerous projects simultaneously. Through the algorithms of various data analyses in the algorithm rule repository, a series of quality assurance measures, such as "double-track parallelism and double-blinded comparison; seamless docking and errorless flow; sampling verification and reverse verification," are realized in the analysis. Using these databases and functional modules, the data processing procedure has been standardized, the effectiveness of data analysis has been enhanced, and the precision of data calculation has been ensured. During the

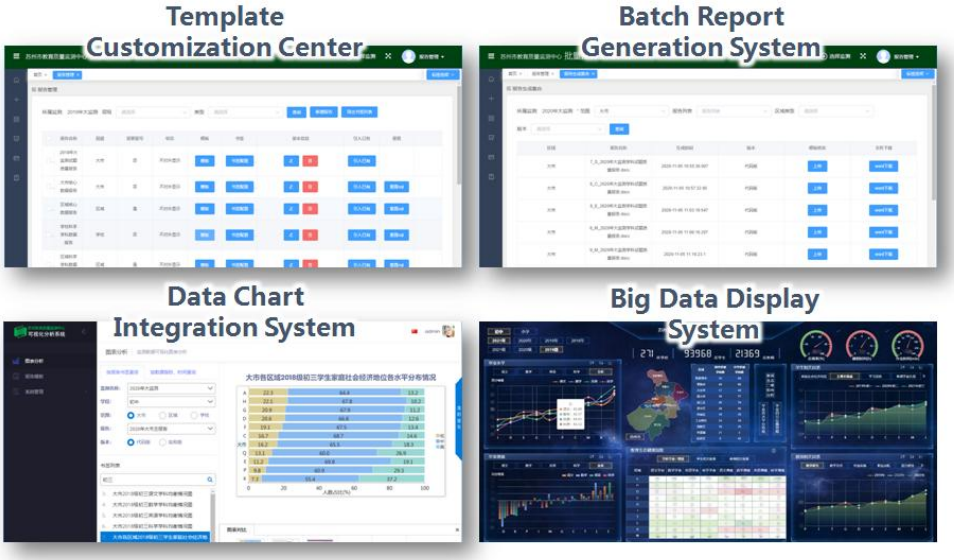

Figure 11. Screenshots of the Functions of Each System at the Data Presentation Stage.

data analysis in 2021, the Suzhou EQM Center completed the basic data processing in just two weeks with high efficiency and high quality and, on this basis, completed the projects of basic data of junior secondary schools, basic data of elementary schools, educational group research, and private school education quality, as well as a total of more than 3,600 reports of various monitoring results, which ensured the smooth implementation of Suzhou's education reform (**Figure 10**).

Not only does the database play a crucial role in the data analysis process, but it also ensures the secure and efficient flow of data inside each system throughout the whole EQM process. By setting data requirements during the data gathering phase, the "Data Standardization" module completes the integration of data from disparate systems. Moreover, the database supplies data sources for subsequent data presentation, which are handled by the "Data Push Control" module and delivered on demand to the batch report generating system, the data chart integration system, the big data display system, and other platforms (**Figure 11**).

Conclusion

The development of databases for the data analysis system is a lengthy process. With the extensive and in-depth promotion of EQM, we will be con-

fronted with new issues and challenges, necessitating ongoing innovation and the study of new technologies in our research. In the era of big data, we believe that the building and maintenance of databases demands not only a reorganization of data structure but also a modernization of big data mentality and data asset management procedures. Together with our contemporaries in the field of EQM, we anticipate seizing these new chances and conquering these new obstacles.

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ARTICLE

Growth Mindset Training and the Effect of Math-Gender Stereotype Threat on Girl Students

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Abstract: *To investigate whether growth mindset training can weaken the effect of math-gender stereotype threat on girl students, this study undertook experimental intervention in a group of grade-11 girl students and found that: (i) Mindsets can moderate the effect of math-gender stereotype threat. Girls with a growth mindset are less likely to be affected by math-gender stereotype threat compared with those with a fixed mindset. (ii) Growth mindset training for girls with a fixed mindset can effectively reduce the effect of math-gender stereotype threat on their math performance.*

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Raising Questions

There have been two contrasting attitudes towards the malleability of individual traits such as intelligence and personalities. One is named the "fixed mindset," which views personal traits as innate and unchangeable; the other is referred to as the "growth mindset," which believes that some basic personal qualities are in constant development, and that individual ability improves as the result of persistent efforts. Those who hold intellectual ability to be an unchangeable quality are more prone to apprehension about failure, mistake, and criticism, whilst those with the growth mindset tend to see failures as opportunities for learning and personal improvement and are more likely to carry on being positive and resilient in subsequent tasks.

The math-gender stereotype is a belief that women have weaker mathematical ability than men. Prior research discovered that individuals who are the targets of a devaluing group stereotype experience extra pressure which may depress their performance. Such an experience is referred to as the "stereotype threat." Will women with the growth mindset feel less anxiety when facing the math-gender stereotype, thus less susceptible to its threat, as they hold that individual competencies are consistently developing and malleable? Since women with the fixed mindset believe that individual abilities are innate and hard to change, are they more severely affected by math-gender stereotype threat? Will growth mindset training mitigate the effect of math-gender stereotype threat on girl students? These are the questions to be addressed in this article.

Study 1: How Do Mindsets Influence the Effect of Math-Gender Stereotype Threat on Girl Students?

Research Design

Subjects

This study selected 202 girl students from high achieving classes in three county-level senior secondary schools and investigated their mindsets and math ability.

Research Tools

- Growth Mindset Scale (GMS) developed by Dweck was employed as a measure, which comprised 20 items. The more highly the student scores, the stronger her disposition towards the growth mindset.
- The math test paper was prepared by a grade-11 math teacher. It was relatively difficult, containing 15 objective test items. The total score was 20 points, and students had 25 minutes to complete the test.

Procedure

The investigation on the mindsets of the 202 girls was carried out in their evening self-study session. They were divided into the stereotype threat group and the non-threat group. Each group consisted of 101 students. The stereotype threat group were asked to read a piece of writing first to activate their awareness of the math-gender stereotype before they started to work on the math test, whereas the control group took the test straightaway without the extra reading.

Research Results

The Analysis of the Effect of Math-Gender Stereotype Threat on Math Performance

The math test scores the two groups got showed that the performance of the girls in the stereotype threat condition is lower than that of girls in the control condition ($t = 2.46$, $p < 0.05$), indicating that the math-gender stereotype threat has a detrimental effect on girls' math performance.

The Moderating Effect of Student Mindsets

The study established an interactive regression model, in which the math test score was the dependent variable, and the stereotype condition (the stereotype threat condition was coded as 1; the control condition as 0) and the type of mindset were independent variables. According to the Bootstrap analysis results (n= 5000, the confidence coefficient = 95%), the overall effect of the regression model is significant ($R^2_{adj} = 0.097$, $F_{(3, 190)} = 6.799$, $p = 0.0002$). The stereotype threat group scored lower than the control group; the math-gender stereotype imposed a depressing effect on math test scores of girl students ($t = -2.2584$, $p < 0.05$; confidence intervals do not contain 0). The growth mindset could positively predict math performance ($t = 2.2817$, $p < 0.01$; confidence intervals do not contain 0); girls with stronger disposition towards the growth mindset got higher math test scores. The coefficient of the product of the stereotype threat condition and the mindset is significant ($t = 2.3488$, $p < 0.05$; confidence intervals do not contain 0), indicating that the mindset had a moderating effect on the impact of the stereotype threat condition on the math test scores.

Study 2: The Dampening Effect of Growth Mindset Training on the Math-Gender Stereotype Threat

Research Design

Subjects

This study recruited 671 grade-11 girl students of the science track from two county-level key high schools who would be measured by the Growth Mindset Scale and

ranked by the scores they got. A total of 181 girls who scored below the 27th percentiles were selected to participate in the experiment as students with the fixed mindset.

Research Tools

The Growth Mindset Scale, the math test paper, and growth mindset training module PPT were used in the experiment.

Procedure

The 181 participants were randomly divided into the mindset training group and the non-training group. Each of the two groups was then subdivided into the stereotype threat group and non-threat group, and thereby four subgroups were established: the mindset training* stereotype threat group of 46 students; the mindset training* non-threat group of 45; non-training* stereotype threat group of 45; non-training* non-threat group of 45. After the test, the numbers of questionnaires retrieved from the four groups were 44, 43, 43, and 42, respectively.

In an evening self-study session, growth mindset training was administered to the mindset training group, while the non-training group performed self-study as usual. When the training finished, the stereotype threat group were requested to read a piece of writing to activate their awareness of math-gender stereotype (as in Study 1). After that, all students were given 25 minutes to complete the math test.

Research Results

To examine the differences in math test scores among the four groups, a 2 × 2 ANOVA was undertaken, using the math test score as dependent variable, and the mindset training condition and the stereotype threat condition as independent variables. The results showed that the overall effect of growth mindset training was significant ($F_{(1.168)}$ = 41.747, p = 0.000), and that the interaction between the mindset training and the stereotype threat conditions was also significant ($F_{(1.168)}$ = 4.075, p = 0.045). The results of simple effects test demonstrated that the difference between the math test scores under the stereotype threat condition and those under the non-threat condition was insignificant (p = 0.725) among girls having received growth mindset training, but significant (p = 0.014) among girls without growth mindset training. The results of the experiment revealed that growth mindset training could effectively weaken the effect of the math-gender stereotype threat on girl students and considerably improve their math performance.

Discussions

The Impact of Mindsets on the Effect of the Math-Gender Stereotype Threat

The math-gender stereotype cannot considerably and adversely affect girl students with a growth mindset, even when they are in the situation where the math-gender stereotype is activated. Nevertheless, it can impose a significant threatening effect on girls with a fixed mindset especially when they are made sensitive to the stereotype; because they believe that individual competences are inborn, thus unallowable.

The Role of Growth Mindset Training in Mitigating the Detrimental Effect of the Math-Gender Stereotype Threat

Deliberate, pertinent training can effectively develop students' growth mindset. The math performance of girls who have received growth mindset training is unexceptionally, significantly better than that of those without such experience, which confirms that growth mindset training is not only effective in reducing the negative effect of the math-gender stereotype threat but can also improve math achievement of every girl. Particularly for girls with a fixed mindset, growth mindset training has a significant dampening effect on the math-gender stereotype threat and is extremely beneficial for their math performance progress.

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ARTICLE

Universities and Innovation Potential of the City: A Quasi-Experimental Study of Newly Built Campuses of Colleges and Universities in China

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Abstract: *Colleges and universities have been playing an increasingly important role in regional innovation-driven development. Based on panel data (1999-2016) of 287 cities in China, this study conducted an empirical analysis of the influences of the new campuses which were built for the expanded college enrollment on the city's patentable inventions and innovations. The Time-varying DID model was adopted in the analysis. The regression results demonstrate that newly built campuses have boosted inventions and innovations in their cities, benefiting various innovators including individuals and firms; that the impact of newly built campuses increases over time; the newly built campuses of vocational colleges have mainly influenced innovation actors like businesses, while those of regular colleges and universities have impacted both individuals and organizations; that the new campus built in the different city from its headquarter exerts greater promoting effects on the innovation of the city than the campus relocated in the original city and the campus of a newly established university; that the indirect effect of newly built campuses on the invention of all innovation actors is more significant than the impact of their direct collaboration with the latter; that a newly built campus have a more prominent effect on regional innovation when it is situated in an area with a high concentration of universities; and that the existence of the old campus of a university amplifies the promoting effect of its newly built campus on local innovation and the amplifying function strengthens over time.*

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Introduction

As a result of the intensified reform of market-oriented economy, serving economic development, undertaking scientific research, and training talent have been equally emphasized in China's higher education. The predominance of higher education institutions in the nation's scientific research and innovation has been well acknowledged. Universities' role in social development was further confirmed by a succession of external policies such as the National Revitalization through Science and Education Strategy 1995, the Action Plan for Revitalizing Education in the 21st Century and the National Key Basic Research Development Plan (the "973 Plan") in 1998, and the empowerment of universities in patent applications in 2002.

Over the past twenty years, local governments have committed substantial investment to constructing additional campuses in response to the expansion of college enrollment. At the same time, they have also attempted to utilize this opportunity to open up more zones for innovation such as high-tech development parks and innovation incubation bases to achieve innovation-driven regional development. Their plans for college town construction unexceptionally revealed their policy intention to integrate local higher education resources, promote the collaboration between industry, education, and research sectors, and develop regional high-tech industries to meet the future challenges of knowledge economy. According to the relevant statistics, among more than 300 major cities (excluding those in Qinghai and Tibet) in China, 209 of them are building new college towns. Can so extensive construction of new campuses really drive the development of regional innovation? What are the underlying influential mechanisms?

Research Hypotheses

The newly built college and university campuses in this study refer to those built in the wake of the expansion of college enrollment initiated in 1999. According to the data collected by our research team, by 2021 there were over 1600 new campuses of various types under construction or completed by colleges and universities in 29 provincial administrative regions (except for Qinghai and Tibet) in mainland China. Further classification of these new campuses is made as follows. Regarding school types, there were 925 new campuses for regular colleges and universities and 693 for vocational colleges. The construction of new campuses by regular colleges and universities reached its peak in three to five years following the initiation of expanded colleges' enrollment in 1999, while the number of new campuses of vocational colleges grew steadily. According to their locations, these new campuses can be divided into three categories: there were 377 "newly established campuses", each of which was built as the first campus of its newly set up school; there were 1091 "relocated campuses in the original cities" which refer to those built in the same cities as the old campuses; there were 150 "relocated campuses in new cities" that were built in cities other than the ones where the parent campuses are located. The construction of "relocated campuses in the original cities" and "newly established campuses" was at its peak in three to five years after the introduction of expanded college enrollment. After that, the "relocated campuses in the original cities"

has maintained a high growth rate, while the increase of "newly established campuses" has shown a significant downward trend.

First of all, according to the existing experience, the operation of the newly built campus can not only promote the invention of the university itself, but also enhance the innovation ability of other actors such as businesses and individuals, through face-to-face communication between the school and firms, scientific and technological service, application of research results, popularization of cutting-edge expertise, and creation of innovative atmosphere. Thus, we propose the first hypothesis (H1): the operation of new campuses of colleges and universities can effectively promote the innovation of the city where they are built, and the influence can spill over into other innovation agents such as enterprises and individuals.

Second, newly built campuses of different types and location characteristics yield different knowledge spillovers and research transfer results to innovation actors in the local city due to their varying backgrounds and educational orientations. Therefore, we put forward hypothesis two (H2): the impact on the city's innovation from newly built campuses of regular universities and vocational colleges may differ; also, there may be differences in the impact between "newly established campuses", "relocated campuses in the original cities", and "relocated campuses in new cities."

Third, there are time gaps between innovation input and output in the process of adjusting and transforming production factors by innovation actors. In the operation of new campuses, innovative elements spill over in the material or immaterial forms. In this process, learning, digestion, absorption, and diffusion of innovative elements by innovation actors are significantly dynamic. Most importantly, the construction and opening of new campuses are long-term processes in real-world contexts. As a result, we bring up the third hypothesis (H3): The positive effect of the new campuses of colleges on the city's innovation is cumulative, which gradually increases over time.

Last, newly built college campuses can influence external innovation actors such as firms and individuals through collaborative invention or through promoting the latter's innovation practices by providing knowledge service. The second influencing path plays a more salient role in boosting patentable inventions in the city. Hence, the fourth hypothesis is suggested: the newly built college campuses are more likely to impact external actors' innovation through indirect involvement than through direct cooperation with them.

Research Models

Based on the existing panel data, this study constructed a difference-in-differences (DID) model to investigate the impact of the newly built college campuses on the city's innovation capacity. The traditional DID method is generally valid to cases in which the policy intervention occurs in a single period of time and the sample intervention status remains unchanged, otherwise the setting of interactions will severely contradict the parallel trend assumption, which may lead to biased estimation coefficients. As a result, we used a more flexible Time-varying DID model instead of the conventional DID model in this study, since there are differences in the opening time among those new campuses and in the number of new campuses built in sampled cities.

A requirement for using DID method is that the experimental group meets the criterion of random distribution. In other words, there are no other potential time-varying characteristics of cities that may affect the estimation results in the model. This study managed to control for the key indicators that may affect the city's construction of new campuses such as economic foundation, population size, the number of existing campuses and the interactions of time trend, etc. and add fixed effects of the city and fixed effects of the year. It also attempted to avoid the interference from other imperceptible omitted variables in the estimation results.

The other requirement for using DID method is that the innovation activities of the experimental group and the control group be aligned with the parallel trend assumption. This study further combined the preliminary Time-varying DID model with the event study method. A parallel trend test was conducted by observing the difference in the impact of the two groups of samples before the intervention; the research hypotheses were verified by inferring the trend from the dynamic changes of the policy effects.

Research Findings

Preliminary Regression Results

Preliminary regression results from equation one of the model demonstrated that the operation of newly built campuses of universities has significantly promoted innovation in the cities where they are located. The regression coefficient of the effect was 0.020, that is, on average, each new campus brought about 2.0% increase in patented inventions for the city. The regression results showed that the regression coefficients of the effects of newly built university campuses on individuals, enterprises, colleges, research institutions and other actors were all positive, and the first three coefficients are statistically significant. This indicates that the knowledge spillover of the new campuses is not limited to the higher education sector but can also affect the innovation activities of external factors, such as businesses and individuals. Thus, H1 is validated.

To check the interference caused by the non-random distribution of newly built college campuses in various cities, this study proceeded to perform a robustness test by focusing on cities with newly built university campuses and incorporating fixed effects of provinces and years and found that the regression results of the test were consistent with the preliminary regression results. This shows that the impact of newly built university campuses on the city's innovation is robust.

To evaluate the potential impact of the possibly, randomly omitted variables on the empirical research conclusions, this study also conducted a placebo test: randomly selected the cities from the experimental group and the opening years of their new campus, and randomly regressed 1000 times according to the preliminary model. According to the regression results, the regression estimation coefficients obtained by random sampling are by no means close to the regression results of this study. Thus, the regression results of this article cannot be affected by randomly changing the policy intervention time.

Disparities in the Impact of Newly Built Campuses

(i) Differences in the Influence of Newly Built Campuses of Different Types

We attempted to replace the core explanatory variables in the preliminary regression model with the numbers of newly built campuses by regular universities and by vocational colleges to compare the difference in their impact on the local cities' innovation. It was found that the two types of new campuses both had significant positive effects on the number of inventions and patents in the local cities. New campuses of regular universities mainly affect the innovation of individuals, businesses, and tertiary education schools, while those of vocational colleges generally influence the invention of businesses and tertiary education schools. Both of them have a positive impact on corporate innovation, and the impact of the latter is slightly stronger than that of the former in this regard; Regular universities exerts more prominent influence on individuals' invention and innovation.

(ii) Variations in the Impact of Newly Built Campuses with Different Locations

We tried to replace the core explanatory variables in the preliminary regression model with the numbers of "newly established campuses", "relocated campuses in the original cities", and "relocated campuses in new cities" to examine the gaps in their effects on the cities' innovation. It was discovered that the impact of "relocated campuses in new cities" was the strongest, which was mainly imposed on the invention of businesses and individuals; and that there is no significant difference in the effects on the cities' innovation between "newly established campuses" and "relocated campuses in the original cities" and the effects are posed on individuals, businesses and tertiary education schools.

The Cumulative Effects of Time

After controlling for the covariates, there was no perceptible difference between the experimental group and the control group before the intervention, and the "counterfactual" estimation in the model was basically reliable. The analysis results also showed that the impact of the new campuses on the innovation capacity of the city gradually increased over time, in a cumulative pattern.

An Expanded Analysis of Influencing Mechanisms

There may exist multiple paths for the influence of newly built college campuses on the innovation of their cities. On the basis of foregoing regression results, this study further examined the comprehensive influence of the new campuses on the patentable innovations of the city in the following four aspects.

- *Direct Collaboration or Indirect Involvement*

In order to determine which form of engagement on part of the newly built college campuses, direct cooperation or indirect involvement, has the more substantial promoting effect on the innovation of the city, we experimented with replacing the explanatory variables in the regression model with the number of invention patents under universities' direct participation and the number of invention patents which did not involve universities' direct engagement, and then a grouped regression was carried out. The results revealed that the indirect involvement rather than the direct engagement of new campuses yields a more substantial promoting effect on the local city's innovation and development.

• *Converging Inventions or Balanced Development*

This study first used as the proxy indicator the logarithm of the difference between the 90% quantile and the 10% quantile of the number of invention patents granted to all districts and counties within a city to examine the degree of concentration and distribution of innovation activities among different areas in the city after the new campuses were put into operation. The results showed that the estimated coefficients of each regression equation were significantly positive, which indicated that innovation activities in various districts and counties in the city have shown a certain degree of convergence after the new campuses were put into use. Based on this finding, this study used the variance of the number of invention patents granted to each district and county as the regression result of the substitution index, which also verifies the above conclusion.

• *The Impact of the Concentration of Newly Built University Campuses*

The greater the number of university campuses in a unit area, the more likely that the innovation actor there will benefit from their knowledge spillovers, and the overall impact of universities on the city's innovation will be more significant. We attempted to replace the core explanatory variables in the preliminary model with the number of college campuses per hundred square kilometers to evaluate the influence of college density on the city's innovation and found that the denser the university campuses per unit area, the more prominent the knowledge spillovers on the overall invention and innovation of the city, and that businesses there are the major beneficiaries.

• *The Influence of the Old Campuses*

We incorporated into model two the interaction between the number of new campuses and the variable of whether there being corresponding old campuses in the same city to examine the relationship between them and its long-term trend. Overall, the existence of the old campus somewhat reinforced the promoting effect of the new campus on the innovation and invention of the city, and this effect was consistently enhanced over time, which was a sign that the new and the old campus have gradually established a close connection in research cooperation.

Conclusions

The operation of newly built college campuses has promoted the innovation and invention of the city where they are located, including the invention of individuals, businesses, and other actors. The promoting effect of the new campuses is cumulative, which strengthens with the increase in years of their operation. The newly built campuses of regular colleges and universities are beneficial for the innovation of individuals and businesses, while those of vocational colleges mainly benefit businesses and other actors. Compared with "newly established campuses", "relocated campuses in the original cities", "relocated campuses in new cities" can impose a more substantial impact on the city's innovation. The expanded analysis shows that compared with their direct cooperation with other innovation actors in the city, new campuses' indirect involvement has more significant influences on the number of invention patents of those actors. After the new campuses being put into use, the innovation and invention activities in the city tend to converge; the higher density of college campuses is in a unit area, the stronger promoting impact they have on the city's innovation. The existence of old college campuses may enhance the promoting function of new campuses, and this enhancing effect will get stronger over time.

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ARTICLE

Transportation Infrastructure and Family Educational Expectations: An Empirical Analysis Based on the China Family Panel Survey

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Abstract: *Based on data from the China Statistical Yearbook and China Family Panel Survey (CFPS), this article investigated the influence of regional transportation infrastructure development on family education expectations. Research results show that there is a significant positive correlation between transportation infrastructure and family educational expectations and that the improvement of transportation infrastructure can enhance the family's willingness to engage their children in higher education. According to the results of influencing mechanism analysis, transportation infrastructure development affects family education expectations by increasing family income and changing family reproduction concepts and educational ideas. In addition, the impact of transportation infrastructure construction on family education expectations is heterogeneous: the positive correlation between them is particularly significant in rural areas with less developed transportation infrastructure, in areas with low average education level of parents and slow information communication, and among families of lower social classes; however, the relationship between the two variables is not prominent in urban areas, in areas where information communication is fast and parents have a higher average education level, and among families with higher social classes. These research findings offer the nation and government new implications for better promoting poverty alleviation through education and rural revitalization in underdeveloped areas.*

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Introduction

As a prerequisite for the social and economic development of a region or nation, the development of transportation infrastructure lays a crucial foundation for the regional resource exchange, information communication, opportunity sharing and advantages complementation, which also profoundly affect regional education resource availability and family educational ideas. Improved transportation infrastructure help boost the income of local families, as a result, raising family educational expectations; at the meantime, it bolsters the inter-regional flow of people and cultural exchange, popularizes urban culture, transforms the backward educational ideas in underdeveloped areas, and thus heightens local families' awareness of the importance of education,

Family education expectations refer to parents' expectations of their children's future education level and academic attainment, which are a key representation of the family's educational outlook. Generally speaking, the impact of family educational expectations on child educational achievement is mainly reflected in two aspects: positive family educational expectations increase parental investment in child education, including increased money input in as well as time and energy devotion to children's learning; at the same time, there exists Rosenthal effect in family educational expectations (Rosenthal effect means that expectations of others will produce an "aspiration effect" on individuals, thus promoting the actualization of individual goals). In this context, this article utilized data from the China Family Panel Survey (CFPS) and China Statistical Yearbook to establish panel data which contain 17073 subjects to examine the influence of transportation infrastructure development on family educational expectations as well as the influencing mechanisms.

Research Design

Sources of Data

The study sourced data from the *China Statistical Yearbook 2014-2018* issued by China's National Bureau of Statistics and the CFPS 2014, 2016 and 2018 undertaken by Institute of Social Science Survey of Peking University. *The China Statistical Yearbook* contains basic data of China's economy, transportation, and population. The CFPS samples come from 25 provincial administrative regions, with a target sample size of 16,000 households. The survey subjects include all family members of the sampled households, and data on family educational expectations, family economic circumstances, parents' education levels and other related aspects are collected.

The Determination of Variables

The Predicted Variable: Family Educational Expectations

Family educational expectations are the dependent variable in this study. The corresponding question in the CFPS questionnaire is "what is the minimum level of education you expect from your kids?" The value of this variable ranges from 0 to 7. The bigger the value, the higher the family educational expectations it represents, with 0 = "no education expectation for kids," 1= "the primary school," 2 = "the junior secondary school," 3 = "the senior secondary school/ secondary technical school/ secondary vocational school," 4 = "the junior college," 5= "the bachelor's degree," 6 = "the master's degree," and 7 = "the doctor's degree."

The Core Explanatory Variable: The Index of Transportation Infrastructure

This study chose railway transport as the index to measure the development level of transportation infrastructure in an area, because compared with other transport modes, railway transport has its unique advantages such as the large delivery capacity, cost-effectiveness, long travel distance, wide coverage, independence from weather conditions, etc., which can promote the inter-regional exchange of labor and information and bolster local social and economic development.

Control Variables

Based on the previous research literature and the available data from the CFPS, this article used the education levels of the father and mother and family book collection to represent the family cultural capital; the family's monthly post and telecommunication expenses as the proxy variable to represent the home social capital; per capita household income and household assets to represent home economic capital. Child characteristics include child gender, age, and being the only child of the family or not. Regional characteristics include the logarithm of the per capita GDP of each province every year along with the core explanatory variable of the regional transportation infrastructure development level.

The Research Model

The following model was constructed to explore the causal relationship between transportation infrastructure and family educational expectations:

$$Edu_{i,t} = \alpha+\beta Tra_{i,t}+\delta X_{i,t}+\varepsilon_{i,t}$$

In this equation, subscript i denotes the sampled individual, and $Edu_{i,t}$ represents the parental educational expectation for i in the year of t; $Tra_{i,t}$ represents the development level of transportation infrastructure in province i in the year of t; Xi denotes the family background, child characteristic, regional characteristic, and other control variables; $\varepsilon_{i,t}$ means the residual. The directivity and significance of coefficient β are the main focus in the model. As the predicted variable in this model is an ordinal categorical variable

with a value range of 0-7, this paper chose to use an ordinal logistic model to perform regression after controlling for the fixed effects.

Analyses of Empirical Research Findings

Findings from Main Empirical Models

Estimate results of the variable of family educational expectations demonstrate that the higher the level of transportation infrastructure and the GDP of a province, the higher the family educational expectations there. However, when the variable of household economic capital is added into the model, the variable of the GDP of each province loses its statistical significance, which indicates that the GDP of each province affects family educational expectations mainly through its effect on the economic capital of local families.

The regression results show that: (1) The coefficient of the core explanatory variable - the development level of transportation infrastructure - in all models is significantly positive, indicating that the development of transportation infrastructure plays a substantial role in raising the educational expectations of local families, as it has been a driving force to the social, economic, and cultural advance in the region. It prompts families to change their educational ideas and improves outcomes of family educational input, and as a result, parents have higher requirements and expectations for children's education attainment. (2) The richer the family capital, the higher the family educational expectations for its kids. (3) The coefficient of the variable of child gender is significantly positive. Boys are likely to receive higher family educational expectations, indicating that gender discrimination still exists in children's education. (4) The coefficient of the variable of being the only child of the family or not is significantly positive, signaling that parents have higher educational expectations for the only child than for children with siblings.

Whichever model it is, the advance in transportation infrastructure increases the number of parents who expect their children to obtain doctor's, master's, or bachelor's degrees, and reduces the number of parents who limit their educational expectations for children to the junior college or below. In other words, the development of transportation infrastructure can significantly boost parents' willingness to engage their children in higher education.

The Robustness Check

Altering the Index of Transportation Infrastructure

To test the robustness of the above results, the development level of highways was used as the index to measure the level of regional transportation infrastructure and performed the regression of the main empirical models again; an additional indicator of transportation infrastructure was produced by combining the standardized railway density and per capita railway kilometers and the coefficient of the explanatory variable was estimated again. The regression results show that the symbol and significance of the explanatory

variable remain unchanged, whether the development level of highways or the reconstructed railway-based index is used to replace the original index of transportation infrastructure, which indicates that improved transportation infrastructure can significantly raise educational expectations of local families.

Using the Ordinal Probit Model

The ordinal probit model was used to conduct regression in order to further verify the stability of the regression results of the ordinal logit model. The regression results show that the symbols and significance of the coefficient of the variable of transportation infrastructure have not changed

Propensity Score Matching

This study used the propensity score matching (PSM) method to address the endogeneity issue that may be caused by the sample self-selection bias: (1) The sample was divided into areas with developed transportation infrastructure (N=8964) and areas with ordinary transportation infrastructure (N=8109). The former was set as the experimental group and the latter as the control group. (2) The control variables in the main regression model 5 were used as the predictor variables to predict the probability of the family residing in an area with developed transportation infrastructure and the propensity scores were calculated. (3) One to one matching, one to four matching and one to four radius matching was performed on sample respectively. The results of propensity score matching show that the standardized deviation of variables is substantially reduced, the absolute deviation of all variables is less than 5%, and the t-test results of most variables do not contradict the assumption that there are no systematic differences between the experimental group and the control group, indicating that the matching result is good. The sample regression results based on PSM show that the symbols and significance of explanatory variables are consistent with those in previous analysis, that is, the improvement of transportation infrastructure can significantly heighten the educational expectations of local families. Therefore, the conclusion of this article is robust and reliable.

Analyses of Influencing Mechanisms

The Effect of Family Income

A three-step mediation analysis was undertaken: (i) to regress the effect of transportation infrastructure on family educational expectations with the results showing that the influence of transportation infrastructure on family educational expectations remains prominently positive when the control variable of family income is not included in the model; (ii) to regress the effect of transportation infrastructure on per capita household income with the results displaying that the improvement of transportation infrastructure can significantly bolster local family income; (iii) to refer to the regression results of the main empirical models which have proved that both household income and transportation infrastructure are positively correlated with family education expectations. The

above analysis indicates that household income can mediate the effect of transportation infrastructure on family educational expectations. In other words, the improvement of transportation infrastructure can heighten educational expectations of local families by promoting the increase of family income.

The Effect of Cultural Concepts

The advance in transportation infrastructure not only has a positive impact on the regional economy, but also speeds up inter-regional information communication, expand people's travelling spheres, and thus boost inter-regional cultural exchange. As a result, some new concepts and thoughts are introduced into the lives of residents, gradually transforming the local culture and residents' ideas. Further, the change in regional cultural background and family cultural capital significantly modifies family educational expectations.

Further Heterogeneity Analyses

The foregoing analyses focus on the influence of transportation infrastructure on family educational expectations and its mechanism --- transportation infrastructure enhances the educational expectations of local families by promoting the economic development of areas within its coverage and changing the family educational concepts. To go further, is there any heterogeneity in the effect of transportation infrastructure on family education expectations? To address this question, this study performed a heterogeneity analysis in the four dimensions: urban and rural division, internet penetration, parental education level, and family social capital, with reference to previous research on this topic.

The Urban vs. Rural Heterogeneity

Regression analyses were carried out on rural and urban households separately and demonstrated that the improvement of transportation infrastructure has a significant positive effect on educational expectations of rural families but has no significant impact on educational expectations of their urban counterparts.

Disparities in Education Level among Parents

To investigate the differences in the impact of the advance in transportation infrastructure on parents with varying education levels, this paper divides the whole sample into two groups: families with high education levels (N = 8,566) and with low education levels (N = 8,507), according to the median of the average education level of parents in a family and conducted regression on them separately. The regression results reveal that improved transportation infrastructure is positively related to educational expectations of parents with lower education levels but has no significant influence on educational expectations of those with higher education levels.

The Divide in the Internet Use

This article chose the Internet penetration rate of each region in every year as the proxy variable of information communication speed and divided the sample into the fast information communication group (N = 9,006) and the slow information communication group (N = 8,067) in accordance with the median of the Internet penetration rate. According to the results of group regression, the coefficients of the variable of transport infrastructure in both the two groups are positive and significant at the 1% level. By comparing the coefficients of the two groups, it is easy to find that the positive impact of transportation infrastructure advancement on family educational expectations is stronger in the slow information communication group.

Disparities in Social Capital

To investigate the heterogeneous effects of the improvement of transportation infrastructure on educational expectations of families with differential social capital, this study divided the sample into two subsamples: higher social class families and lower social class families and conducted group regression. The results show that the development level of transportation infrastructure is positively correlated with educational expectations of lower social class families but has no significant impact on educational expectations of higher social class families.

Conclusions

Through the ordinal logit model analysis of data from the CFPS, the article drew the following conclusions: (i) The more developed the regional transportation infrastructure, the higher the family educational expectations. The improved transportation infrastructure results in stronger intention of families to engage children in higher education. (ii) The advanced transportation infrastructure positively affects family educational expectations by increasing local household income and transforming parents' family reproduction concepts and educational ideas. (iii) The improvement of transportation infrastructure in underdeveloped rural areas can significantly heighten educational expectations of local families but that in cities has no prominent influence on educational expectations of urban families. (iv) The advance in transportation infrastructure imposes a significant positive impact on family educational expectations in both fast and slow information communication regions, with a stronger impact on the latter. (v) Upgrading transportation infrastructure leads to higher educational expectations in families with lower parental education levels and less social capital but has no remarkable influence on educational expectations of families with higher parental education levels and rich social capital.

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NEWSLETTER

Parental Phubbing and Young Children' Problem Behavior: A Moderated Mediation Model

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CHILD problem behaviors refer to those behaviors that are detrimental to physical and mental health of young children, including externalizing problems such as aggression, violence, disobedience to discipline, etc. and internalizing ones like anxiety, depression, withdrawal and so on. Problem behaviors impede children's acquisition of knowledge and skills. The parent-child relationship is considered a key factor affecting children's growth, and the quality of parent-child interaction can predict child problem behaviors. The popularization of smart phones and other electronic devices today has led to a special human behavior dubbed "phubbing", which is not beneficial to interpersonal communication and interaction. As a result, it is necessary to undertake a deep investigation into the negative impact of parental phubbing on child development.

This study sampled 527 parents (189 fathers and 338 mothers) from14 kindergartens in Liaoning, Shandong, and Shanxi Provinces, involving 127 three-year-olds, 157 four-year-olds, and 148 five-year-olds, and 95 six-year-olds. The Parental Phubbing Scale, Child-Parent Relationship Scale, Conners' Child Problem Behavior Scale, and family social and economic status (SES) measurement were used as research tools; the common method bias test was adopted as the research method.

The results of the study show that: the overall severity of phubbing among parents is high, while the severity of problem behavior in young children is of lower-middle level; parental phubbing can not only directly predict child problem behaviors, but also indirectly predict them through the parent-child relationship; young children's age enhanced the predictive effect of parental phubbing on child problem behaviors, but weakened that of the parent-child relationship on child problem behaviors; When the parent scores between 18.7 and 24.5 points in the Parental Phubbing Scale, the problem behavior of his or her child surpasses the alert threshold.

To ensure the healthy growth of young children, parents should be alert to the cumulative risk effect of their phubbing and its threshold, reduce their cell phone dependence, and dedicate quality time to children.

NEWSLETTER

The Relationship between Peer Attachment and Mobile Phone Addiction of Junior Secondary School Students: An Analysis Based on a Moderated Mediation Model

By Yang, C., Lian, S. L., Chen, C. Y., Sun, X. J., & Zhou, Z. K.
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PEER attachment refers to the intimacy between adolescents and their peers, in which they give each other warmth and support. Good peer attachment can reduce emotional and behavioral problems. Peer attachment is also considered as an important factor affecting adolescents' mobile phone addiction. In order to clarify the relationship between peer attachment and mobile phone addiction and its mechanism, this study constructed a moderated mediation model to examine the mediation of negative emotions and the moderating effect of the ability to be alone.

In this study, 782 junior middle school students were surveyed in groups by class-based cluster sampling. The measuring instruments included the Inventory of Peer Attachment, the Depression Anxiety Stress Scale, Mobile Phone Addiction Index, and the Ability to Be Alone Scale.

The research results show that: (i) After controlling for gender, age, grade, being only child or not, and mobile phone use years, peer attachment has a significant negative predictive effect on mobile phone addiction. (ii) Negative emotions exert complete mediation on the relationship between peer attachment and cell phone addiction. (iii) The direct effect of peer attachment on cell phone addiction and the mediating effect of negative emotions are both moderated by the ability to be alone.

The moderated mediation model constructed from the perspective of compensation theory is used to clarify how peer attachment affects mobile phone addiction of junior secondary school students (the mediating effect of negative emotions) and to respond to the question when peer attachment has a more significant impact on mobile phone addiction (the moderating effect of the ability to be alone). The results of the study have theoretical and practical significance for deepening the research on the causes of mobile phone addiction and guiding junior secondary school students to develop good peer attachment to ensure sound psychosocial functioning.

Source: Psychological Development and Education, 2022; 38(4):538-545.

NEWSLETTER

Autocratic Parenting Style and Adolescent Perseverance: A Moderated Mediation Model

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PERSEVERANCE, as an important positive mental quality, can predict not only academic performance, but also nonacademic outcomes. The cultivation of perseverance needs the nourishment of a good external environment, including the support of parents, teachers, and peers as well as the influence of socialization, while improper environmental elements such as neglect, autocracy, rough treatment, discrimination hinder the cultivation of individual perseverance.

This study constructed a moderated mediation model to examine the relationship between authoritarian parenting style, self-concept clarity, self-worth, and the development of adolescent perseverance. A total of 2,101 adolescents were tested with the Family Rearing Style Questionnaire, Adolescent Self-reported Perseverance Scale, Self-concept Clarity Questionnaire, and Self-worth Scale. The results showed that: (i) Authoritarian parenting was significantly and negatively correlated with self-concept clarity and perseverance of adolescents and was significantly and positively related to their self-worth; there was a significant positive correlation between self-concept clarity, self-worth, and perseverance of teenagers. (ii) In the mediation chain of autocratic parenting, self-concept clarity, and perseverance, self-worth moderated both the first half and the second half of the path. In the first half of the path, self-worth can alleviate the negative influence of autocratic parenting on the development of self-concept clarity; in the second half of the path, self-worth can enhance the positive impact of self-concept clarity on perseverance.

Source: Educational Research and Experiment, 2021; 2021(5):84-90.

NEWSLETTER

A Longitudinal Study on the Immediate and Long-term Effects of Television Exposure on Preschoolers' Executive Function

By Xiong, Y. C., Yu, H. X., Liu, Y. P., & Li, H.
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EXECUTIVE function comprises a series of higher-order cognitive abilities of individuals that can effectively regulate their behavior and thinking. It has three main components: working memory, inhibition, and set shifting. Young children need to use their executive function to make plans, eliminate interference, keep focused, and memorize and retain information, as well as to adapt themselves to different rules and perform self-monitoring. Childhood executive function affects children's development in various aspects, such as psychology, social adaptation, early language ability, etc. It can also predict their later academic achievements and lay a foundation for the development of higher cognitive competences in their adulthood. Television is one of the most popular electronic media. Existing research on the impact of television exposure on child development found that children's television viewing time is somewhat correlated with their executive function.

This study adopted longitudinal research design and lasted for one year, aiming to examine the immediate and long-term effects of television exposure on preschoolers' executive function. Cluster sampling were conducted in three kindergartens in Ningbo City of Zhejiang Province and a total of 289 subjects included in the study with 29 kids in the 2-year-old group, 74 in the 3-year-old group, 65 in the 4-year-old group, and 121 in the 5-year-old group. The media use questionnaire (parents' version) and the preschool children's executive function scale were used to collect children's data in the first, sixth, and twelfth months through the same process. The cross-lagged regression was applied in data analysis.

The research results showed that, over time, children's executive function scored significantly more points in the 12th month than at the outset and in the 6th month of the study. At all three points of investigation, children spent more time watching TV on weekends than weekdays, and their weekly television viewing time was negatively related to their executive function, demonstrating that has an immediate negative impact on their executive function. However, television exposure could not predict children's

executive function in a long term, indicating that the longitudinal connection between television viewing time and executive function in young children is not significant.

The study makes the following suggestions to parents of preschool children: (i) Avoid exposing children to television at too early an age; (ii) Set a time limit on children's television watching; (iii) Enrich children's home activities during weekends and holidays; (iv) Engage in high-quality parent-child interaction and reduce dependence on digital games.

Source: Studies in Preschool Education, 2022; 2022(8):53-63.

NEWSLETTER

Negative Parenting Styles and Preschoolers' Social Adaptation Difficulties: The Mediating Effect of Parent-Child Conflicts

By Liang, Z. B., Wu, A. L., & Zhang, G. Z.
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CHILDREN'S social adaptation is a manifestation of the level of their socialization. Positive social adaptation is represented by qualities such as pro-activeness, sensitivity, cooperation, and popularity among peers in children's social interaction. Social adaptation difficulties include externalizing behavior problems like anger and aggression and internalizing ones such as anxiety and withdrawal. Childhood social adaptation problems can impose negative influences on individuals' future development.

The parenting style is an integration of parents' values, attitudes, and behavior in child rearing, working on children in three dimensions: warmth and caring, behavioral discipline, and phycological control. In early childhood, children learn by simulating the words and actions of their parents. The language, behaviors, and responses delivered by parents in the process of child upbringing directly affect the development of social skills of children in the early years. Negative parenting behavior will induce social adaptation difficulties in young children.

This study constructed a model of the relationships between negative parenting behavior, child-parent conflicts, and child social adaptation difficulties, to analyze: (i) the father vs. mother differences in the impact of negative parenting behavior on child social adaptation; (ii) the mediating effect of child-parent conflicts on the relation between negative parenting styles and child social adaptation difficulties.

Through cluster sampling, 446 second-year kindergarteners and their parents were selected as subjects from 6 kindergartens (including one community, one bilingual, two private, and two public kindergartens) in X City. In the first year of the study, the Child-Rearing Practices Report Q-Sort and the Child-Parent Relationship Scale were utilized to investigate parents' rearing behavior and the child-parent relationships among subjects. The Social Competence and Behavior Evaluation Scale, SCBE-30 was employed to assess children's social adaptation in the following year.

The research findings demonstrate that negative parenting behavior of fathers and mothers can both positively predict children's anger and aggression, and besides, the negative parenting behavior of mothers also positively predicts children's anxiety and withdrawal, indicating that it has a wider adverse influence than that of fathers; and that father-son conflicts can mediate the relation between the negative parenting behavior of the father and children's anger and aggression, while mother-son conflicts can mediate the relationship between negative parenting behavior of the mother and children's anxiety and withdrawal as well as anger and aggression. Therefore, to improve children's social adaptation, parents should be mindful of the impact of their rearing behavior and parent-child relationships on the development of their preschool kids; avoid negative parenting practices such as threatening and coercion, verbal abuse and corporal punishment, overinvolvement and overprotection, etc.; and secure close parent-child relationships.

Source: Studies in Preschool Education,2022;2022(03):43-52.

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